Appendix 5.1.3.1A
2013 Geochemical Characterization Report

Blackwater Gold Project

2013 Geochemical Characterization Report

Prepared for:
New Gold Inc.
Suite 1800 – 555 Burrard Street
Vancouver, BC V7X1M9

Prepared by:
AMEC Environment and Infrastructure
a division of AMEC Americas Ltd.
Suite 600, 4445 Lougheed Hwy.
Burnaby, BC V5C 5A9

AMEC File: VE52455
September 2014

Version B

TABLE OF CONTENTS

ACRONYMS ..... **I**

1.0 INTRODUCTION **1**
1.1 Scope of Work 1
1.2 Regulatory Context 2
1.3 Site Overview 3
1.3.1 Regional and Project Geology 3
1.3.2 Alteration and Mineralization 6
1.3.3 Geological Features Relevant to ML/ARD Characterization 11
1.3.4 Site Description 11

2.0 METHODS **16**
2.1 Geochemical Sampling Program 16
2.1.1 Overburden 18
2.1.2 Waste Rock and Ore 18
2.1.3 Metallurgical Tailings Program 21
2.2 Analytical Methods 21
2.2.1 Static Testing 21
2.2.1.1 Mineralogy 21
2.2.1.2 Elemental Content 22
2.2.1.3 Acid Base Accounting 22
2.2.1.4 Net Acid Generation Test 24
2.2.1.5 Shake Flask Extraction 24
2.2.2 Kinetic Testing 25
2.2.2.1 Humidity Cell Testing 25
2.2.2.2 Modified Humidity Cell Tests 26
2.2.2.3 Field Test Cells 26
2.2.2.4 Sub-aqueous Column Tests 27
2.2.3 Project-Specific Testing 28
2.2.3.1 Oxygen Consumption 28
2.2.3.2 ABCC 28
2.2.3.3 Sequential NAG 29
2.2.3.4 Kinetic NAG 29
2.2.3.5 pH Neutralization Experiments 29
2.2.3.6 Sequential Extractions 29
2.2.3.7 SO_2/Air Cyanide Destruction 30
2.2.3.8 Adsorption Experiments 31

3.0 RESULTS AND CONCLUSIONS **32**
3.1 Overburden 32
3.1.1 Mineralogy 32
3.1.2 Elemental Content 32
3.1.3 Acid Base Accounting 36
3.1.4 NAG Test 38
3.1.5 Shake Flask Extraction 39
3.1.6 Conclusions 44
3.2 Waste Rock 44
3.2.1 Mineralogy 45
3.2.2 Elemental Content 46
3.2.3 Acid Base Accounting 49

3.2.3.1 Paste pH 57
3.2.3.2 Sulphur Species and Acid Potential 57
3.2.3.3 Neutralization Potential 63
3.2.3.4 Neutralization Potential Ratios 68
3.2.4 Comparison of Sample Compositing Methodologies 75
3.2.5 Net Acid Generation 78
3.2.6 Sequential NAG 80
3.2.7 Kinetic NAG 82
3.2.8 Shake Flask Extraction 82
3.2.9 Humidity Cell Tests 85
3.2.9.1 pH, Acidity and Alkalinity 88
3.2.9.2 Sulphate 90
3.2.9.3 Dissolved Metals 91
3.2.10 Modified Humidity Cell Tests 99
3.2.11 Subaqueous Column Tests 99
3.2.11.1 pH, Acidity and Alkalinity 100
3.2.11.2 Sulphate 103
3.2.11.3 Dissolved Metals 104
3.2.12 Field Bin Tests 111
3.2.12.1 pH, Acidity and Alkalinity 112
3.2.12.2 Sulphate 116
3.2.12.3 Dissolved Metals 117
3.2.13 Sulphide and NP Depletion 124
3.2.14 Oxygen Consumption 129
3.2.15 Acid Base Consumption Curve 129
3.2.16 pH Neutralization Experiments 130
3.2.17 Conclusions 136
3.3 Ore 137
3.3.1 Mineralogy 137
3.3.2 Elemental Content 138
3.3.3 Acid Base Accounting 139
3.3.3.1 Paste pH 139
3.3.3.2 Sulphur and Acid Potential 139
3.3.3.3 Neutralization Potential 141
3.3.3.4 Neutralization Potential Ratios 143
3.3.4 Net Acid Generation 143
3.3.5 Shake Flask Extraction 146
3.3.6 Humidity Cell Testing 146
3.3.6.1 pH and Alkalinity 149
3.3.6.2 Sulphate 150
3.3.6.3 Dissolved Metals 151
3.3.7 pH Neutralization Experiments 155
3.3.8 Conclusions 156
3.4 Metallurgical Test Tailings 156
3.4.1 Mineralogy 156
3.4.2 Elemental Content 158
3.4.3 Acid Base Accounting 158
3.4.4 Paste pH 158
3.4.4.1 Sulphur and Acid Potential 158
3.4.4.2 Neutralization Potential 162
3.4.4.3 Neutralization Potential Ratios 162
3.4.5 Net Acid Generation Test 162

3.4.6 Shake Flask Extraction 166
3.4.7 Humidity Cell Testing 168
3.4.7.1 pH, Acidity and Alkalinity 170
3.4.7.2 Sulphate 172
3.4.7.3 Dissolved Metals 172
3.4.8 SO_2/ Air Cyanide Destruction and Aging Test 176
3.4.9 Conclusions 179

4.0 ML/ARD SEGREGATION CRITERIA 181

5.0 ARD BLOCK MODEL 186

6.0 WATER QUALITY MODELLING 198
6.1 Assumptions Common to All Models 198
6.2 Low Grade Ore Stockpile 199
6.2.1 Geochemical Source Term 199
6.2.2 Model Structure and Assumptions 201
6.2.3 Low Grade Ore Stockpile Results 201
6.3 Temporary Ore Stockpile 202
6.3.1 Geochemical Source Term 204
6.3.2 Model Structure and Assumptions 204
6.3.3 Temporary Ore Stockpile Results 205
6.4 Combined East and West Dump 208
6.4.1 Geochemical Source Terms 208
6.4.2 Model Structure and Assumptions 211
6.4.3 East and West Dump Results 211
6.5 Waste Rock in the Tailings Storage Facility 214
6.5.1 Material Balance 214
6.5.2 Geochemical Source Terms 215
6.5.3 Model Structure and Assumptions 218
6.5.4 Model Results 218
6.5.5 Equilibrium Modelling 219
6.6 Open Pit 220
6.6.1 Pit Model Description 221
6.6.2 Model Assumptions and Data Sources 221
6.6.3 Exposed Pit Surface Area 221
6.6.4 Pit Hydrology and Water Management 223
6.6.5 Geochemical Source Terms 224
6.6.6 Assumptions 227
6.6.7 Pit Water Quality Model Mixing Scenarios 228
6.6.8 Estimated Pit Water Quality Model Results 230
6.7 East Dump and Impact of Imperfect Segregation 233
6.7.1 Model Structure and Assumptions 235
6.7.2 Source Terms 236
6.7.3 Results 238
6.8 Geochemical Testing and Modelling Results Used for Site Water Quality Model 239
6.9 Conceptual Model for Tailing Storage Facility Quality 240

7.0 ML/ARD RULES FOR MINE WASTE MANAGEMENT 244
7.1 Overburden 244
7.2 Waste Rock 244
7.3 Ore and Tailings 245
7.4 Low-Grade Stockpile 246

7.5 Open Pit 246

8.0 CONCLUSIONS 247

REFERENCES AND BIBLIOGRAPHY 250

List of Tables

Table 1-1: Lithologic Codes for Blackwater Project 5
Table 2-1: Geological Exploration Program Metals Database 16
Table 3-1: Results of XRD-Rietveld Quantitative Phase Analysis – Overburden 32
Table 3-2: Statistical Summary of Elemental Content – Overburden (n=95) 35
Table 3-3: Statistical Summary of ABA Analysis Results – Overburden (n=95) 36
Table 3-5: Summary of NAG Test Leachate Results – Overburden 40
Table 3-6: Statistical Summary of Shake Flask Results – Overburden (n=14) 42
Table 3-7: Waste Rock ABA Samples by ARD Class and Oxidation Facies 44
Table 3-8: Results of XRD-Rietveld Quantitative Phase Analysis – Waste Rock 47
Table 3-9: Statistical Summary of Elemental Content – Waste Rock 48
Table 3-10: Statistical Summary of ABA Analysis Results - Waste Rock (n=890) 50
Table 3-11: Statistical Summary of ABA Analysis Results - Waste Rock - Oxide Weathering Facies (n=62) 50
Table 3-12: Statistical Summary of ABA Analysis Results - Waste Rock - Transition Weathering Facies (n=248) 51
Table 3-13: Statistical Summary of ABA Analysis Results – Waste Rock - Sulphide Weathering Facies (n=580) 51
Table 3-14: Statistical Summary of ABA Analysis Results - PAG 1 Waste Rock (n=415) 52
Table 3-15: Statistical Summary of ABA Analysis Results - PAG 2 Waste Rock (n=122) 53
Table 3-16: Statistical Summary of ABA Analysis Results - NAG 3 Waste Rock (n=49) 54
Table 3-17: Statistical Summary of ABA Analysis Results - NAG 4 Waste Rock (n=26) 55
Table 3-18: Statistical Summary of ABA Analysis Results - NAG 5 Waste Rock (n=278) 56
Table 3-19: Comparison of Modified Sobek NP and Siderite Corrected NP in Waste Rock 65
Table 3-20: Waste Rock Neutralization Potential Ratio Distribution According to Weathering Facies 68
Table 3-21: Neutralization Potential Ratio Distributions Using Different Sources of Neutralization Potential and Acid Potential 72
Table 3-24: Statistical Summary of NAG Test Leachate Analysis Results – Waste Rock 81
Table 3-25: Sequential NAG Test Results for Waste Rock 81
Table 3-26: Kinetic NAG Test Waste Rock Samples 82
Table 3-27: Statistical Summary of Shake Flask Extraction Results – Waste Rock (n=58) 84
Table 3-28: Average Cd and Zn Concentrations in SFE by Waste Type 84
Table 3-29: Waste Rock Humidity Cell Samples 87
Table 3-30: Waste Rock Humidity Cell Loads (Average of All Weeks) 98
Table 3-31: Subaqueous Waste Rock Leachate Column Samples 100
Table 3-33: Waste Rock Field Bin Samples 113
Table 3-34: Sulphate Release Rates and Calculated Depletion Times for Acid Potential 125
Table 3-35: Calcium and Magnesium Release Rates and Calculated Neutralization Potential Depletion Times 126
Table 3-36: Theoretical Waste Rock Depletion and Lag Times Based on Laboratory Humidity Cell Tests 127

Table 3-37: Comparison of the Number of Weeks until Acidic Leachate between Humidity Cell and Field Bin Tests 128
Table 3-38: Samples used for the Acid Base Consumption Curve Tests 129
Table 3-39: pH Neutralization Experiments Iron, Cadmium and Zinc Percent Removed 135
Table 3-40: Waste Rock Classification Based on NPR and Zn Concentrations 136
Table 3-41: Results of XRD-Rietveld Quantitative Phase Analysis - Ore 138
Table 3-42: Statistical Summary of Elemental Content - Ore (n=72) 140
Table 3-43: Statistical Summary of Acid Base Accounting Analysis Results - Ore (n=72) 140
Table 3-44: Statistical Summary of NAG Test Results – Ore (n=36) 144
Table 3-45: Statistical Summary of NAG Test Leachate Analysis Results – Ore (n=7) 145
Table 3-46: Statistical Summary of Shake Flask Extraction Results – Ore (n=8) 147
Table 3-47: Low-Grade Ore Stockpile Humidity Cell Samples 147
Table 3-48: Average Low-Grade Ore Humidity Cell Leaching Rates 148
Table 3-49: Results of Mineralogical Analysis – Metallurgical Samples 157
Table 3-50: Elemental Content Analysis Results – Metallurgical Test Samples 160
Table 3-51: Acid Base Accounting Analysis Results – Metallurgical Test Samples 161
Table 3-52: Metallurgical Test Tailings NAG Test Results 163
Table 3-53: Summary of NAG Test Leachate Results – Metallurgical Tailings 165
Table 3-54: Shake Flask Extraction Analysis Results – Metallurgical Tailings Sample 167
Table 3-55: Metallurgical Tailings Humidity Cell Samples 168
Table 3-56: Average Metallurgical Tailings Humidity Cell Leaching Rates 169
Table 3-57: Results from SO_2/air Cyanide Destruction Tests 177
Table 3-58: Tailings Supernatant Ageing Test Results 178
Table 4-1: ARD Waste Rock Segregation Criteria 181
Table 5-1: Comparison of ABA and Metal Parameters for Ore by Oxide Facies – Feasibility Study Block Model 188
Table 5-2: Comparison of ABA and Metal Parameters for Low Grade Ore by Oxide Facies – Feasibility Study Block Model 188
Table 5-3: ABA and Metal Parameters for Waste Rock – Feasibility Study Block Model 191
Table 6-1: Calculated Waste Rock Surface Area 198
Table 6-2: Low Grade Ore Loading Rates (mg/m^2/wk) 200
Table 6-3: Annual Predicted Low Grade Ore Stockpile Drainage Quality 201
Table 6-4: Source Term Loading Rates from Low Grade Ore Humidity Cells 204
Table 6-5: Predicted Monthly Concentrations from the Temporary Ore Stockpile 206
Table 6-6: Geochemical Tests Used to Calculate Source Terms 208
Table 6-7: Summary of Humidity Cell Loading Rates for NAG 4 and NAG 5 Waste Rock (mg/m^2/wk) 209
Table 6-8: Average Water Quality Results from Monitoring Station WQ10 210
Table 6-9: Predicted Annual Drainage Chemistry from Combined East and West Dumps 211
Table 6-11: Humidity Cell Tests Used to Develop Waste Rock and Low Grade Ore Source Terms 216
Table 6-12: Summary of Humidity Cell Loads (mg/m^2/wk) from the PAG 1, PAG 2, NAG 3 and Low Grade Ore Humidity Cells 217
Table 6-13: Predicted Annual TSF Interstitial Water Quality from the Waste Rock and Low Grade Ore 218
Table 6-14: Comparison Base Case and PHREEQC Seepage Concentrations 220
Table 6-15: Exposed Pit Wall Surface Area 222
Table 6-16: Geochemical Source Terms 226
Table 6-17: Pit Water Quality Model Results (mg/L) 230
Table 6-18: East Dump Waste Tonnages (Norwest 2013) 235
Table 6-19: Waste Rock and Overburden Source Terms 237
Table 6-20: Predicted East Dump Drainage Quality (mg/L) 238

Table 6-21: Estimated Worst Case Seepage Quality Reaching Creek 661 at Year 400 years (mg/L) 239
Table 6-22: Testing and Modelling Results Provided for Site Water Quality Model 239
Table 8-1: Waste Rock Classification Based on NPR and Zn Concentrations 247

List of Figures

Figure 1-1: Project Location 2
Figure 1-2: Top of Bedrock Geology in Vicinity of Blackwater Deposit 4
Figure 1-3: Profile of Blackwater Deposit and Host Rock (Cross-Section 5200E) 6
Figure 1-4 Plan Map of Bedrock Geology of the Open Pit 9
Figure 1-5 Bedrock Geology Map of the Ultimate Open Pit Walls 10
Figure 1-6: General Site Layout at End of Operations 12
Figure 1-7: General Site Layout at Closure 13
Figure 2-1: Geological Database Drill Holes in the Ultimate Pit and NAG 5 Blocks 17
Figure 2-2: Dedicated Waste Rock Drill Holes 20
Figure 2-3: Field Test Cells 27
Figure 3-1: Cadmium in Overburden versus Depth 33
Figure 3-2: Zinc in Overburden versus Depth 34
Figure 3-3: Comparison of MPA vs. NP for Overburden Samples 37
Figure 3-4: Comparison of NAG pH and NPR for Overburden Samples 38
Figure 3-5: Carbonate Mineralogy 45
Figure 3-6: Box and Whisker Plot of Paste pH Waste Rock 58
Figure 3-7: Box and Whisker Plot of Waste Rock Total Sulphur Concentrations 58
Figure 3-8: Comparison of Sulphide Sulphur and Total Sulphur for Waste Rock by Type 59
Figure 3-9: Cumulative Frequency Plot of Total Sulphur Concentrations in Waste Rock 59
Figure 3-10: Total Sulphur from ABA vs. ICP Sulphur for Waste Rock by Type 60
Figure 3-11: Box and Whisker Plot of Waste Rock Adjusted Sulphur Concentrations 61
Figure 3-12: Maximum Potential Acidity vs. Adjusted Acid Potential (subtract ZnS AP) for Waste Rock by Type 61
Figure 3-13: Total Sulphur Concentrations by Lithology 62
Figure 3-14: Box and Whisker Plot of Modified Sobek Neutralization Potential – Waste Rock 63
Figure 3-15: Box and Whisker Plot of Carbonate Neutralization Potential – Waste Rock 64
Figure 3-16: Neutralization Potential by Lithology 66
Figure 3-17: Comparison of Modified Sobek NP and Carbonate NP for Waste Rock Samples 67
Figure 3-18: Modified Sobek Neutralization Potential vs. ICP Neutralization Potential – Waste Rock 67
Figure 3-19: Modified Sobek Neutralization Potential vs. Maximum Potential Acidity – Waste Rock Type 69
Figure 3-20: Box and Whisker Plot of Neutralization Potential Ratio – Waste Rock 69
Figure 3-21: Modified Sobek Neutralization Potential vs. Maximum Potential Acidity – Weathering Facies 70
Figure 3-22: Comparison of NPR calculated using MPA and Sphalerite Adjusted AP 71
Figure 3-23: Comparison of NPR calculated using Modified Sobek NP and ICP Ca NP 72
Figure 3-24: NPR by Lithology 74
Figure 3-25: ARD Classification from Waste Rock Drilling Program (14 drill holes) 75
Figure 3-26: Comparison of Phase 1 and Phase 2 Samples for Total Sulphur 76

Figure 3-27: Comparison of Phase 1 and Phase 2 Samples for Modified Sobek Neutralization Potential 77
Figure 3-28: Comparison of Phase 1 and Phase 3 Samples for Total Sulphur 77
Figure 3-29: Comparison of Phase 1 and Phase 3 Samples for Modified Sobek Neutralization Potential 78
Figure 3-30: Comparison of NAG pH and NPR for Waste Rock 79
Figure 3-31: Waste Rock Cumulative Frequency Plot and Humidity Cell NPR Values 85
Figure 3-32: Waste Rock Cumulative Frequency Plot and Humidity Cell Total Sulphur Concentrations 86
Figure 3-33: Waste Rock Cumulative Frequency Plot and Humidity Cell Zinc Concentrations 86
Figure 3-34: Waste Rock Humidity Cell pH values 89
Figure 3-35: Waste Rock Humidity Cell Alkalinity Loads 89
Figure 3-36: Waste Rock Humidity Cell Acidity Loads 90
Figure 3-37: Waste Rock Humidity Cell Sulphate Loads 91
Figure 3-38: Waste Rock Humidity Cell Cadmium Loads 94
Figure 3-39: Waste Rock Humidity Cell Zinc Loads 95
Figure 3-40: Waste Rock Humidity Cell Copper Loads 95
Figure 3-41: Waste Rock Humidity Cell Lead Loads 96
Figure 3-42: Waste Rock Humidity Cell Iron Loads 96
Figure 3-43: Waste Rock Humidity Cell Arsenic Loads 97
Figure 3-44: Subaqueous Waste Rock Leachate Column pH values 101
Figure 3-45: Subaqueous Waste Rock Leachate Column Acidity Loads 102
Figure 3-46: Subaqueous Waste Rock Leachate Column Alkalinity Loads 103
Figure 3-47: Subaqueous Waste Rock Leachate Column Sulphate Loads 104
Figure 3-48: Subaqueous Waste Rock Leachate Column Cadmium Loads 105
Figure 3-49: Subaqueous Waste Rock Leachate Column Zinc Loads 106
Figure 3-50: Subaqueous Waste Rock Leachate Column Copper Loads 107
Figure 3-51: Subaqueous Waste Rock Leachate Column Iron Loads 108
Figure 3-52: Subaqueous Waste Rock Leachate Column Lead Loads 109
Figure 3-53: Subaqueous Waste Rock Leachate Column Arsenic Loads 110
Figure 3-54: Waste Rock Kinetic Field Bin pH values 114
Figure 3-55: Waste Rock Kinetic Field Bin Acidity Loads 115
Figure 3-56: Waste Rock Kinetic Field Bin Alkalinity Loads 116
Figure 3-57: Waste Rock Kinetic Field Bin Sulphate Loads 117
Figure 3-58: Waste Rock Kinetic Field Bin Cadmium Loads 119
Figure 3-59: Waste Rock Kinetic Field Bin Zinc Loads 120
Figure 3-60: Waste Rock Kinetic Field Bin Copper Loads 121
Figure 3-61: Waste Rock Kinetic Field Bin Iron Loads 122
Figure 3-62: Waste Rock Kinetic Field Bin Lead Loads 123
Figure 3-63: Waste Rock Kinetic Field Bin Arsenic Loads 124
Figure 3-64: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD2-9) 131
Figure 3-65: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD-037) 132
Figure 3-66: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD-509) 132
Figure 3-67: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD-283/288) 133
Figure 3-68: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD-509/288) 133

Figure 3-69: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD-283) 134
Figure 3-70: Solid Phase Selenium and Zinc Concentrations in Ore Samples 139
Figure 3-71: Comparison of Sulphide Sulphur and Total Sulphur for Ore Samples (n=7) 141
Figure 3-72: Comparison of Modified Sobek NP and Carbonate NP for Ore Samples 142
Figure 3-73: Comparison of Modified Sobek NP and ICP Ca NP for Ore Samples 142
Figure 3-74: Comparison of AP vs. NP for Ore Samples 143
Figure 3-75: Comparison of NAG pH and NPR for Ore Samples 144
Figure 3-76: Low-Grade Ore Humidity Cell pH 149
Figure 3-77: Low-Grade Ore Humidity Cell Acidity Loads 150
Figure 3-78: Low Grade Ore Humidity Cell Sulphate Loads 151
Figure 3-79: Low Grade Ore Humidity Cell Cadmium Loads 152
Figure 3-80: Low Grade Ore Humidity Cell Zinc Loads 152
Figure 3-81: Low Grade Ore Humidity Cell Copper Loads 153
Figure 3-82: Low Grade Ore Humidity Cell Iron Loads 154
Figure 3-83: Low Grade Ore Humidity Cell Lead Loads 154
Figure 3-84: Low-Grade Ore Humidity Cell Arsenic Loads 155
Figure 3-85: Comparison of Sulphide Sulphur and Total Sulphur for Tailings 159
Figure 3-86: Comparison of Modified Sobek NP and ICP Ca NP for Tailings Samples 162
Figure 3-87: Comparison of NAG pH and NPR for Metallurgical Test Samples 164
Figure 3-88: Metallurgical Tailings Humidity Cell pH 170
Figure 3-89: Metallurgical Tailings Humidity Cell Acidity 171
Figure 3-90: Metallurgical Tailings Humidity Cell Alkalinity 171
Figure 3-91: Metallurgical Tailings Humidity Cell Sulphate Loads 172
Figure 3-92: Metallurgical Tailings Humidity Cell Cadmium Loads 173
Figure 3-93: Metallurgical Tailings Humidity Cell Zinc Loads 174
Figure 3-94: Metallurgical Tailings Humidity Cell Copper Loads 174
Figure 3-95: Metallurgical Tailings Humidity Cell Iron Loads 175
Figure 3-96: Metallurgical Tailings Humidity Cell Lead Loads 175
Figure 3-97: Metallurgical Tailings Humidity Cell Arsenic Loads 176
Figure 3-98: Copper, Zinc and Cadmium Concentrations in 30 Day Ageing Test 179
Figure 4-1: Humidity Cell Test Zn vs. Neutralization Potential Ratio for Waste Rock, Ore and Tailings Samples (n=24) 182
Figure 4-2: Humidity Cell Test Cd vs. Neutralization Potential Ratio for Waste Rock, Ore and Tailings Samples (n=24) 183
Figure 4-3: Humidity Cell Test Zn Concentration vs. Zn Content and Humidity Cell Test pH 183
Figure 4-4: Humidity Cell Test Cd Concentration vs. Cd Content and Humidity Cell Test pH 184
Figure 4-5: Cd vs. Zn Content for Humidity Cell Tests 185
Figure 5-1: Feasibility Study Block Model – Distribution of Waste Rock and Overburden 189
Figure 5-2: Feasibility Study Block Model – Distribution of Waste Rock 189
Figure 5-3: Block Model – Cross Section 5893300N 192
Figure 5-4: Block Model – ARD Classification of Ultimate Pit Walls 192
Figure 5-5: Block Model – ARD Classification of High Wall after Flooding of Open Pit 193
Figure 5-6: Waste Rock Blocks with <0.2 Total Sulphur 194
Figure 5-7: Waste Rock Blocks with > 10 kg CaCO3/t NP 195
Figure 5-8 : Andesite Waste Rock Blocks 196
Figure 5-9: Andesite, NAG 4 and NAG 5 Waste Rock Blocks 196
Figure 6-1: Low Grade Ore Stockpile Tonnage 199
Figure 6-2: Predicted Low Grade Ore Stockpile Zinc Concentrations 202
Figure 6-3: Predicted Low Grade Ore Stockpile Cadmium Concentrations 202

Figure 6-4: Monthly Tonnage of Ore in the Temporary Stockpile 203
Figure 6-5: Predicted Temporary Ore Stockpile Zinc Concentrations 207
Figure 6-6: Predicted Temporary Ore Stockpile Cadmium Concentrations 207
Figure 6-7: Predicated Zinc Concentrations in East and West Dump Drainage 213
Figure 6-8: Predicated Cadmium Concentrations in East and West Dump Drainage 213
Figure 6-9: Annual Tonnages of Waste Rock and Low Grade Ore in the TSF 214
Figure 6-10: Predicted Seepage Zinc Concentrations 219
Figure 6-11: Predicted Seepage Cadmium Concentrations 219
Figure 6-12: Open Pit Water Management 224
Figure 6-13: CompleteStratification Case – Meromictic Pit Lake 229
Figure 6-14 : Stratification Case – Meromictic Pit Lake 229
Figure 6-15: Predicted Open Pit Sulphate Concentrations 232
Figure 6-16: Predicted Open Pit Zinc Concentrations 232
Figure 6-17: Predicted Open Pit Cadmium Concentrations 233
Figure 6-18: ARD Block Model – Sample Bench Shovel Cuts (1548 Bench) 235
Figure 6-19 Conceptual Model for Contaminant Transport and Behaviour in TSF (Operations) 242
Figure 6-20: Conceptual Model for Contaminant Transport and Behaviour in TSF (Closure and Post Closure) 243

List of Annexes

Annex 1: Mineralogy Results
Annex 2: Elemental Content Analysis Results
Annex 3: Acid Base Accounting and Net Acid Generation Test Results
Annex 4: Net Acid Generation Leachate Test Results
Annex 5: Shake Flask Extraction Test Results
Annex 6: Waste Rock and Ore Humidity Cell and Modified Humidty Cell Test Results
Annex 7: Metallurgical Tailings Humidity Cell Test Results
Annex 8: Waste Rock Sub-aqueous Column Test Results
Annex 9: Field Bin Test Results
Annex 10: EGi. 2013. Specialized ARD Testing of Samples from the Blackwater Gold Project, BC, Canada.
Annex 11: pH Neutralization Test Results
Annex 12: Predicited Drainage Quality Modelling Results
Annex 13: Lorax Environmental Conceceptual TSF Model and Metal Sorption Potential of Natural Substrates Underlying the Blackwater TSF
Annex 14: SGS 2013. Exceprt of Cyanide Destruction Test Work
Annex 15: Lorax Environmental Metal Sorption Potential of Natural Substrates

ACRONYMS

Abbreviations and Units of Measure	Definition
ABA	Acid Base Accounting
ASTM	American Society for Testing and Materials
AP	Acid Potential, expressed in kg $CaCO_3$/t
BCWQO FWAL	British Columbia Water Quality Objectives for Protection of Freshwater Aquatic Life
BCWQO DW	British Columbia Water Quality Objectives for Drinking Water
CN	Cyanide
CNP	Carbonate Neutralization Potential, expressed in kg $CaCO_3$/t
EA	Environmental Assessment
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry
ICP-Ca NP	Neutralization potential calculated from ICP-MS calcium concentrations
kg $CaCO_3$/t	Kilograms calcium carbonate per tonne
MDL	Method Detection Limit
MEND	Mine Environment Neutral Drainage
mg/kg	Milligrams per kilogram
ML/ARD	Metal Leaching/Acid Rock Drainage
MMER	Metal Mining Effluent Regulations
NAG test	Net Acid Generation test
NP	Neutralization Potential, expressed in kg $CaCO_3$/t
NPR	Neutralization Potential Ratio
PAG	Potentially Acid Generating
PEA	Preliminary Economic Assessment
ppm	Parts per million
SED	Sedimentary
SFE	Shake Flask Extraction
SO_2	Sulphur dioxide
TIC	Total Inorganic Carbon
TSF	Tailings storage facility
WAD CN	Weak acid dissociable cyanide
WOL	Whole Ore Leach
XRD	X-ray diffraction

1.0 INTRODUCTION

The proposed Blackwater Project (the Project) is located 110 km southwest of Vanderhoof, British Columbia (**Figure 1-1**). Currently in the development stage, the Project is a prospective open pit gold/silver mine containing approximately 7.5 million ounces (Moz) of gold (measured and indicated resources).

This report presents the geochemical characterization of waste rock, ore, overburden, and tailings for the Project. This report is the foundation of a robust metal leaching/acid rock drainage (ML/ARD) characterization program that will be used both for predictions of future drainage quality and as a guide for waste management planning. This report supports the Project Environmental Assessment.

1.1 Scope of Work

The objective of the geochemical characterization program is to assess the metal leaching and acid generation characteristics of mine wastes that will be produced during the life of the Project and those that will remain on site after closure. Included in the scope of work are a number of specific objectives:

- Develop a geochemical database to address geochemical implications for the site at a level consistent with EA requirements, and Incorporate into an ARD block model;
- Develop a geochemical assessment report for inclusion with the EA document;
- Develop geochemical source terms for use in predictive water quality models; and
- Develop site-specific ARD criteria for mine planning and closure.

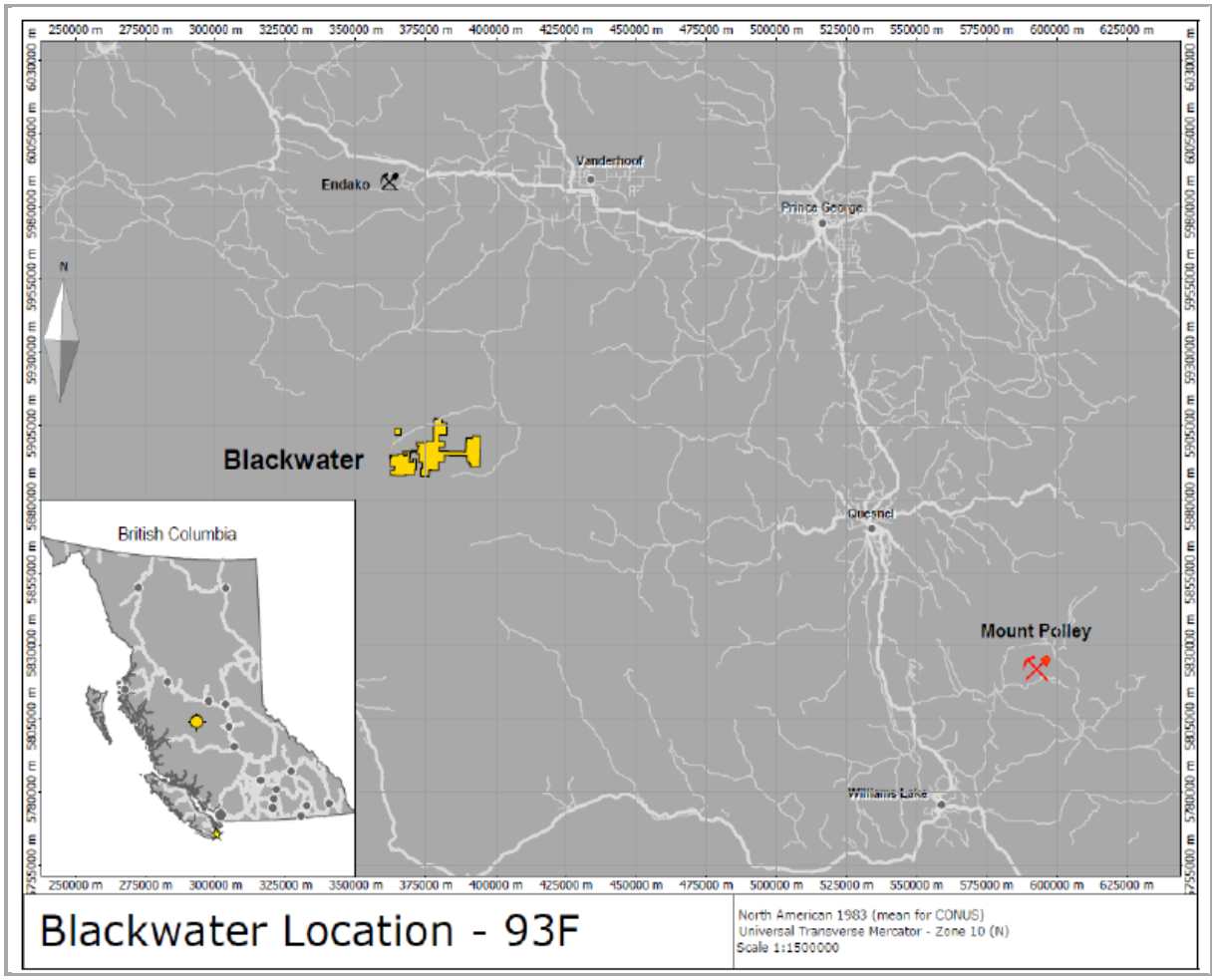


Figure 1-1: Project Location

1.2 Regulatory Context

In British Columbia, metal leaching and acid rock drainage (ML/ARD) assessment is conducted in accordance with both the *Policy for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia* (British Columbia Ministry of Energy and Mines, 1998), and the Mine Environment Neutral Drainage (MEND) document *Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials* (Price, 2009). This latter document is an update of the *Draft Guidelines and recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia* (Price, 1997). Additional best practices guidance came from the *Water and Air Monitoring Guidance Document for Mine Proponents and Operators* (BC Ministry of Environment, 2012) and the Global Acid Rock Drainage guide (GARD Guide, 2009).

From a regulatory standpoint, assessment and management of ML/ARD is conducted on a site-specific basis. However, generic classification of rock as either potentially acid generating (PAG)

or non-potentially acid generating (non-PAG) is done using the measured neutralization potential ratio (NPR) of a sample or rock unit. At a screening level, rock with an NPR less than 2 is generally considered PAG, whereas rock with an NPR greater than 2 is generally considered non-PAG. Rock with an NPR value between one and two is generally categorized as having an uncertain acid generating potential. Ongoing ML/ARD assessment of a project is used to reduce this uncertainty and define a site-specific threshold between PAG and non-PAG materials.

These NPR criteria are also applied to tailings, but it is accepted in the industry that the NPR threshold between PAG and non-PAG tailings is usually less than 2, often in the range of 1.4 to 1.5. However, site-specific studies are required to establish this value.

1.3 Site Overview

1.3.1 Regional and Project Geology

The discussion of the regional and project geology, and alteration and mineralogy are taken from the feasibility study (AMEC 2013).

The Blackwater Project is located on the Nechako Plateau near the geographic centre of British Columbia. The plateau is part of the Intermontane Belt superterrane situated between the Coast Belt to the west and the Omineca Belt to the east. Topographic relief for the plateau is moderate with elevations ranging from 1,000 to 1,800 m above sea level. The Intermontane Belt consists of an assemblage of three accreted tectonostratigraphic terranes: Stikine, Cache Creek, and. The Project area is underlain by rocks of the Stikine terrane, comprising an assemblage of magmatic arc and related sedimentary rocks that span Jurassic to early Tertiary time. These rocks have been exposed within an easterly trending structural high termed the Nechako uplift.

The Nechako uplift is bounded to the north and south by the northeast-striking Natalkuz and Blackwater faults, respectively (Diakow and Levson, 1997; Diakow et al., 1997). The latest extensional displacement along these faults juxtaposes older Mesozoic and Tertiary rocks in the central part of the uplift against younger Cretaceous and Tertiary volcanic rocks to the north and south (Diakow and Webster,1994; Diakow and Levson, 1997; Friedman et al., 2001). Though the Natalkuz and Blackwater faults are poorly defined due to scarce bedrock exposures, a feature characteristic of the Nechako Plateau in general, strong linear trends marking the traces of these structures are evident in the available gravity and airborne magnetics data for the region. The eastern and western limits of the uplift are not clearly defined by current geologic mapping coverage. The northwesterly trending Chedakuz fault and adjacent Nechako range transect the uplift and mark the eastern limit of the Project area. To the west the Nechako uplift extends into a provincial park well beyond the area currently being explored by New Gold.

Quaternary glacial overburden, colluvial, and fluvial deposits mask approximately 95% of the bedrock within the Project area. Outcrop is sparse and limited to peaks and ridges and stream gullies draining off the flanks of Mt. Davidson. Property geology is therefore based largely on observations from geologic field mapping and exploration drilling conducted between 2009 and 2013. **Figure 1-2** is a sketch map of the top-of-bedrock geology for the Blackwater Project

development area. The red dashed line shown in **Figure 1-2** delineates the outer limits of the pyrite probability shell generated for the mineral resource estimate.

The Project site is underlain by a sequence of volcanic units consisting of heterolithic breccias, rhyolitic tuff, and andesite. The local volcanic section is further subdivided as follows: a lower sequence of andesite, felsic volcaniclastic rock, heterolithic breccias, and tuff, which host the Blackwater deposit, and an upper sequence of post-mineral Eocene age felsic volcanic and fragmental rocks and mafic to intermediate flows belonging to the Ootsa Lake Group. The felsic volcaniclastic rocks and tuff of the lower sequence are late Cretaceous in age based on U-Pb geochronologic dating of zircons which yielded ages ranging from 72.4 + 1.0 Ma and 74.1 + 2.2 Ma (Mortensen, 2011). The adjacent andesites have been interpreted to conformably underlie the felsic volcaniclastic rocks and thus belong to the late Cretaceous Kasalka Group. Additional work is required to fully constrain the age of the andesite in the lower volcanic sequence.

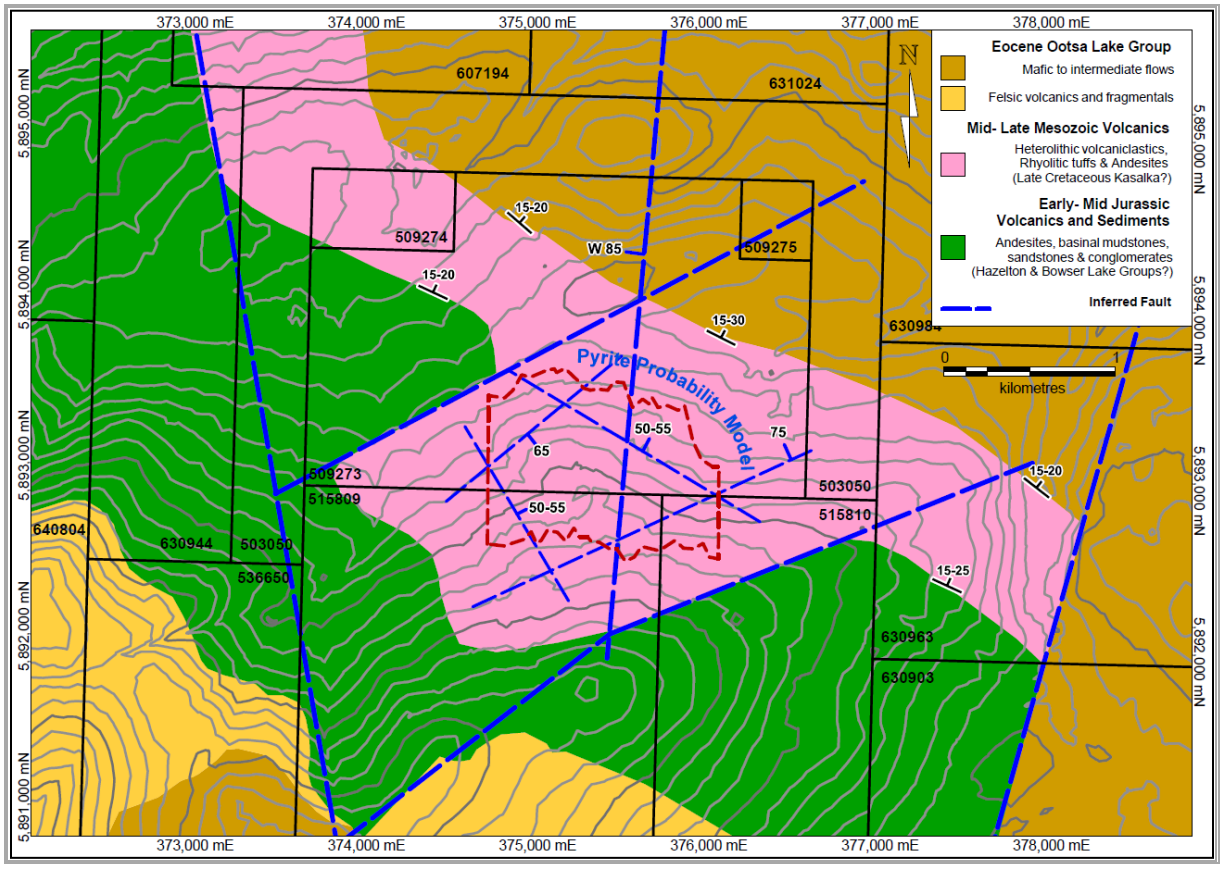


Figure 1-2: Top of Bedrock Geology in Vicinity of Blackwater Deposit

Note: Red dashed line delineates outer limits of mineral resource discussed in **Section 1.3.2**.
Source:Figure courtesy New Gold, 2013

Together the lower and upper volcanic sequences comprise a gently northeasterly dipping section underlain by basinal mudstones, fine sandstones, and conglomerates interpreted as

belonging to the late Jurassic Bowser Lake Group. These units are cross-cut by well-developed systems of northeast-, northwest-, and northerly-striking faults that define a polygonal structural fracture pattern at all scales.

Host rocks within the Blackwater deposit area are pervasively hydrofractured, pyritized, and altered to a mixture of silica and sericite. Locally the amount of silica introduced through hydrofracturing and silicification may affect 25% or more of the total volume of altered host rocks. At the deposit scale, brittle-style tectonic deformation affects all rock units. Interpretation and correlation of clearly recognizable faults are made difficult by the intense hydrofracturing and multiple fault sets. Instead, extensive zones of broken rocks cross-cut the mineralized zone and grade laterally into unbroken rock with no obvious bounding fault surfaces.

Within the Blackwater deposit and surrounding area, the Kasalka volcanics commonly contain dark reddish-brown garnet crystal fragments up to a centimetre in diameter as an accessory in the heterolithic breccias, locally making up 1% to 2% of the rock. XRF data on the garnets indicate they are Mn-rich spessartine.

Outcrops of massive felsic lapilli tuff assigned to the Ootsa Lake Group are found along the uppermost elevations of Mt. Davidson to the south of the deposit. The Ootsa rocks comprise felsic and andesitic units that are distinguished from those hosting the Blackwater deposit by their darker gray colour, larger lithic clasts, plagioclase phyric content and the presence of fresh, black, stubby euhedral doubly-terminated quartz crystals up to 1 mm across, which commonly make up a few percent of the rock.

The lithological codes used in the Blackwater drill hole database have been defined according to observed descriptive criteria only. The codes do not include assignment of individual rock units to formally defined regional stratigraphic units. The lithologic codes used in the Blackwater exploration geology and geochemistry database are presented in **Table 1-1**.

Table 1-1: Lithologic Codes for Blackwater Project

New Code	Code	Description
OB	OB	Overburden
AND	AND	Andesite
FT	FT	Felsic tuff (laminated volcanics)
Fragmentals	FLPT	Felsic lapilli tuff
	VC	Volcaniclastic
	EC	Epiclastic
SED	SED	Argillite/Sandstone/Conglomerate

More recently New Gold's geologists combined the FLPT, VC and EC types into a "fragmentals" geological unit thus yielding five types: overburden, andesite, laminated volcanics (FT), fragmentals and sediments

Glacial overburden and colluvial and fluvial deposits obscure bedrock on the Blackwater property except on the peak and ridges of Mt. Davidson. A typical cross-section illustrating the geology and mineralization at the Project site is provided in **Figure 1-3**.

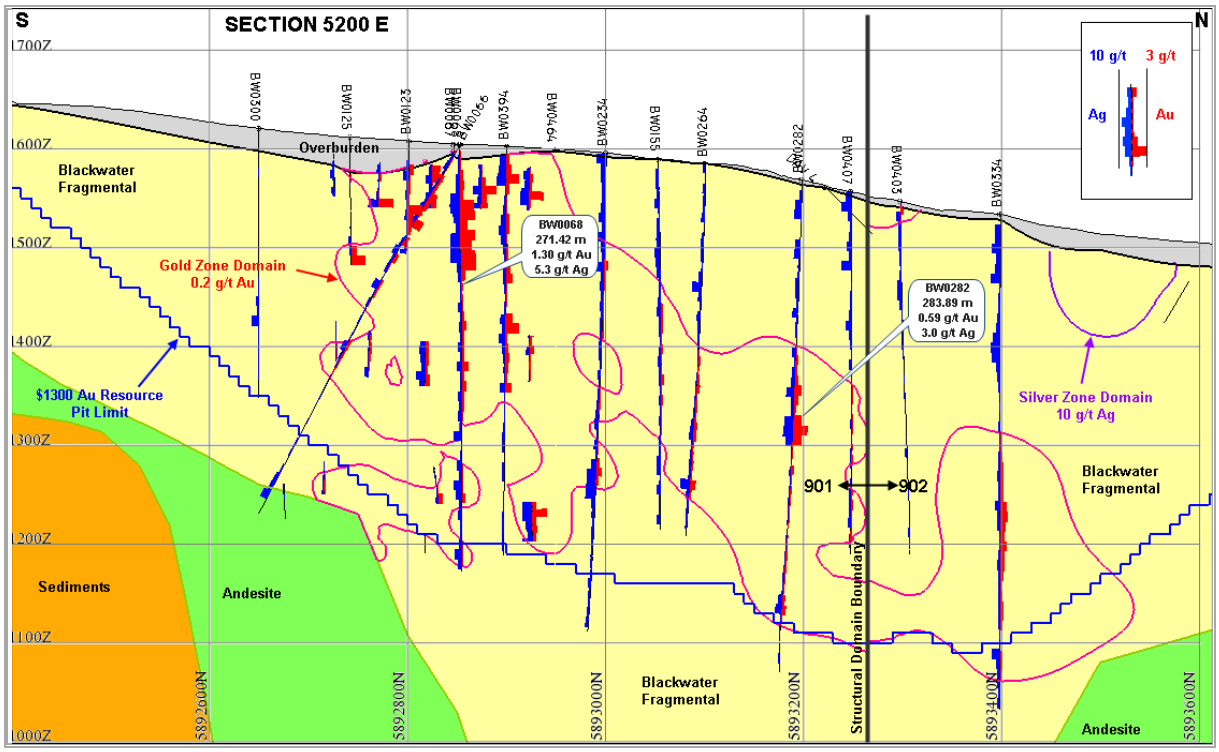


Figure 1-3: Profile of Blackwater Deposit and Host Rock (Cross-Section 5200E)

1.3.2 Alteration and Mineralization

The Blackwater deposit has characteristics of an intermediate sulphidation epithermal gold-silver deposit. Core drilling has defined a zone of continuous Au mineralization that extends at least 1,300 m along its longest dimension east-west and at least 950 m north-south. The vertical thickness of the zone ranges up to 600 m, remaining open at depth in a few locations.

In general, all rocks at Blackwater are mineralized, with trace pyrite-pyrrhotite-sphalerite in outboard andesite flows and volcaniclastics, or as gold-bearing polymetallic sulphide mineralization within the fragmental felsic unit of the deposit. The only exceptions are Eocene (?) dacite porphyry dykes intersected along the southern and northwestern part of the drilling grid, and amygdaloid mafic intermediate flows in the northern part of the grid, possibly related with the Eocene Ootsa Group.

Mineralized rocks within the main Blackwater resource area can be broadly divided into a thick succession of felsic to intermediate pyroclastic and volcaniclastic rocks, volcanic flows and breccias, and related volcanic and lithic-derived sedimentary units (fine to coarse epiclastic rocks). Whole-rock analysis indicates that these units range from rhyolite to dacite to andesite in

composition. Detailed age relationships between the mineralized host rocks at Blackwater are not entirely understood, but the vertical succession and locally observed progressive inter-bedding of these units suggest the andesite to be oldest, followed by the felsic tuffs and subsequently the felsic volcaniclastic rocks.

Disseminated Au-Ag mineralization is defined by an east-west-trending tabular-conical-shaped deposit with a lateral extent of up to 1,300 m east-west x 950 m north-south. Mineralization remains open at depth in the southwestern part of the deposit as well as to the north and northwest. The centre of the deposit has an average thickness of 350 m and, where open, a vertical extension of up to 600 m. The mineralized zone plunges shallowly to the north and northwest with inferred steep, north-plunging higher-grade mineralized shoots, measuring tens of metres thick, likely influenced by near-vertical structural intersections.

Gold-silver mineralization is associated with a variable assemblage of pyrite-sphalerite-marcasite-pyrrhotite ± chalcopyrite ± galena ± arsenopyrite (± stibnite ± tetrahedrite ± bismuthite).

Sulphide mineralization at Blackwater can be divided into the following types:

- Disseminated – as pinhead to coarse blebby sulphide grains and aggregates typically ranging from 1% to 5% total volume of the rock, but locally exceeding this volume. Disseminations may be uniform or irregular, with sulphides displaying an anhedral to euhedral crystal form. Disseminations of a dark-grey, very fine grained sulphide material called “dendritic-black-sulphide” (DBS) is common at Blackwater and may form as fine disseminations to coarse clusters, as thicker coatings to fractures, or as an irregular network of “dendritic” micro-cracks within the rock mass.
- Porosity infill – sulphides that fill, rim, or replace devitrified pyroclasts, tephra, and juvenile pumiceous material. Sulphides also commonly form parallel to compositional layering and laminations within felsic pyroclastic flows and laminated tuff units. Mineralized amygdules and altered feldspars are also observed in the andesite flow units.
- Vein – polymetallic, anhedral to euhedral sulphide assemblages in sub-millimetre to centimetre-scale polymetallic veinlets-veins of quartz-sericite-chlorite-clay (illite) ± (iron) carbonate ± tourmaline ± vivianite.
- Hydrothermal brecciation and related silicification – centimetre- to metre-scale zones of hydrothermal brecciation, alteration, and elevated sulphide content. These breccia zones are typically healed with silica-sericite-sulphide cement and cut by a micro-stockwork of vitric quartz ± sulphide veinlets.
- Structure-related – sulphides crushed to comminuted in brittle fault breccia and gouge.

Hydrothermal alteration (and possibly contact metamorphism) has produced several superimposed alteration assemblages, including pervasive silica-sericite-clay (illite) ± biotite alteration and veinlet / fracture-controlled silica-sericite-chlorite-clay ± iron carbonate ± tourmaline. An early (?) biotite-silica-albite ± chlorite/actinolite hornfelsing event may have been

significant, although mineralization in these rocks appears to be lower than in units without evident hornfelsing. Visible native gold has been noted in some drill holes.

Secondary quartz occurs in several modes:

- pervasive, amorphous to translucent silicification with associated illite ± sericite. Commonly holes display intense silicification of felsic units, epiclastics, and more intermediate volcaniclastic rocks with biotite alteration of the matrix (hornfels).
- cryptocrystalline silica replacements in felsic ash-tuff layering
- silica cement/matrix to local hydrothermal brecciation
- sub-millimetre vitric quartz veinlets in zones of intense silicification; commonly as a micro-stockwork.

Given the lack of outcrop, geological interpretation has been based primarily on drill information plotted on section and plan views.

The current Blackwater geological model is based on three principal components: lithology and structure, alteration, and mineralization. The lithologic and structural component includes andesite, volcanic fragmentals, and laminated volcanics. Gold and silver mineralization is hosted predominantly within a central core of felsic tuffs and volcaniclastic breccias that are enveloped by a sequence of massive and more-cohesive andesitic flows and tuffs. The deposit is roughly rhombohedral in plan, bounded by near-vertical northwest- and northeast-trending faults. The fragmental package is funnel-shaped and elongated WNW-ESE and open to the southwest at depth. The alteration component indicates the presence of two centres of texture-destructive sericitic alteration cored by an ammonium-bearing overprint and haloed by early potassic alteration and hornfelsed andesite. The mineralization component has been built through a combined “Pyrite + DBS” simulation, which identified the pyritic mineralization domain and independently confirmed the presence of key faults seen in the lithologic and structural model.

Calcite is a characteristic feature of the generally unmineralized andesite found along the edges of the deposit. The location of andesite and other major rock units is shown as surface and ultimate pit walls plan views in **Figure 1-4** and **Figure 1-5**.

Three oxidation facies resulting from post-glacial weathering are recognized at the deposit. The oxide facies generally occurs at or near surface, and represents the most intensive weathering. The deeper sulphide facies is generally unweathered, preserves the sulphide mineralization, and is found at greater depths than the oxide facies. The intermediate transition facies has characteristics of both the sulphide and oxide facies.

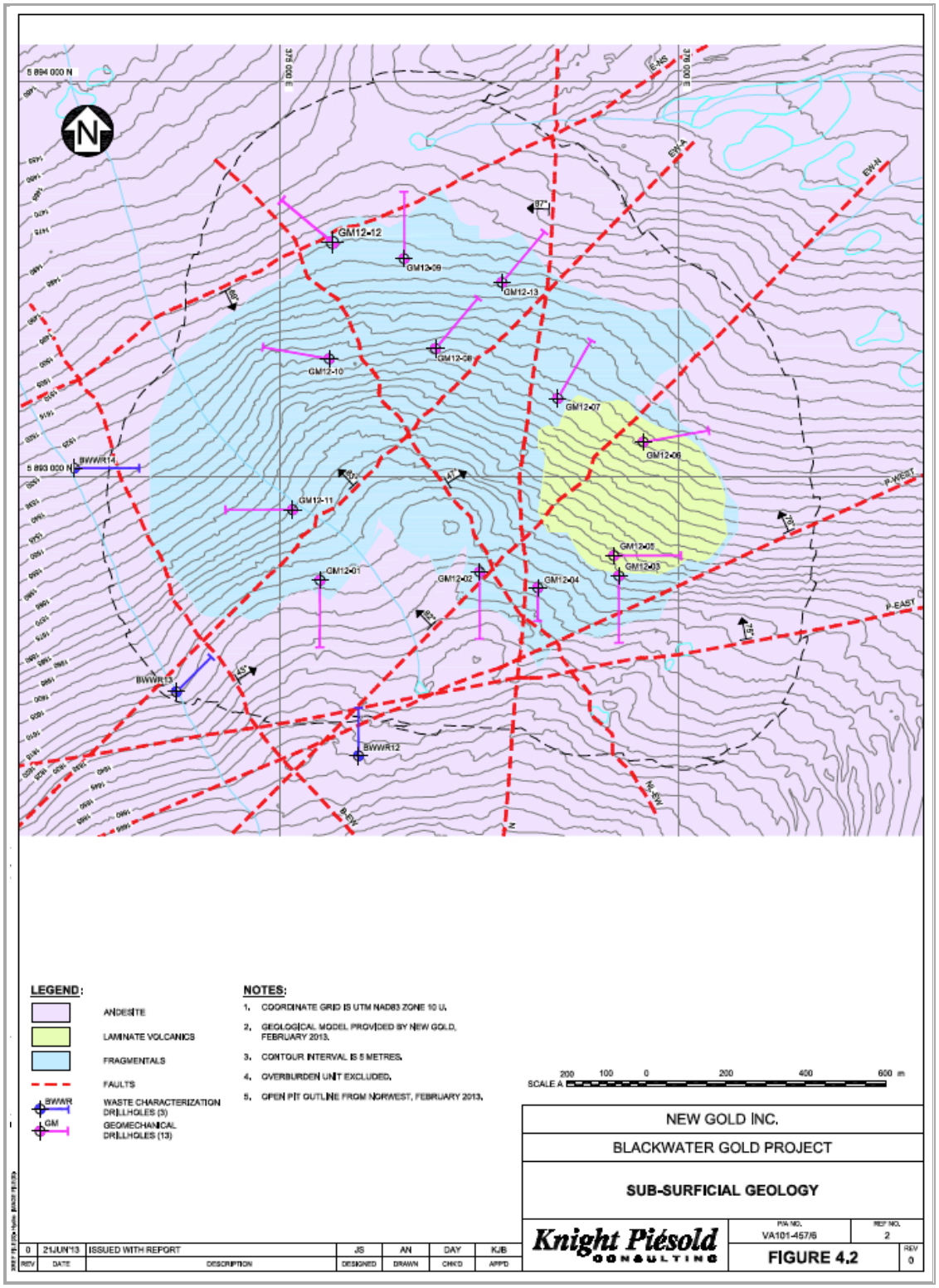


Figure 1-4 Plan Map of Bedrock Geology of the Open Pit

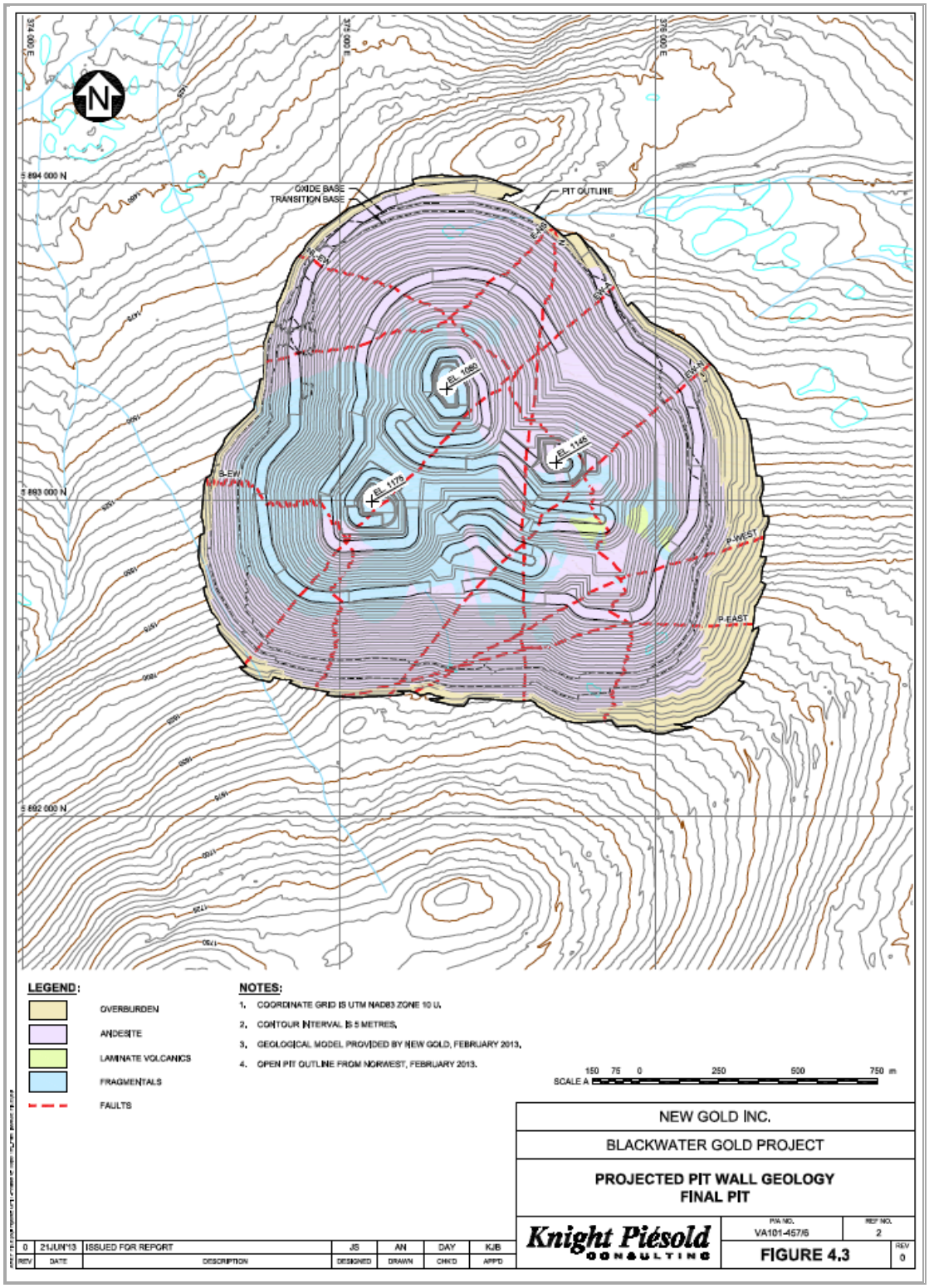


Figure 1-5 Bedrock Geology Map of the Ultimate Open Pit Walls

1.3.3 Geological Features Relevant to ML/ARD Characterization

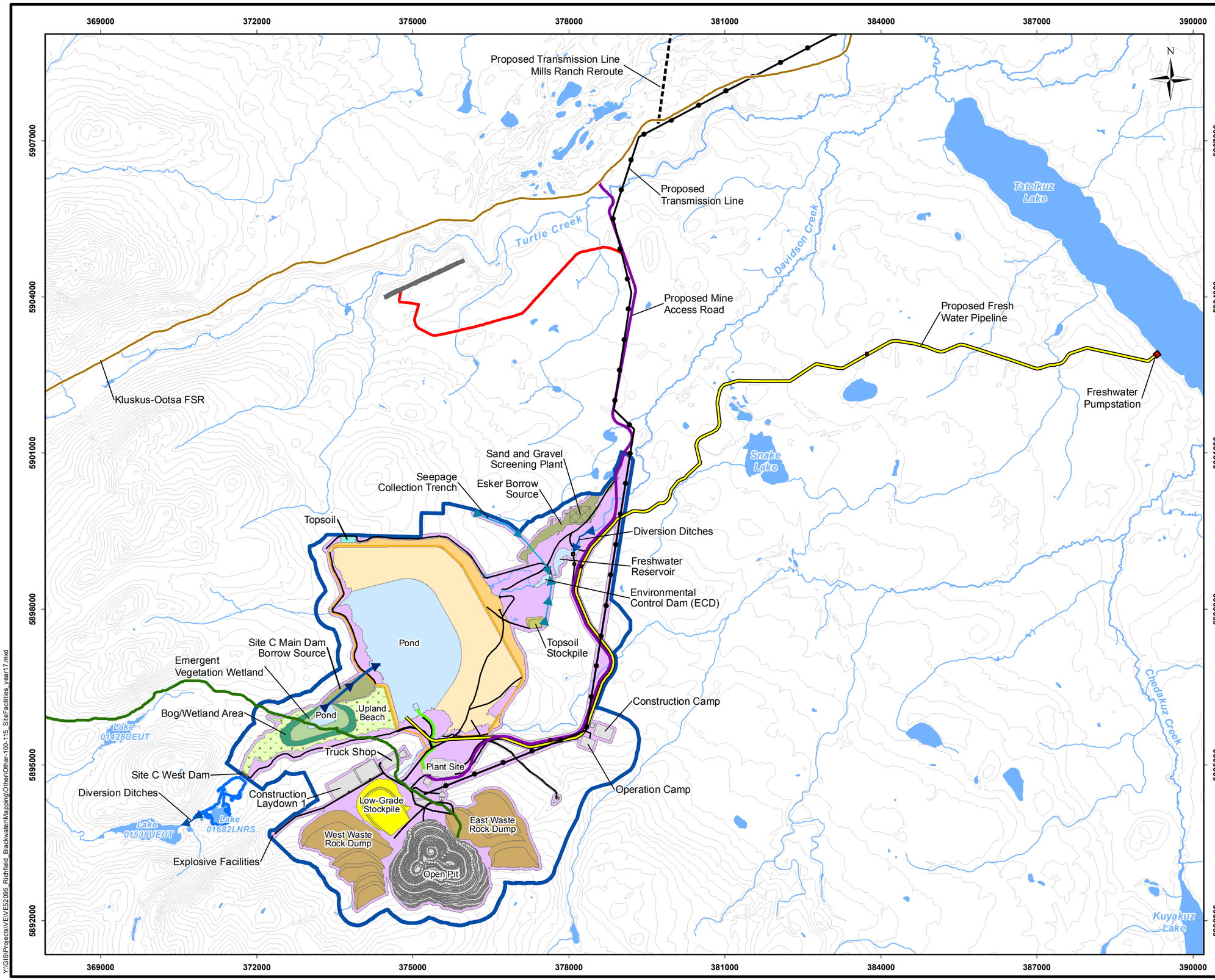
The following features of the geology are relevant to the ML/ARD characterization:

- The main rock types are felsic to intermediate volcanic and volcaniclastic rocks;
- The deposit host rocks have been intensely hydrofractured and silicified. This intensive silicification has generally overprinted lithological units;
- Pyrite, pyrrhotite, and sphalerite are the most common metal sulphide minerals.
- Calcite is a diagnostic feature of unmineralized andesite peripheral to the deposit.

1.3.4 Site Description

Figure 1-6 shows the site layout at the end of mining operations. **Figure 1-7** shows the site at closure. The main components of the project are:

- The tailings storage facility (TSF), with tailings and waste rock storage;
- The on-land non-PAG waste rock and overburden dumps;
- The low grade ore stockpile
- The temporary ore stockpile; and,
- The open pit.



Reference
BC Government GeoBC Data Distribution

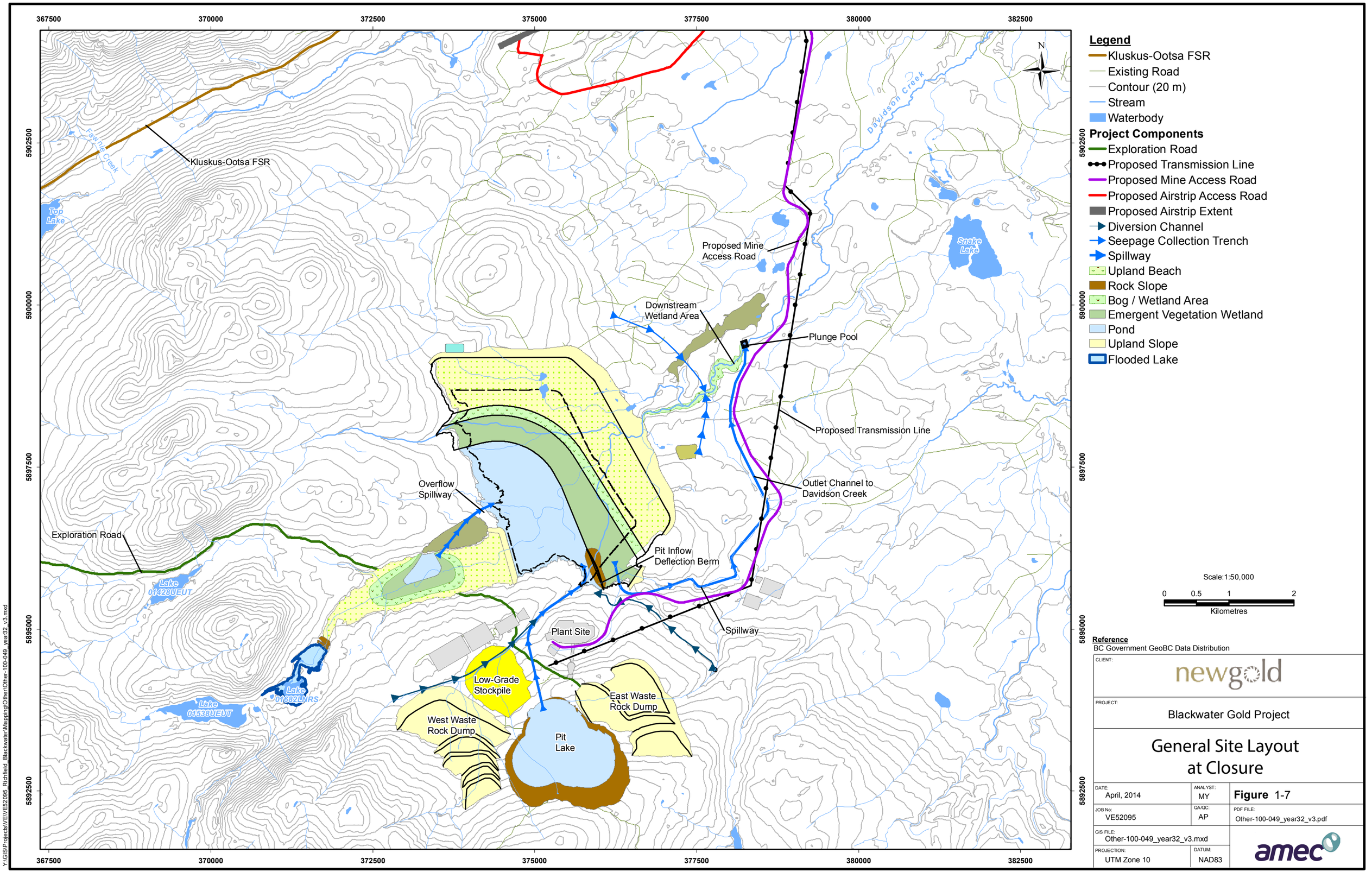
CLIENT: newgold

PROJECT: Blackwater Gold Project

General Site Layout at End of Operations

DATE: April, 2014	ANALYST: MY	**Figure** 1-6
JOB No: VE52095	QA/QC: AP	PDF FILE: Other-100-115_SiteFacilities_year17_minsite.pdf
GIS FILE: Other-100-115_SiteFacilities_year17.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\Other\Other-100-115_SiteFacilities_year17.mxd



Reference
BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

General Site Layout at Closure

DATE: April, 2014	ANALYST: MY	**Figure** 1-7
JOB No: VE52095	QA/QC: AP	PDF FILE: Other-100-049_year32_v3.pdf
GIS FILE: Other-100-049_year32_v3.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	amec

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\Other\Other-100-049_year32_v3.mxd

The deposit will be mined using open pit mining methods over a 17-year mine life. Based on the feasibility study mine plan (Norwest, 2013a), open pit mining is expected to produce the following mine waste materials:

- 344 Mt of ore (including 50 Mt of low grade ore);
- 598 Mt of waste rock; and
- 92 Mt of overburden.

The mill throughput will be nominally 60,000 tonnes per day (t/d), or 21.9 million tonnes per year (Mt/yr). The ore will be processed using a cyanide whole ore leach (WOL) process. Tailings from the leaching circuit will be thickened with a portion of the cyanide containing solution recirculated in the mill. The tailings solution and solids will be treated in an SO_2 / air cyanide destruction circuit prior to disposal in the TSF.

The open pit will have a footprint of approximately 238 ha. It will be approximately 2 km wide from east to west, and approximately 1.5 km north to south. The final depth will be approximately 550 m deep from surface.

The waste rock will be segregated and managed based on ML/ARD characteristics. Current management plans segregate the waste rock into five categories based on NPR and zinc concentrations:

- PAG 1: Waste rock with an NPR <1;
- PAG 2: Waste rock with NPR values between 1 and 2;
- NAG 3: Waste rock with NPR values greater than 2 and zinc concentrations greater than or equal to1,000 mg/kg;
- NAG 4: Waste rock with NPR values greater than 2 and zinc concentrations between 600 to 1,000 mg/kg; and
- NAG 5: Waste rock with NPR values greater than 2 and zinc concentrations less than 600 mg/kg.

The PAG 1 and PAG 2 PAG and the NAG 3 metal leaching NAG waste rock will be permanently submerged in the TSF. The NAG 4 and NAG 5 non-PAG, non-metal leaching waste rock will be placed in an on land stockpile with overburden. NAG 4 and NAG 5 will also be used for site construction.

A stockpile of low-grade ore will accumulate mostly during the first five years of mining and will be processed during the final three years of operations.

The TSF will have a footprint of approximately 1117 ha, and will hold 344 Mt of tailings and 366 Mt of PAG and metal leaching (79 Mt) waste rock. The main dam (TSF Dam D) height will be approximately 150 m high.

At the end of mining, the site will be reclaimed. The NAG 4/overburden stockpile (the West dumps) will be progressively reclaimed during operations with the placement of an overburden cover to reduce infiltration. Much of the overburden in the East dump will be rehandled and used for reclamation at the end of mining. The open pit will be flooded with water from the TSF, groundwater inflow, direct precipitation and runoff from the catchment area. Once the pit is flooded, approximately 18 years after the end of operations, pit lake water will flow to the TSF. The smaller TSF C cell, which will hold some waste rock and the first 3 years of tailings, will be reclaimed during mining operations. The final tailings lift will be oxide ore tailings with a final overburden cover on the exposed beach, with a contingency for a full overburden cover. Oxide ore tailings derived from the low grade stockpile will be placed on the TSF D cell beach with additional overburden cover to ensure the sulphide tailings are kept submerged. Oxidized transition ore tailings from the low grade stockpile might also be used in the TSF D cell beach cover if test work shows no ARD and minimal ML potential of the tailings. All waste rock and sulphide ore tailings in the TSF will be completely and permanently submerged beneath a water cover.

2.0 METHODS

2.1 Geochemical Sampling Program

Geochemical sampling for ABA and related parameters was conducted from 2011 through 2013 using exploration and geotechnical drill core to obtain overburden, waste rock, and ore samples. A dedicated 14-hole drilling program was completed in 2012 to obtain additional waste rock samples peripheral to the south and west walls of the open pit.

In addition, one metre core from most of the geological exploration program holes were sampled and analyzed (after aqua regia digestion) for metals by ICP-MS. A summary of the geological metal database within the ultimate pit shell is presented in **Table 2-1**.

Table 2-1: Geological Exploration Program Metals Database

Drill Hole Series	Year	Company	Holes Drilled	Total Metres	Intervals Analyzed	Metres Assayed
BW0042 to BW0059*	2009	RVC	18	3,621.23	3,408	3,413.62
BW0060 to BW 0116	2010	RVC	56	20,920.17	19,864	20,048.28
BW0117 to BW0175	2011	RVC	59	19,727.37	18,243	18,840.15
	Subtotal	**RVC**	**133**	**44,268.77**	**41,515**	**42,302.05**
BW0176 to BW0295,297, 298	2011	New Gold	125	49,315.78	45,577	46,230.03
BWMET01 to BWMET04	2011	New Gold	4	1,435.91	1,347	1,364.73
BW0299 to BW1013, 296	2012	New Gold	716	207,333.15	192,848	195,943.88
GM12-01 to 05 and 08	2012	New Gold	6	2,200.50	2,024	2,077.84
BWWR-01 to 14	2012	New Gold	14	2,952.50	1,120	2,697.45
Pilot Holes	2012	New Gold	2	470.36	390	406.89
BW1014	2013	New Gold	1	420.00	413	414.00
	Subtotal	**New Gold**	**868**	**264,128.20**	**243,719**	**249,134.82**
		Total	**1001**	**308,396.97**	**285,234**	**291,436.87**

Geological database drill holes covered a wide area of the pit as shown in **Figure 2-1** which plots the drill hole traces, ultimate pit shell and the NAG 5 waste rock blocks from the ARD block model. A thick layer of overburden is present in the south eastern end of the pit (top in figure) and thinner zones are present at higher elevations elsewhere. Overburden that will be mined in these peripheral zones of the pit were not targeted in the geological drilling program. However KP conducted sonic drilling in the thick overburden deposit and samples were tested for ABA and related parameters.

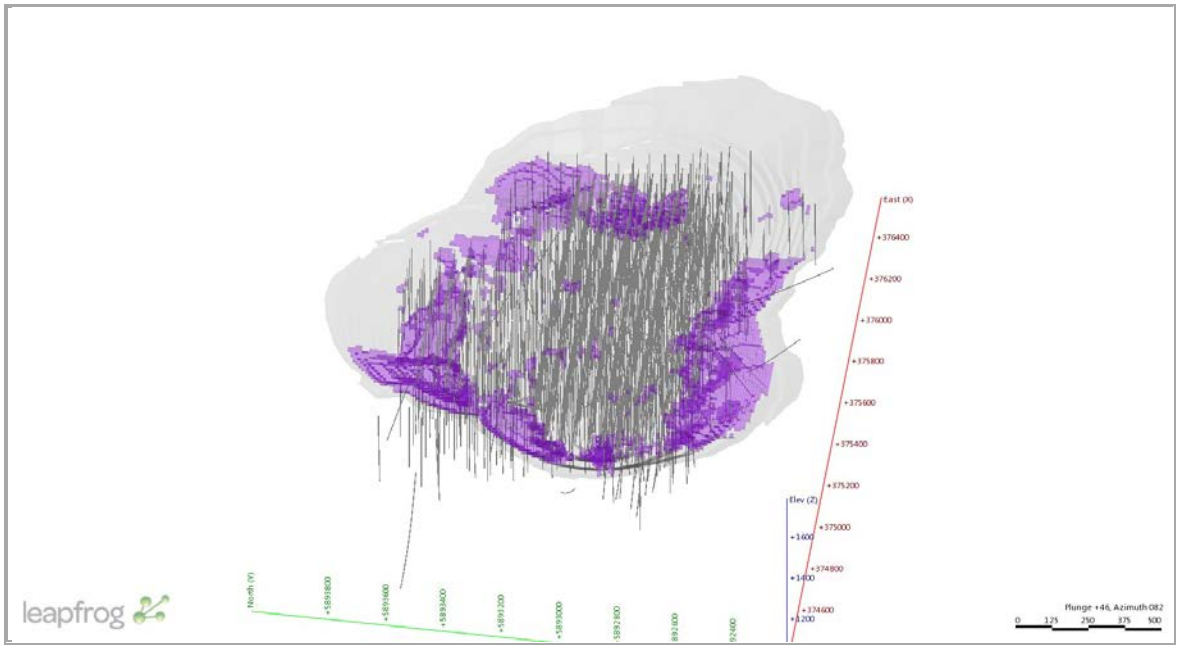


Figure 2-1: Geological Database Drill Holes in the Ultimate Pit and NAG 5 Blocks

Tailings were obtained from the metallurgical testing program. A summary of the ML/ARD characterization program is presented in **Table 2-2**.

Table 2-2: Geochemistry Test Work Summary

Test	Lab	Number of Samples					
		Exploration Samples	Waste Rock	Ore	Tailings	Overburden	
						Open Pit/TSF/ Plant Site	Access Road
Acid Base Accounting	ALS		890	72	12	76	19
Multi-element Chemistry	ALS	285,234	617	72	12	76	19
Mineralogy/Petrography	UBC/ Vancouver Petrographics		25	48	-	2	-
Shake Flask Extraction	ALS		58	8	5	14	-
Net Acid Generation (NAG) Test	ALS		587	36	8	29	-
NAG Leachate	ALS		78	7	5	5	
Kinetic Tests							
Humidity Cells	ALS		19	2	5	-	-
Modified Humidity Cells	ALS		3	1	-	-	-
Saturated Columns	SGS-CEMI		2	-	-	-	-
Kinetic Field Bins	AMEC		6	2	-	-	-
Project Specific Tests							
Oxygen Consumption	EGi		1	-	-	-	-
Acid Buffering Characteristic Curve	EGi		12	-	-	-	-
Sequential NAG	EGi		4	-	-	-	-
Kinetic NAG	EGi		6	-	-	-	-

Test	Lab	Number of Samples					
		Exploration Samples	Waste Rock	Ore	Tailings	Overburden	
						Open Pit/TSF/ Plant Site	Access Road
Humidity Cell pH Neutralization	ALS		5	1	-	-	-
Sequential Extraction	ALS		10	-	-	-	-
Adsorption Experiments	Lorax		6				
Scanning Electron and Optical Microscopy	Lorax		5		2		
SO_2 Air/Cyanide Destruction	SGS				23		

Note: UBC = University of British Columbia

2.1.1 Overburden

Overburden samples were collected from drill core and from surface test pit locations in the area of the open pit and the TSF in 2011 and 2012.

Samples from the access road alignment were collected in 2013. Existing access roads from exploration activities were used to intersect the alignment and surface grab samples were collected.

2.1.2 Waste Rock and Ore

More than 890 samples of waste rock, and 72 ore samples were collected and analyzed for ML/ARD parameters. All waste rock and ore samples were 10 m composite samples generated using three different sampling methodologies. In general, ARD samples were chosen from drill core intervals selected based on lithology, oxidation facies, and results of the exploration assays of sulphur, calcium, and zinc concentrations.

The first phase of ARD samples were created by compositing 1 m coarse rejects from exploration assays over a 10 metre drill core length. During this phase, 169 waste rock and 14 ore samples were collected.

ARD samples from the second phase of sampling were composites generated by collecting one 10 to 15 cm-long section of half drill core every metre over a 10 m interval. In total, 73 waste rock, 27 ore, and 20 overburden samples were collected. Twenty-six of these samples were duplicates from Phase 1 collected for comparing compositing methodologies. Also included in the second phase were 12 samples from archived historic drill core (1994).

The third phase of sampling used fine grained assay pulps from exploration drilling to create 10 m composite ARD samples. There were 355 waste rock samples collected in the third phase. Twenty of these samples were duplicates from Phase 1 collected for comparing compositing methodologies.

The final phase of ARD sampling involved the drilling of 14 dedicated drill holes in waste rock along the deposit edges (the drill holes shown in the open pit on **Figure 2-2**). Two hundred and seventy three waste rock samples were collected. These waste rock samples were also 10 m composites generated by compositing ten -1 m coarse rejects.

ALS Minerals (ALS) in Burnaby, BC, completed all compositing, sample preparation, and sub-sampling.

In addition to the ML/ARD characterization samples, there are more than 285,234 aqua regia multi-element analyses of exploration drill core samples.

While the geochemical ABA testing program attempted to sample a broad range of lithologies, grades and locations within the pit, statistics derived from those data may not be representative of the entire ore and waste rock mass. The ARD block model based on the full ABA and the very large geological ICP metal database provides a more representative estimate of ARD potential and metals levels in ore and waste rock in the Blackwater pit and is described later in this report.

370000 372500 375000 377500 380000

5900000 5897500 5895000 5892500

Seepage Collection Trench
Sand and Gravel Screening Plant
Esker Borrow Source
Topsoil
Diversion Ditches
Freshwater Reservoir
Environmental Control Dam (ECD)
Topsoil Stockpile
Pond
Site C Main Dam Borrow Source
Emergent Vegetation Wetland
Upland Beach
Pond
Bog/Wetland Area
Construction Camp
Truck Shop
Construction Laydown 1
Plant Site
Operation Camp
Site C West Dam
Diversion Ditches
Low-Grade Stockpile
West Waste Rock Dump
East Waste Rock Dump
Open Pit
Explosive Facilities
BWWR10
BWWR09
BWWR13
BWWR06
BWWR08
BWWR05
BWWR02
BWWR07
BWWR01
BWWR14
BWWR03
BWWR12
BWWR04
BWWR11
Davidson Creek
Snake Lake
Lake 01682LNRS
Lake 01538UEUT

N

Legend

- Drill Location
- Contour (20 m)
- Stream
- Waterbody

Project Components

- Exploration Road
- Proposed Mine Access Road
- Proposed Transmission Line
- Proposed Fresh Water Pipeline
- Proposed Pumpstation footprint
- Proposed Mine Footprint
- Proposed Mine Site
- Bog / Wetland Area
- Dam
- Dump
- Embankment Fill
- Emergent Vegetation Wetland
- Environmental Control Dam (ECD)
- Borrow Source
- Fresh water Reservoir
- Low-Grade Stockpile
- Open Pit
- Plant Site
- Pond
- Tailings Beach
- Top Soil
- Topsoil Stockpile
- Upland Beach
- Flooded Lake

Scale:1:40,000

0 0.5 1 2

Kilometres

Reference

BC Government GeoBC Data Distribution

CLIENT: newgold

PROJECT: Blackwater Gold Project

Dedicated Waste Rock Drill Holes

DATE:	ANALYST:	**Figure** 2-2
April, 2014	MY	
JOB No: VE52095	QA/QC: AP	PDF FILE: 07-100-006_drill_location1_v2_minsite.pdf
GIS FILE: 07-100-006_drill_location1_v2.mxd		
PROJECTION: UTM Zone 10	DATUM: NAD83	

amec

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\07_hydrogeology\Baseline\07-100-006_drill_location1_v2.mxd

2.1.3 Metallurgical Tailings Program

ML/ARD testing of tailings was conducted using material from the metallurgical testing programs, including:

- four samples of flotation rougher tails, including repeats;
- one sample of flotation cleaner tails;
- eight samples from cyanide leach testing, including repeats; and
- five samples of composite head ore, including repeats.

2.2 Analytical Methods

2.2.1 Static Testing

Static tests used for characterization include optical and X-ray diffraction mineralogy, acid base accounting (ABA), multi-element analysis after aqua regia digestion, shake flask extraction (SFE), and the net acid generation test (NAG test). Static test methods as described in Price (2009) are summarized below.

2.2.1.1 Mineralogy

Mineralogical analysis provides information on the major mineralogical phases in a sample, and on the forms of acid generating and acid neutralizing minerals.

Mineralogical analysis was conducted using optical microscopy and quantitative X-ray diffraction (XRD) with Rietveld refinement. Petrographic thin sections for microscopy were created by mounting thin slices of rock onto glass slides, and grinding the rock down to a thickness of 0.3 millimetres (mm). Optical mineralogy and petrography provides information on mineral grain size, modal abundances and the spatial association of mineral phases. It also provides information on mineral modes of occurrence (i.e., phenocrysts, groundmass, replacement, vein, etc.). One notable limitation of optical mineralogy from an ML/ARD perspective is that it does not identify separate carbonate mineral phases.

Samples for QXRD were crushed to less than 10 µm, mounted onto glass slides, and analyzed using an X-ray diffractometer. QXRD is semi-quantitative, and reports percentages of crystalline mineral phases, but unlike optical mineralogy it does provide information on grain sizes of the relationships between minerals. QXRD can identify and quantify carbonate species. QXRD can also identify minerals with low modal abundances as the method has low detection limits (Raudsepp and Pani, 2001 and 2003).

2.2.1.2 Elemental Content

Elemental analysis is used to quantify the concentration of elements in solid phases and to check if elements occur in concentrations greater than normally found in 'average' earth crust. This helps to identify samples with anomalous geochemical parameters.

The elemental content for the Project was determined by aqua regia digestion (3:1 hydrochloric acid to nitric acid) followed by an ICP-MS scan. The digestion is near total: the majority of minerals are dissolved (including sulphides, carbonates, and oxides), excepting some refractory minerals that are incompletely dissolved. The analysis provides the concentrations of most elements that occur in solid phases, but does not provide an assessment of mineral solubility or metal leaching potential of the sample.

2.2.1.3 Acid Base Accounting

Acid base accounting (ABA) is a method to measure the acid generation and neutralization potential of geologic material. Following the modified Sobek procedure, ABA consists of the following testing techniques and calculations (Price, 2009; Price, 1997).

Paste pH

Paste pH reflects current chemical conditions by measuring the hydrogen ion activity in the supernatant of an equal mixture (solid: solution) of ground / crushed solids and de-ionized water. Paste pH measures the balance between readily-available neutralization potential (NP) and any stored acidity that may be present a sample.

Sulphur Speciation and Acid Potential

The total sulphur concentration in a rock occurs as a combination of sulphide, acid-leachable sulphate, acid-insoluble sulphate, organic sulphur, or elemental sulphur. Metal sulphide minerals include pyrite, pyrrhotite, sphalerite and most economic metal minerals. Acid-leachable sulphate minerals often include gypsum, anhydrite and other Fe, Mg, Ca sulphate minerals such as alunite and jarosite. The most common acid-insoluble sulphate mineral is barite. The most common organic sulphur mineral is coal. Elemental sulphur can be present in metal deposits as an alteration mineral. At most metal mines, sulphide and sulphate are generally the most common sulphur species, while organic and elemental sulphur are generally negligible. Mineralogical testing is used to confirm the sulphur speciation results.

For the Blackwater Project, total sulphur was determined by Leco furnace, and acid-leachable sulphate sulphur was determined by dilute hydrochloric acid digestion and colorimetry. The difference between the total sulphur concentration and the acid-leachable sulphate concentrations is the sulphide sulphur concentration. Mineralogical investigations during exploration did not indicate the presence of organic or acid-insoluble sulphate minerals.

Acid generation results from the oxidation of sulphide minerals. The sulphide concentration of a rock is used to calculate the acid potential (AP). AP is expressed in terms of the amount in kilograms of calcium carbonate required to neutralize the acidity produced, as kg $CaCO_3$/tonne of rock. The AP calculation assumes that all sulphide minerals are present as pyrite. The presence of non-ferrous sulphides, such as sphalerite, may overestimate AP as these minerals do not generate acidity from oxidation as iron sulphide minerals such as pyrite and pyrrhotite.

The maximum potential acidity (MPA) is calculated using the total sulphur concentration. The MPA may result in an overestimation of acid generation potential as it assumes that all sulphur present has the potential to generate acidity (including non-acid generating minerals such as gypsum or sphalerite). MPA was conservatively used in calculations for the Blackwater Project, although both AP and a sphalerite-adjusted AP were also examined.

Neutralization Potential

Neutralization potential (NP) is the measure of the total acid load a rock is capable of neutralizing (MEND 2009). NP is a major determinant of drainage chemistry, which depends on the minerals present and their reactivity. Three mineral groups contribute to NP:

- Carbonate minerals;
- Silicate and aluminosilicates; and,
- Aluminum and iron hydroxides and oxyhdroxides.

Calcite and dolomite are the most common and effective acid neutralizing carbonate minerals. Other carbonate minerals, such as siderite, have no net NP. Silicate and aluminosilicate minerals do provide some acid buffering potential but are generally effective only with low rates of acid generation. The final class, aluminum and iron hydroxides and oxyhydroxides can buffer acid at pH values less than approximately 4.

For the Project, NP was determined by four methods:

- Modified Sobek NP;
- Siderite corrected Sobek NP;
- Carbonate NP (CNP) as determined by total inorganic carbon content; and,
- Carbonate NP (Ca NP) as determined by the solid phase calcium concentration after aqua regia digestion.

The modified Sobek method is a chemical analysis that measures the amount of NP available from carbonate minerals and highly reactive silicate minerals capable of neutralizing acid by reaction with a known normality and volume of acid. This can lead to an overestimation of NP if siderite is present. The siderite corrected NP uses hydrogen peroxide to ensure the total reaction of iron and manganese carbonates. The CNP is calculated from a measurement of total inorganic carbon (TIC). This can lead to an overestimation of the actual NP as the calculation assumes that all carbon in the sample occurs as calcite. The Ca NP is calculated from the solid

phase calcium concentration. The presence of organic carbon (not common at metal deposits) or carbonate minerals other than calcite will cause the CNP to be overestimated. Additionally, other Ca containing minerals can also lead to an overestimation of the Ca NP.

Neutralization Potential Ratio

The ratio of NP to AP is defined as the Neutralization Potential Ratio (NPR). For this project, NPR was conservatively calculated using the modified Sobek NP and MPA. The NPR using AP and sphalerite-adjusted AP were also investigated.

2.2.1.4 Net Acid Generation Test

The Net Acid Generation (NAG) test is a procedure that determines the balance between acid-producing and acid-neutralizing components of a sample. Much like ABA, the results indicate if a sample is PAG or non-PAG (for the rest of this document, the simpler term non-acid generating, NAG, will be used synonymously as non-PAG). The test uses hydrogen peroxide to oxidize sulphide minerals and produce sulphuric acid. The acid formed by sulphide oxidation is neutralized by carbonates or other readily-available sources of NP in the sample. The pH at the end of the peroxide reaction is called the NAG pH. The solution is then titrated with sodium hydroxide. The amount of base required to titrate to the pH 4.5 endpoint is considered to be the free acidity in the samples. Titration to an endpoint pH of 7.0 is considered to indicate the acidity associated with metal hydroxide precipitates.

One limitation of the NAG test is insufficient addition of hydrogen peroxide may result in incomplete oxidation of sulphide minerals, possibly resulting in an underestimation of a sample's acid generation capacity. Single application of hydrogen peroxide is most effective for sulphide concentrations less than about 1% (AMIRA, 2002; Price, 2009; Miller et al., 1997). Results of NAG testing are also used to confirm results from ABA.

For a subset of samples, the leachate generated by the NAG test was retained and analyzed for pH, hardness, sulphate, and total metals. The NAG leachate is not a measure of expected drainage chemistry, but is used to identify elements that may be released at elevated concentrations during sulphide oxidation. NAG test leachate concentrations were compared to values defined by the Metal Mining Effluent Regulations (MMER) and British Columbia Water Quality Objectives for the protection of freshwater aquatic life (BCWQO FWAL) as a screening tool. For the purposes of this screening, concentrations were considered elevated if they were more than ten times higher than the BCWQO FWAL or greater than the MMER value.

2.2.1.5 Shake Flask Extraction

Shake flask extraction (SFE) tests are used to determine the presence of readily soluble elements. The SFE test is conducted using de-ionized water and solids mixed in a 3:1 ratio and then agitated for 24 hours. The resulting leachates are analyzed for pH, sulphate, and dissolved metals. As with the NAG test leachate results, the SFE results are not a measure of expected

drainage chemistry, but are used to indicate which elements may be readily leachable. SFE results were considered elevated when concentrations were greater than allowed under the MMER or ten times the BCWQO FWAL values.

2.2.2 Kinetic Testing

Kinetic tests provide information on the weathering and oxidation rates, including the relative rates of sulphide oxidation, and metal leaching. The tests are used to determine rates of acid generation and acid neutralization under laboratory conditions, including the lag time before net acidic conditions occur. A number of kinetic tests are being conducted for the Project, including humidity cells and leach column tests, and field test cells. The following sections describe kinetic test methods being conducted on the Project mine materials.

2.2.2.1 Humidity Cell Testing

Humidity cell tests are a standardized procedure designed to determine primary mineral reaction rates under accelerated subaerial, aerobic weathering conditions in the laboratory. Humidity cell test results are also used to examine the NP and sulphide depletion times, and the relative kinetic rates of acid generation and acid neutralization. Although humidity cells are not a direct measure of drainage chemistry, the results can be used to generate source terms for predictive drainage chemistry modelling. One of the limitations of humidity cells is that the testing generally does not promote the formation of secondary weathering products that often control drainage chemistry and tend to attenuate metal concentrations.

In humidity cell tests, crushed rock samples are placed in specially designed cells and leached with de-ionized water in a weekly cycle. Dry air is circulated through the cell for 3 days, followed by 3 days of humid air. On the last day of the weekly cycle, the sample is flushed with 500 mL of water. The leachate is collected and analyzed for pH, metals, and anions. Humidity cell testing typically continues for a minimum of 20 weeks or until loadings rates have stabilized for at least 10 weeks.

Humidity cell testing for the waste rock and low grade ore is ongoing at ALS Environmental, using standard humidity cell procedures as outlined in *Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials* (Price, 2009). Metallurgical tailings test samples are being tested at McClelland Labs according to ASTM D 5744-07 (option A), which uses a larger sample volume (up to 2 kg) and a larger leachate volume (1 litre (L)) than those in MEND humidity cell standards.

2.2.2.2 Modified Humidity Cell Tests

The humidity cell procedure was modified for a subset of tests to investigate the effects of extending the exposure time between leaching events as follows:

- 3 leaching events with 2 weeks of air circulation between leaching;
- 3 leaching events with 3 weeks of air circulation between leaching; and,
- 3 leaching events with 5 weeks of air circulation between leaching.

The adjustment to the regular protocol was intended to provide a longer period of time between leaching events allowing for a greater accumulation of oxidation products than in the regular humidity cell routine.

Three waste rock, one low-grade ore, and one metallurgical tailings humidity cell tests were submitted for the modified testing. Upon completion of the modified cycle, the test samples will either be returned to the original humidity cell test protocol or terminated. ALS Environmental and McClelland Laboratories are performing the experiments.

2.2.2.3 Field Test Cells

Field test cells are kinetic tests used to evaluate the metal leaching and acid generation characteristics of a sample under actual site conditions. As with humidity cell testing, the field test cells are equipped with a drainage collection system to allow collection of seepage from the sample. Field test cells are usually considered to be a more realistic method of estimating seepage quality from mine rock than laboratory humidity cells. The Blackwater field tests were designed to hold approximately 2.5 to 3 kg of crushed rock.

There are nine field cells for the Project (Figure 2-3). The waste rock and ore used for tested were crushed to the same passing diameter used in laboratory humidity cells. The pails are open to the environment and receive direct precipitation year round. Leachate from the field tests is measured and collected monthly during non-frozen months. The leachate is analyzed for pH, anions, and dissolved metals at AMEC's Edmonton laboratory.

Figure 2-3: Field Test Cells

2.2.2.4 Sub-aqueous Column Tests

Sub-aqueous column testing is used to evaluate oxidation and metal leaching from waste rock samples in a submerged, low oxygen environment, similar to conditions expected to occur in the tailings storage facility (TSF). The columns were set up to allow for a vertical upward flow of de-oxygenated water (nitrogen gas had been bubbled through the water to strip out oxygen) through the waste rock. This inlet solution was monitored for total carbon and inorganic carbon on a weekly basis, and the pH recorded once a month. Leachate was monitored weekly for pH, electrical conductivity (EC), and dissolved oxygen (DO). General parameters, fluorine, chlorine, and metals by ICP-MS were monitored weekly for the first 20 cycles, and then bi-weekly thereafter. All sample collection was carried out under sub-oxic conditions, and the experiments maintained under very low light to best simulate subaqueous conditions.

Due to limitations at the analytical lab, two different sampling protocols were used during the testing period:

- Collecting approximately 250 mL of leachate on the sampling day with dissolved oxygen measured in-line directly from the column, and

- Continuous circulation of de-oxygenated water pumped from a 5 L container into the column at a controlled flow rate of 1.8 centimetres per day (cm/day). The leachate was collected over a 7-day period before sampling from a sealed collection bottle.

Samples were collected using the first method for weeks 1 to 7 and after week 20, while the second method was used between weeks 8 and 20. At week 21, sample collection reverted to the first method as results from weeks 8-20 indicated elevated dissolved oxygen concentrations.

Two waste rock samples were chosen for the sub-aqueous column testing. SGS-CEMI is conducting the testing.

2.2.3 Project-Specific Testing

Project-specific testing included a variety of testwork intended to answer specific questions related to the geochemical behaviour of waste rock and to guide management practices. EGi, in Sydney, Australia, performed the experimental work for oxygen consumption, acid buffering characteristic curve (ABCC), sequential NAG, and kinetic NAG testing. ALS Environmental performed the pH neutralization experiments and sequential extractions.

2.2.3.1 Oxygen Consumption

The rate of sulphide oxidation in a PAG waste rock sample was calculated using results from the oxygen consumption test. This provides a direct measurement of the oxidation rate, as compared to the humidity cell oxidation rate calculated from sulphate production.

The oxygen consumption rate of a PAG sample was tested using a sulphide oxidation chamber (SOC). The test sample was placed within the sealed SOC, and a fixed volume of air was slowly pumped through the sample in a closed loop. The oxygen concentration within the chamber was monitored at regular time intervals. The rate of decrease in the oxygen concentration was used to calculate the oxidation rate of the material based on the mass, surface area, and particle density of the sample, and the air volume within the chamber. A complete description of the testing apparatus and methods used is given in the EGi report (**Annex 7**).

2.2.3.2 ABCC

The acid buffering characteristic curve (ABCC) is produced by slow titration of a sample with acid, and provides an indication of the relative reactivity of the measured neutralization potential. The shape of the curve is also characteristic of mineral species contributing NP at different pH values. ABCC testing was performed on ten waste rock samples selected using ABA test results. The EGi report includes a complete and detailed description of the testing methods (**Annex 7**).

2.2.3.3 Sequential NAG

One limitation of the NAG test is that samples with greater than 1% sulphide sulphur may not completely oxidize, under reporting the acid generating potential. The sequential NAG test overcomes this limitation through successive additions of peroxide to the sample. Essentially, the test is a series of single addition NAG tests performed on one sample (Price, 2009).

Four waste rock samples were selected for sequential NAG testing based on previous ABA test results. The results were used to assess the applicability of the single addition NAG test. The EGi report includes a complete description of the testing methods (**Annex 7**).

2.2.3.4 Kinetic NAG

Kinetic NAG tests are the same as the single addition NAG tests, except that pH and temperature are monitored continuously throughout the experiment (Price, 2009). The kinetic NAG procedure was used to gain an insight into the reactivity of sulphides and the likely lag time to onset of acidic conditions. Both the single NAG and kinetic NAG tests are attractive operational characterization tools, as they combine sulphide oxidation and acid neutralization into a single test (Price, 2009).

Kinetic NAG tests were performed on six waste rock samples chosen based on ABA test results. EGi included a complete description of the methods in their report (**Annex 7**).

2.2.3.5 pH Neutralization Experiments

A series of experiments were conducted on acidic, metal-rich waste rock humidity cell leachate to evaluate the reduction of dissolved metals in solution by increasing pH. These tests were designed to simulate the reaction of acidic waste rock drainage with higher pH solutions with excess alkalinity produced in the milling process or by specific alkali addition.

The pH neutralization experiments were performed by titrating acidic humidity cell leachate with hydrated lime to reach three different pH endpoints. Each subsample was titrated to pH 8, 9, or 11 and the dissolved metals concentrations were measured. The experiments, performed by ALS Environmental, were intended to quantitatively measure the removal of metals that precipitate from solution at alkaline pH.

2.2.3.6 Sequential Extractions

Ten samples were submitted to ALS for sequential extraction following the Tessier 1979 extraction method (Tessier, et al., 1979). Sequential extraction uses different chemical digestions to determine the portioning of trace metals into different fractions affected by various environmental conditions: exchangeable, bound to carbonates, bound to Fe-Mn oxides, bound to organic matter and residual. The exchangeable fraction includes adsorbed trace metals that were released by changes in water composition that affect sorption-desorption processes. The carbonate fraction

captures the metals susceptible to changes to a pH of 5.0. The Fe-Mn oxide fraction targets metals that are unstable under anoxic condition but also extracts secondary and amorphous sulphide minerals. The organic fraction captures metals that can be released under oxidizing conditions and includes primary sulphide minerals. The final fraction, the residual, contains refractory minerals and the metals associated with this fraction are unlikely to be released.

2.2.3.7 SO_2/Air Cyanide Destruction

The test work completed by SGS used transition and sulphide ore samples. The objectives of the program were to confirm the metallurgical response of these two-ore types to whole ore cyanidation for gold and silver extraction and to examine the response of the materials to cyanide destruction (SGS, 2013). Representative cyanide destruction products were prepared for detailed environmental characterization. An Excerpt of Cyanide Destruction Test Work is provided in **Annex 14**.

The cyanide destruction test work was performed in three phases. An initial set of tests were performed on one transition cyanide leach pulp and one sulphide leach pulp examining the effects of pH and retention time on the destruction of the contained cyanide and the concentration of metals in solution. The main objective of the test work was to generate a cyanide destruction discharge pulp containing less than 1 mg/L CN(wad), while minimizing reagent additions.

The chemical reaction for the oxidation of weak-acid dissociable cyanide (CNwad) using sodium metabisulphite ($Na_2S_2O_2$ as the source of SO_2) and air (source of oxygen) is as follows:

$$2\ CN^- + Na_2S_2O_2 + 2\ O_2 + 2\ OH^- \rightarrow 2CNO^- + Na_2SO_4 + SO_4^{2-} + H_2O$$

This reaction is catalyzed by the presence of copper. The feed usually contains some copper (as copper cyano complexes), and if required, additional copper is added as copper sulphate. Hydrated lime is added to the reactor to provide the OH^- ion for the above reaction.

The base metals that previously complexed with the cyanide are liberated and precipitated as metal hydroxides. Ferrocyanide is not destroyed in the process and is instead precipitated with other base metals as mixed metal ferrocyanide solids. Thiocyanate, if present, is partially oxidized to cyanate and sulphate. The cyanate ion is unstable and slowly hydrolyzes to ammonium and carbonate ions. The rate of hydrolosis of the cyanate ion increases with decreasing pH. The carbonate ion precipitates as calcium carbonate. A small amount of the ammonium ions is found to form ammonia (NH_3) and eventually escapes from the solution as ammonia gas.

The standard procedure for cyanide destructions (CND) using SO_2/air starts with a batch test. The reactor is first filled with the feed solution or pulp. The required amount of copper sulphate is added. The reactor content is then treated in batch mode with $Na_2S_2O_5$ and air to reduce the concentration of CN_{WAD} in solution to approximately 1 mg/L. The oxidation reduction potential of the pulp is monitored with a Pt/Ag/AgCl combination electrode, whilst the residual CN_{WAD}

concentration in the solution phase is monitored during the test using the picric acid method. The objective of the batch test is to produce treated product with low residual cyanide for use as start material for the first continuous test. In subsequent tests, the treated produce in the reactor from the previous test is taken for anlaysis of CN_T, Cu, and Fe. Samples from selected tests are usually submitted for CN_T, CN_{WAD}, SCN, ICP scan and other species of interest.

For cyanide destruction testwork using SO_2/air method the objective was to generate product containing <1 mg/L residual CN_{WAD}. An initial set of test parameters were specified by New Gold, examining the effect of retention time, operating pH and SO_2 stoichiometry.

The pulps and solutions were submitted to SGS Environmental Laboratory for environmental characterization including: modified ABA and SFE, and analysis of the cyanide destruction solutions. Additionally, ageing tests were conducted on the supernatant. Samples of the supernatant were collected any analyzed after 1, 7, 14 and 30 days. The age tests are ongoing.

2.2.3.8 Adsorption Experiments

A series of laboratory based experiments were performed by Lorax Environmental to examine the potential attenuation of metal concentrations in TSF seepage in the subsurface environment. The objectives were to quantify the relative sorption potential for metals with respect to three substrate types (weathered bedrock, sand & gravel, and till) and to assess the implications of the results with regards to the potential for metal attenuation along seepage pathways. **Annex 15** contains the full report and experimental details.

The <0.15 mm (100 mesh) fraction of the three materials was collected since this fraction contains the majority of a sample's surface area and will largely govern sorption potential. The experiment used leachate collected over several weeks from two humidity cell tests. The leachate had circum-neutral pH and elevated concentrations of zinc and cadmium. The solids were added to the leachate and agitated for 24 hours on a shaker table. After 24 hours, the bottles were centrifuged and a filtered supernatant sample was collected. The supernatant was preserved and sent to ALS Environmental Laboratories for dissolved metals analysis.

3.0 RESULTS AND CONCLUSIONS

3.1 Overburden

Ninety-five overburden samples were collected at the Blackwater property for ML/ARD assessment. Fifty-seven samples from the open pit, plant site, and TSF areas were collected from exploration drill core and shallow test pits. An additional nineteen samples from the overburden-bedrock interface were collected from the open pit area to determine if there was incorporation of sulphide bearing mineralized rock into the overburden. A final 19 samples of surficial overburden material were collected along the proposed access road alignment.

3.1.1 Mineralogy

Two overburden samples from the open pit area were submitted for Rietveld-XRD mineralogical analysis. Quartz, feldspar, and plagioclase were identified as the dominant minerals (**Table 3-1**). Sulphide minerals were not detected in either overburden sample. Dolomite was the only carbonate mineral identified, and was only detected in one sample (modal abundance of 0.8%).

Complete results are given in **Annex 1**.

Table 3-1: Results of XRD-Rietveld Quantitative Phase Analysis – Overburden

	BW-ARD-310 OVB (wt %)	**BW-ARD-315 OVB (wt %)**
Quartz	35.7	37.3
Muscovite	9.5	11.0
Biotite	-	2.5
Clinochlore	4.1	2.5
K-feldspar	16.7	17.1
Plagioclase	26.5	29.1
Hematite	0.6	0.5
Actinolite	6.3	-
Dolomite	0.8	-
Total	100	100

3.1.2 Elemental Content

Aqua regia ICP-MS results for all of the overburden samples are summarized in **Table 3-2**. The results were compared to average crustal concentrations, and were considered elevated if they were greater than ten times the crustal average (Price, 1997). Complete results are given in **Annex 2**.

Elevated cadmium concentrations were reported in 33 of 95 samples (35%), and nineteen samples had elevated zinc concentrations (20%). Antimony, lead, selenium, and bismuth were

also present in elevated concentrations in some samples. In general, metal concentrations were greater in samples at the overburden/oxide interface than in other samples.

Figure 3-1 and **Figure 3-2** plot Cd and Zn versus sample depth for overburden collected from the mine site (excludes access road samples) and samples collected specifically from the overburden/bedrock interface. Overburden samples collected between 80 and 100 m are also generally near the bedrock interface. In general, the zinc and cadmium concentration of the overburden-bedrock interface samples and samples collected from more than 80 m depth are greater than overburden samples collected from more shallow depth. The majority of samples from less than 80 m depth contained less than 1.5 ppm Cd and 700 ppm Zn (e.g., less than ten times the average crustal abundance). Conversely, not all samples near the overburden-bedrock interface contained greater than ten times the average crustal abundance. Forty-seven percent of overburden/bedrock interface samples had zinc concentrations, and 16% had cadmium concentrations less than 10 times average crustal abundance. Elevated concentrations are a measure of the solid phase chemistry and not a direct measure of leachable metals.

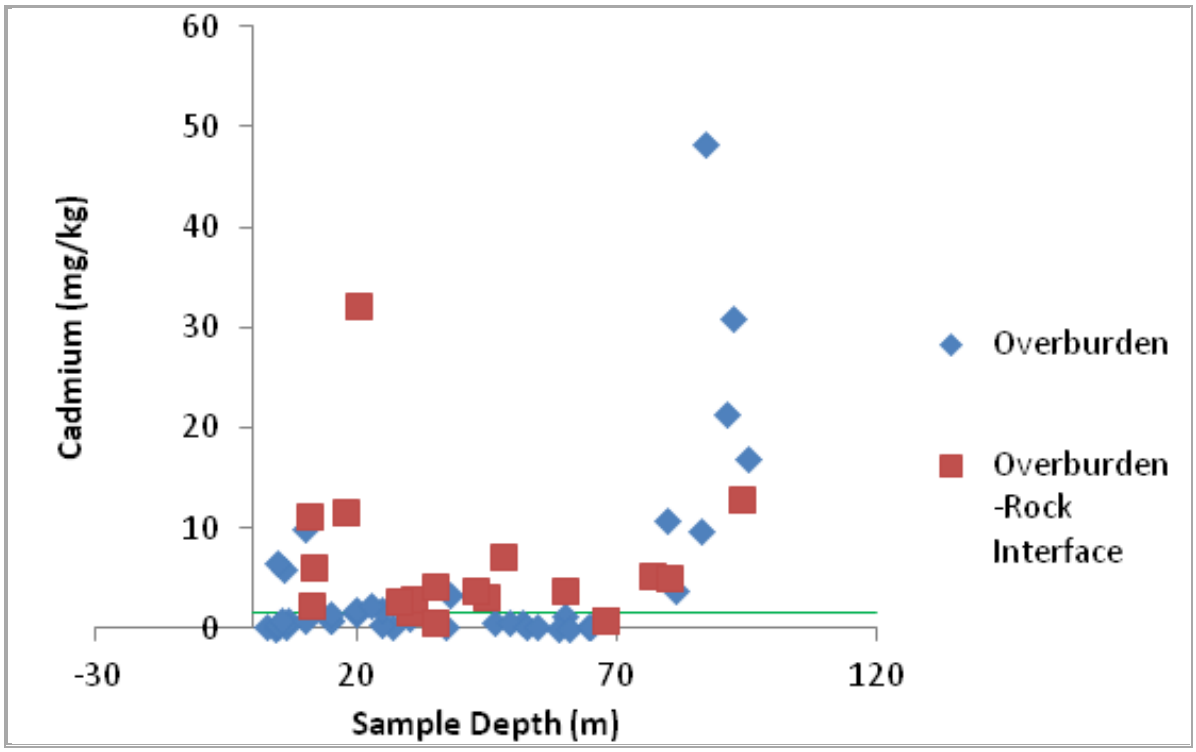


Figure 3-1: Cadmium in Overburden versus Depth

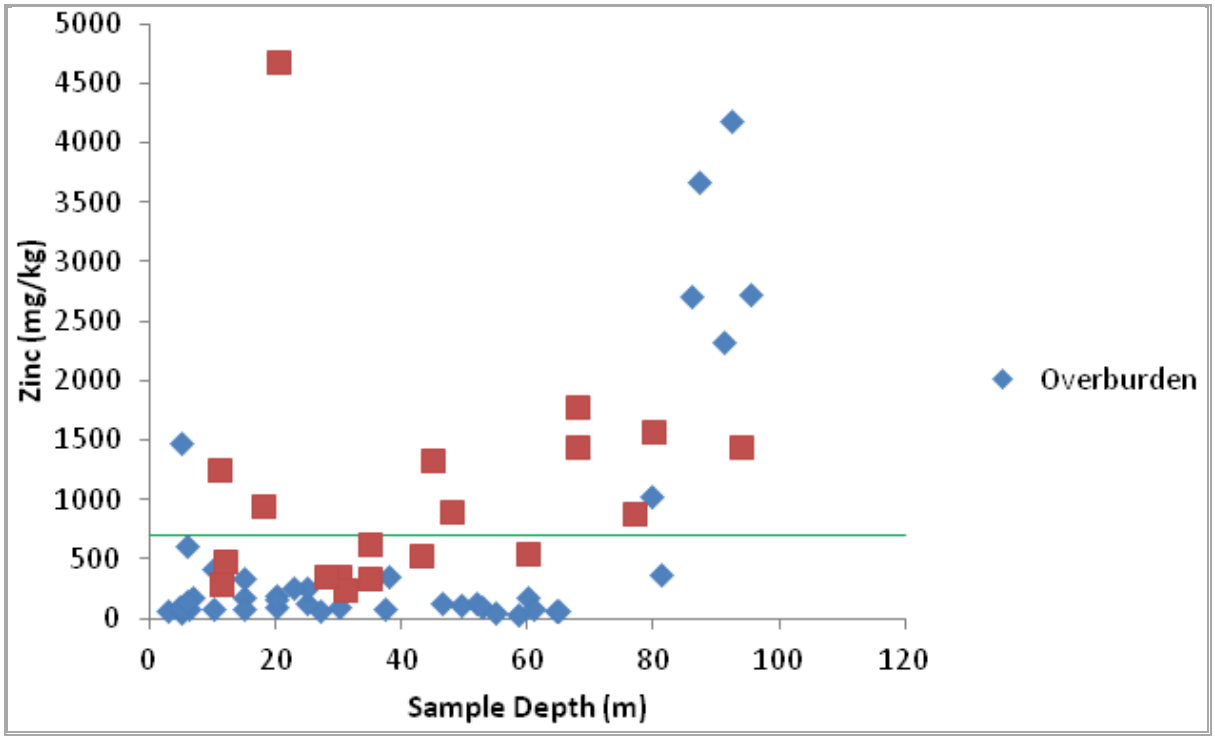


Figure 3-2: Zinc in Overburden versus Depth

Table 3-2: Statistical Summary of Elemental Content – Overburden (n=95)

	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga
	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg
Maximum	**19.8**	5.5	**375**	1.2	10	350	1.7	**5.5**	5.4	**48.3**	56.3	135	80	50.4	217	5.8	16.9
95th Percentile	**5.9**	3.4	**254**	0.3	10	232	1.2	**3.3**	3.1	**14.2**	46.3	19.2	65	27	105	4.8	11.6
75th Percentile	**1.2**	1.9	**37.9**	0.2	10	130	0.8	**2**	0.84	**2.8**	36.5	14.5	38	10.2	42.5	3.8	8.3
Median	0.3	1.5	9.9	0.2	10	110	0.63	0.48	0.42	0.73	30.5	8.8	23	4.1	25	3.2	5.5
25th Percentile	0.11	1.2	5.9	0.2	10	80	0.51	0.15	0.24	0.15	27.8	6.4	16	2.1	13.7	2.3	4.3
Minimum	0.02	0.5	2	0.2	10	30	0.27	0.05	0.03	0.03	19	1.9	6	0.66	4.8	1.5	1.6
Average	**1.3**	1.7	**45.3**	0.22	10	117	0.7	**0.99**	0.8	**3.4**	32.3	11.8	29	8.1	36.8	3.1	6.5
Standard Deviation	2.7	0.93	77.7	0.12	0	60.9	0.27	1.2	1	7.4	7.8	13.7	16.9	9.8	38.4	1	3.2
10x Crustal Average	*0.75*	*82.3*	*18*	*40*	*100*	*4250*	*30*	*0.85*	*41.5*	*1.5*	*665*	*250*	*1020*	-	*600*	*56*	*190*
	Ge	**Hf**	**Hg**	**In**	**K**	**La**	**Li**	**Mg**	**Mn**	**Mo**	**Na**	**Nb**	**Ni**	**P**	**Pb**	**Rb**	**Re**
	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Maximum	0.24	0.75	**1**	2.1	1.9	27.4	83.1	2.5	5590	10.6	0.19	1.6	45	**8660**	**2770**	88.6	0.002
95th Percentile	0.18	0.67	**1**	0.96	1	21.9	60.7	1.7	2352	4.3	0.13	0.93	33.1	**2039**	**1116**	73.6	0.001
75th Percentile	0.12	0.49	0.04	0.27	0.42	19.7	18.8	0.65	1485	2.1	0.07	0.43	24	**1550**	75	28.7	0.001
Median	0.08	0.33	0.02	0.047	0.27	15.3	11.3	0.42	870	1.2	0.05	0.28	14.4	**730**	24.1	19.1	0.001
25th Percentile	0.05	0.24	0.01	0.02	0.19	13.8	8	0.29	552	0.89	0.03	0.18	10.3	**570**	8	12.5	0.001
Average	0.09	0.36	0.18	0.22	0.37	16.2	17.3	0.6	1127	1.8	0.055	0.37	17.2	**1060**	**207**	25.2	0.001
Minimum	0.05	0.05	0.01	0.008	0.07	8.6	2.2	0.03	230	0.43	0.01	0.05	2.4	**270**	2	4.8	0.001
Standard Deviation	0.047	0.17	0.36	0.36	0.32	3.7	17.3	0.5	886	1.7	0.038	0.29	8.7	969	509	19.5	0
10x Crustal Average	*15*	*30*	*0.85*	*2.5*	*21*	*390*	*200*	*23.3*	*9500*	*12*	*23.6*	*200*	*840*	*0.15*	*140*	*900*	*0.007*
	S	**Sb**	**Sc**	**Se**	**Sn**	**Sr**	**Ta**	**Te**	**Th**	**Ti**	**Tl**	**U**	**V**	**W**	**Y**	**Zn**	**Zr**
	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Maximum	**0.68**	**35**	11.4	**0.8**	1.2	482	0.02	0.45	20	0.31	**10**	13.8	133	**132**	19.2	**4680**	24.7
95th Percentile	0.033	**19.4**	9.2	**0.7**	1	157	0.01	0.052	20	0.27	**10**	10	122	10	11.6	**2437**	22
75th Percentile	0.01	**6.9**	5.3	0.4	0.7	72.8	0.01	0.02	5.8	0.15	1.4	2.2	68	1.83	9.2	528	16.2
Median	0.01	2	4	0.35	0.5	40.1	0.01	0.01	4.6	0.11	0.45	1.5	50	0.24	8	162	12.6
25th Percentile	0.01	0.81	3.2	0.28	0.4	27.1	0.01	0.01	3.4	0.08	0.19	0.96	39	0.15	6.5	65	8.9
Average	0.022	**5.3**	4.6	0.37	0.56	62.5	0.01	0.027	6.8	0.12	2.1	2.9	57.5	4.2	8.3	522	12.6
Minimum	0.01	0.34	0.8	0.2	0.2	4.1	0.01	0.01	1.9	0.006	0.04	0.37	4	0.05	3	31	1.8
Standard Deviation	0.07	7.1	2.2	0.15	0.22	63.8	0.0019	0.054	5.9	0.069	3.5	3.4	28.9	14.3	2.6	875	5.4
10x Crustal Average	*0.3*	*2*	*220*	*0.5*	*23*	*3700*	*20*	-	*96*	*5.7*	*8.5*	*27*	*1200*	*12.5*	*330*	*700*	*1650*

Note: Bold values are 10x higher than crustal abundance (Price, 1997).

3.1.3 Acid Base Accounting

A summary of the ABA results for the overburden samples is provided in **Table 3-3**. Complete results are given in **Annex 3**.

Paste pH values ranged from 6.3 to 8.9, with a median value of 7.6 (**Table 3-3**). No overburden samples reported acidic paste pH values.

Table 3-3: Statistical Summary of ABA Analysis Results – Overburden (n=95)

	Paste pH	Fizz Rating	Total C (%)	CO_2 C (%)	Mod. Sobek NP (kg $CaCO_3$/t)	CNP (kg $CaCO_3$/t)	NNP (kg $CaCO_3$/t)
Maximum	8.9	3	2	5.6	127	128	127
95th Percentile	8.7	2	0.8	2.9	65.8	31.7	65.8
75th Percentile	8.1	1	0.1	0.2	14	4.2	13.5
Median	7.6	1	0.1	0.2	8	4.2	7
25th Percentile	7.2	1	0.05	0.2	4	4.2	3
Minimum	6.3	1	0.05	0.2	1	0	-16
Average	7.7	1.2	0.1	0.44	15.6	8.1	14.9
Standard Deviation	0.62	0.45	0.2	0.9	22.2	19	22.5
	Total S (%)	**Sulphate S[1] (%)**	**Sulphate S[2] (%)**	**Sulphide S (%)**	**MPA (kg $CaCO_3$/t)**	**AP (kg $CaCO_3$/t)**	**NPR (NP/MPA)**
Maximum	0.66	0.02	0.04	0.65	20.6	20.3	423
95th Percentile	0.04	0.01	0.03	0.03	1.3	1	201
75th Percentile	0.02	0.01	0.02	0.02	0.6	0.63	45
Median	0.01	0.01	0.01	0.01	0.3	0.31	20
25th Percentile	0.01	0.01	0.01	0.01	0.3	0.31	8.3
Average	0.02	0.01	0.01	0.02	0.73	0.7	44
Minimum	0.01	0.01	0.01	0.01	0.3	0.31	0.2
Standard Deviation	0.067	0.002	0.01	0.07	2.1	2.1	69.4

Note: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by hydrochloric acid leach.

Total sulphur concentrations in overburden samples were very low, ranging from 0.01% to 0.66% with a 95th percentile of only 0.04%. Median (0.01%) and average values (0.02%) were at or near the method detection limit of 0.01%. Sulphate sulphur concentrations were very low, with five of 95 samples greater than the lower detection limit. Consequently, the concentration of sulphide sulphur was also very low, ranging from below detection to 0.66%. The highest total sulphur concentration (0.66%) was reported from a sample collected from the overburden-bedrock interface and might have included bedrock material.

The maximum potential acidity (MPA) values of the overburden samples were very low and ranged from 0.3 to 20.6 kg $CaCO_3$/t, with a median of 0.3 kg $CaCO_3$/t. AP values calculated from sulphide sulphur reported a very low range, from less than 0.3 kg $CaCO_3$/t to 20.31 kg $CaCO_3$/t.

Modified Sobek NP values ranged from 0 to 127 kg $CaCO_3$/t. CNP values calculated from total inorganic carbon were low, and ranged from less than 0 to 128 kg $CaCO_3$/t. The two samples that had no NP were from the overburden-bedrock interface.

The NPR was greater than 2 for 95% of overburden samples (**Figure 3-3)**. All samples from the access road, open pit, TSF and plant site area had NPR values greater than two and are classified as non-PAG. Two out of nineteen samples from the overburden-bedrock interface had NPR values less than one and are classified as PAG; four samples from the interface had NPR values between 1-2 and have an uncertain potential for acid generation. However, of these 6 samples with NPR values less than two, all had low total sulphur concentrations less than 0.05%, except one sample at 0.66%. This suggests that the low NPR values at the interface are related to low NP rather than high acid potential.

Overall, the results indicate that there is little to no potential for ARD from the overburden.

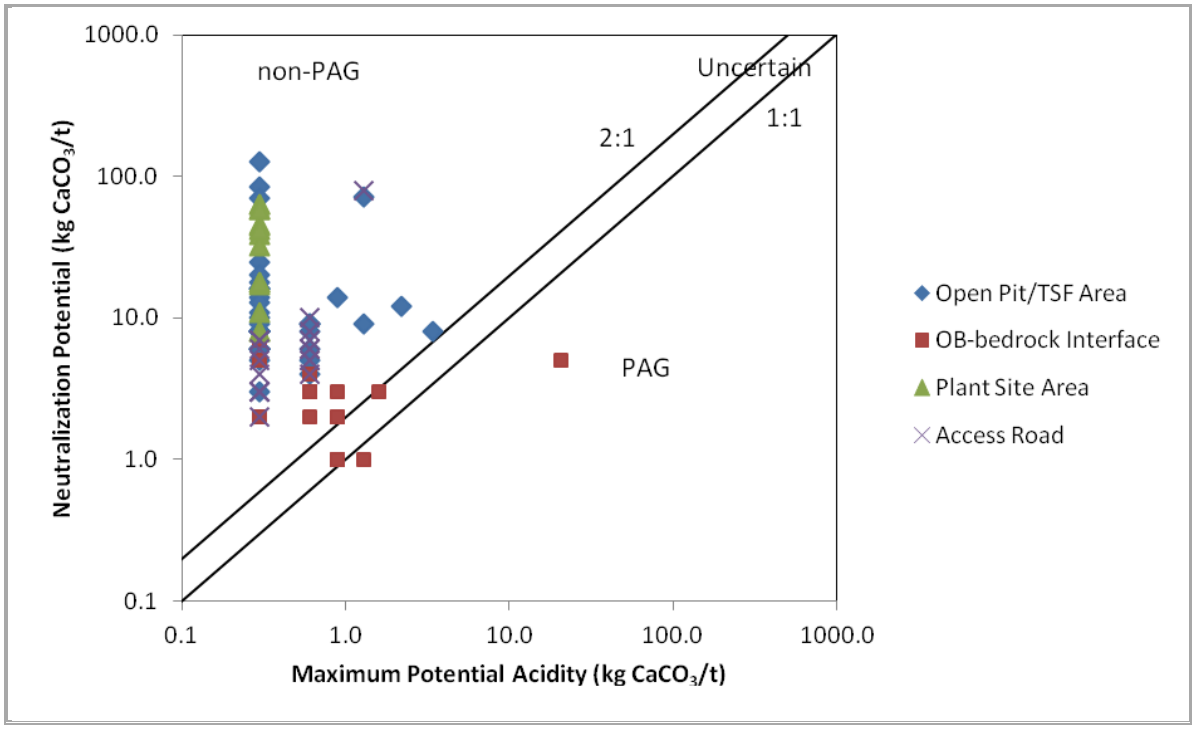


Figure 3-3: Comparison of MPA vs. NP for Overburden Samples

3.1.4 NAG Test

To further examine the balance of acid production and acid neutralization in overburden, the NAG test was completed on 29 overburden samples from the open pit and plant site area. All samples had NPR values greater than 2.

Complete results are given in **Annex 3**.

All overburden samples reported final NAG pH values greater than 4.5, indicating that these samples are non-PAG (**Figure 3-4**). NAG pH values ranged from 6.1 to 11, with an average pH of 7.8 (**Table 3-4**). The results support the non-PAG classification determined by ABA.

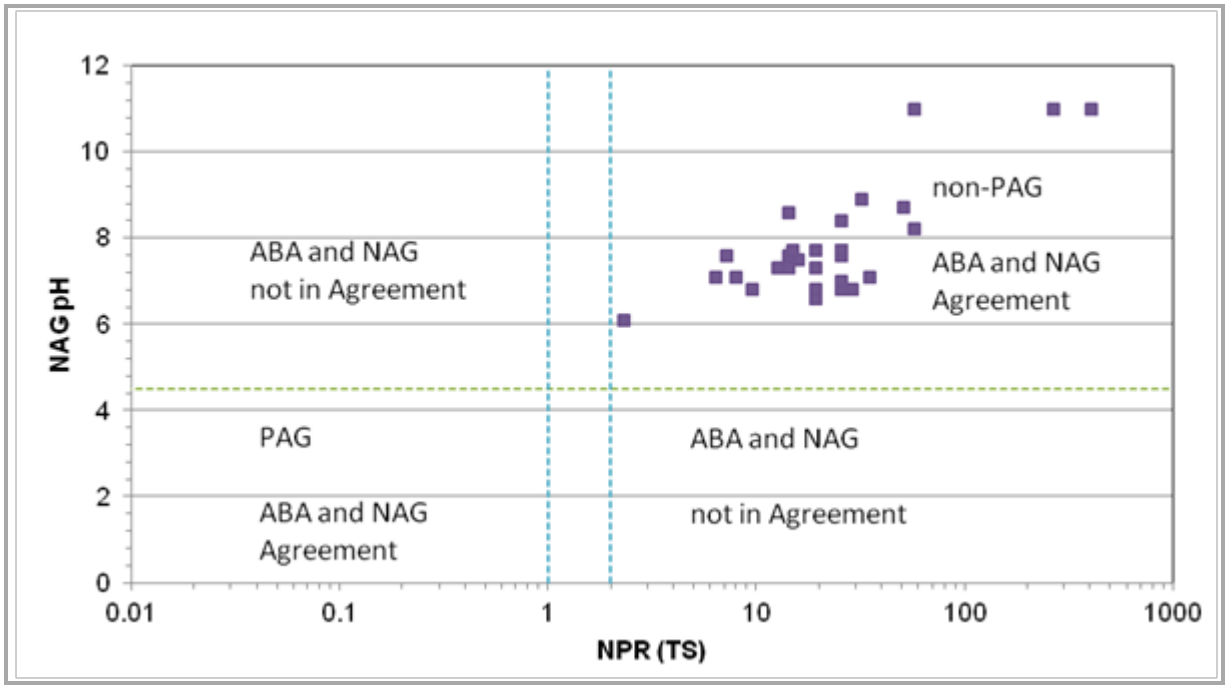


Figure 3-4: Comparison of NAG pH and NPR for Overburden Samples

Table 3-4: Statistical Summary of Net Acid Generation Test – Overburden (n=29)

	NAG @ pH 4.5 (kg H_2SO_4/t)	NAG @ pH 7.0 (kg H_2SO_4/t)	NAG pH
Minimum	0.01	0.01	6.1
Maximum	0.01	2.9	11
Median	0.01	0.01	7.6
Average	0.01	0.4	7.8
25th Percentile	0.01	0.01	7.1
75th Percentile	0.01	0.01	8.2
95th Percentile	0.01	2.7	11
Standard Deviation	0	0.9	1.3

All metals concentrations in NAG test leachate were below MMER values. Aluminum concentrations were greater than ten times the BCWQO FWAL guidelines in four of five samples and greater for iron in three of five samples. Experience at other projects indicates that elevated aluminum is often related to colloidal concentrations rather than dissolved concentrations. Similarly, iron may be present in colloidal form. Elevated concentrations relative to the BCWQO FWAL guidelines were also observed for silver, lead, and vanadium in at least one sample. Detection limit values for selenium concentrations in NAG test leachates were higher than the BCWQO FWAL value of 0.002 mg/L. Mercury was not analyzed for the NAG test leachate.

In general, there were low metal concentrations in NAG leachate.

Leachate from a subset of five NAG tests was analyzed for pH, hardness, sulphate, and total metals. The leachate analysis results are given in **Table 3-5**. NAG test leachate results were compared against MMER and ten times the BCWQO FWAL guideline values for reference purposes only.

3.1.5 Shake Flask Extraction

Measurement of readily soluble components in overburden samples in the open pit and plant site area were determined using shake flask extraction testing of fourteen samples. Results are presented in **Table 3-6**. Complete results are given in **Annex 5**. Results were compared against MMER and the ten times the BCWQO guideline values for comparative purposes only. SFE is not a direct measure of expected drainage chemistry, but an indication of metals that may be leachable.

Except for zinc in one sample, SFE leachate concentrations were below MMER values. All overburden samples had aluminum concentrations greater than ten times the BCWQO FWAL and 10 out of 14 samples were higher in iron. Arsenic, cadmium, and vanadium concentrations were ten times higher than the BCWQO guideline values for FWAL in at least two samples, and lead and zinc were higher in one sample. Mercury and selenium concentrations were less than the detection limit for all samples.

Table 3-5: Summary of NAG Test Leachate Results – Overburden

	Unit	MMER	BCWQO FWAL	10 x BCWQO FWAL	BW-ARD-301	BW-ARD-309	BW-ARD-305	BW-ARD-310	BW-ARD-315
Hardness	(mg/L)				19	9.2	13.7	15	9.9
pH	Units	6.0-9.5	**6.5-9.0**		7.2	7.3	8	6.5	7.7
Sulfate	(mg/L)		**100**	**1000**	18	1.4	0.68	29.9	3.2
Total Metals									
Al	(mg/L)		**0.05****	**0.5**	**21**	**17**	**24.5**	0.35	**3**
Sb	(mg/L)		**0.02**	**0.2**	0.003	0.0013	0.0027	0.0015	0.0031
As	(mg/L)	0.5	**0.005**	**0.05**	0.04	0.025	**0.062**	0.00084	0.015
Ba	(mg/L)				0.13	0.13	0.17	0.051	0.031
Be	(mg/L)		**0.0053**	**0.053**	<0.001	<0.001	<0.001	<0.0005	<0.0005
Bi	(mg/L)				<0.001	<0.001	<0.001	<0.0005	<0.0005
B	(mg/L)		**1.2**	**12**	0.027	0.031	0.026	0.035	0.025
Cd	(mg/L)		**0.00006+**	**0.0006+**	**0.00094**	**0.0011**	**0.0016**	**0.0033**	**0.00058**
Ca	(mg/L)		**8**	**80**	2.6	1.2	1.9	3.6	2.6
Cr	(mg/L)				0.04	0.014	0.034	0.0066	0.012
Co	(mg/L)		**0.004**	**0.04**	0.011	0.0053	0.008	0.0067	0.00073
Cu	(mg/L)	0.3	**0.002***	**0.02**	0.043	0.043	0.028	0.01	0.011
Fe	(mg/L)		**0.35**[¥]	**3.5**	**20.8**	**9.5**	**17.7**	0.15	1.5
Pb	(mg/L)	0.2	**0.003-0.004***	**0.03-0.04**	**0.1**	0.013	0.03	0.002	0.016
Li	(mg/L)				0.014	<0.01	0.018	<0.005	<0.005
Mg	(mg/L)				3	1.5	2.2	1.5	0.8
Mn	(mg/L)		**0.64-0.69***	**7**	0.49	0.57	0.62	0.94	0.2
Mo	(mg/L)		**2**	**20**	0.0031	0.004	0.0025	0.0043	0.0064
Ni	(mg/L)	0.5	**0.025-0.15***[¥]	**0.20-1.5**	0.012	0.0072	0.013	0.0033	0.0014
P	(mg/L)				0.55	0.42	0.67	<0.3	<0.3
K	(mg/L)				6.6	5.1	6.1	4.9	7.8
Se	(mg/L)		**0.002**	**0.02**	<0.002	<0.002	<0.002	<0.001	<0.001
Si	(mg/L)				38.3	34.9	39.9	6.7	11.8
Ag	(mg/L)		**0.0001***	**0.001**	0.00085	0.00018	0.0006	**0.0016**	0.0003
Na	(mg/L)				7.5	6.7	6.7	7.6	8.3
Sr	(mg/L)				0.043	0.023	0.043	0.063	0.022

	Unit	MMER	BCWQO FWAL	10 x BCWQO FWAL	BW-ARD-301	BW-ARD-309	BW-ARD-305	BW-ARD-310	BW-ARD-315
Th	(mg/L)		**0.0003**	**0.003**	0.00043	0.00031	0.00049	<0.0001	0.00012
Sn	(mg/L)				0.026	0.023	0.034	0.00082	0.0051
Ti	(mg/L)		**4.6**	**46**	1.3	0.37	0.95	0.018	0.075
U	(mg/L)		**0.5**	**5**	0.0031	0.0019	0.0018	0.00031	0.00076
V	(mg/L)		**0.006**	**0.06**	**0.13**	0.056	**0.13**	0.038	0.033
Zn	(mg/L)	0.5	**0.075***	**0.75**	0.14	0.082	0.19	0.054	0.051

Notes: MMER = Metal Mining Effluent Regulations; BCWQO = British Columbia Water Quality Objective, **Bold** values are 10x higher than BCWQO for freshwater aquatic life (FWAL) (30 days); * hardness dependent; ** pH dependent; ¥ freshwater aquatic life (Max), + site specific Cd concentration of 0.00006 mg/L

Table 3-6: Statistical Summary of Shake Flask Results – Overburden (n=14)

		MMER	BCWQO FWAL	10 X FWAL	Max.	95th Percentile	75th Percentile	Median	25th Percentile	Avg.	Min.
Physical Tests											
Hardness	(mg/L)				405	358	213	132	43	152	20
pH	Units		**6.5-9.0**		**9.4**	**9.3**	8.3	7.8	7.4	7.9	**6.4**
Cond.	(uS/cm)				97.1	79	60.9	35.5	29.5	45.9	20.4
Leachable Anions & Nutrients											
SO4	(mg/L)		**100**	**1000**	43.5	39.9	14.6	6.4	0.76	11.7	0.5
Acid.	(mg/L CaCO3)				4.7	4.3	2.7	2.4	1.7	2.4	1
Alk.	(mg/L CaCO3)				52.1	43.8	30.7	23.5	12	23.2	6.8
Dissolved Metals											
Al	(mg/L)		**0.05-0.07****	**0.5-0.7**	**60.3**	**50**	**25.9**	**17.5**	**3.3**	**19.5**	**0.31**
Sb	(mg/L)		**0.02**	**0.2**	0.014	0.01	0.0046	0.0028	0.0024	0.004	0.00091
As	(mg/L)	**0.5**	**0.005**	**0.05**	**0.067**	**0.067**	0.027	0.024	0.017	0.029	0.01
Ba	(mg/L)				0.33	0.22	0.15	0.097	0.018	0.099	0.002
Be	(mg/L)		**0.0053**	**0.053**	0.0019	0.0016	0.001	0.00067	0.00051	0.00085	0.0005
Bi	(mg/L)				0.001	0.001	0.001	0.0005	0.0005	0.00068	0.0005
B	(mg/L)		**1.2**	**12**	0.02	0.02	0.02	0.011	0.01	0.014	0.01
Cd	(mg/L)		**0.00006+**	**0.0006+**	**0.021**	**0.011**	**0.0023**	**0.00073**	0.0001	**0.0027**	0.00005
Ca	(mg/L)		**8**	**80**	9.4	8.1	6.1	3.9	2.7	4.4	1.7
Ct	(mg/L)				0.027	0.026	0.013	0.0092	0.002	0.01	0.0005
Co	(mg/L)		**0.004**	**0.04**	0.03	0.028	0.0085	0.0058	0.00099	0.0078	0.0001
Cu	(mg/L)	**0.3**	**0.006***	**0.06**	0.028	0.027	0.019	0.013	0.0035	0.013	0.001
Fe	(mg/L)		**0.35¥**	**3.5**	**36.7**	**29.6**	**22.1**	**10.3**	1.2	**13**	0.03
Pb	(mg/L)	**0.2**	**0.009***	**0.09**	**0.17**	**0.14**	0.038	0.017	0.0011	0.036	0.0001
Li	(mg/L)				0.039	0.035	0.011	0.01	0.0053	0.012	0.005
Mg	(mg/L)				4.3	3.4	2.8	1.8	0.91	1.9	0.31
Mn	(mg/L)		**1.3***	**13**	1.8	1.3	0.64	0.4	0.09	0.51	0.0005
Hg	(mg/L)		**0.00002**	**0.0002**	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Mo	(mg/L)		**2**	**20**	0.1	0.1	0.047	0.0066	0.0023	0.027	0.0013
Ni	(mg/L)	**0.5**	**0.11*¥**	**1.1**	0.016	0.015	0.013	0.0094	0.002	0.0083	0.0005
P	(mg/L)				0.82	0.68	0.57	0.36	0.3	0.44	0.3

		MMER	BCWQO FWAL	10 X FWAL	Max.	95th Percentile	75th Percentile	Median	25th Percentile	Avg.	Min.
K	(mg/L)				7.4	6.6	4.5	3.2	2.3	3.6	1.9
Se	(mg/L)		**0.002**	**0.02**	0.001	0.001	0.001	0.0005	0.0005	0.0007	0.0005
Si	(mg/L)				96.2	88.7	49.9	25.4	8.1	34.4	5.6
Ag	(mg/L)		**0.0015***	**0.015**	0.0013	0.0012	0.00054	0.00021	0.000075	0.00039	0.00005
Na	(mg/L)				10	8	6.2	5.5	4.5	5.6	3.8
Sr	(mg/L)				0.11	0.1	0.06	0.05	0.04	0.06	0.03
Th	(mg/L)		**0.0003**	**0.003**	0.00043	0.00039	0.00031	0.00016	0.0001	0.00021	0.0001
Sn	(mg/L)				0.001	0.001	0.001	0.0005	0.0005	0.0007	0.0005
Ti	(mg/L)		**4.6**	**46**	1.7	1.5	1	0.53	0.05	0.61	0.01
U	(mg/L)		**0.5**	**5**	0.0061	0.0048	0.002	0.0011	0.00033	0.0016	0.000063
V	(mg/L)		**0.006**	**0.06**	**0.12**	**0.1**	0.037	0.032	0.024	0.039	0.011
Zn	(mg/L)	**0.5**	**0.054***	**0.54**	**0.93**	**0.58**	0.16	0.082	0.016	0.17	0.01

Notes : MMER = Metal Mining Effluent Regulations; BCWQO = British Columbia Water Quality Objective, **Bold** values are 10x higher than BCWQO for freshwater aquatic life (FWAL) (30 days); * hardness dependent, parameters were screened against the BCWQO FWAL guideline value for the average water hardness of the overburden SFE results; ** pH dependent; ¥ freshwater aquatic life (Max); + site specific Cd concentration of 0.00006 mg/L

3.1.6 Conclusions

All overburden samples from the open pit, plant, TSF and access road area were classified as non-PAG based on ABA results, a conclusion supported by the NAG test. One sample from the overburden-bedrock interface had elevated sulphur and was classified as PAG. Three additional samples from the overburden-bedrock interface had NPR values less than two; the low NPR values were related to their low NP values rather than elevated sulphur concentrations.

Mineralogical analysis of two samples from the open pit area did not identify any sulphide mineral species. The metal content of the overburden was generally low, although cadmium, zinc, and arsenic did occur at values greater than ten times the crustal average. With the exception of iron and aluminium, the metal concentrations measured in the SFE and NAG leachate tests were generally very low, although these laboratory-based tests are not a direct measure of expected site drainage representing more aggressive leaching conditions than those expected under field conditions. Overall, the overburden is non-PAG, but some material near the bedrock-overburden interface may have limited potential for acid generation.

Moreover, studies by Lorax Environmental Inc. (Lorax, 2013b, **Annex 15**) found that samples of weathered bedrock, basal till and sand and gravel units under the proposed Blackwater TSF effectively attenuated cadmium and zinc concentrations by values greater than 95% and 92% respectively (**Annex 13** and Section 6.0). The weathered bedrock unit, followed by basal till and the sand and gravel units most effectively attenuated cadmium concentrations. Attenuation of zinc was most significant for the sand and gravel unit, followed by the basal till and the weathered bedrock units. Overall, however, variations in attenuation capacity between the three units were minor. The basal till unit is considered to have the highest sorption potential regarding cadmium and zinc owing to the particle size distribution and pH buffering capacity.

3.2 Waste Rock

Eight hundred and ninety (890) waste rock samples were collected for ABA analyses, including 68 duplicates. Samples were classified by oxidation facies and by ARD class (**Table 3-7**). In addition to the ABA samples, there were approximately 50,000 exploration samples analyzed for multi-element geochemistry.

Table 3-7: Waste Rock ABA Samples by ARD Class and Oxidation Facies

	Description	Oxide	Transition	Sulphide	Total
PAG 1	NPR < 1	16	97	302	415
PAG 2	1 > NPR < 2	7	30	85	122
NAG 3	NPR > 2, Zn > 1000 mg/kg	10	10	29	49
NAG 4	NPR > 2, Zn 600- 1000 mg/kg	2	7	17	26
NAG 5	NPR > 2, Zn < 600 mg/kg	27	104	147	278
Total		62	248	580	**890**

3.2.1 Mineralogy

Twenty five waste rock samples were selected for Rietveld-XRD mineralogical analysis: eight PAG 1, three PAG 2, five NAG 3, three NAG 4, and six NAG 5. Summary results are presented in **Table 3-8**. Complete results are given in **Annex 1**.

Quartz, potassium feldspar, plagioclase, and a variety of phyllosilicates were identified as the most abundant minerals in the waste rock samples. Sulphide minerals were identified in only 12 of the 25 samples. Pyrite or pyrrhotite were identified in seven samples, with abundances that ranged from 0.3% to 4%. Sphalerite was recorded in 11 of the 25 samples, with abundances that ranged from 0.1% to 0.8%. Notably, rhomboclase (an acidic iron sulphate mineral) was identified in one sample. PAG 1 and PAG 2 samples were more likely to have pyrite or sphalerite than NAG 3, 4, or 5 samples.

Carbonate minerals were identified in 15 waste rock samples. Calcite and siderite were the most common carbonate minerals (**Figure 3-5** and **Table 3-8**. Calcite concentrations ranged from 0.7% to 3.3%, and siderite ranged from 0.5% to 6.3%. Siderite was found only in the PAG 1, PAG 2 and NAG 4 samples. Calcite was more commonly found in the NAG 4 and NAG 5 samples. Ankerite (0.3%) and dawsonite (0.2%) were reported in one sample each.

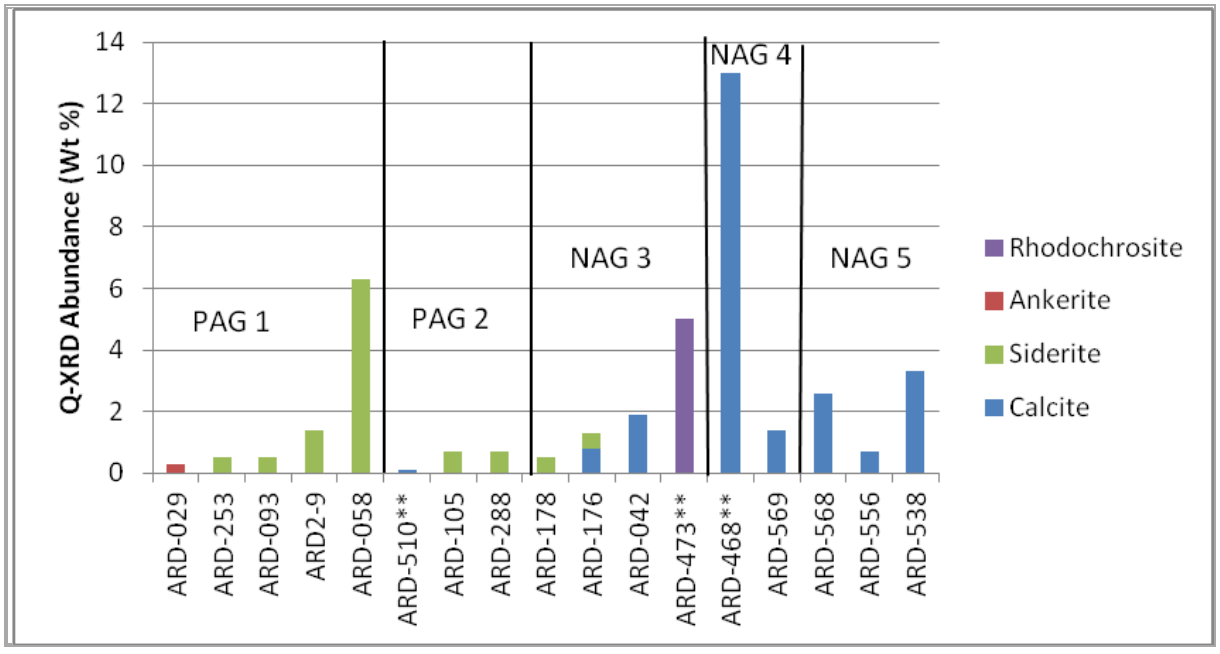


Figure 3-5: Carbonate Mineralogy

Blackwater geologists identified eight drill holes outside of the ore zone that had over 100 m of calcite veining. Lorax Environmental completed a detailed study on five waste rock samples

using optical mineralogy and scanning electron microscopy (Lorax, 2013a). The mineralogical investigation concluded:

- The waste rock is composed of vari-textured, felsic volcanic and sun-volcanic rock in which igneous textures are largely overprinted by strong hydrothermal alteration that led to partial of full recrystallization of a quartz-feldspar matrix as well as replacement by dominantly sericite-biotite assemblages;
- High solid phase zinc content samples (PAG 1 and NAG 3) were found to have the highest sphalerite abundances. Sphalerite was the dominant host for both zinc and cadmium in these samples
- Sphalerite was the dominant repository for cadmium and zinc, although both elements were identified as minor components in pyrite, polymetallic sulphides, as well as several non-sulphide phases including Fe-Mn-carbonate and Fe-hydroxide. Discrete cadmium sulphide was identified in one sample
- In general, cadmium showed a more diffuse distribution pattern than zinc which may be attributed to cadmium residing in a wider variety of mineralogical phases or lack of resolution owing to cadmium concentrations near the analytical detection limit of the SEM.

3.2.2 Elemental Content

Results from aqua regia ICP-MS analysis of ABA samples are summarized in **Table 3-9**; complete results are given in **Annex 2**. Results were compared to average crustal concentrations, and were considered elevated where concentrations were greater than ten times the crustal average (Price, 1997). The following elements were elevated in more than 60% of the samples: arsenic, bismuth, cadmium and phosphorus. Silver and bismuth were elevated in at least 50% of the samples while zinc was elevated in 49%. Lead and selenium were elevated in 29% and 30% of the samples, respectively.

Table 3-8: Results of XRD-Rietveld Quantitative Phase Analysis – Waste Rock

Sample ID	ARD2-10**	ARD-037	ARD-029	ARD-073	ARD-253	ARD-184	ARD-093	ARD 2-9	ARD-058	ARD-510**	ARD-105	ARD-288	ARD-159	ARD-648**	ARD-178	ARD-176	ARD-132	ARD-042	ARD-473**	ARD-048	ARD-468**	ARD-170	ARD-569	ARD-527	ARD-568	ARD-556	ARD-538	ARD-547	ARD 2-7	ARD-206
ARD Class/Ox Facies	PG 1/Sx	PAG 1/Sx	PAG 1/Sx	PAG 1Sx	PAG 1/Sx	PAG 1/Sx	PAG 1/Sx	PAG 1/T	PAG 1/T	PAG 2/Sx	PAG 2/Sx	PAG 2/Sx	PAG 2/T	NAG 3/ Sx	NAG 3/Sx	NAG 3/Sx	NAG 3/Sx	NAG 3/Sx	NAG 3/T	NAG 3/T	NAG 4/Sx	NAG 4/Sx	NAG 4/Sx	NAG 4/Sx	NAG 5/Sx	NAG 5/Sx	NAG 5/Sx	NAG 5/Sx	NAG 5/Sx	NAG 5/Ox
Quartz	46.3	37.4	60.8	53.3	33.3	47.8	35.1	27.8	45.9	35.8	30.1	36.1	54.7	36.6	30.7	30.9	27	30.7	44.4	30.8	56.3	20.7+	34.6	47.5	29	27.6	36.9	33.8	31.1	49.5
Muscovite / Illite-Muscovite 2M1	19.4	18.4	32.3	25.5	15.6	35.5	21.9	20.5	28.1	17.9	4.2	10.4	25.4	-	17.9	13.7	-	4.3	10.7	12.9	18.3	-	7.1	8.6	4.9	6	4.5	-	9.2	24.8
Phlogopite 1M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.9	20	-	7.4	-	-	13.3	-	18.6	17.4	9.3	13.6	20.4	-
Biotite	-	10.7	4.2		18.1	2.8	19.9		-	7.7	23.4	18.8		7.9	14.6	23.5	-	-	1.7	-	4.6	3.1	-	-	-	-	-	-	-	13.7
Montmorillonite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.7	-	-	-	-	-	-	-	-
Kaolinite	-	-	-	0.5		1.6	1	-	4.3	1.1	-	-	6.6	-	-	0.7	-	-	v	-	-	-	1.1	-	-	-	-	-	-	1.077 *
K-feldspar	33.1	26	2.4	20	26	11	20.2	39.5	13	19.9	21.9	16.8	13.1	9.6	25.2	13.1	15.8	14.5	10.1	15	-	27.8	21.1	27	15.7	28.4	27.3	18.4	17	10.6
Plagioclase	-	-	-	-	0.9	-	-	-	-	13.9	15.1	10	-	38.4	3	15.6	28.7	24.6	21.4	19.7	-	33.5	18.6	12.6	23.6	15.7	14.1	25.1	16.1	-
Clinochlore	-	6.4	-	-	4.8	-	-	6.6	-	-	4	6.8	-	-	7.1	-	3.1	3.3	-	11.7	-	-	-	1.3	4.5	3.1	4.6	2.8	4.7	-
Actinolite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.7	-	-	-	-	-	1.1	-	-	-	-	4.3	-	-
Pyrite	0.5	0.4	-	0.6	-	1	-	4	2.1	-	0.3	-	-	-	-	-	-	-	-	-	2.9	-	-	-	-	-	-	-	-	-
Pyrrhotite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-
Sphalerite	0.7	0.7	0.15*	0.1	0.8	0.3	0.8	0.3	-	-	0.4	0.5	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	0.24*
Rhomboclase	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-
Calcite	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	0.8	-	1.9	-	-	13	-	1.4	-	2.6	0.7	3.3	-	-	-
Siderite	-	-	-	-	0.5	-	0.5	1.4	6.3	-	0.7	0.7	-	-	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ankerite	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhodochrosite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	0.5	-	-	3.7	-	-	-	7.4	1	1	1.8	0.7	4.3	2.5	4.9	-	1.8	2.9	1	1.1	-	1.3	1.5	-
Total	**100**	**100**	**100**	**100**	**100**	**100**	**99.9**	**100.1**	**99.7**	**100.1**	**100.1**	**100.1**	**99.8**	**99.9**	**100**	**100.1**	**100**	**100**	**97.6**	**100**	**100**	**79.2**	**100.1**	**99.9**	**99.9**	**100**	**100**	**100**	**100**	**98.6**

Notes: **+**includes cristobalite
*Mineral phase may not be correctly identified due to pattern interference

** Analyzed as part of Lorax Mineralogy Study
Other may include hematite, dawsonite, stilbite, garnet group, illmenite, hydroxylapatite

Table 3-9: Statistical Summary of Elemental Content – Waste Rock

	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga
	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg
Count	890	890	890	890	638	890	890	890	890	890	638	890	890	638	890	890	890
Maximum	**87.3**	9.1	**3430**	3.5	20	4040	2.9	**27**	4.5	**219**	96.4	40.2	215	61.4	**802**	8.6	20
95th Percentile	**8.1**	8.3	**515**	0.2	10	1301	1.8	**5.2**	3.1	**41.9**	38.9	21	118	38	136	6.3	20
75th Percentile	**2.8**	7	**123**	0.2	10	830	1.5	**2**	1.5	**13.5**	31.2	16.9	68	25.3	59.6	4.8	18.6
Median	**0.9**	3.4	**47.9**	0.2	10	130	0.95	**1**	0.45	**3.4**	25.8	10.3	39	16.3	32.1	3.5	10
25th Percentile	0.25	1.5	**20.9**	0.037	10	50	0.59	0.4	0.12	**0.3**	20.9	3.1	17.4	4.1	14	1.7	4.6
Minimum	0.04	0.26	1.7	0.0025	10	10	0.08	0.01	0.01	0.03	9.6	0.1	1	0.3	0.5	0.26	0.69
Average	**2.3**	3.9	**121**	0.16	10	393	1	1.6	0.92	**10.9**	26.6	10.3	46.2	16.6	49.8	3.4	10.8
Standard Deviation	4.6	2.8	229	0.17	0.56	501	0.52	2.1	1	19.7	8.1	7.4	36.2	12.7	73.5	1.9	6.9
10x Crustal Average	*0.75*	*82.3*	*18*	*40*	*100*	*4250*	*30*	*0.85*	*41.5*	*1.5*	*665*	*250*	*1020*	-	*600*	*56*	*190*
	Ge	**Hf**	**Hg**	**In**	**K**	**La**	**Li**	**Mg**	**Mn**	**Mo**	**Na**	**Nb**	**Ni**	**P**	**Pb**	**Rb**	**Re**
	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Count	638	638	638	638	890	890	638	890	890	890	890	638	890	890	890	638	637
Maximum	0.28	1	**0.52**	**21.6**	6	32.7	96.3	2.3	**19850**	**46.6**	2.7	0.98	160	**2390**	**10000**	160	0.018
95th Percentile	0.19	0.67	0.07	1.9	4.7	20	68.5	1.7	5838	5.3	1.7	0.56	38.7	**1850**	**1475**	112	0.002
75th Percentile	0.14	0.48	0.02	0.46	2.9	18.7	50	1.1	3140	3.3	0.34	0.33	29	**1650**	**209**	86.5	0.001
Median	0.1	0.19	0.01	0.17	1.5	13.7	31.8	0.45	1780	2.3	0.08	0.25	16.5	**870**	31.9	58.4	0.001
25th Percentile	0.06	0.1	0.01	0.043	0.56	10.3	6.1	0.15	811	1.6	0.01	0.19	3.5	**400**	15	16	0.001
Minimum	0.05	0.04	0.01	0.005	0.08	4.7	0.3	0.01	22	0.31	0.01	0.05	0.2	**20**	2.8	3.2	0.001
Average	0.11	0.29	0.022	0.46	1.9	14.3	31.4	0.63	2309	2.7	0.36	0.28	18	**969**	**293**	56.4	0.001
Standard Deviation	0.049	0.22	0.042	1.1	1.5	4.6	23.4	0.57	2150	2.4	0.59	0.14	17.2	654	746	36.9	0.001
10x Crustal Average	*15*	*30*	*0.85*	*2.5*	*21*	*390*	*200*	*23.3*	*9500*	*12*	*23.6*	*200*	*840*	*0.15*	*140*	*900*	*0.007*
	S	**Sb**	**Sc**	**Se**	**Sn**	**Sr**	**Ta**	**Te**	**Th**	**Ti**	**Tl**	**U**	**V**	**W**	**Y**	**Zn**	**Zr**
	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Count	890	890	890	638	638	890	637	638	890	890	890	890	890	890	638	890	638
Maximum	**3.5**	**73.5**	22	**4.6**	1.8	969	0.02	1.9	11.1	0.67	20	**38.9**	192	**480**	19.1	**17980**	30.8
95th Percentile	**1.5**	**23.6**	12	**1.1**	1.2	390	0.01	0.22	10	0.54	6.3	7.6	139	7.1	9.6	**5729**	20.8
75th Percentile	**0.69**	**11**	7	**0.6**	0.8	139	0.01	0.04	10	0.27	5	5	93	5	7.5	**2150**	14.5
Median	0.3	**6.4**	4	0.4	0.5	47.3	0.01	0.02	6.2	0.19	1.7	1.9	45.5	0.38	6.4	**671**	7.7
25th Percentile	0.08	**2.8**	1.8	0.3	0.3	15.2	0.01	0.01	3.8	0.06	0.87	0.6	15	0.19	5.4	**154**	3.7
Average	**0.48**	**8.6**	4.8	**0.5**	0.57	99.3	0.01	0.052	6.5	0.19	2.6	2.8	57.2	2.6	6.6	**1544**	9.4
Minimum	0.005	0.52	0.1	0.2	0.2	1.2	0.01	0.01	1.5	0.005	0.07	0.13	1	0.05	2.4	24	1.1
Standard Deviation	0.54	8	3.7	0.35	0.34	132	0.0013	0.13	2.8	0.15	2.3	3	47	16.5	2	2095	6.4
10x Crustal Average	*0.3*	*2*	*220*	*0.5*	*23*	*3700*	*20*	*-*	*96*	*5.7*	*8.5*	*27*	*1200*	*12.5*	*330*	*700*	*1650*

Note: **Bold** values are 10x higher than crustal abundance (Price, 1997).

3.2.3 Acid Base Accounting

There have been 890 waste rock ABA analyses conducted for the Project, including 68 duplicate samples. The duplicate samples included field and laboratory duplicates to compare sample compositing methodologies, and pre-test ABA testing for humidity cell testing. Duplicates were included in the summary Tables and Figures.

A statistical summary of ABA results for all waste rock samples is given in **Table 3-10**. Complete results are given in **Annex 3**. Summary results for the oxide, transition, and sulphide oxidation facies are given in **Table 3-11** through **Table 3-13**. Summary ABA results for the five waste rock classes are given in **Table 3-14** through **Table 3-18**.

Table 3-10: Statistical Summary of ABA Analysis Results - Waste Rock (n=890)

	Paste pH	Total C (%)	CO_2 C (%)	Modified Sobek NP (kg $CaCO_3$/t)	CNP (kg $CaCO_3$/t)	Ca NP (kg $CaCO_3$/t)	NNP (kg $CaCO_3$/t)	Total S (%)
Maximum	9.6	1.1	4.2	92	95	112	91	3.2
95th Percentile	9	0.42	1.5	39	34.7	77.5	32.6	1.5
75th Percentile	8.4	0.12	0.4	17	10	36.9	8	0.62
Median	7.8	0.05	0.2	10	4.2	11.1	1	0.27
25th Percentile	7.1	0.05	0.2	4	4.2	3.1	-9	0.07
Minimum	4.1	0.05	0.05	0.01	4.2	0.25	-97	0.01
Average	7.7	0.12	0.44	13.2	9.8	23.1	-0.31	0.44
Stnd Dev.	1	0.1	0.51	12.8	12	26	20.6	0.51
	Sulphate S[1] (%)	**Sulphate S [2](%)**	**Sulphide S (%)**	**MPA (kg $CaCO_3$/t)**	**AP (kg $CaCO_3$/t)**	**Zn Adjusted AP (kg $CaCO_3$/t)**	**NPR (NP/MPA)**	**AP Adjusted NPR (NP/Adjusted AP)**
Maximum	0.1	0.1	3.2	100	98.8	94.9	180	772
95th Percentile	0.05	0.05	1.4	45.8	44.9	39	23.3	41.9
75th Percentile	0.02	0.02	0.59	19.4	18.4	14.9	5	7.2
Median	0.01	0.01	0.25	8.4	7.8	6.2	1.2	1.6
25th Percentile	0.01	0.01	0.06	2.2	1.9	1.5	0.36	0.49
Average	0.017	0.017	0.43	13.8	13.4	11.1	6.1	12
Minimum	0.01	0.01	0.01	0.3	0.31	0.01	0.01	0.01
Stnd Dev.	0.016	0.014	0.5	15.8	15.6	14.2	15.7	47.8

Notes: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by hydrochloric acid leach

Table 3-11: Statistical Summary of ABA Analysis Results - Waste Rock - Oxide Weathering Facies (n=62)

	Paste pH	Total C (%)	CO2 C (%)	Modified Sobek NP (kg CaCO3/t)	CNP (kg CaCO3/t)	Ca NP (kg CaCO3/t)	Total S (%)
Maximum	8.7	0.3	1.2	36	28	87.9	1
95th Percentile	8.6	0.11	0.38	12.7	9.5	32	0.6
75th Percentile	8	0.05	0.2	4	4.2	2.7	0.09
Median	7.6	0.05	0.2	2	4.2	1	0.02
25th Percentile	7.3	0.05	0.2	1	4.2	0.5	0.01
Minimum	4.1	0.05	0.2	0	4.2	0.25	0.01
Average	7.5	0.1	0.23	3.8	5	5.6	0.11
Stnd Dev	0.91	0.04	0.14	5.3	3	13.7	0.22
	Sulphate S1 (%)	**Sulphate S2 (%)**	**Sulphide S (%)**	**MPA (kg CaCO3/t)**	**AP (kg CaCO3/t)**	**NPR (NP/MPA)**	**NPR (NP/AP)**
Maximum	0.1	0.1	1	31.3	31.3	17	16
95th Percentile	0.07	0.06	0.5	18.4	15.7	16.2	16
75th Percentile	0.02	0.02	0.07	2.8	2.1	6.7	6.4
Median	0.01	0.01	0.01	0.6	0.31	3.3	3.8
25th Percentile	0.01	0.01	0.01	0.3	0.31	0.6	1.3
Minimum	0.01	0.01	0.01	0.3	0.31	0.001	0.001
Average	0.02	0.019	0.09	3.3	2.9	4.7	5
Stnd Dev	0.02	0.02	0.21	6.8	6.5	4.7	4.4

Notes: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by hydrochloric acid leach.

Table 3-12: Statistical Summary of ABA Analysis Results - Waste Rock - Transition Weathering Facies (n=248)

	Paste pH	Total C (%)	CO_2 C (%)	Modified Sobek NP (kg $CaCO_3$/t)	CNP (kg $CaCO_3$/t)	Ca NP (kg $CaCO_3$/t)	Total S (%)
Maximum	9.3	1	3.5	74	81	107	2.1
95th Percentile	9	0.36	1.3	33	29.6	84.4	1
75th Percentile	8.5	0.08	0.3	11	6.7	28.7	0.31
Median	7.9	0.05	0.2	7	4.2	8.7	0.13
25th Percentile	7	0.05	0.2	3.5	4.2	3.2	0.02
Minimum	4.5	0.05	0.05	0.01	4.2	0.25	0.01
Average	7.6	0.1	0.38	9.9	8.4	20.9	0.25
Stnd Dev	1	0.13	0.48	10.8	11	26.3	0.34
	Sulphate S^1 (%)	**Sulphate S^2 (%)**	**Sulphide S (%)**	**MPA (kg $CaCO_3$/t)**	**AP (kg $CaCO_3$/t)**	**NPR (NP/MPA)**	**NPR (NP/AP)**
Maximum	0.14	0.11	2	65.9	61.6	133	128
95th Percentile	0.05	0.04	0.98	31.9	30.5	36.7	35
75th Percentile	0.02	0.02	0.3	9.7	9.2	8.4	9.6
Median	0.01	0.01	0.1	4.1	3.8	2.1	2.5
25th Percentile	0.01	0.01	0.02	0.6	0.63	0.51	0.54
Minimum	0.01	0.01	0.01	0.3	0.31	0.001	0.001
Average	0.018	0.015	0.24	7.8	7.4	9	9.5
Stnd Dev	0.02	0.014	0.33	10.8	10.4	19.6	19.1

Notes: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by hydrochloric acid leach

Table 3-13: Statistical Summary of ABA Analysis Results – Waste Rock - Sulphide Weathering Facies (n=580)

	Paste pH	Total C (%)	CO_2 C (%)	Modified Sobek NP (kg $CaCO_3$/t)	CNP (kg $CaCO_3$/t)	Ca NP (kg $CaCO_3$/t)	Total S (%)
Maximum	9.6	1.1	4.2	92	95	112	3.2
95th Percentile	9	0.44	1.6	42	37	80.4	1.6
75th Percentile	8.5	0.14	0.5	20	11.7	41.4	0.77
Median	8	0.07	0.3	12	5.8	16.1	0.4
25th Percentile	7.2	0.05	0.2	6	4.2	6.7	0.16
Minimum	4.4	0.05	0.2	0.01	4.2	0.25	0.01
Average	7.8	0.13	0.49	15.6	10.8	26.4	0.55
Stnd Dev	0.99	0.14	0.52	13.2	11.9	26.1	0.55
	Sulphate S^1 (%)	**Sulphate S^2 (%)**	**Sulphide S (%)**	**MPA (kg $CaCO_3$/t)**	**AP (kg $CaCO_3$/t)**	**NPR (NP/MPA)**	**NPR (NP/AP)**
Maximum	0.09	0.09	3.2	100	98.8	180	173
95th Percentile	0.05	0.04	1.6	50.3	49.5	20.6	25
75th Percentile	0.02	0.02	0.76	24.1	23.8	3.3	3.7
Median	0.01	0.01	0.38	12.5	11.9	0.95	1
25th Percentile	0.01	0.01	0.14	5	4.4	0.33	0.33
Minimum	0.01	0.01	0.01	0.3	0.31	0.001	0.001
Average	0.017	0.018	0.54	17.2	16.8	5.2	5.5

Notes: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by hydrochloric acid leach

Table 3-14: Statistical Summary of ABA Analysis Results - PAG 1 Waste Rock (n=415)

	Paste pH	Total C (%)	CO_2 C (%)	Modified Sobek NP (kg $CaCO_3$/t)	CNP (kg $CaCO_3$/t)	Ca NP (kg $CaCO_3$/t)	Total S (%)
Maximum	9.2	0.65	2.4	38	54	71	3.2
95th Percentile	8.6	0.18	0.7	18	15	39.7	1.7
75th Percentile	7.9	0.07	0.3	11	5.8	10.7	1
Median	7.2	0.05	0.2	7	4.2	6	0.62
25th Percentile	6.5	0.05	0.2	3	4.2	1.1	0.35
Minimum	4.1	0.05	0.05	0.01	4.2	0.2	0.01
Average	7.1	0.075	0.29	7.8	6.2	10.1	0.76
Stnd Dev	1.03	0.067	0.25	6.2	5.6	13.1	0.57
	Sulphate S[1] (%)	**Sulphate S[2] (%)**	**Sulphide S (%)**	**MPA (kg $CaCO_3$/t)**	**AP (kg $CaCO_3$/t)**	**NPR (NP/MPA)**	**NPR (NP/AP)**
Maximum	0.1	0.1	3.2	100	98.8	1	3.2
95th Percentile	0.06	0.05	1.7	54.4	53.4	0.9	0.93
75th Percentile	0.03	0.02	1	32.5	31.9	0.6	0.61
Median	0.01	0.01	0.59	19.4	18.4	0.33	0.34
25th Percentile	0.01	0.01	0.34	10.9	10.6	0.18	0.19
Minimum	0.01	0.01	0.01	0.3	0.3	0.001	0.001
Average	0.022	0.018	0.74	23.8	23.2	0.4	0.42
Stnd Dev	0.02	0.02	0.56	17.7	17.6	0.26	0.33

Notes: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by hydrochloric acid leach.

Table 3-15: Statistical Summary of ABA Analysis Results - PAG 2 Waste Rock (n=122)

	Paste pH	Total C (%)	CO_2 C (%)	Modified Sobek NP (kg $CaCO_3$/t)	CNP (kg $CaCO_3$/t)	Ca NP (kg $CaCO_3$/t)	Total S (%)
Maximum	9.2	0.92	3.4	48	77	96.4	1
95th Percentile	9	0.33	1.2	36	27.4	68.6	0.76
75th Percentile	8.6	0.11	0.4	19	9.2	40.6	0.45
Median	8.1	0.06	0.2	13	5	15.7	0.28
25th Percentile	7.5	0.05	0.2	8	4.2	8.2	0.18
Minimum	5.9	0.05	0.05	1	4.2	0.25	0.02
Average	8	0.11	0.41	14.5	9.2	25.5	0.33
Stnd Dev	0.7	0.12	0.46	9.8	10.3	22.6	0.22
	Sulphate S[1] (%)	**Sulphate S[2] (%)**	**Sulphide S (%)**	**MPA (kg $CaCO_3$/t)**	**AP (kg $CaCO_3$/t)**	**NPR (NP/MPA)**	**NPR (NP/AP)**
Maximum	0.12	0.11	1	30.3	30.3	2	5.1
95th Percentile	0.03	0.05	0.76	23.8	23.7	1.9	2.1
75th Percentile	0.01	0.02	0.44	14	13.8	1.7	1.8
Median	0.01	0.01	0.27	8.8	8.4	1.5	1.6
25th Percentile	0.01	0.01	0.16	5.5	4.8	1.2	1.2
Minimum	0.01	0.01	0.01	0.6	0.31	1	1
Average	0.015	0.019	0.32	10.3	10	1.4	1.6
Stnd Dev	0.013	0.014	0.22	6.9	6.9	0.28	0.51

Notes: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by hydrochloric acid leach.

Table 3-16: Statistical Summary of ABA Analysis Results - NAG 3 Waste Rock (n=49)

	Paste pH	Total C (%)	CO_2 C (%)	Modified Sobek NP (kg $CaCO_3$/t)	CNP (kg $CaCO_3$/t)	Ca NP (kg $CaCO_3$/t)	Total S (%)
Maximum	9.3	0.89	3.3	71	74.2	67.9	0.6
95th Percentile	8.8	0.67	2.4	47.9	55.7	66.3	0.47
75th Percentile	8.5	0.26	0.95	32	21.3	53.9	0.24
Median	8.1	0.1	0.4	16	8.3	23.4	0.14
25th Percentile	7.5	0.05	0.2	11	4.2	11.9	0.08
Minimum	6.1	0.05	0.2	2	4.2	0.5	0.01
Average	7.9	0.19	0.72	21.9	16.1	30.8	0.19
Stnd Dev	0.72	0.21	0.75	15.9	17.2	23.5	0.16
	Sulphate S[1] (%)	**Sulphate S[2] (%)**	**Sulphide S (%)**	**MPA (kg $CaCO_3$/t)**	**AP (kg $CaCO_3$/t)**	**NPR (NP/MPA)**	**NPR (NP/AP)**
Maximum	0.1	0.1	0.6	20	19.1	23.3	22.4
95th Percentile	0.03	0.04	0.47	14.6	14.6	16.7	16
75th Percentile	0.01	0.02	0.21	7.4	6.4	9.2	9
Median	0.01	0.01	0.14	4.4	4.4	3.7	3.9
25th Percentile	0.01	0.01	0.07	2.4	2.2	2.5	2.8
Minimum	0.01	0.01	0.01	0.3	0.31	2	2
Average	0.014	0.017	0.18	6	5.7	6.3	6.4
Stnd Dev	0.01	0.01	0.16	5.1	4.9	5.4	5.2

Notes: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by hydrochloric acid leach.

Table 3-17: Statistical Summary of ABA Analysis Results - NAG 4 Waste Rock (n=26)

	Paste pH	Total C (%)	CO2 C (%)	Modified Sobek NP (kg CaCO3/t)	CNP (kg CaCO3/t)	Ca NP (kg CaCO3/t)	Total S (%)
Maximum	8.8	0.91	3.4	78	75.9	97	0.35
95th Percentile	8.8	0.8	2.9	63	66.3	90.2	0.35
75th Percentile	8.5	0.36	1.3	33	29.8	63.3	0.28
Median	8.2	0.19	0.7	23	15.8	38.2	0.12
25th Percentile	7.4	0.08	0.3	13	6.9	9.2	0.04
Minimum	6.3	0.05	0.2	2	4.2	0.25	0.01
Average	7.9	0.29	1.1	26	24	39.6	0.16
Stnd Dev	0.67	0.26	0.97	20.7	21.9	32.6	0.12
	Sulphate S1 (%)	**Sulphate S2 (%)**	**Sulphide S (%)**	**MPA (kg CaCO3/t)**	**AP (kg CaCO3/t)**	**NPR (NP/MPA)**	**NPR (NP/AP)**
Maximum	0.05	0.04	0.35	10.9	10.9	22	41.6
95th Percentile	0.02	0.04	0.34	10.8	10.6	18.7	19
75th Percentile	0.02	0.02	0.27	8.1	8.4	9.9	9.6
Median	0.01	0.01	0.1	3.6	3.4	6.1	6.9
25th Percentile	0.01	0.01	0.03	1.4	0.9	2.5	3.2
Minimum	0.01	0.01	0.01	0.3	0.31	2.1	2.2
Average	0.015	0.016	0.15	4.7	4.6	7.6	9.2
Stnd Dev	0.0086	0.009	0.12	3.6	3.8	5.8	8.5

Notes: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by hydrochloric acid leach.

Table 3-18: Statistical Summary of ABA Analysis Results - NAG 5 Waste Rock (n=278)

	Paste pH	Total C (%)	CO_2 C (%)	Modified Sobek NP (kg $CaCO_3$/t)	CNP (kg $CaCO_3$/t)	Ca NP (kg $CaCO_3$/t)	Total S (%)
Maximum	9.6	1.1	4.2	92	95.1	112	0.63
95th Percentile	9.1	0.52	1.9	50.2	43.4	96.9	0.32
75th Percentile	8.7	0.19	0.7	27	15.8	62	0.11
Median	8.4	0.08	0.3	13	6.7	32	0.04
25th Percentile	8	0.05	0.2	6	4.2	12.5	0.01
Minimum	6.5	0.05	0.05	1	4.2	0.25	0.01
Average	8.3	0.16	0.58	18.1	13.1	38.7	0.085
Stnd Dev	0.57	0.17	0.62	15.9	14	31.1	0.11
	Sulphate S^1 (%)	**Sulphate S^2 (%)**	**Sulphide S (%)**	**MPA (kg $CaCO_3$/t)**	**AP (kg $CaCO_3$/t)**	**NPR (NP/MPA)**	**NPR (NP/AP)**
Maximum	0.07	0.08	0.6	19.7	18.8	180	173
95th Percentile	0.03	0.04	0.31	10	9.7	66.8	64
75th Percentile	0.01	0.02	0.1	3.4	3.1	16.8	19.2
Median	0.01	0.01	0.03	1.3	0.94	6.8	9.1
25th Percentile	0.01	0.01	0.01	0.3	0.31	4.1	4.8
Minimum	0.01	0.01	0.01	0.3	0.31	2	2.1
Average	0.013	0.016	0.078	2.6	2.4	16.5	17.3
Stnd Dev	0.007	0.011	0.1	3.3	3.2	24.8	23.8

Notes: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by hydrochloric acid leach.

3.2.3.1 Paste pH

Paste pH values ranged from 4.1 to 9.6, with a median pH of 7.8 for all waste rock samples (n=890). Fifty-six samples (7%) reported paste pH values less than 6. The box and whisker plots shown in **Figure 3-6** plots the distribution of data and shows the minimum and maximum values (the upper and low bars), the 75th and 25th percentiles (the top and bottom of the box), the median (vertical line between the 75th and 25th percentiles) and the average values (diamond symbol). Statistical outliers are shown in red. As shown in **Figure 3-6**, and subsequent box and whisker plots, the median paste pH values for all oxidation facies and ARD classes are slightly alkaline, with values between 7.2 and 8.4. The PAG 1 samples had the lowest median paste pH values (**Figure 3-6**).

3.2.3.2 Sulphur Species and Acid Potential

For all waste rock samples, the concentrations of total sulphur ranged from less than 0.01% to 3.2%, with a median of 0.27% (**Table 3-10, Figure 3-7**).

Sulphate concentrations in most samples were very low, generally near the lower detection limit of 0.01%. The maximum sulphate concentration was 0.14%. Sulphide sulphur concentrations ranged from less than 0.01% to 3.2%, with a median of 0.25% (**Table 3-10**). **Figure 3-8** illustrates the significant, 1:1 relationship between total sulphur and sulphide sulphur (r^2 = 0.99). The results indicate that sulphur at Blackwater primarily occurs as sulphide. The results in **Figure 3-8** suggest that samples with less than approximately 0.08% total sulphur have a higher percentage of sulphate; 65% of these samples are either oxide or transition facies samples.

Sulphide facies samples had higher concentrations of total sulphur and sulphide sulphur than the oxide and transition facies (**Figure 3-7**). The median total sulphur value was 0.4% for the sulphide weathering facies (n=580), 0.12% for the transition facies (n=248), and 0.02% for the oxide facies (n=62).

The median total sulphur content of the waste rock samples decreased across the five ARD classes (**Figure 3-7**) and **Table 3-14** through **Table 3-17**. The median total sulphur contents by waste rock type were:

- PAG 1: 0.6%;
- PAG 2: 0.3%;
- NAG 3: 0.14%;
- NAG 4: 0.12%; and
- NAG 5: 0.04%.

The cumulative frequency plot of total sulphur concentrations, presented in **Figure 3-9**, shows that approximately 88% of the samples had a concentration less than 1.0%.

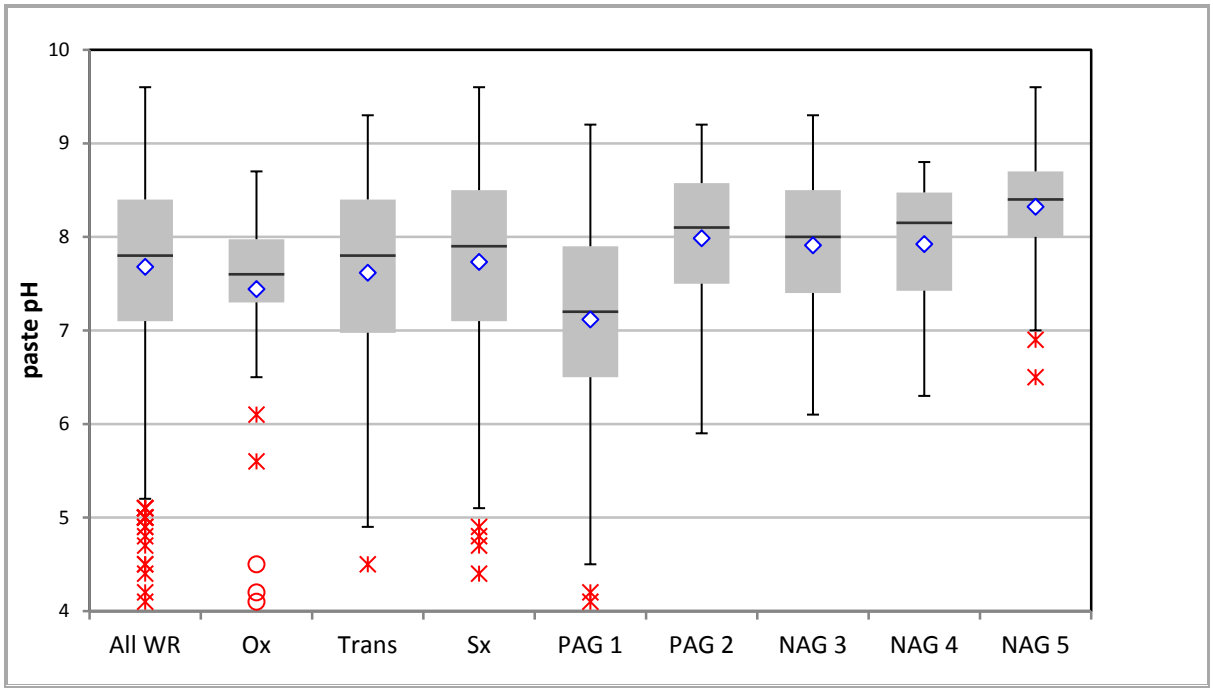


Figure 3-6: Box and Whisker Plot of Paste pH Waste Rock

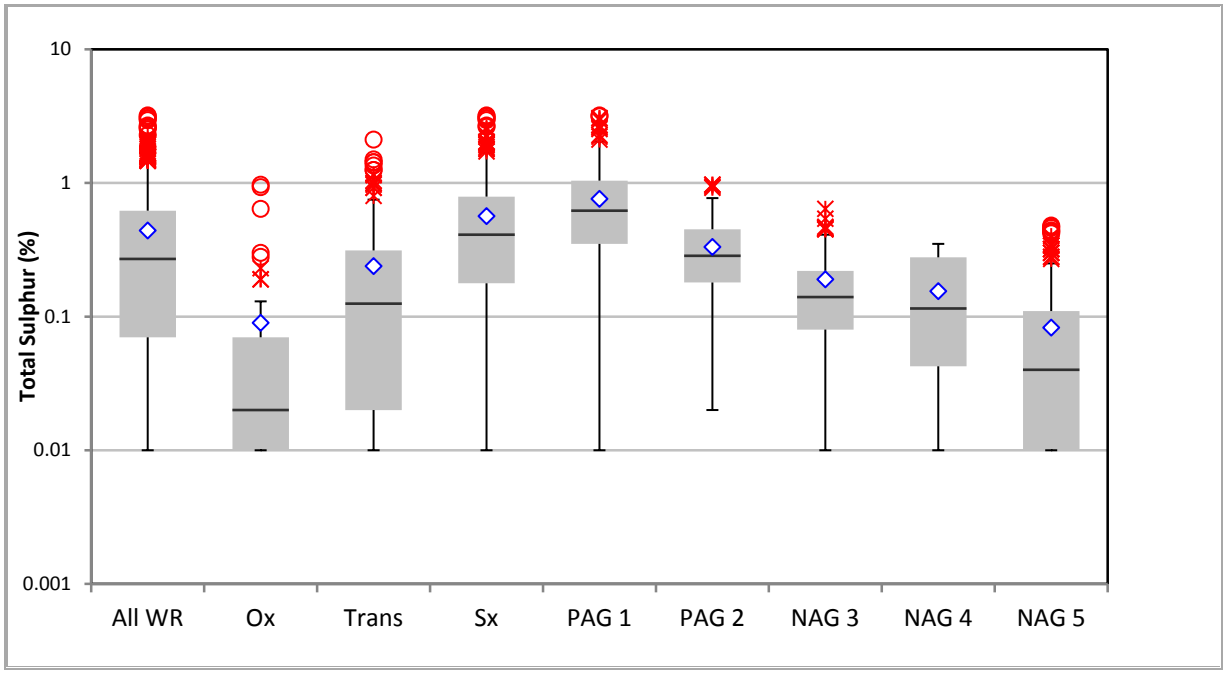


Figure 3-7: Box and Whisker Plot of Waste Rock Total Sulphur Concentrations

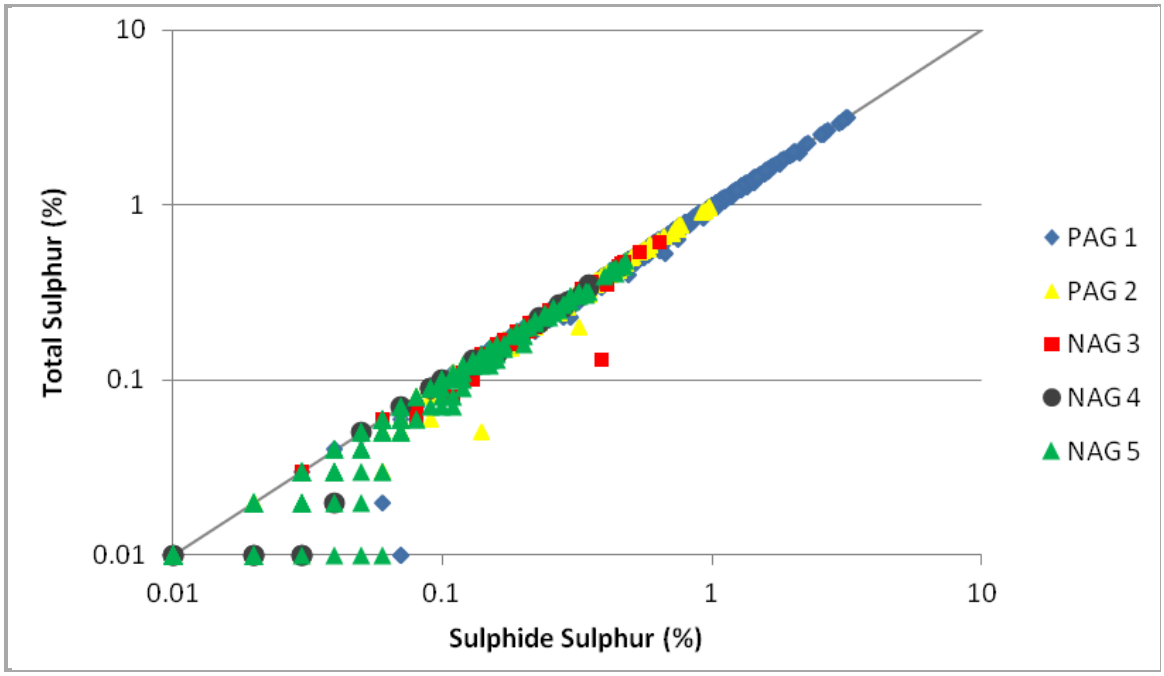


Figure 3-8: Comparison of Sulphide Sulphur and Total Sulphur for Waste Rock by Type

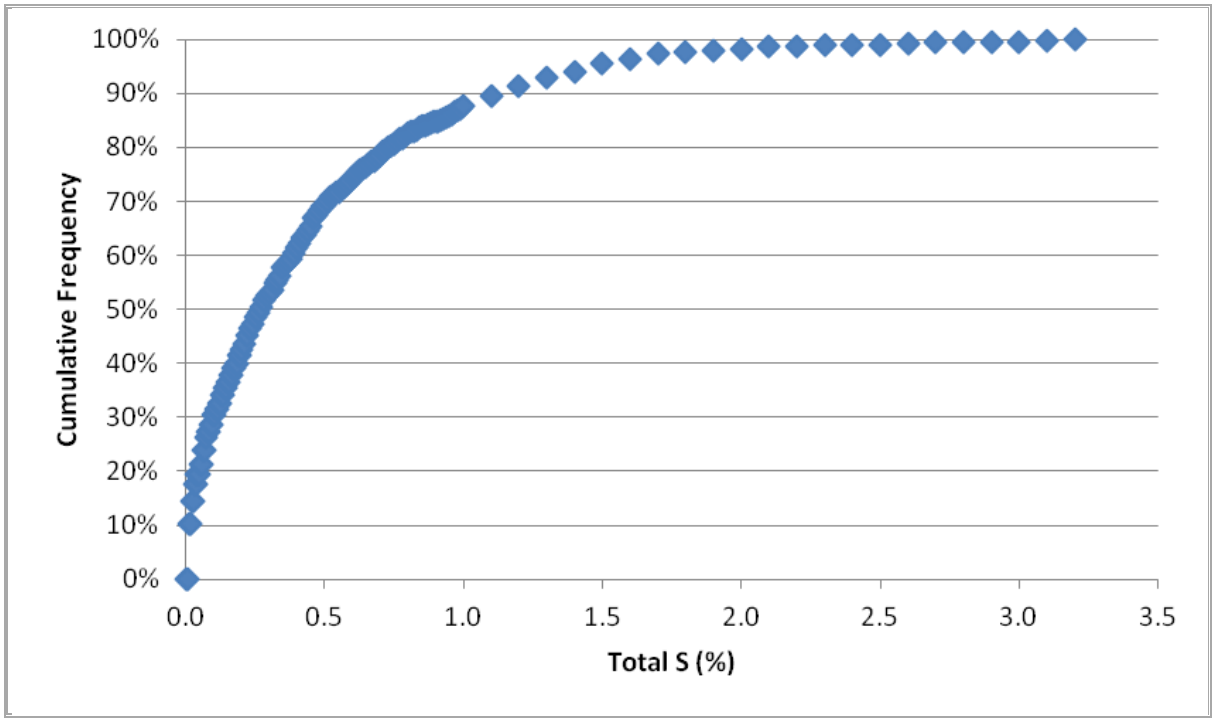


Figure 3-9: Cumulative Frequency Plot of Total Sulphur Concentrations in Waste Rock

A significant 1:1 relationship exists between total sulphur measured during ABA and sulphur measured from aqua regia digestion with ICP-MS finish (r^2=0.99; **Figure 3-10**). This relationship suggests that ICP sulphur is a suitable surrogate for total sulphur measured in ABA.

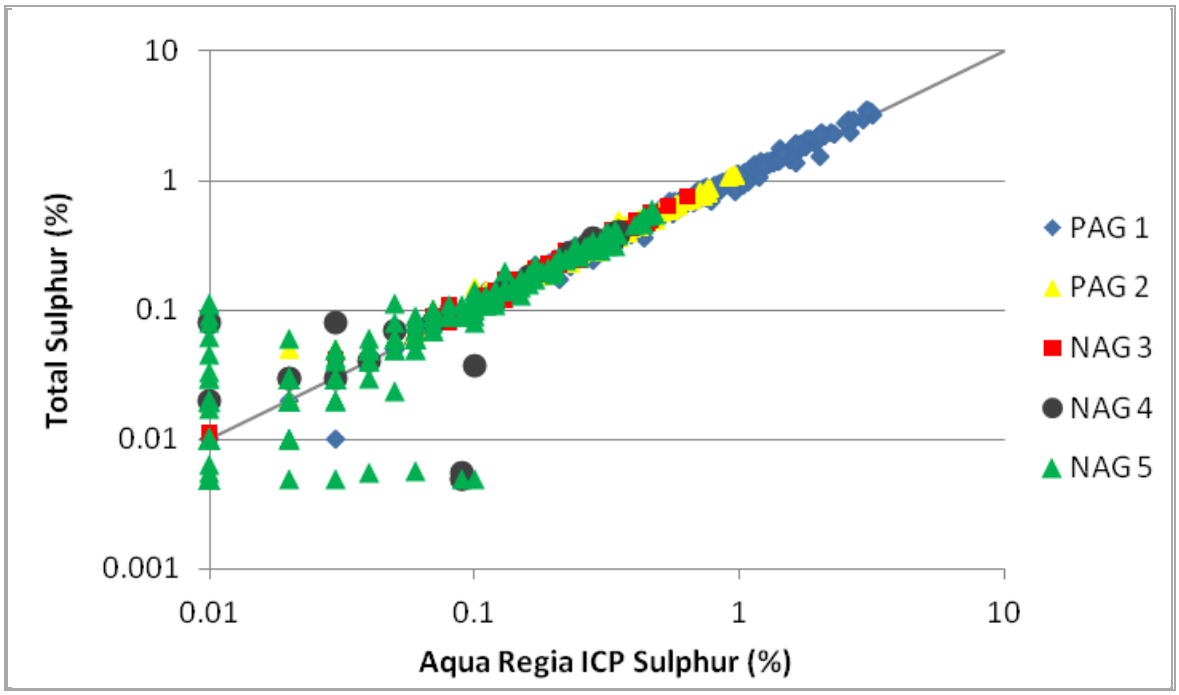


Figure 3-10: Total Sulphur from ABA vs. ICP Sulphur for Waste Rock by Type

Sphalerite is a common sulphide mineral at the Project, and elevated concentrations of zinc were found in almost 50% of the waste rock samples. Sphalerite was detected in 11 of the 13 waste rock samples that had sulphide minerals. However, sphalerite does not generate acid with oxidation, but it does contribute to the total and sulphide sulphur concentrations measured in ABA and aqua regia digestion. Hence, sphalerite content could lead to an overestimation of MPA and AP. To evaluate the effect of sphalerite content on the AP, an "adjusted" sulphur concentration was calculated. This calculation assumed that all zinc measured in the aqua regia digestion occurs as sphalerite. **Figure 3-11** shows the adjusted sulphur distribution across the waste rock oxidation facies and ARD categories. The adjusted values were less than both AP and MPA values, and ranged from less than 0.011 kg CaCO3/t to 95 kg CaCO3/t in all samples (**Table 3-10**, and **Figure 3-12**). Forty-five percent of the sample had MPA values 50% or more greater than the sphalerite adjusted AP. The total sulphur concentrations and MPA provide a conservative estimate for ARD prediction and were used in this assessment. Total sulphur in the ABA database was generally lower in the fragmental rock unit and highest in the sediments while the andesite and felsic tuff lithologies are similar (**Figure 3-13**). As explained previously the ABA database was chosen to provide a wide coverage of ABA parameters and may not be fully representative of the waste rock blocks to be mined.

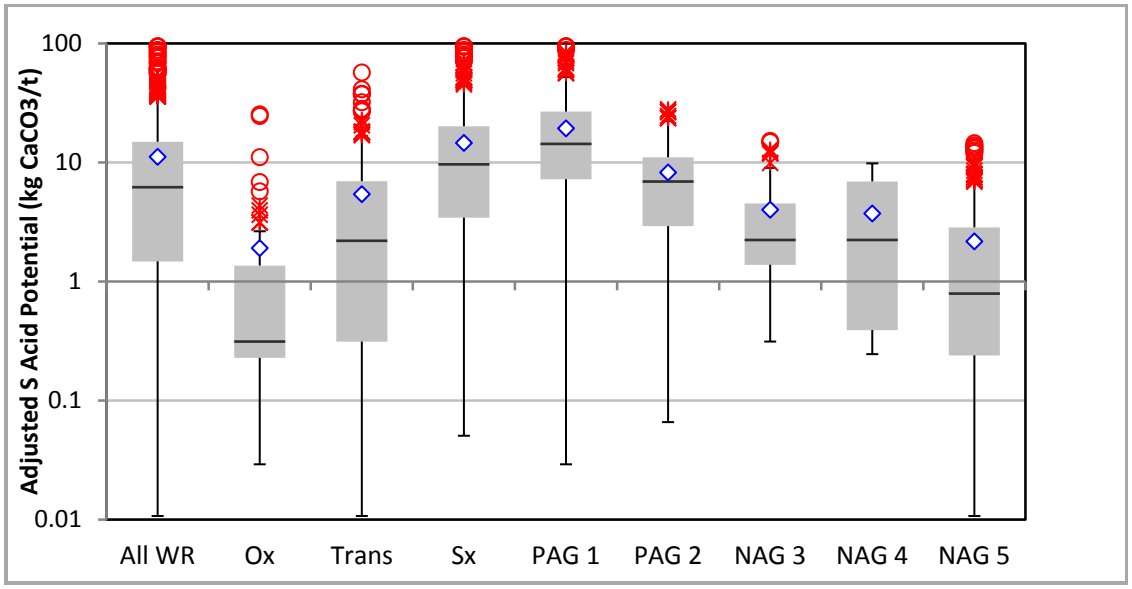


Figure 3-11: Box and Whisker Plot of Waste Rock Adjusted Sulphur Concentrations

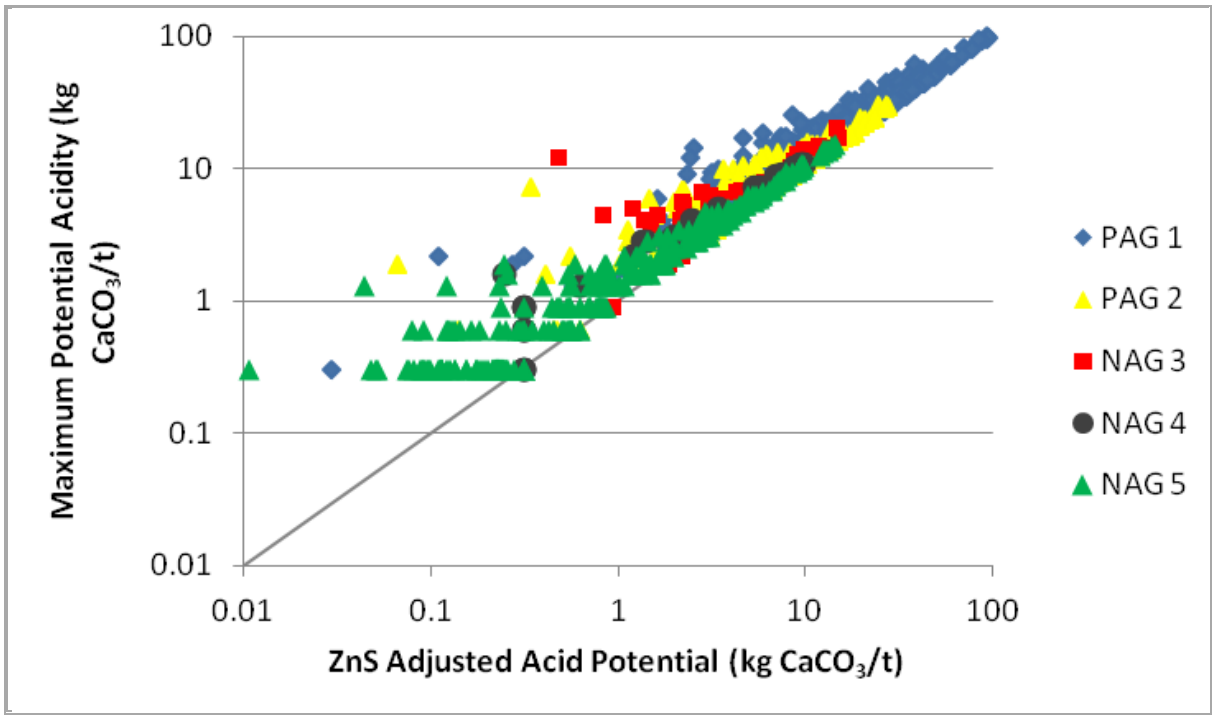


Figure 3-12: Maximum Potential Acidity vs. Adjusted Acid Potential (subtract ZnS AP) for Waste Rock by Type

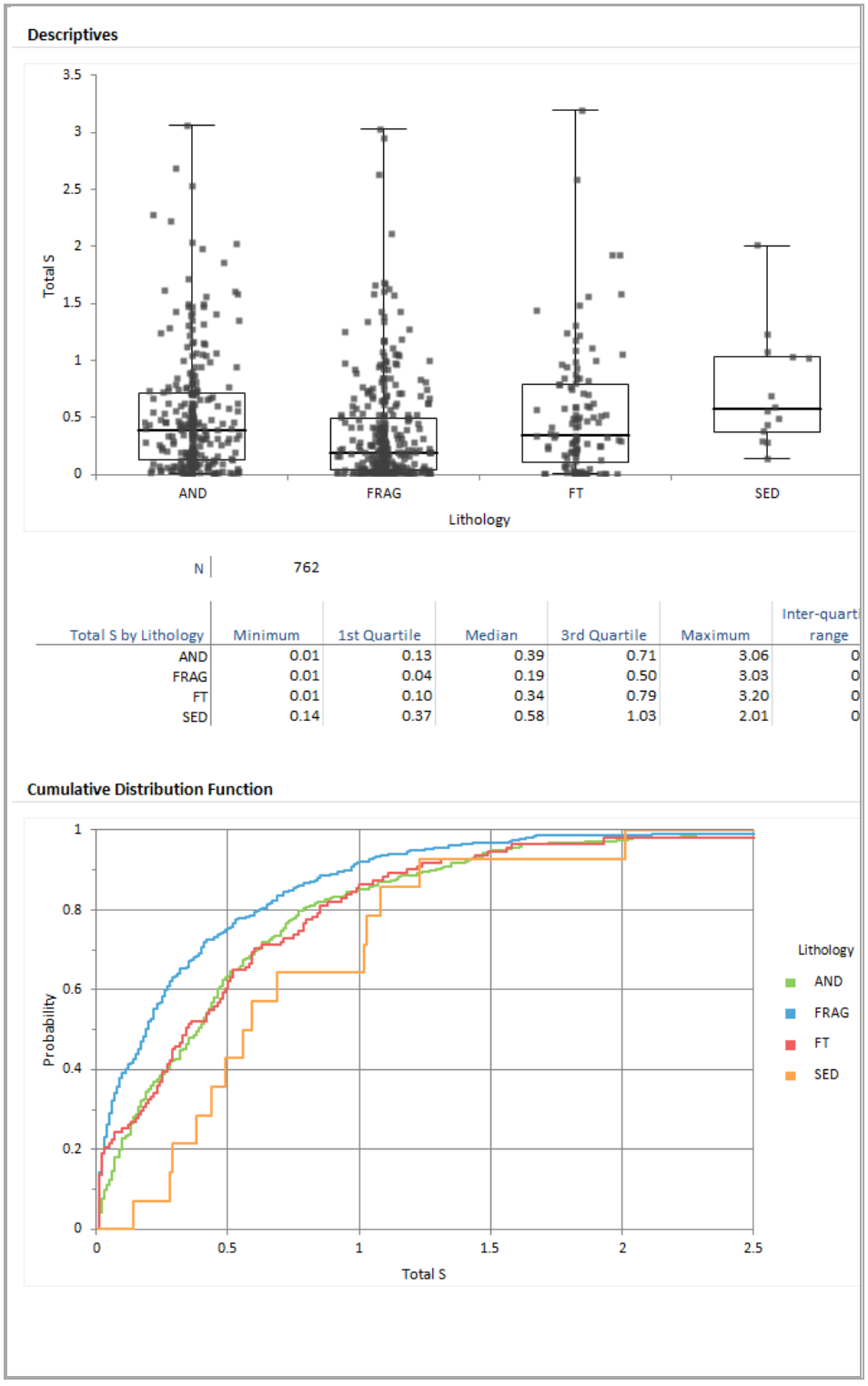


Figure 3-13: Total Sulphur Concentrations by Lithology

3.2.3.3 Neutralization Potential

The waste rock modified Sobek NP values were generally low and ranged from 0.01 to 92 kg $CaCO_3$/t, with a median of 10 kg $CaCO_3$/t (**Table 3-10**). As shown in **Figure 3-14**, the highest median NP (12 kg $CaCO_3$/t) was in the sulphide weathering facies (**Table 3-13**) and lowest in the oxide facies (2 kg $CaCO_3$/t) (**Table 3-11**), likely reflecting the removal of NP during weathering.

The PAG 1 and PAG 2 waste rock had low NP values that ranged from 0.01 to 48 kg $CaCO_3$/t, with median values of 7 kg and 13 kg $CaCO_3$/t, respectively. NAG 3, 4 and 5 waste rock samples had a wider range of NP values (from 1 to 92 kg $CaCO_3$/t), with median values of 16 kg, 23 kg, and 13 kg $CaCO_3$/t, respectively.

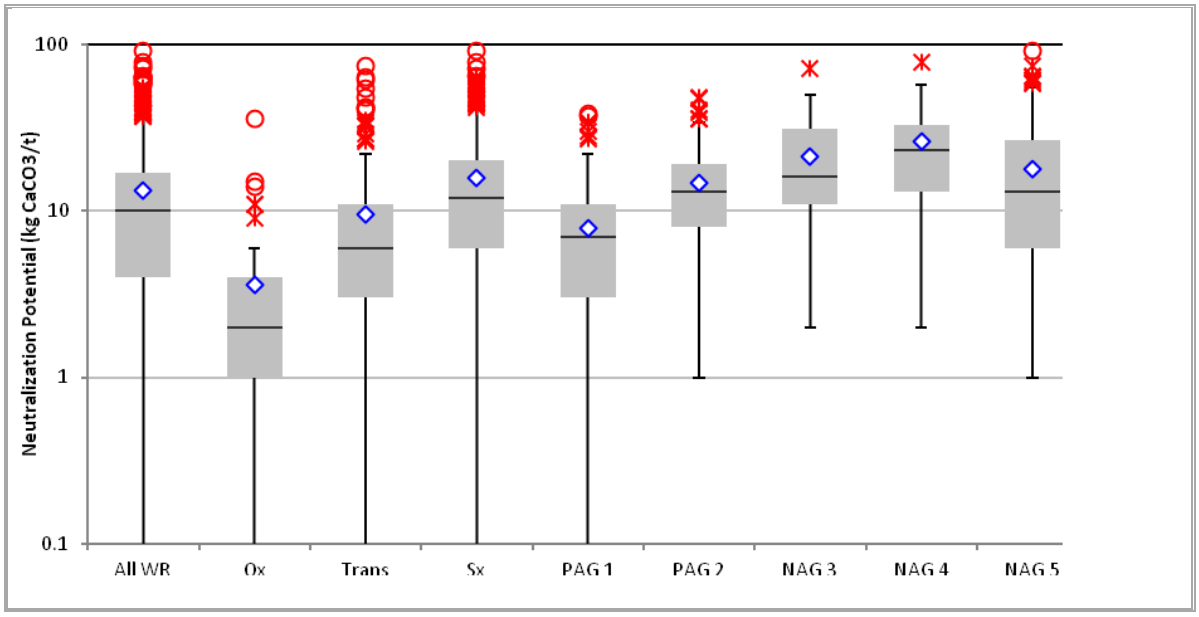


Figure 3-14: Box and Whisker Plot of Modified Sobek Neutralization Potential – Waste Rock

The NP attributed to carbonate minerals (CNP, calculated from total inorganic carbon concentrations) was also low, and ranged from 4.2 kg $CaCO_3$/t to 95 kg $CaCO_3$/t in all samples, with a median of 4.2 kg $CaCO_3$/t (**Table 3-10**). The median CNP values were 4.2 kg $CaCO_3$/t for oxide facies, 4.2 kg $CaCO_3$/t for transition facies, and 5.8 kg $CaCO_3$/t for sulphides facies. An increase in the median CNP value across the waste rock categories from PAG 1 (4.2 kg $CaCO_3$/t) to NAG 4 (15.8 kg $CaCO_3$/t) was observed (**Figure 3-15**). However, NAG 5 reported a lower median CNP value of 7.5 kg $CaCO_3$/t. The lower NP values in the NAG 5 (n=278) compared with NAG 4 (n=26) maybe a limitation of the smaller dataset for NAG 4 samples.

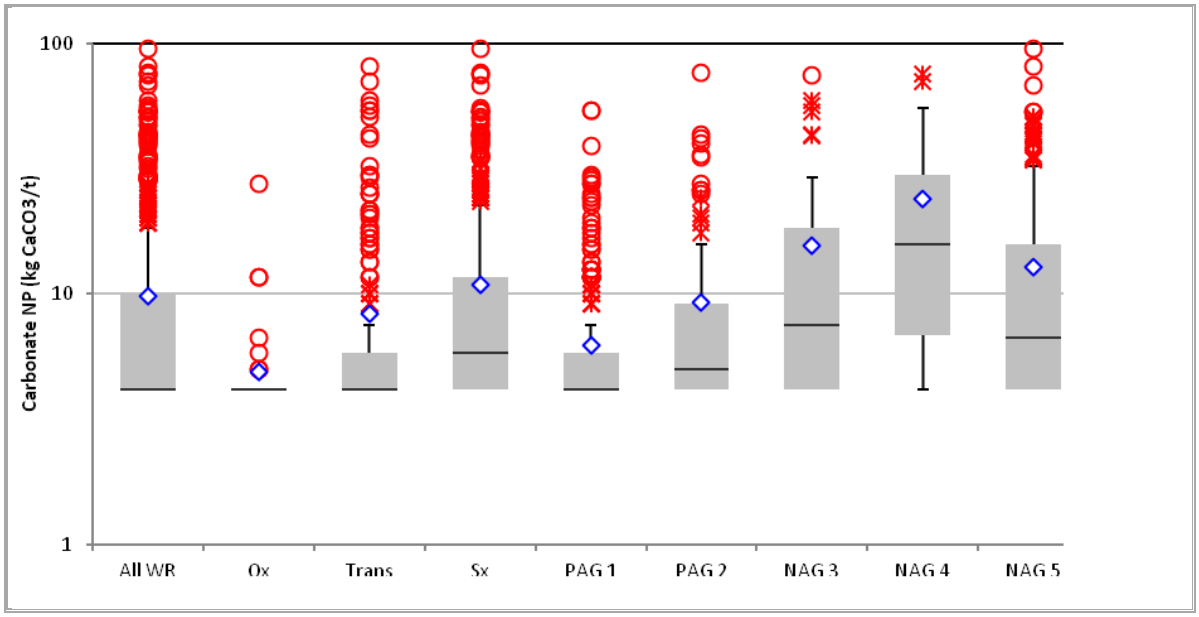


Figure 3-15: Box and Whisker Plot of Carbonate Neutralization Potential – Waste Rock

Sobek NP was generally greater than CNP, although there were exceptions especially at lower NP values, (**Figure 3-17**), suggesting that non-carbonate minerals (silicates) are contributing to the NP in waste rock. At NP values less than approximately 15 kg $CaCO_3$/t, non-carbonate NP appears to play an important role in neutralization capacity. With increasing NP values, carbonate-bearing minerals appear to contribute greater amounts of neutralization potential.

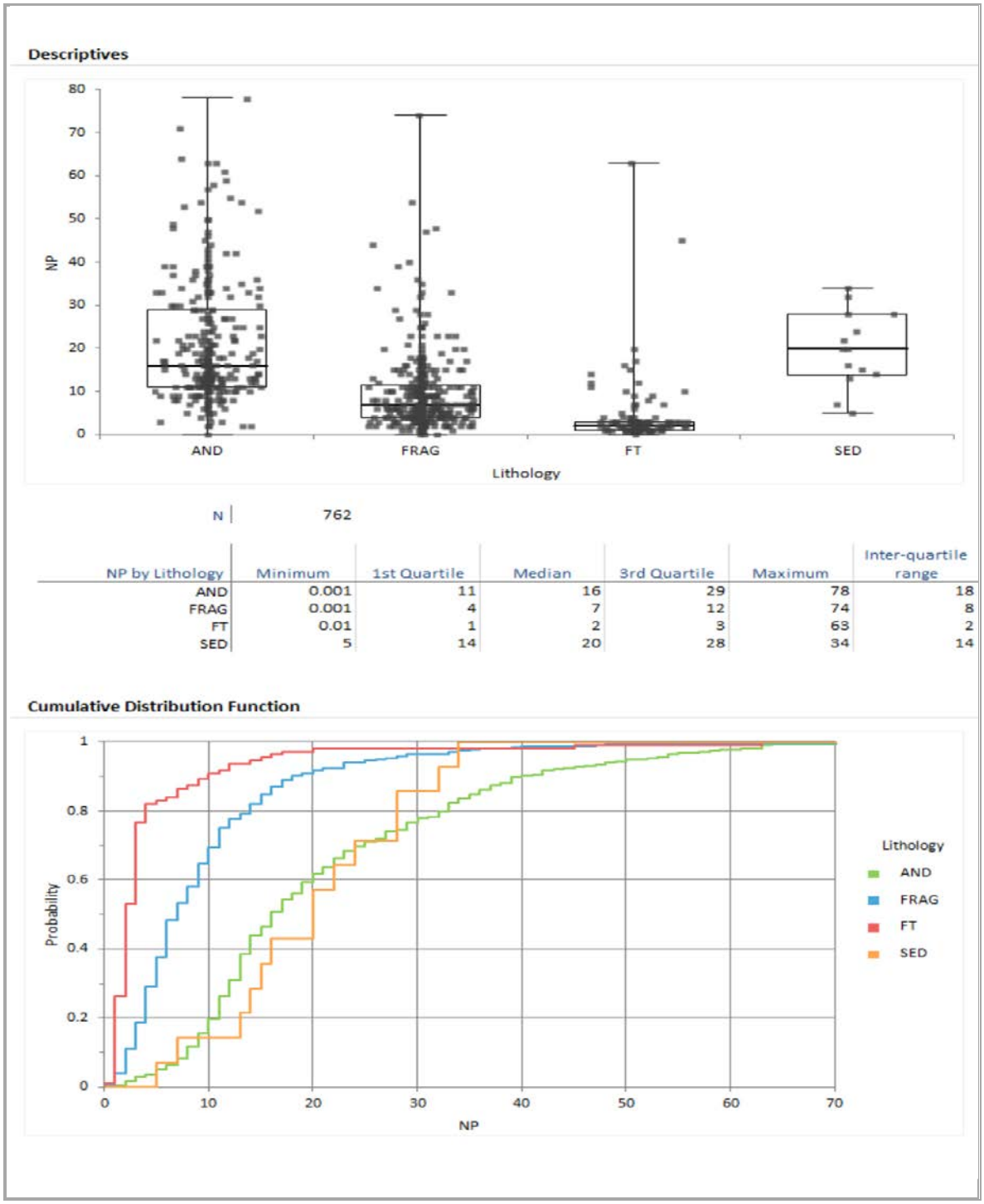
The iron-carbonate mineral siderite was found in eight of 17 carbonate-containing waste rock samples tested using Rietveld-XRD (**Table 3-19** and **Table 3-7**). Of these 17 carbonate-containing samples, calcite was identified in the one PAG 2 sample and seven NAG 3, 4 and 5 waste rock samples, whereas siderite was observed only in the PAG 1, 2 and NAG 3 samples. The presence of siderite can overestimate NP measured by the modified Sobek test. Therefore, a subset of samples were analyzed for siderite corrected NP. The results, shown in **Table 3-19**, indicate that generally the modified Sobek NP values were greater than the siderite corrected NP. The exception was the NAG 3 sample that had essentially equal modified Sobek NP and siderite corrected NP values. The difference between siderite corrected and modified Sobek NP ranged from only -4 to 1 kg $CaCO_3$/t. The impact of siderite on NP values is more pronounced at higher concentrations of siderite and very low modified Sobek NP values, such as in PAG 1 and PAG 2 waste rock. Management plans call for all PAG 1, 2 and NAG 3 waste rock to be segregated during mining and permanently submerged in the TSF and mineralogical results did not report siderite in any NAG 4 or 5 waste rock samples. Therefore, presence of siderite should not have a significant effect on management plans or ARD potential.

Table 3-19: Comparison of Modified Sobek NP and Siderite Corrected NP in Waste Rock

Sample ID	Sample Type	Siderite (%)	Siderite Corrected NP	Modified Sobek NP kg $CaCO_3$/t	Difference
BW-ARD2-9	PAG 1	1.4	7	9	-2
BW-ARD-058	PAG 1	6.3	10	12	-2
BW-ARD-288	PAG 2	0.7	14	18	-4
BW-ARD-009	Ore	0.6	12	14	-2
BW-ARD-176	NAG 3	0.5	34	33	1

The NP was higher in the andesite and sediment rock units compared to the fragmental and felsic tuff (**Figure 3-16**). The higher NP in andesite is consistent with New Gold's geologist's observations of calcite stringers in that rock unit.

Modified Sobek NP results were compared to NP calculated from aqua regia ICP calcium concentrations (ICP-Ca NP (**Figure 3-17**). Above approximately 15 kg $CaCO_3$/t, modified Sobek NP is less than the ICP-Ca NP. This suggests that using ICP-Ca concentrations may overestimate the NP at values greater than 15 kg $CaCO_3$/t, as there appear to be Ca-bearing minerals present that do not contribute to NP. Conversely, at lower NP values, ICP-Ca NP may slightly underestimate NP, as non-carbonate NP appears to play an important role in neutralizing capacity. The comparison shown in **Figure 3-18** suggests that using ICP-Ca NP as a surrogate for ABA NP may overestimate the NP where NP is greater than approximately 15 kg $CaCO_3$/t.



NP by Lithology	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
AND	0.001	11	16	29	78	18
FRAG	0.001	4	7	12	74	8
FT	0.01	1	2	3	63	2
SED	5	14	20	28	34	14

Figure 3-16: Neutralization Potential by Lithology

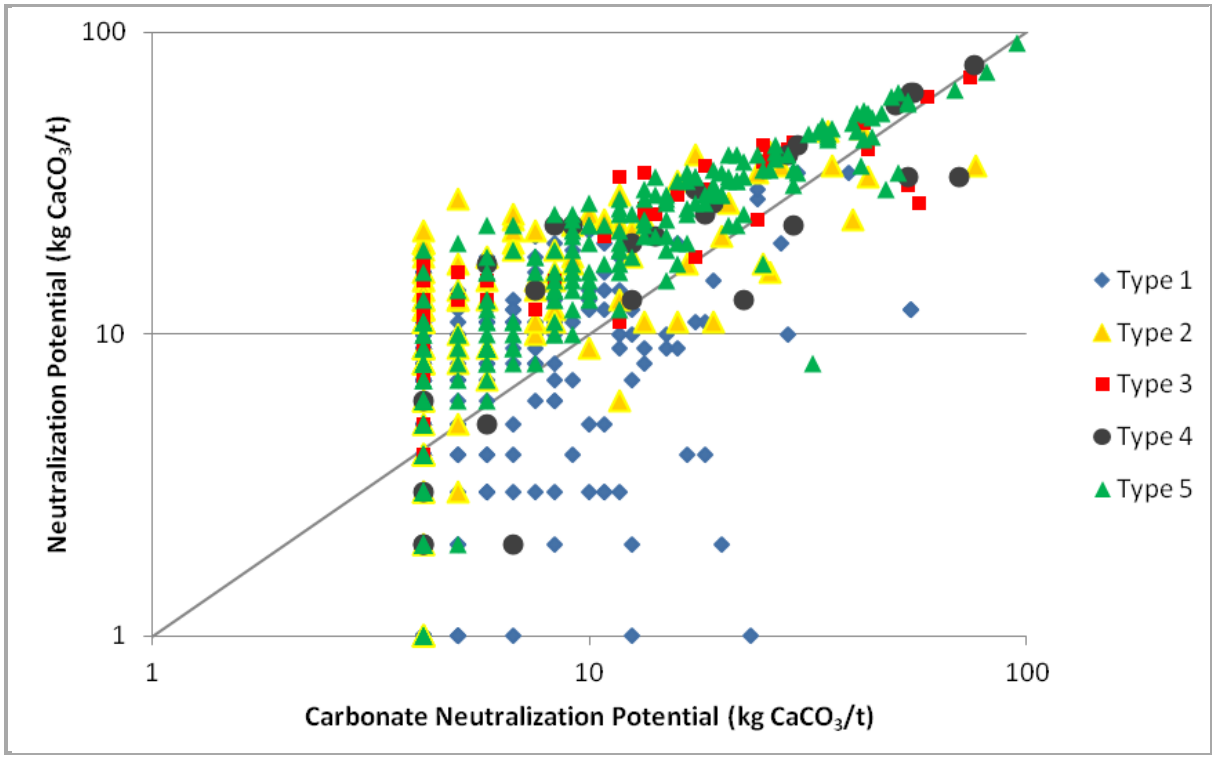


Figure 3-17: Comparison of Modified Sobek NP and Carbonate NP for Waste Rock Samples

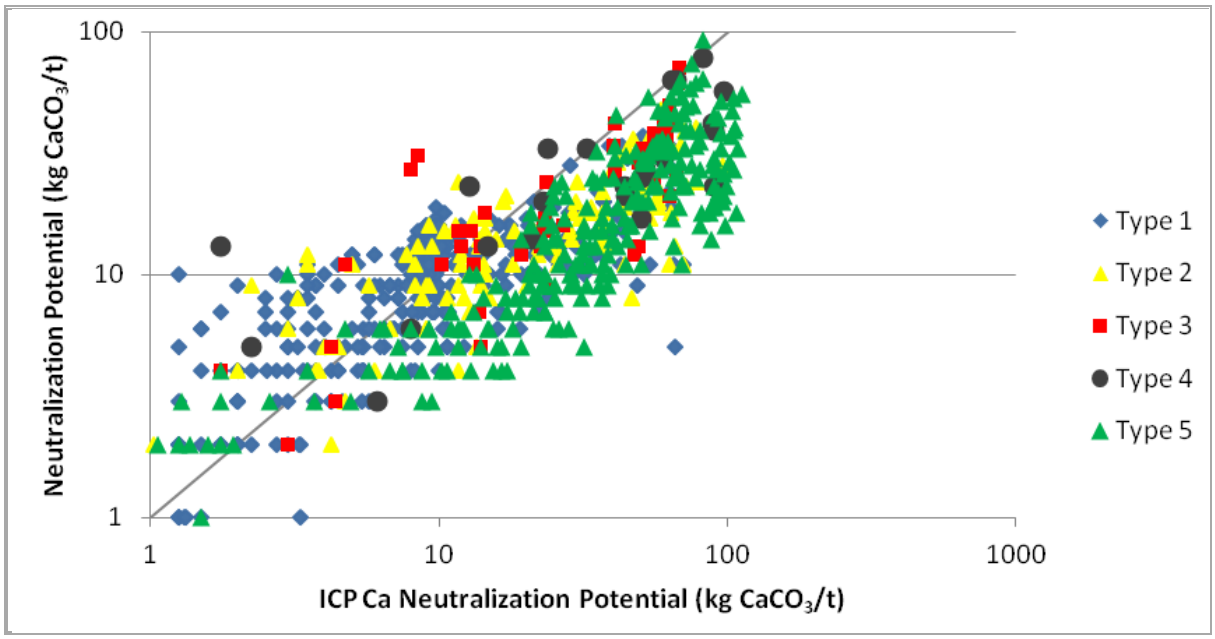


Figure 3-18: Modified Sobek Neutralization Potential vs. ICP Neutralization Potential – Waste Rock

3.2.3.4 Neutralization Potential Ratios

Neutralization potential ratios (NPR) were conservatively calculated using the ratio of the modified Sobek NP to MPA (**Figure 3-19**). The NPR of all waste rock samples ranged from 0 to 180 (**Table 3-10**). Average and median NPR values were 6.1 and 1.2, respectively, with 60% of samples having an NPR less than two, and 47% having an NPR less than one (**Figure 3-20** and **Table 3-20**).

For the weathering facies, the sulphide facies had the lowest median NPR at 0.9 (**Table 3-13**), the oxide facies the highest median value at 5.0 (**Table 3-11**), and the transition facies was intermediate at 1.9 (**Table 3-12** and **Figure 3-20**). The NPR distribution for each weathering facies is shown in **Figure 3-21** and summarized in **Table 3-20**. The sulphide facies had the greatest number of samples with NPR less than two. The oxide facies had the greatest number of samples with NPR values greater than two.

Table 3-20: Waste Rock Neutralization Potential Ratio Distribution According to Weathering Facies

	% Samples NPR<1	% Samples NPR 1-2	% Samples NPR > 2
Oxide	26	11	63
Transition	39	12	49
Sulphide	52	15	33

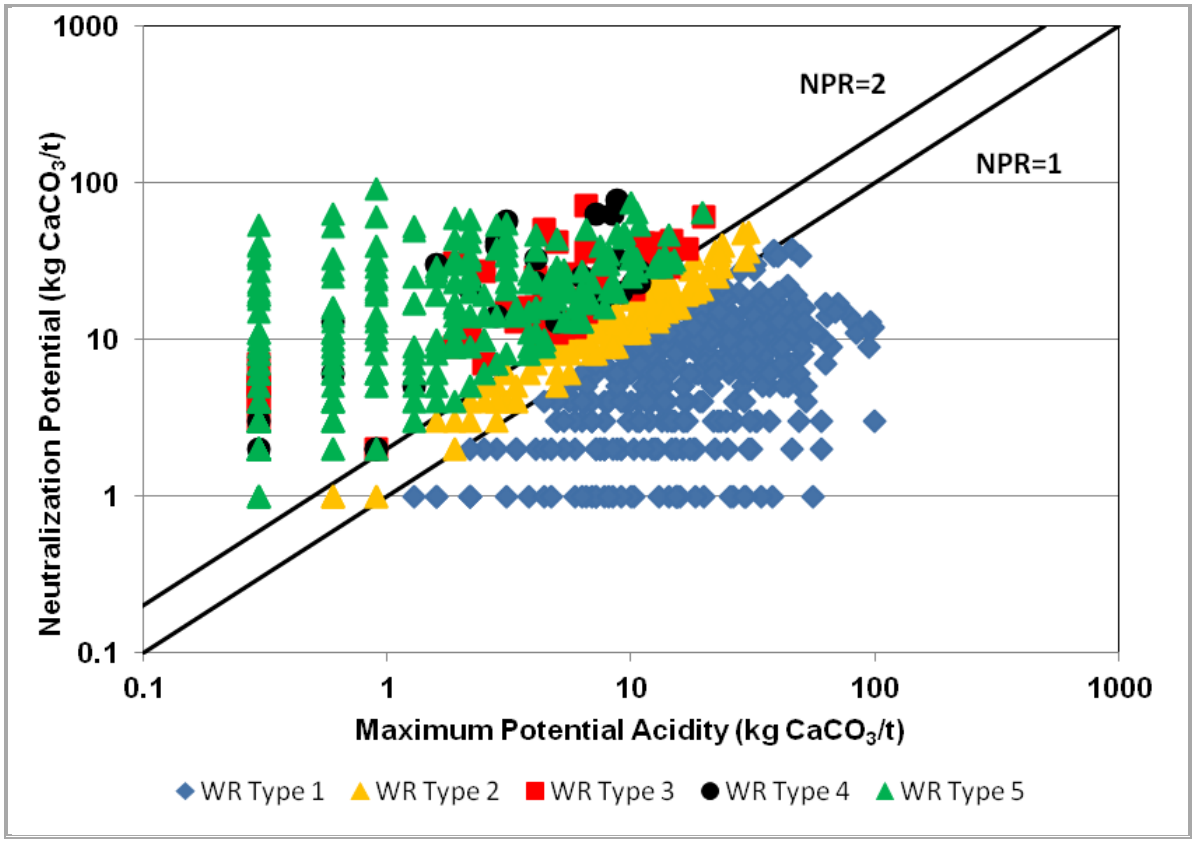


Figure 3-19: Modified Sobek Neutralization Potential vs. Maximum Potential Acidity –Waste Rock Type

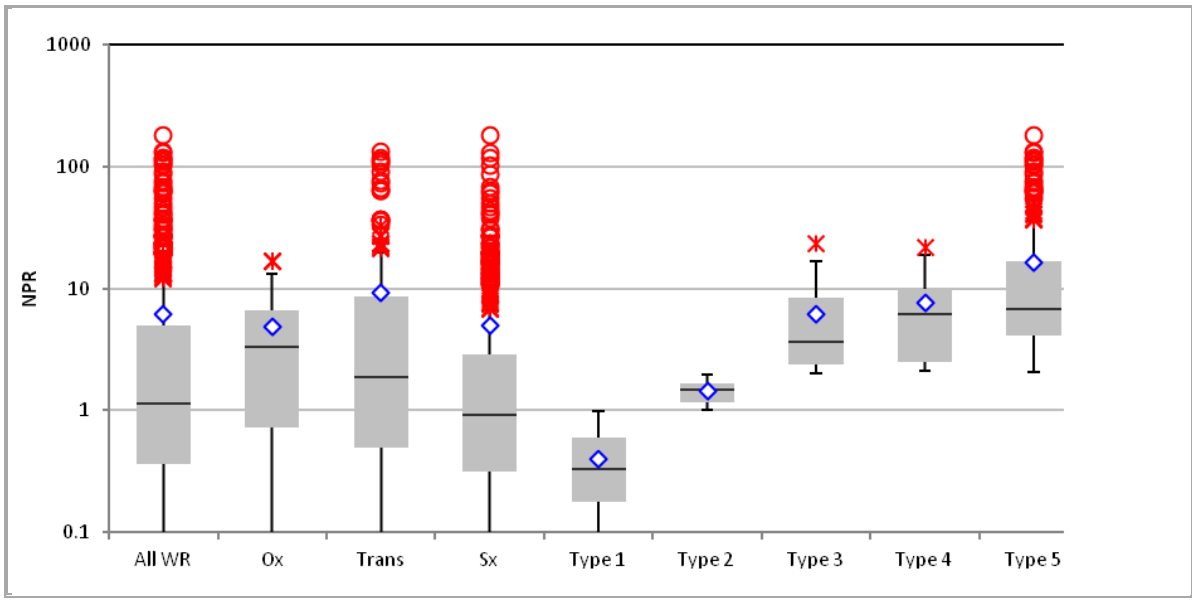


Figure 3-20: Box and Whisker Plot of Neutralization Potential Ratio – Waste Rock

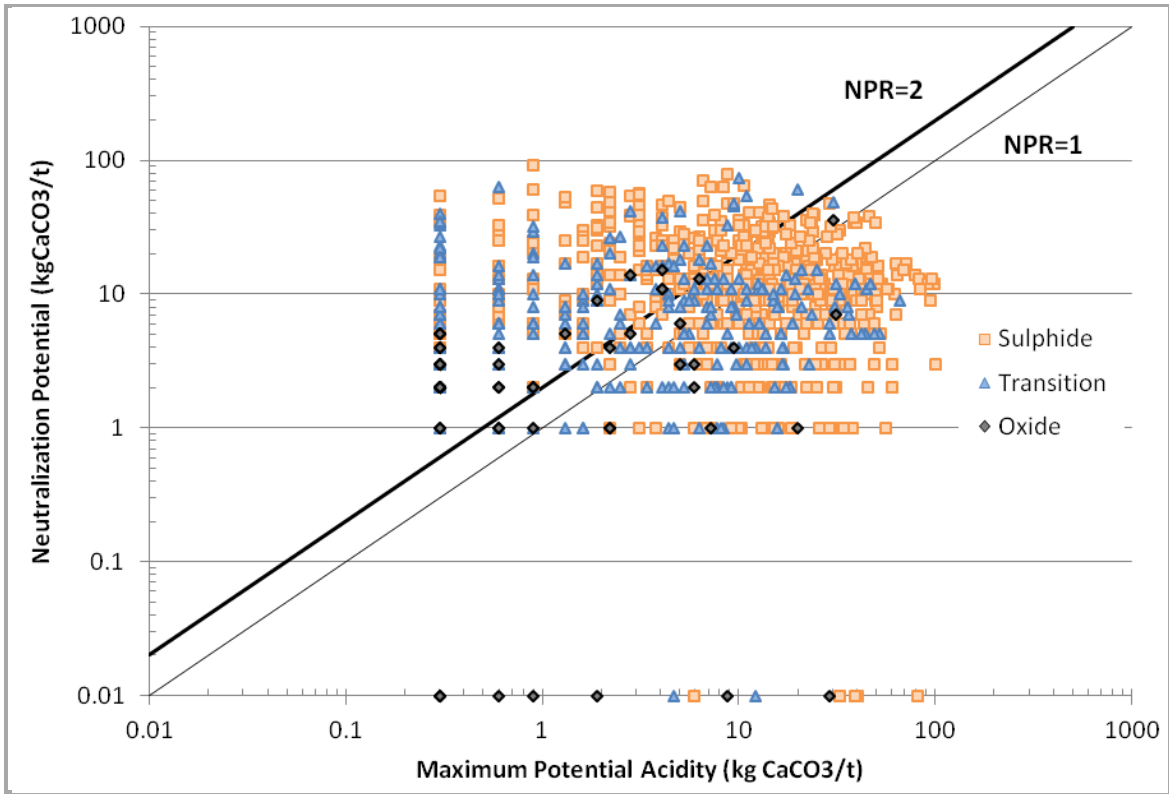


Figure 3-21: Modified Sobek Neutralization Potential vs. Maximum Potential Acidity – Weathering Facies

The median NPR values increased across the five waste rock classes, with PAG 1 having the lowest median (0.3) and NAG 5 the highest (6.8) (**Figure 3-20**). The median NPR values of the non-PAG rock types were all above the threshold of two.

A variation on the NPR values was calculated using zinc-adjusted AP values instead of MPA to account for the presence of sphalerite. These adjusted NPR values ranged from less than 0.1 to 772. **Figure 3-22** shows that both methods to calculate NPR resulted in similar results. Where the results do not agree, NPR calculated from MPA was conservative.

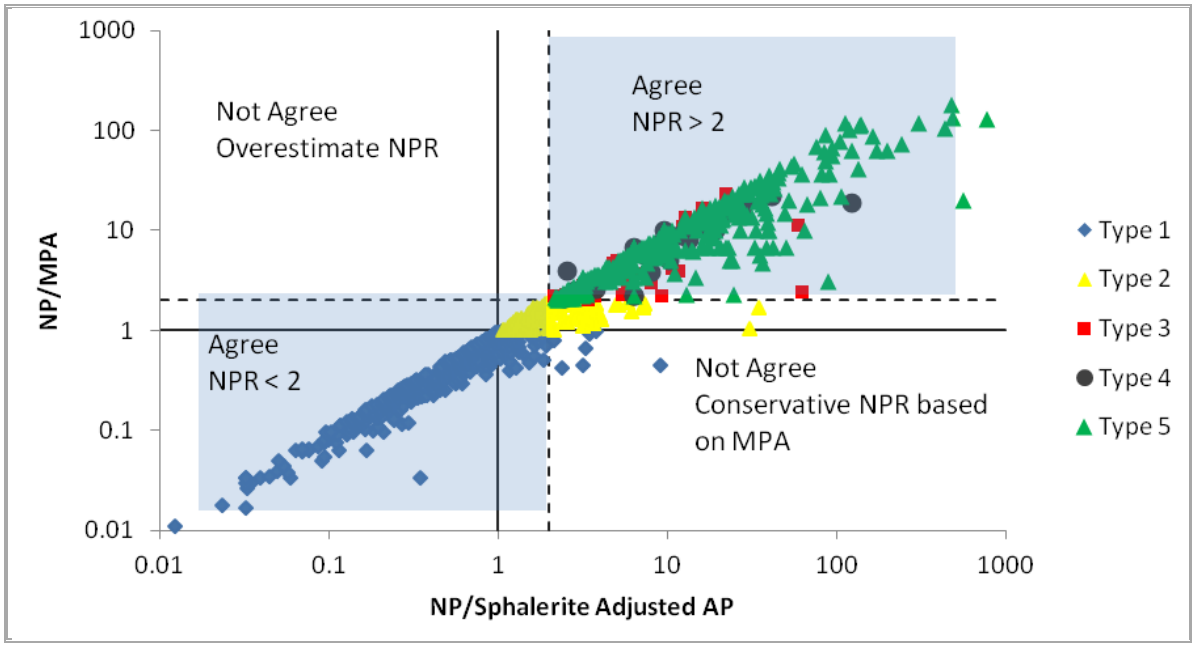


Figure 3-22: Comparison of NPR calculated using MPA and Sphalerite Adjusted AP

Figure 3-23, NPR calculated using the modified Sobek NP was compared against NPR calculated using ICP Ca NP. These results show that there is generally good agreement between both methods of calculating NPR. There are a small number of samples where the ICP Ca NP overestimates the NPR relative to the modified Sobek NP. Approximately 10% of samples (86 out of 890) overestimate the NPR. However, of these samples, 35 had zinc concentrations greater than 1000 mg/kg and would be classified as NAG 3 and managed with the PAG 1 and PAG 2 waste rock in the TSF. Approximately 6% of waste rock samples overestimate the NPR using ICP Ca NP compared with the more conservative modified Sobek NP.

The percentage of samples classified as PAG or non-PAG varied, depending on how the NPR was calculated (**Table 3-21**). Waste management plans call for all PAG 1, PAG 2, and NAG 3 waste rock to be permanently submerged in the TSF, and for NAG 4 and 5 waste rock to be placed in on-land dumps or used for construction. Using the ICP-Ca NP to calculate NPR is a concern if it shifts material classified as PAG 1, 2, or NAG 3 into the NAG 4 or 5 categories. As shown in **Table 3-21**, only a small percentage of samples (4%, 39 of 890 samples) shift into the NAG 4 or NAG 5 groups from PAG 1, PAG 2 or NAG 3. A detailed investigation of these 39 samples showed that only 16 of the 39 misclassified samples were within the ultimate pit (2% or 16 of 890 samples).

Table 3-21: Neutralization Potential Ratio Distributions Using Different Sources of Neutralization Potential and Acid Potential

	PAG 1 (%)	PAG 2 (%)	NAG 3 (%)	NAG 4 (%)	NAG 5 (%)
NP/ZnS Adjusted AP	40	14	10	4	33
ICP Ca NP/MPA	45	10	9	3	33

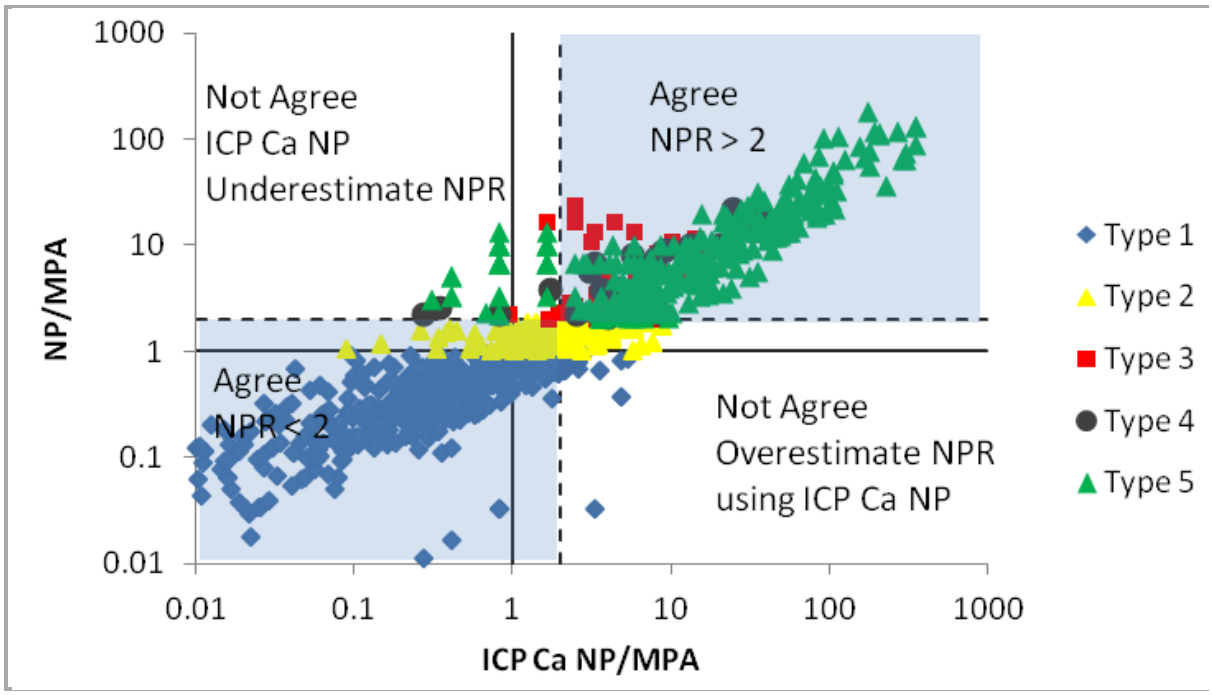


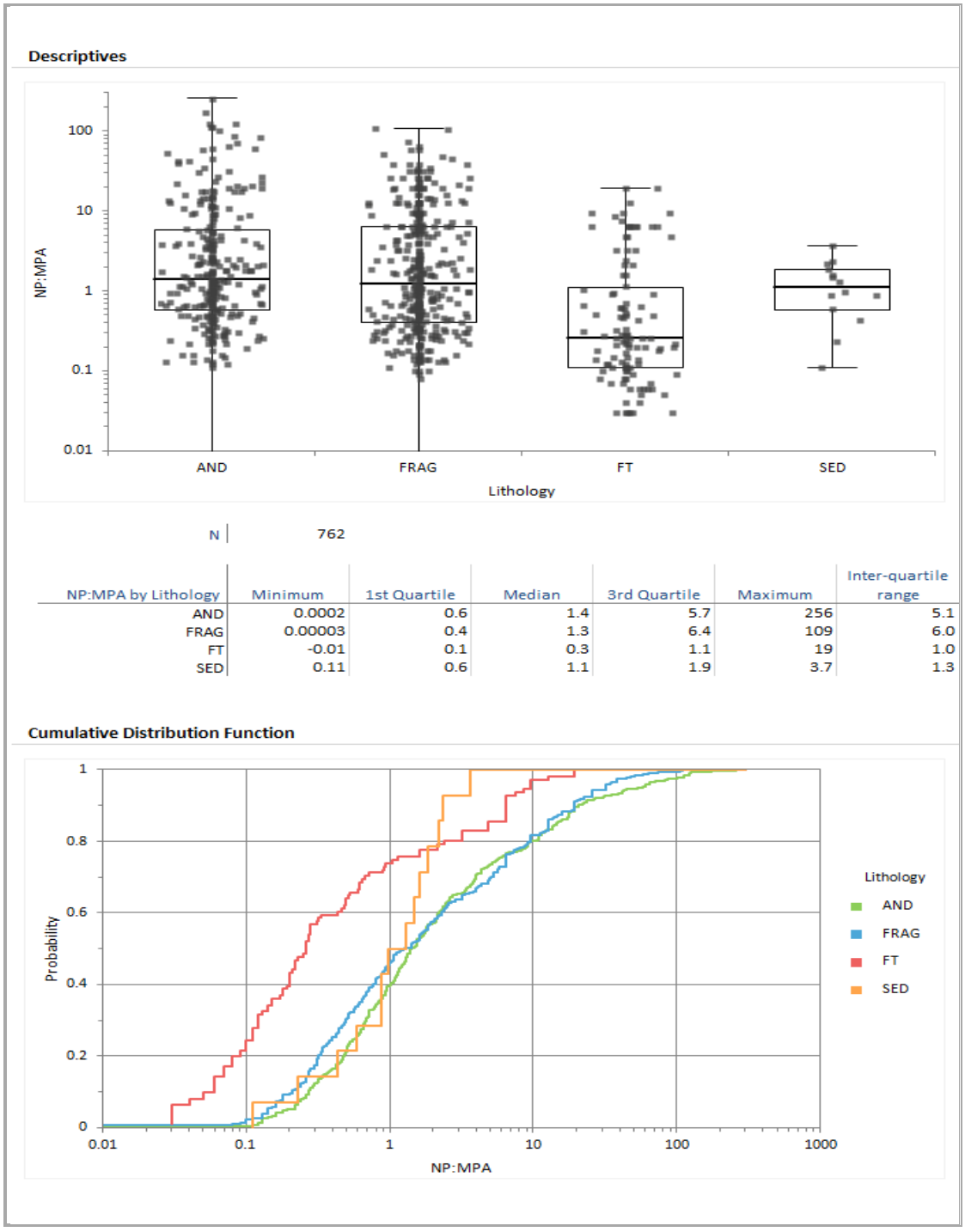
Figure 3-23: Comparison of NPR calculated using Modified Sobek NP and ICP Ca NP

The percentage of samples in each ARD category, median NPR, total sulphur, NP, and zinc values for each waste rock type are shown in **Table 3-22**. As discussed previously, the total sulphur decreased as the NPR value increased across the waste rock types. Except for PAG 2 waste rock, zinc concentrations also decreased across the ARD classes. This indicates that segregating based on NPR values will lead to segregation based on concentrations of sulphur and zinc.

Table 3-22: Select ABA Parameters Summarized by Waste Rock Type

	No. Samples (%)	Median NPR	Median TS (%)	Median NP (kg $CaCO_3$/t)	Median Zinc (mg/kg)
PAG 1	415 (47%)	0.3	0.6	7	1720
PAG 2	122 (14%)	1.5	0.3	13	878
NAG 3	49 (6%)	3.6	0.14	16	1600
NAG 4	26 (3%)	6.1	0.12	23	797
NAG 5	278 (31%)	6.8	0.05	13	128

In general, the andesite and fragmental lithologies exhibited the highest NPR with the felsic tuff the lowest (**Figure 3-24**). Thirteen holes were drilled specifically targeting waste rock in the south and west periphery of the pit. The south wall of the pit represents the high wall and therefore a significant quantity of waste rock is adjacent to that wall. Samples were composited over 10 m and analyzed for ABA. Intervals were assigned to the ARD classes using NPR (based on total sulphur and modified Sobek NP) and zinc content. Results were used in part to develop the ARD block model described previously and the data are illustrated in **Figure 3-25**. In general, singleton NAG 4 and NAG 5 intervals were relatively rare; these NAG waste rock classes occurred in long contiguous intervals



N	762

NP:MPA by Lithology	Minimum	1st Quartile	Median	3rd Quartile	Maximum	Inter-quartile range
AND	0.0002	0.6	1.4	5.7	256	5.1
FRAG	0.00003	0.4	1.3	6.4	109	6.0
FT	-0.01	0.1	0.3	1.1	19	1.0
SED	0.11	0.6	1.1	1.9	3.7	1.3

Figure 3-24: NPR by Lithology

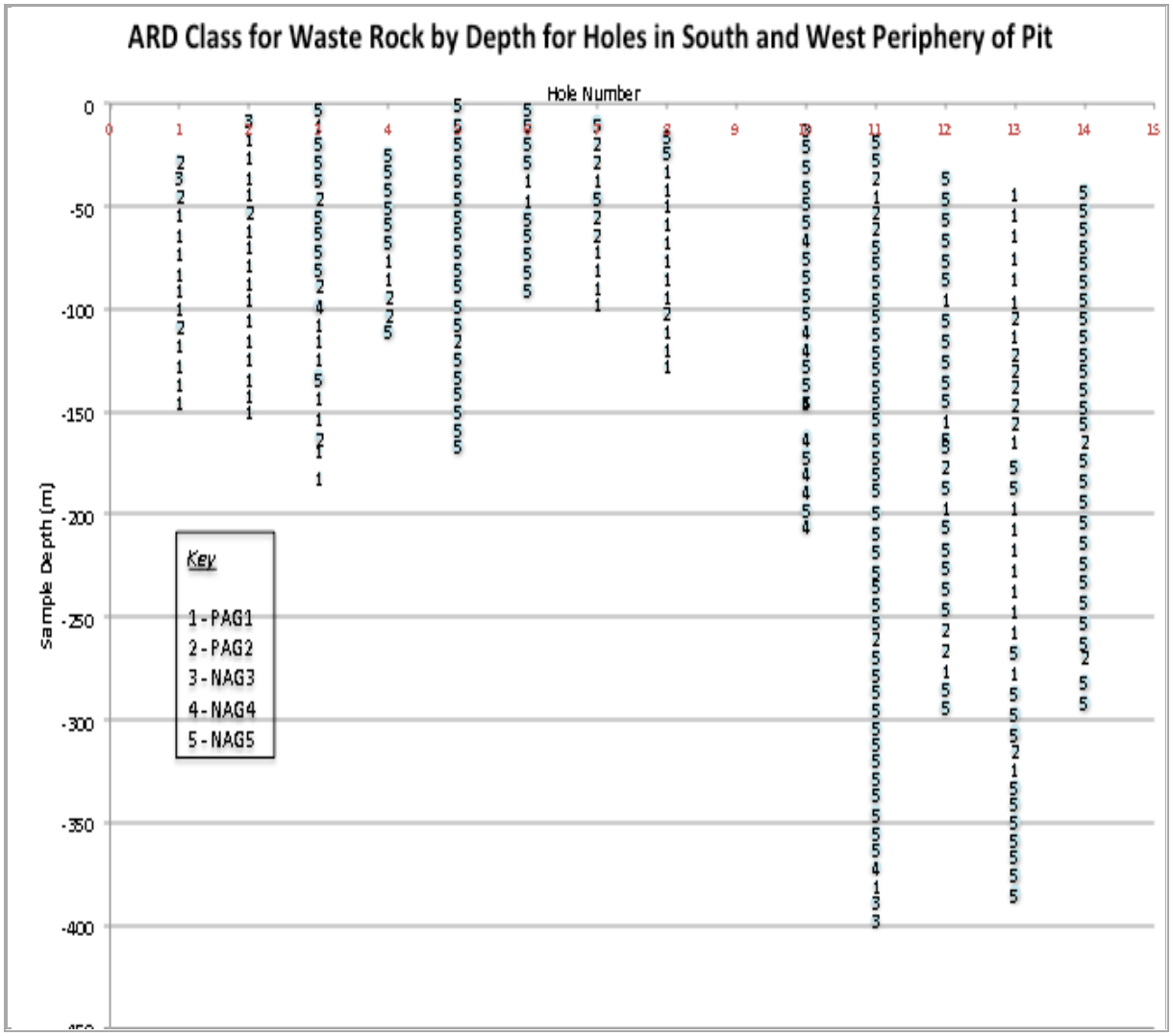


Figure 3-25: ARD Classification from Waste Rock Drilling Program (14 drill holes)

3.2.4 Comparison of Sample Compositing Methodologies

As previously discussed, three different compositing techniques were used to create the 10 m composite ABA samples. For Phase 1 (n=169 waste rock samples), ten coarse rejects of 1 m drill core intervals composited at the laboratory. For Phase 2 (n=73 waste rock samples), individual 10 cm to 15 cm drill core samples were collected every metre over a ten m length of core and composited in the field. For Phase 3 (n=265 waste rock samples), 10 fine-grained assay pulps of 1 m drill core intervals were composited at the laboratory. The different methodologies produced similar results for ABA.

Total sulphur values for Phase 1 and Phase 2 duplicates (n=26) are compared in **Figure 3-26**. The total sulphur values reported in Phase 1 and Phase 2 are similar, with generally less than 20% difference between the two phases, and a significant correlation (r^2 = 0.96). Comparatively, modified Sobek NP values were generally less consistent between the two phases (**Figure 3-27)**, though the correlated values still had a significant r^2 value of 0.87.

The comparison of total sulphur values for Phase 1 and Phase 3 duplicates (n=20) is shown in **Figure 3-28**. In general, the majority of duplicate samples reported less than a 10% difference in total sulphur values between Phase 1 and Phase 3. The correlation r^2 value for these samples based on total sulphur was 0.99. NP values in samples of reject material were higher than NP values in pulp samples in the majority of cases, but still reported a significant r^2 value of 0.62 (**Figure 3-29**).

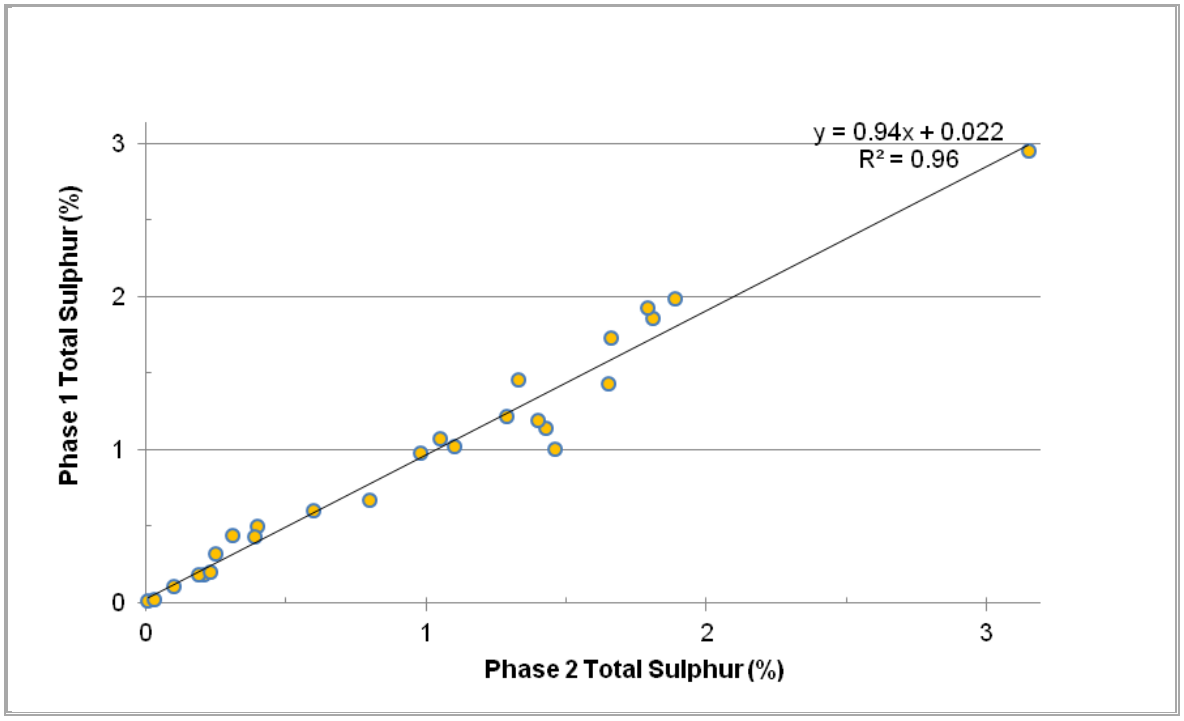


Figure 3-26: Comparison of Phase 1 and Phase 2 Samples for Total Sulphur

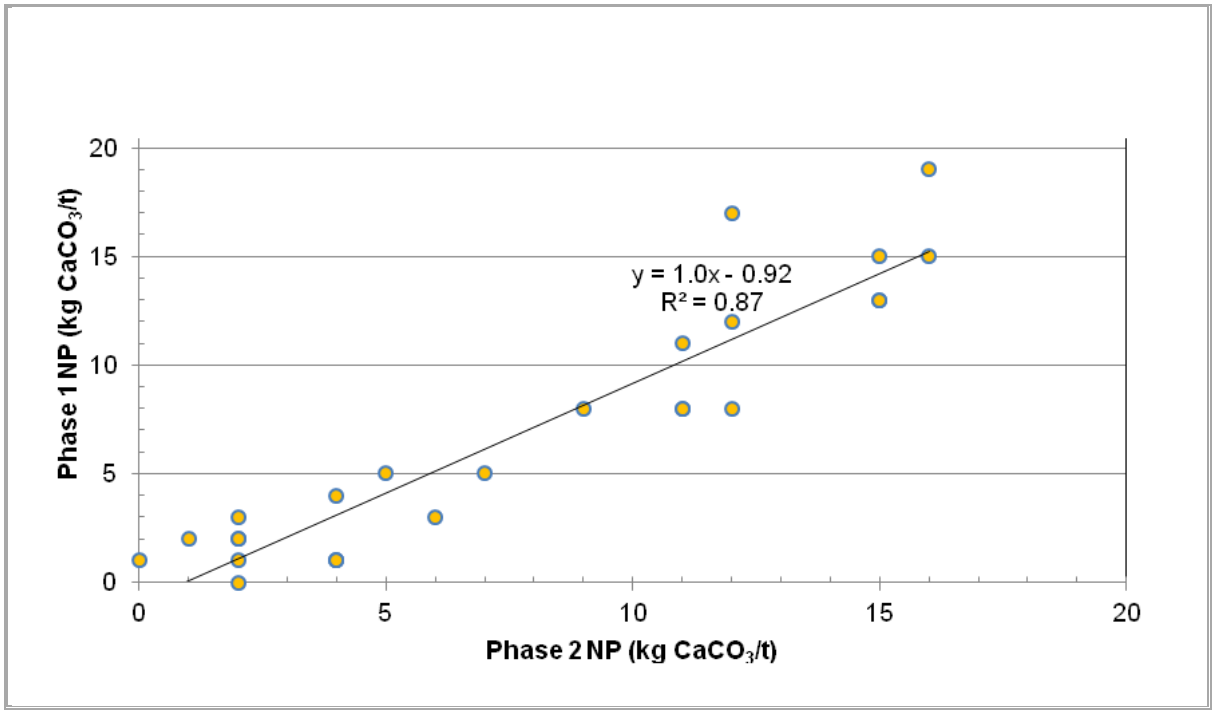


Figure 3-27: Comparison of Phase 1 and Phase 2 Samples for Modified Sobek Neutralization Potential

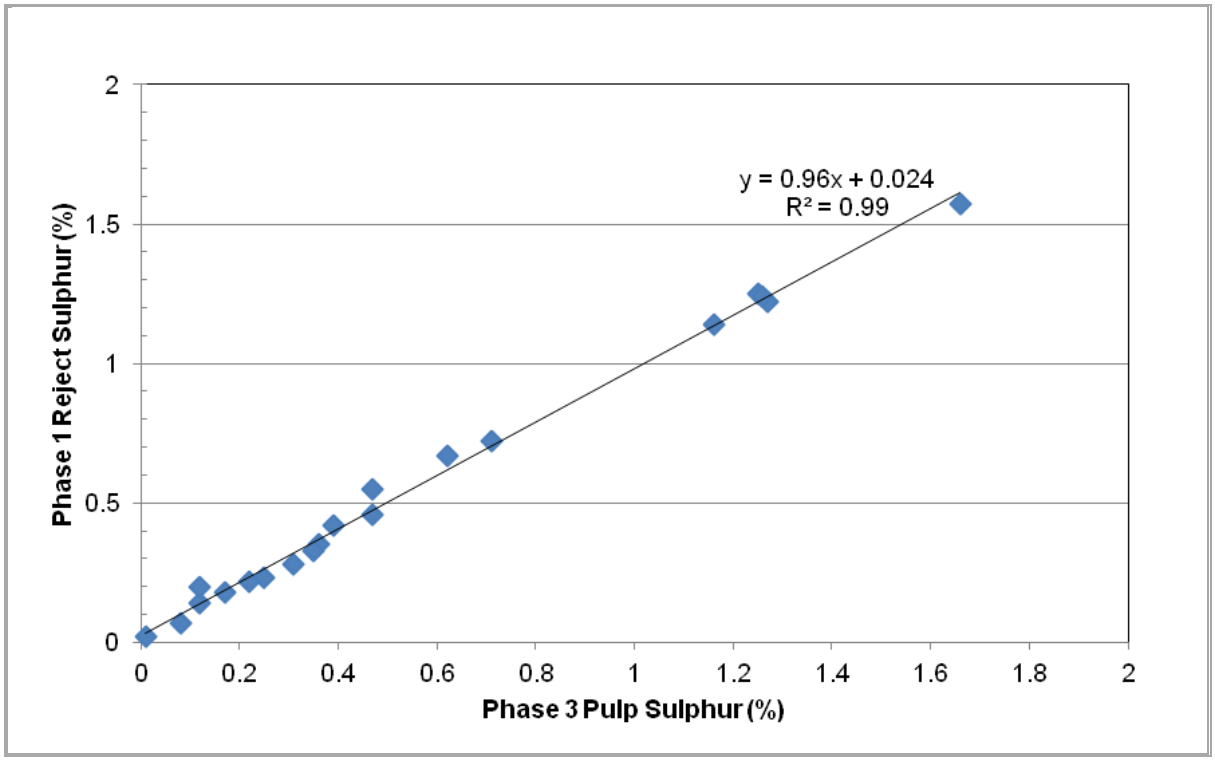


Figure 3-28: Comparison of Phase 1 and Phase 3 Samples for Total Sulphur

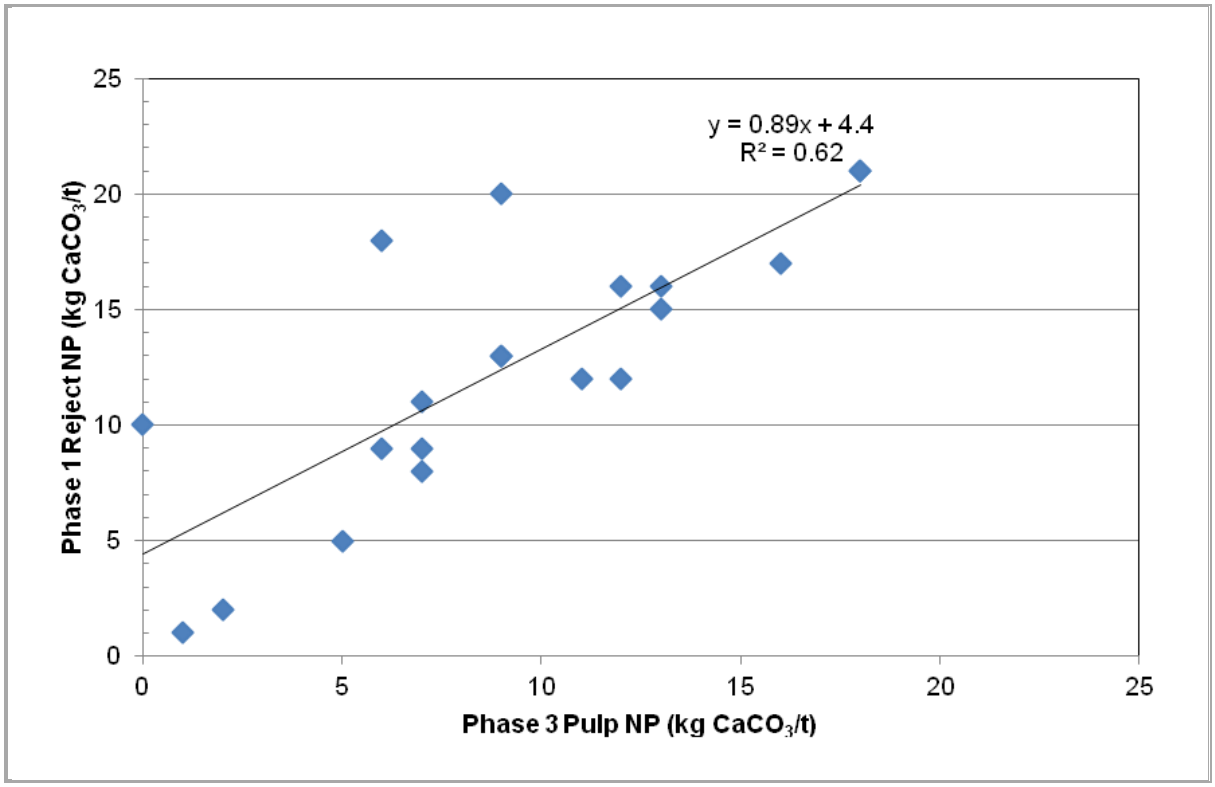


Figure 3-29: Comparison of Phase 1 and Phase 3 Samples for Modified Sobek Neutralization Potential

3.2.5 Net Acid Generation

The NAG test was completed on 587 waste rock samples (**Table 3-23**) to provide another estimate of acid generation and acid neutralization in waste rock samples. The NAG test uses a different analytical methodology than ABA, but provides complementary results. Complete results are given in **Annex 3**.

Fifty-four percent of waste rock samples reported final NAG pH values less than 4.5, indicating that these samples are PAG. With only one exception, the samples that reported a NAG pH less than 4.5 also reported NPR values less than two (**Figure 3-30**). The outlier sample is a NAG 5 sample with a very low total sulphur concentration of 0.01%. Additionally, there were one hundred one samples that had a NAG pH greater than 4.5 (non-PAG classification) but had NPR values less than 2. Thirty-four of these samples were PAG 1 and sixty-seven were PAG 2. This suggests that if the NAG test results were taken as definitive, then the ABA results were conservative as ABA classifies more samples as PAG.

The relationship between ABA and NAG test data indicates that the NAG test results confirm the results of the ABA testing. The NAG pH data suggests that an NPR value of 1.7 could potentially

separate acid generating from non-acid generating rock, even when using the conservative MPA rather than the ZnS adjusted AP (**Figure 3-30)**.

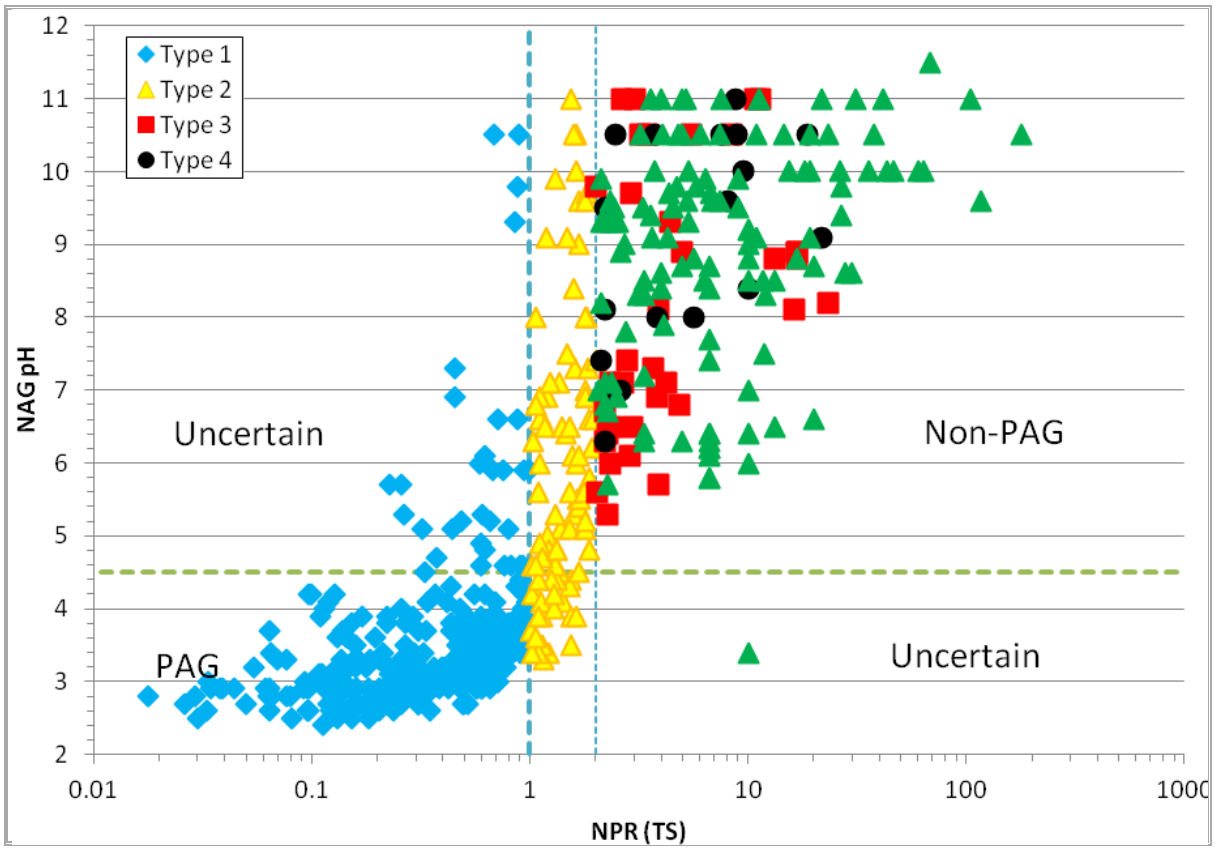


Figure 3-30: Comparison of NAG pH and NPR for Waste Rock

Table 3-23: Statistical Summary of NAG Test Results - Waste Rock (n=587)

	NAG @ pH 4.5 (kg H_2SO_4/t)	NAG @ pH 7.0 (kg H_2SO_4/t)	NAG pH
Minimum	0.01	0.01	2.4
Maximum	78	91.4	12
Median	0.31	4.4	4.1
Average	5.3	9.7	5.4
25th Percentile	0.01	0.01	3.1
75th Percentile	6.2	13.3	7.4
95th Percentile	25.5	37.6	11
Standard Deviation	10.3	13.9	2.7

A subset of 78 samples were selected for total metals analysis of NAG test leachate. A statistical summary of NAG test leachate analysis is presented in **Table 3-24**. Complete results are given in **Annex 3**.

The test results were compared against MMER and ten times the BCWQO (FWAL) values to provide a screening of the results, and do not imply compliance or non-compliance with the specified guidelines. Concentrations were considered elevated when they were higher than MMER or ten times the BCWQO FWAL values.

The majority (78%) of NAG test leachate samples had zinc concentrations that were greater than the MMER value of 0.5 mg/L. Approximately 25% of samples also reported NAG leachate copper and lead concentrations greater than MMER.

Ninety-two percent of the NAG leachate samples reported pH values less than BCWQO FWAL guideline values. The majority of samples reported concentrations that were at least ten times greater than the BCWQO FWAL guideline values for silver, aluminium, cadmium, cobalt, copper, lead, and zinc. Elevated concentrations of arsenic, chromium, iron, nickel, selenium, thallium, and vanadium were observed in at least one sample. Detection limits for selenium concentrations in NAG test leachates were generally higher than the BCWQO FWAL value (0.002 mg/L).

3.2.6 Sequential NAG

The sequential NAG test is a stepwise series of static NAG tests. The testing was completed to determine if single addition NAG testing was sufficient to completely oxidize all sulphide minerals in the waste rock samples and to examine the longer term neutralizing capacity. Four PAG 2 waste rock samples were selected in order to refine the site-specific NPR value. Test results are presented in **Table 3-25**. Complete results are given in **Annex 8**. Each sample was subjected to four sequential NAG stages.

Two of the samples had NAG pH values less than 4.5 in Stage 1, indicating the presence of free acidity and acidity associated with metal hydroxides. Two samples had NAG pH values greater than 7.0. By Stage 2, the NAG pH in all samples was greater than 4.5.

The sequential NAG results suggest that single addition NAG testing was sufficient to oxidize all the sulphide for the waste rock. The results also suggest that, at an NPR of 1.3, no free acidity was generated. The results from this small data set suggest that the NPR threshold between PAG and non-PAG is less than 2, possibly as low as 1.3.

Table 3-24: Statistical Summary of NAG Test Leachate Analysis Results – Waste Rock

		MMER	BCWQO FWAL	10 x FWAL	n	Max	95th Percentile	75th Percentile	Median	25th Percentile	Average	Min
Hardness	(mg/L)		-		78	154	94	39.2	20.8	10.6	29.5	0.5
pH	Units	6.0-9.5	6.5-9.0		72	8.7	7.3	**4.5**	**3.4**	**2.9**	**4.0**	**2.5**
Sulphate	(mg/L)		100	**1000**	78	538	462	273	152	79.1	184	0.75
Al	(mg/L)		0.046-0.05**	**0.46-0.05**	78	**26.2**	**20.1**	**11.2**	**5.5**	**0.69**	**6.6**	0.03
Sb	(mg/L)		0.02	**0.2**	78	0.017	0.0074	0.003	0.001	0.0005	0.0024	0.00014
As	(mg/L)	0.5	0.005	**0.05**	78	**0.24**	0.024	0.0026	0.0016	0.00056	0.008	0.0001
Ba	(mg/L)		1	**10**	78	0.21	0.16	0.12	0.083	0.044	0.084	0.0031
Be	(mg/L)		0.0053	**0.053**	78	0.011	0.01	0.005	0.003	0.0005	0.0039	0.0005
B	(mg/L)		1.2	**12**	78	0.2	0.2	0.1	0.057	0.049	0.08	0.023
Cd	(mg/L)		0.00006	**0.0006**	78	**2.3**	**0.49**	**0.21**	**0.091**	**0.012**	**0.17**	0.00005
Ca	(mg/L)		8	**80**	78	61.5	27.1	8.6	3.3	1.5	7.1	0.12
Cr	(mg/L)		0.001	**0.01**	78	**0.028**	**0.013**	0.009	0.0052	0.0039	0.0065	0.0011
Co	(mg/L)		0.004	**0.04**	78	**0.23**	**0.18**	**0.12**	**0.064**	0.011	**0.072**	0.0001
Cu	(mg/L)	0.3	0.002-0.006*	**0.03-0.06**	78	**5.6**	**1.9**	**0.63**	**0.33**	**0.045**	**0.56**	0.0015
Fe	(mg/L)		0.35	**3.5**	78	**11.4**	**5.6**	1.7	0.41	0.03525	1.3	0.03
Pb	(mg/L)	0.2	0.003-0.009*	**0.03-0.09**	78	**8.4**	**3**	**0.4**	**0.055**	0.012	**0.57**	0.000083
Mn	(mg/L)		0.61-1.28*	**6.1-12.8**	78	**37**	**28.5**	5.6	2.6	0.99	5.5	0.00095
Mo	(mg/L)		2	**20**	78	0.072	0.038	0.019	0.014	0.0026	0.014	0.0001
Ni	(mg/L)	0.5	0.025-0.11*	**0.25-1.1**	78	**0.37**	**0.3**	0.17	0.071	0.01	0.1	0.0005
Se	(mg/L)		0.002	**0.02**	78	**0.02**	**0.02**	0.01	0.005	0.001	0.0063	0.001
Ag	(mg/L)	-	0.00005-0.0015*	**0.0005-0.015**	78	**0.023**	**0.012**	**0.0047**	**0.0022**	**0.0011**	**0.004**	0.00001
Th	(mg/L)	-	0.0003	**0.03**	78	**0.007**	**0.004**	0.002	0.001	0.000533	0.0015	0.0001
Ti	(mg/L)	-	4.6	**46**	78	0.44	0.13	0.01	0.01	0.01	0.028	0.01
U	(mg/L)	-	0.5	**5**	78	0.023	0.014	0.004	0.00078	0.0001	0.003	0.00001
V	(mg/L)	-	0.006	**0.06**	78	**0.07**	0.043	0.028	0.019	0.0056	0.019	0.001
Zn	(mg/L)	0.5	0.008-0.056*	**0.08-0.56**	78	**95.6**	**73.9**	**27**	**10.8**	**2.6**	**19.7**	0.003

Note: **Bold** values are 10x higher than BCWQO for freshwater aquatic life (30 days); * hardness dependent; ** pH dependent; + site specific objective at hardness of 50 mg/L.

Table 3-25: Sequential NAG Test Results for Waste Rock

				Stage 1			Stage 2			Stage 3			Stage 4			Total Seq. NAG to pH 4.5	Total Seq. NAG to pH 7.0
					NAG (pH 4.5)	NAG (pH 7)		NAG (pH 4.5)	NAG (pH 7)		NAG (pH 4.5)	NAG (pH 7)		NAG (pH 4.5)	NAG (pH 7)		
Sample ID	Total S (%)	NP (kg $CaCO_3$/t)	NPR	NAG pH	(kg $CaCO_3$/t)		NAG pH	(kg $CaCO_3$/t)		NAG pH	(kg $CaCO_3$/t)		NAG pH	(kg $CaCO_3$/t)		(kg $CaCO_3$/t)	
BW-ARD-651	0.73	25	1.1	4.4	0.1	3	5.5	0	0	6	0	0	6.2	0	0	0.1	3
BW-ARD-652	0.74	34	1.5	7.8	0	0	6.2	0	0	6.9	0	0	7.1	0	0	0	0
BW-ARD-653	0.66	27	1.3	7.6	0	0	5.6	0	0	6.3	0	0	6.9	0	0	0	0
BW-ARD-695	0.94	32	1.1	4.4	0.2	3	5.2	0	0	5.8	0	0	6.5	0	0	0.2	2.6

3.2.7 Kinetic NAG

The kinetic NAG test is used to predict the lag period required for the development of acidic conditions (Miller et al., 1997). Kinetic NAG tests were performed on six waste rock samples (five PAG 1 samples and one PAG 2; **Table 3-26)**, and the complete results are included as **Annex 7**. The samples had NP values that ranged from the median to the 75th percentile. A summary of the results is as follows (EGi, 2013):

- The kinetic NAG tests for the five PAG 1 samples demonstrated a slowly decreasing pH, but no sample decreased below pH 4.5, and there were no temperature spikes.
- The pH remained alkaline for PAG 2 sample BW-ARD-655 with no apparent increase in temperature.

The results indicate that the sulphides in the samples are slow to react, and long lag periods are predicted before the onset of acidic conditions for samples with elevated NP (2 to 5 years or longer) (EGi, 2013). Complete results are given in **Annex 10**.

Table 3-26: Kinetic NAG Test Waste Rock Samples

ARD Class	ARD Sample No.	Facies	NP	TS	NPR (TS)
PAG 1	BW-ARD-608	S	6	0.71	0.27
PAG 1	BW-ARD-619	S	10	0.46	0.7
PAG 1	BW-ARD-650	S	20	1.3	0.5
PAG 2	BW-ARD-655	S	15	0.45	1.1
PAG 1	BW-ARD-671	S	10	0.81	0.4
PAG 1	BW-ARD-672	S	10	0.69	0.46

3.2.8 Shake Flask Extraction

Fifty-eight waste rock samples were selected for shake flask extraction (SFE) testing. A statistical summary of the results is presented in **Table 3-27**. Complete results are given in **Annex 5**. The results were compared against MMER and ten times the BCWQO FWAL guideline values for comparison purposes only. Shake flask extraction testing is not a direct measure of expected drainage quality.

While the majority of samples reported SFE metal concentrations less than MMER values, several metals had at least one sample that exceeded MMER. Forty-four percent of samples were greater than MMER for zinc, 14% for lead, 6% for nickel, 2% for arsenic.

Twenty-nine percent of the waste rock SFE samples had pH values less than BCWQO FWAL guidelines of 6.5, and 3% had pH values above the BCWQO FWAL maximum of 9.0. In the majority of samples, aluminum and zinc concentrations were greater than ten times BCWQO FWAL guidelines. Many metals, including arsenic, cadmium, cobalt, copper, iron, lead, manganese, nickel and antimony, recorded elevated metal concentrations in at least one

sample. Detection limit values for selenium and mercury were generally higher than the BCWQO FWAL values.

The results in **Table 3-28** show that the cadmium and zinc in SFE leachate decrease across the waste rock types, with the NAG 4 and NAG 5 samples having the lowest average concentrations.

Table 3-27: Statistical Summary of Shake Flask Extraction Results – Waste Rock (n=58)

	Unit	MMER	BCWQO FWAL	10 x BCWAQO FWAL	Max.	95th percentile	75th percentile	Median	25th percentile	Min.	Avg.
Hardness	(mg/L)	-	-		472	222	122	65	35.8	8.2	92.5
pH	Units	**6.0-9.5**	**6.5-9.0**		**9.1**	8.8	7.9	6.9	6.1	**4.6**	7
Cond.	(uS/cm)	-	-		1030	570	308	162	108	21.9	229
Sulphate	(mg/L)	-	**100**	**1000**	529	237	109	47.8	23.9	3.1	85.1
Acidity	(mg/L	-	-		378	95.2	8.3	3.8	2.8	1	21.5
Alkalinity	(mg/L)	-	-		46.8	39.5	15.7	6.9	3.7	1.3	12.3
Al	(mg/L)	-	**0.02-0.05****	**0.2-0.5***	**31.2**	**17.2**	**6.2**	**0.2**	0.04	0.006	**4.2**
Sb	(mg/L)	-	**0.02**	**0.2**	0.13	0.091	0.032	0.012	0.0047	0.0005	0.024
As	(mg/L)	**0.5**	**0.005**	**0.05**	**1.3**	**0.21**	**0.05**	0.023	0.0089	0.002	**0.07**
Be	(mg/L)	-	**0.0053**	**0.053**	0.025	0.0057	0.0025	0.00065	0.0005	0.0005	0.002
B	(mg/L)	-	**1.2**	**12**	0.5	0.12	0.05	0.02	0.013	0.01	0.043
Cd	(mg/L)	-	**0.00006+**	**0.0006+**	**1.8**	**0.61**	**0.0072**	**0.0013**	**0.0004**	0.00005	**0.09**
Ca	(mg/L)	-	**8**	**80**	40.6	22.3	10.9	6.2	2	0.18	8.1
Co	(mg/L)	-	**0.004**	**0.04**	**2.5**	**0.43**	**0.042**	0.007	0.002	0.0001	**0.13**
Cu	(mg/L)	**0.3**	**0.002-0.019***	**0.02-0.19***	**0.21**	**0.064**	0.01	0.005	0.0011	0.001	0.016
Fe	(mg/L)		**0.35**	**3.5**	**51**	**22.6**	**10**	1.2	0.082	0.03	**6.4**
Pb	(mg/L)	**0.2**	**0.003-0.026***	**0.03-0.26***	**10**	**1.4**	**0.03**	0.006	0.001	0.000	**0.37**
Mn	(mg/L)	-	**0.64-2.68***	**6.4-26.8***	**56.5**	**24.8**	**6.3**	1.0	0.54	0.016	**5.9**
Hg	(mg/L)	-	**0.00002**	**0.0002**	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Mo	(mg/L)	-	**2**	**20**	0.024	0.0083	0.002	0.0011	0.0005	0.0001	0.0024
Ni	(mg/L)	**0.5**	**0.025-0.15***	**0.25-1.5***	**2.8**	**0.55**	0.07	0.014	0.004	0.0005	0.16
Se	(mg/L)	-	**0.002**	**0.02**	**0.025**	0.0057	0.0025	0.0005	0.0005	0.0005	0.002
Ag	(mg/L)	-	**0.00005-0.0015***	**0.0005-0.015***	**0.0025**	**0.001**	0.0004	0.0001	0.00005	0.00005	0.0003
Th	(mg/L)	-	**0.0003**	**0.003**	**0.009**	**0.004**	0.0008	0.0004	0.0001	0.0001	0.0009
Ti	(mg/L)	-	**4.6**	**46**	1.7	0.82	0.19	0.01	0.01	0.01	0.19
U	(mg/L)	-	**0.5**	**5**	0.013	0.004	0.001	0.0003	0.0001	0.0000	0.0008
V	(mg/L)	-	**0.006**	**0.06**	0.058	0.046	0.015	0.005	0.0015	0.001	0.011
Zn	(mg/L)	**0.5**	**0.008-0.294***	**0.08-2.94***	**220**	**34.5**	**1.8**	**0.5**	**0.082**	0.01	**7.4**

Note: **Bold** values are 10x higher than BCWQO for freshwater aquatic life (30 days); ** pH dependent; + site specific objective at hardness 50 mg/L

Table 3-28: Average Cd and Zn Concentrations in SFE by Waste Type

	Cd (mg/L)	Zn (mg/L)
PAG 1	0.14	11.7
PAG 2	0.002	0.44
NAG 3	0.006	0.61
NAG 4	0.005	0.18
NAG 5	0.003	0.26

3.2.9 Humidity Cell Tests

Nineteen waste rock samples from all five waste rock classes were chosen for humidity cell testing. A summary of these samples is provided in **Table 3-29**. **Figure 3-31** through **Figure 3-33** shows the range of NPR values, total sulphur and solid phase zinc concentrations tested in humidity cells. The NPR values tested in humidity cells ranged from the 5th to 87th percentile, total sulphur concentrations ranged from the 26th to 98th percentile and zinc concentrations ranged from the 37th to 92nd percentile.

Weekly analysis of humidity cell leachate included measurements of pH, conductivity, alkalinity, acidity, sulphate, and dissolved metals. Humidity cell test results are presented in **Figure 3-34** through **Figure 3-43**. PAG 1 tests are plotted in red, PAG 2 tests in green, NAG 3 tests in purple, NAG 4 test in blue, and NAG 5 in orange.

Table 3-30 provides the average humidity cell loading rates for all weeks of testing and the average for the last ten weeks. Complete results are given in **Annex 6**.

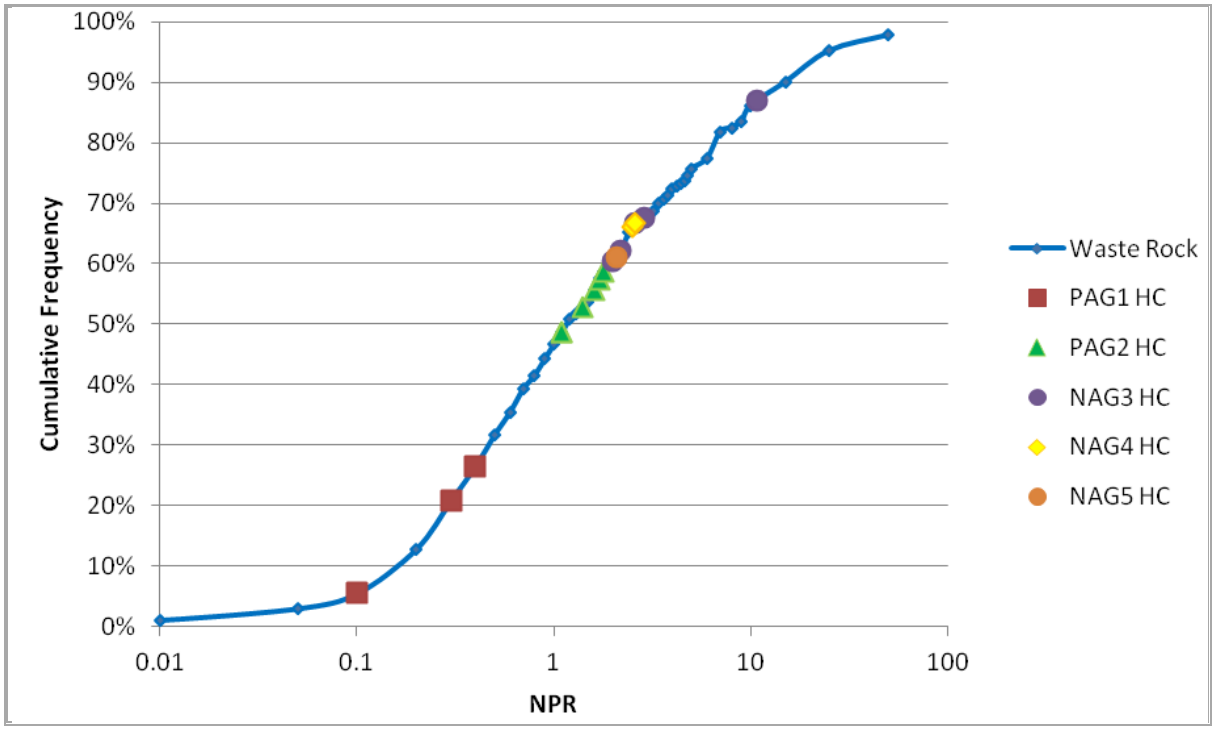


Figure 3-31: Waste Rock Cumulative Frequency Plot and Humidity Cell NPR Values

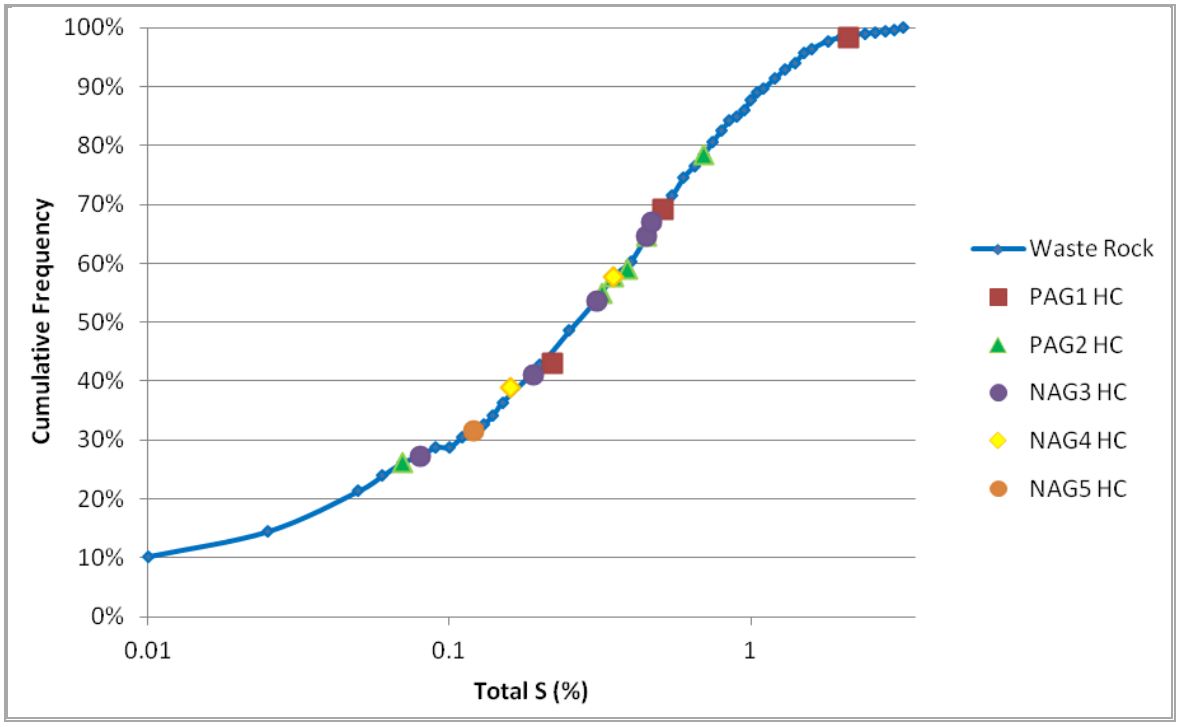


Figure 3-32: Waste Rock Cumulative Frequency Plot and Humidity Cell Total Sulphur Concentrations

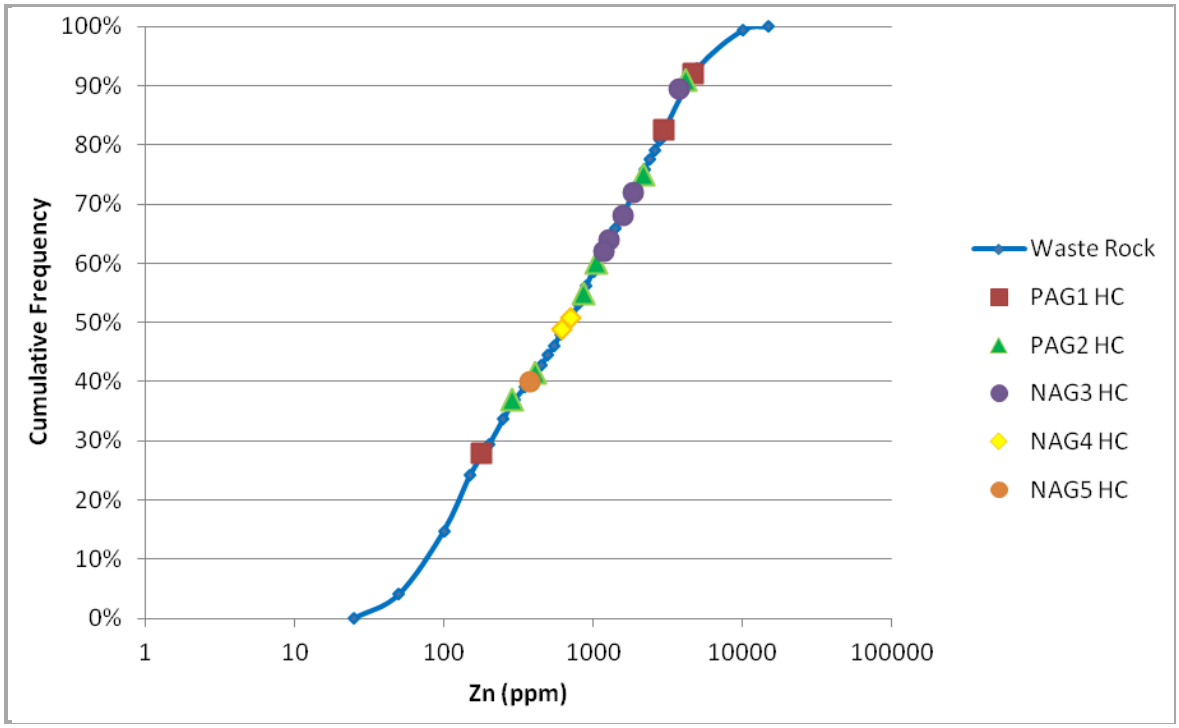


Figure 3-33: Waste Rock Cumulative Frequency Plot and Humidity Cell Zinc Concentrations

Table 3-29: Waste Rock Humidity Cell Samples

ARD Class	ARD Sample No.	Description	Test Duration (weeks)	Facies	NP (kg CaCO3/t)	TS (%)	NPR	Zn (ppm)	Cd (ppm)
PAG 1	BW-ARD2-9	PAG, high S, low NP	107	T	9	2.1	0.1	3,000	23.8
PAG 1	BW-ARD-037	PAG, average S, low NP, high Zn	70	S	6	0.5	0.3	4,690	23.5
PAG 1	BW-ARD-509	PAG, low metals	68	S	3	0.2	0.4	178	0.78
PAG 2	BW-ARD-566	PAG, elevated metals	36	O	9	0.7	1.1	1,050	7.74
PAG 2	BW-ARD-537	PAG, median metals	66	S	12	0.4	1.1	285	2.05
PAG 2	BW-ARD-499	PAG, median Zn	62	O	4	0.07	1.4	855	5.55
PAG 2	BW-ARD-510	PAG, median metals	46	S	19	0.4	1.6	405	0.71
PAG 2	BW-ARD-176	PAG, moderate Zn	105	S	24	0.4	1.7	2,160	18.2
PAG 2	BW-ARD-288	PAG, high Zn	91	S	18	0.3	1.8	4,140	24.5
NAG 3	BW-ARD-526	NAG, Silicate NP, elevated metals	66	S	5	0.3	2	1,280	22.4
NAG 3	BW-ARD-606	NAG, moderate Zn	12	S	13	0.2	2.2	1,580	6.5
NAG 3	BW-ARD-648	NAG, moderate Zn	43	S	37	0.4	2.6	1,180	7.7
NAG 3	BW-ARD-473	NAG, high Zn	30	T	27	0.08	10.8	3,790	1.9
NAG 3	BW-ARD-692	NAG, moderate Zn	43	S	43	0.5	2.9	1,840	21
NAG 3	BW-ARD-153	NAG, moderate Zn	21	S	13	0.1	3.9	1,750	10.9
NAG 3	BW-ARD-238	NAG, moderate Zn	21	T	15	0.1	3.9	1,400	7.7
NAG 4	BW-ARD-338	NAG, low Zn	43	S	27	0.4	2.5	707	6.3
NAG 4	BW-ARD-468	NAG, low Zn	30	S	13	0.2	2.6	622	3.4
NAG 5	BW-ARD-610	NAG, very Low Zn	43	S	8	0.1	2.1	378	1.3

Note: NPR = NP/MPA, NP is modified Sobek NP.

3.2.9.1 pH, Acidity and Alkalinity

The three PAG 1 humidity cell samples (BW-ARD2-9, BW-ARD-037, and BW-ARD-509) had pH values less than 6 during all weeks of testing (**Figure 3-34**). The pH trends for the three PAG 1 cells reached steady state conditions. Sample BW-ARD-037 had pH values that remained relatively steady throughout the seventy-week test period at approximately 5 (averaging 4.9 in the last 10 cycles). BW-ARD-509 had pH values that rapidly decreased from 7.4 to approximately 5 during the first fifteen weeks of testing before reaching a steady pH of approximately 3.7 at week 49.

PAG 2 sample BW-ARD-566 had the greatest range in pH values, with a decrease from 7.6 to 5.1 over thirty-seven weeks of testing. PAG 2 sample BW-ARD-537 also reported a decreasing trend in pH (pH 6.9 to 5.1 over sixty-nine weeks). Sample BW-ARD-288 had steady pH values near 6 for weeks thirty though eighty-one with fluctuations between pH 5 and 6 for the last ten weeks of testing.

The remaining PAG 2 samples, and all of the NAG 3, 4, and 5 humidity cells, generally reported pH values between 6.5 and 8.2. Four humidity cell tests had rapid pH decreases in the first few weeks, from highly alkaline to more neutral pH values, including NAG 3 samples BW-ARD-606, BW-ARD-648, BW-ARD-473 and BW-ARD-692. NAG 3 sample BW-ARD-526 reported a relatively stable pH trend around 7 throughout the forty-six week test period. Both NAG 4 samples (BW-ARD-338 and BW-ARD-468) were stable at pH 8 throughout testing.

The pH trends are summarized as follows:

- PAG 1: all 3 humidity cells had acid pH (< 6) from the start of testing or shortly after testing began;
- PAG 2: three humidity cells produced acidic leachate (pH < 6) after 20 to 30 weeks of testing; three humidity cells had neutral pH (6 to 8) for the duration of testing;
- NAG 3: all 7 humidity cells had neutral pH (approximately 6.5 to 8);
- NAG 4: both humidity cells had alkaline pH (approx. 8); and,
- NAG 5: the humidity cell was alkaline pH (approx. 8).

Alkalinity was detected in many of the humidity cells (generally the NAG 3, 4, 5 and neutral PAG 2 cells with neutral pH values), but concentrations and loads were low (**Figure 3-35**). The samples with measurable alkalinity were generally non-PAG waste rock, although three PAG 2 humidity cells generated measureable alkalinity. The remaining humidity cells reported alkalinity values below the detection limit of 2 mg/L for the majority of weeks tested.

As expected, acidity produced in the humidity cells followed an opposite pattern as the alkalinity. Most tests with neutral to alkaline pH produced no to very low amounts of acidity (**Figure 3-36**). Generally, the tests with pH values of six or less produced more acidity. The humidity cell with the lowest pH values (BW-ARD2-9, pH less than 3) generated the most acidity with maximum value greater than 500 mg/kg/wk (approximately 1000 mg/L).

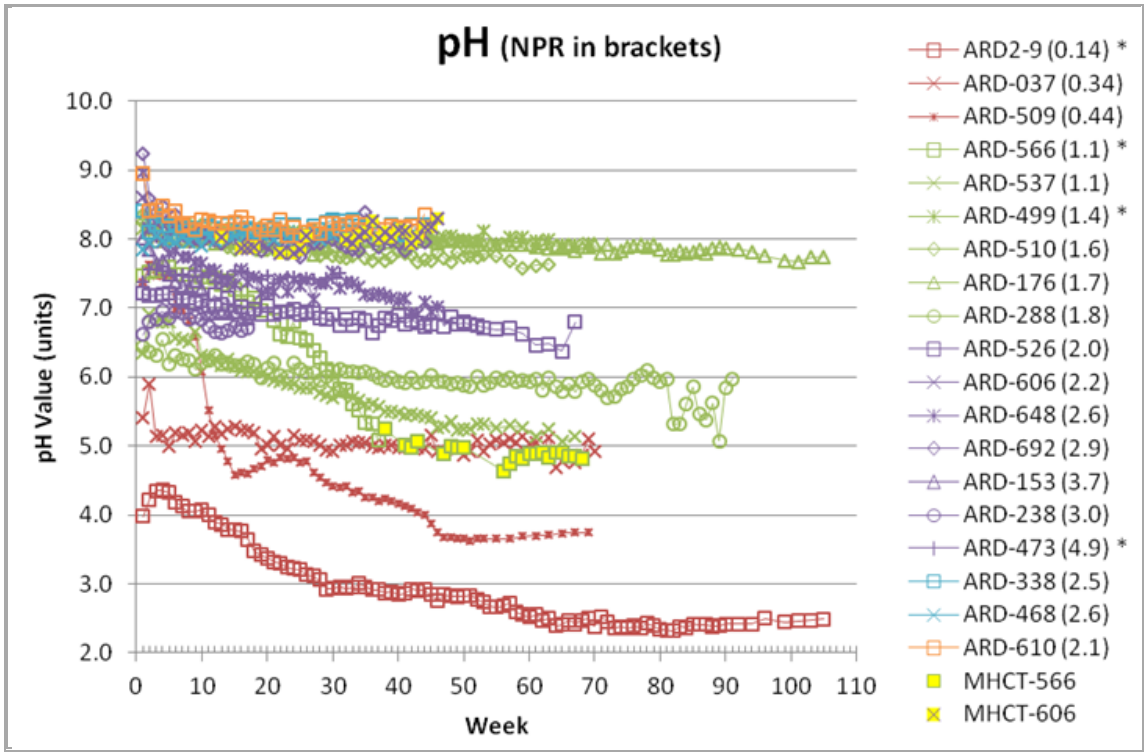


Figure 3-34: Waste Rock Humidity Cell pH values

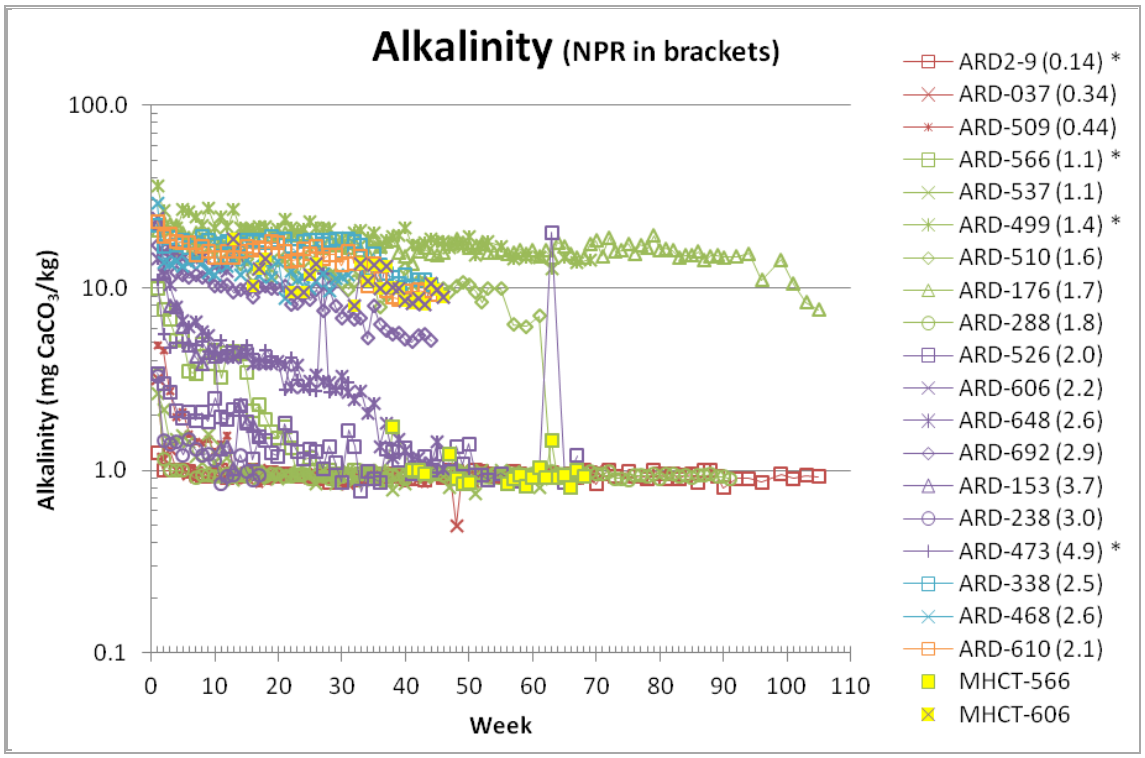


Figure 3-35: Waste Rock Humidity Cell Alkalinity Loads

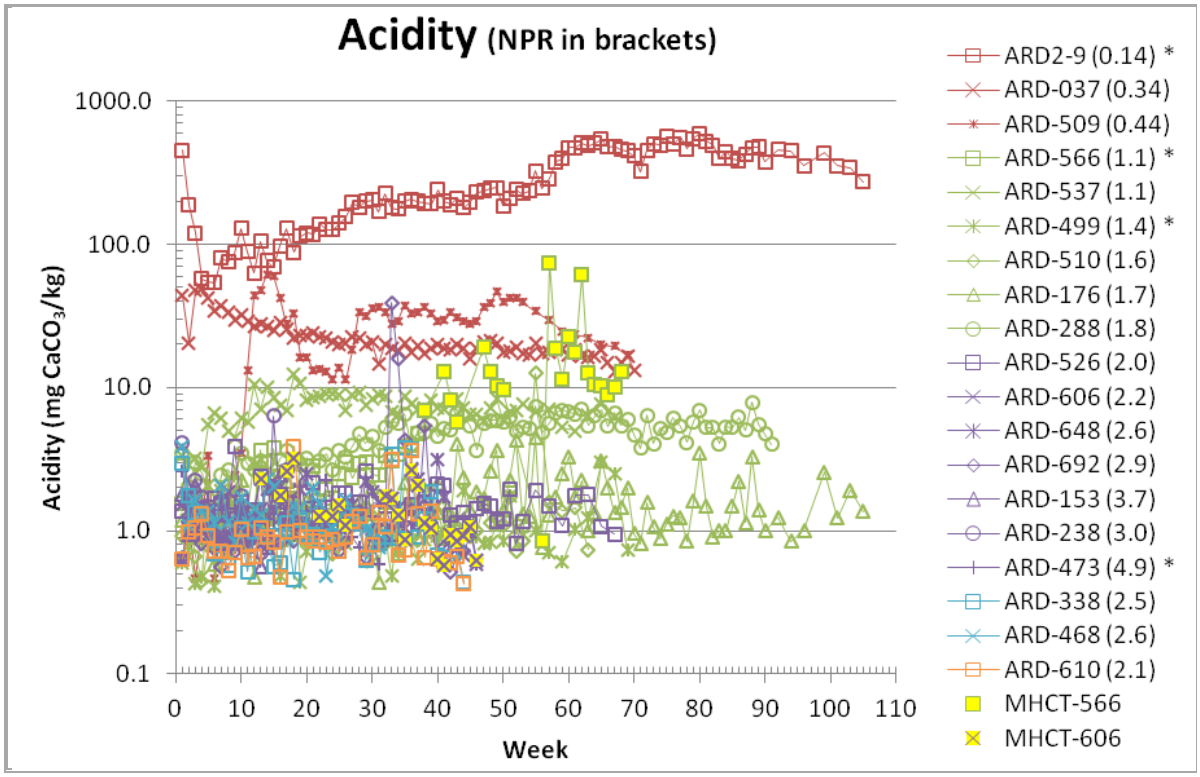


Figure 3-36: Waste Rock Humidity Cell Acidity Loads

3.2.9.2 Sulphate

In general, the average sulphate loads were below 50 mg/kg/wk (100 mg/L) for each of the humidity cells (**Figure 3-37**). The exception was for PAG 1 sample BW-ARD2-9, which reported a range of sulphate loads from 114 mg/kg/wk to 713 mg/kg/wk (between approximately 181 mg/L and 1400 mg/L). PAG 1 sample BW-ARD-509 had a rapid increase in sulphate loads to approximately 100 mg/kg/wk (approximately 200 mg/L) during weeks one through fifteen, then a decrease in load to approximately 30 to 50 mg/kg/wk (between approximately 50 and 100 mg/L) during weeks 15 to 70.

The sulphate loads in the other humidity cells were generally low with loads less than approximately 20 mg/kg/wk (about 40 mg/L) that were either stable or slightly decreasing.

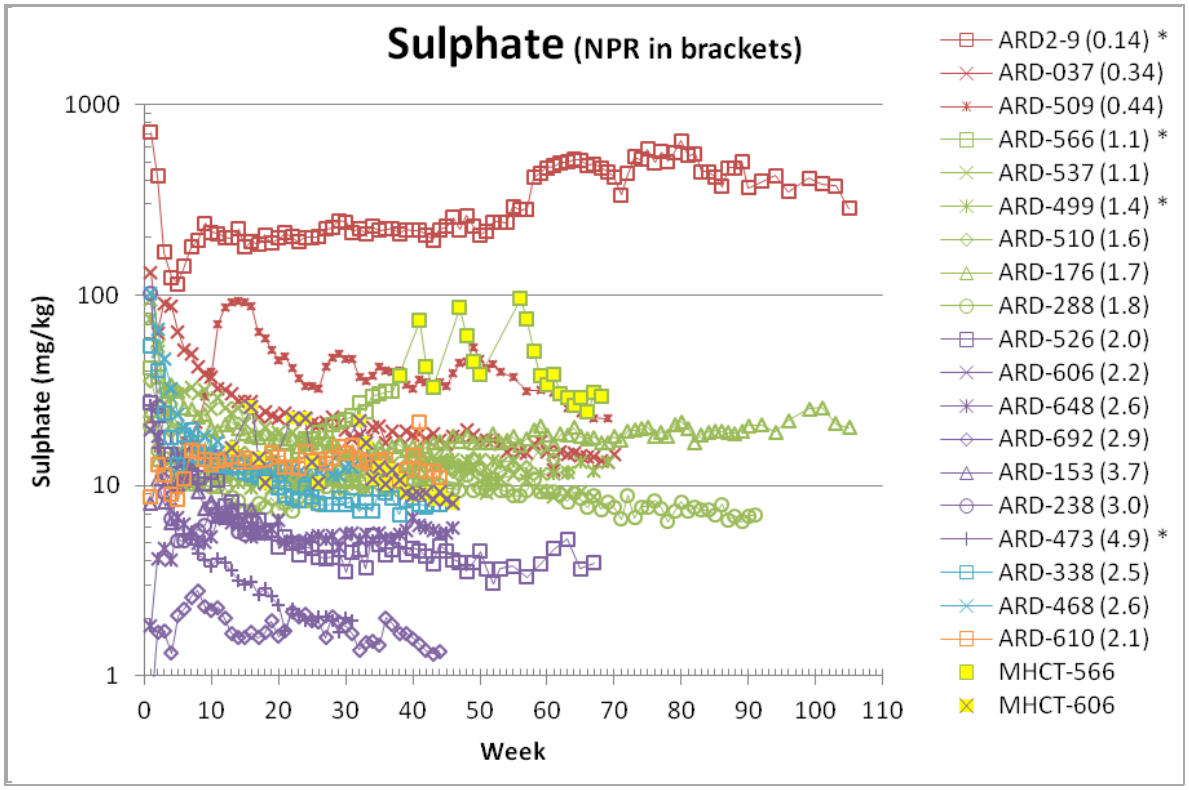


Figure 3-37: Waste Rock Humidity Cell Sulphate Loads

3.2.9.3 Dissolved Metals

This report discuss six metals in detail (cadmium, zinc, copper, lead, iron, and arsenic), although the entire suite of metals was monitored and reviewed as part of the test program. These metals were chosen based on the deposit style and results of the multi-element geochemistry. Zinc and cadmium are of particular interest for the Project due to the presence of sphalerite and elevated concentrations of both metals in the waste rock.

In general, leachates from the PAG 1 sample BW-ARD-2-9 reported the highest dissolved metal loadings and concentrations compared to the other waste rock samples.

Cadmium

In general, the acid generating humidity cells tests produced the most cadmium in leachate (**Figure 3-38**).

PAG 1 sample BW-ARD-2-9 had the greatest cadmium loads of all the humidity cell tests with values greater than 0.1 mg/kg/wk (approximately 0.3 mg/L) for most of the testing period. PAG 1

sample BW-ARD-037 had relatively stable loads through testing of approximately 0.04 mg/kg/wk (approximately 0.1 mg/L).

Five humidity cell tests had long-term cadmium loading rates between approximately 0.005 and 0.02 mg/kg/wk (0.05 mg/L to 0.01 mg/L): one PAG 1 test BW-ARD 509; three PAG 2 tests, BW-ARD-288, 566 and 537; and one NAG 3 test BW-ARD-526.

The remaining twelve humidity cell tests generated low amounts of cadmium with loads less than 0.001 mg/kg/wk (0.002 mg/L). The PAG 1, PAG 2, and low NPR NAG 3 humidity cells had the higher cadmium loads than the higher NPR NAG 3 and NAG 4 and 5 samples.

Zinc

As with cadmium, zinc loads were the highest in the acid generating PAG 1 and PAG 2 humidity cells (**Figure 3-39**). PAG 1 test BW-ARD2-9 had the most zinc release with maximum loads greater than 50 mg/kg/wk (approximately 100 mg/L). Loadings decreased to 6 mg/kg/wk (17 mg/L) in the test between week 60 and the end of the testing period at 103 weeks. PAG 1 test BW-ARD-037 had slightly lower zinc loads than BW-ARD2-9, with maximum load of 23 mg/kg/wk (approx. 48 mg/L) occurring at week 5 decreasing to 8/mg/kg/wk (approx. 16 mg/L) at the end of testing.

Also similar to cadmium, there were four humidity cell tests that had similar long term loading rates between about 4 and 1 mg/kg/wk (about 8 to 2 mg/L): one PAG 1 test BW-ARD 509; three PAG 2 tests, BW-ARD-288, 566 and 537.

The NAG 3 humidity cells generally had low, but increasing zinc trends. BW-ARD-526 had the highest loads and concentrations of the seven NAG 3 samples, with zinc that increased from 0.03 to 0.15 mg/kg/wk (approx 0.06 to 0.4 mg/L). The loads from the other NAG 3 samples were less than 0.1 mg/kg/wk (0.2 mg/L).

Many NAG 3, 4, and 5 cells had zinc concentrations below the detection limit (0.003 mg/L) for the majority of the test period, including BW-ARD-499, BW-ARD-606, BW-ARD-692, BW-ARD-610, BW-ARD-338, and BW-ARD-468.

Copper

Copper loads were low for the majority of humidity cells (**Figure 3-40**). All NAG 4 and 5 cells and most NAG 3 cells reported concentrations below the copper MDL for all weeks of testing (BW-ARD-176, BW-ARD-288, BW-ARD-509, BW-ARD-566, BW-ARD-510, BW-ARD-526, BW-ARD-606, BW-ARD-648, BW-ARD-692, BW-ARD-610, BW-ARD-338, BW-ARD-468, and BW-ARD-473).

The maximum copper load of 1 mg/kg/wk (approx. 2 mg/L) was observed during the first flush of PAG 1 sample BW-ARD2-9. Copper release from the sample decreased during the last forty weeks of testing to less than 0.1 mg/kg/wk (approximately 0.25 mg/L).

Increasing copper loading was observed in PAG 1 samples BW-ARD-037 (max = 0.005 mg/kg/wk, 0.01 mg/L), BW-ARD-509 (max = 0.4 mg/kg/wk, 0.8 mg/L), and PAG 2 sample BW-ARD-537 (max = 0.0015 mg/kg/wk, 0.03 mg/L).

Lead

Lead loading trends were variable between tests, but generally similar to other metals discussed where acid generating humidity cells tended to have higher lead loads (**Figure 3-41**). PAG 1 samples BW-ARD-037 and BW-ARD-509 had increasing loads, while loads in BW-ARD-2-9 decreased. The average lead loading was relatively higher for PAG 1 sample BW-ARD-037 compared to BW-ARD2-9.

PAG 2 sample BW-ARD-288 had increasing lead loads that stabilized toward the end of the 85-week test period at approximately 0.04 mg/kg/wk (approx. 0.1 mg/L). The NAG 3 tests reported stable lead loading trends that were generally below 0.001 mg/kg/wk, except for BW-ARD-238. NAG 4 sample BW-ARD-338 reported an increasing lead loading trend that decreased between weeks 26-44 to less than 0.001 mg/kg/wk.

The remaining cells (BW-ARD-176, BW-ARD-537, BW-ARD-499, BW-ARD-566, BW-ARD-510 and BW-ARD-610) either reported low and stable lead loads or were below the lead MDL for most of the test period.

Iron

Iron loads were generally low for most of the humidity cell tests (**Figure 3-42**).

Iron loads were highest in PAG 1 sample BW-ARD2-9, with maximum values of approximately 85 mg/kg/wk (approx. 180 mg/L) occurring during weeks 62-103 of testing. PAG 1 sample BW-ARD-509 had elevated iron loads that rapidly decreased weeks 40 through 70 from approximately 10 mg/kg/wk to 0.02 mg/kg/wk (25 mg/L to 0.04 mg/L). PAG 1 sample BW-ARD-037 decreased from a maximum of 0.8 mg/kg/wk (1.6 mg/L) at week 4 to 0.17 mg/kg/wk (0.33 mg/L) by week 70.

PAG 2 sample BW-ARD-566 reported increasing iron loads from weeks 25 to 37 to a maximum of 0.41 mg/kg/wk (approximately 0.9 mg/L).

The remaining samples (BW-ARD-176, BW-ARD-288, BW-ARD-509, BW-ARD-537, BW-ARD-499, BW-ARD-510, BW-ARD-526, BW-ARD-648, BW-ARD-606, BW-ARD-692, BW-ARD-610, BW-ARD-338, BW-ARD-468, and BW-ARD-473) reported iron concentrations below the iron MDL (0.03 mg/L) for the majority of the test period.

Arsenic

Loading trends for arsenic are presented in **Figure 3-43**. Most cells reported very low and decreasing loading trends throughout the test period. Compared to the other metals, arsenic

loads were low for all cells, and ranged from a minimum of 0.03 mg/kg/wk to a maximum of 0.0001 mg/kg/wk.

Selenium and mercury were less than or very near the detection limit in all humidity cell tests for all weeks of testing (**Annex 6**).

Table 3-30 provides the average humidity cell loading rates for all weeks of testing and the average for the last ten weeks. Complete results are given in **Annex 6**.

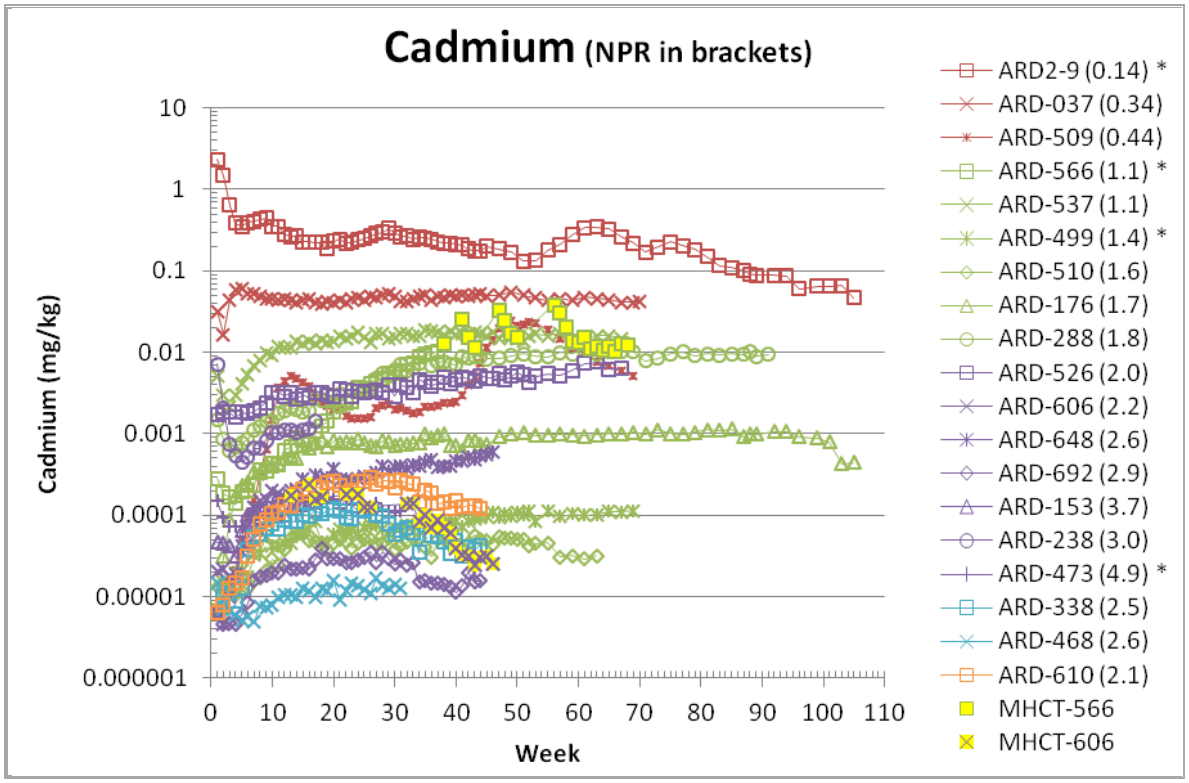


Figure 3-38: Waste Rock Humidity Cell Cadmium Loads

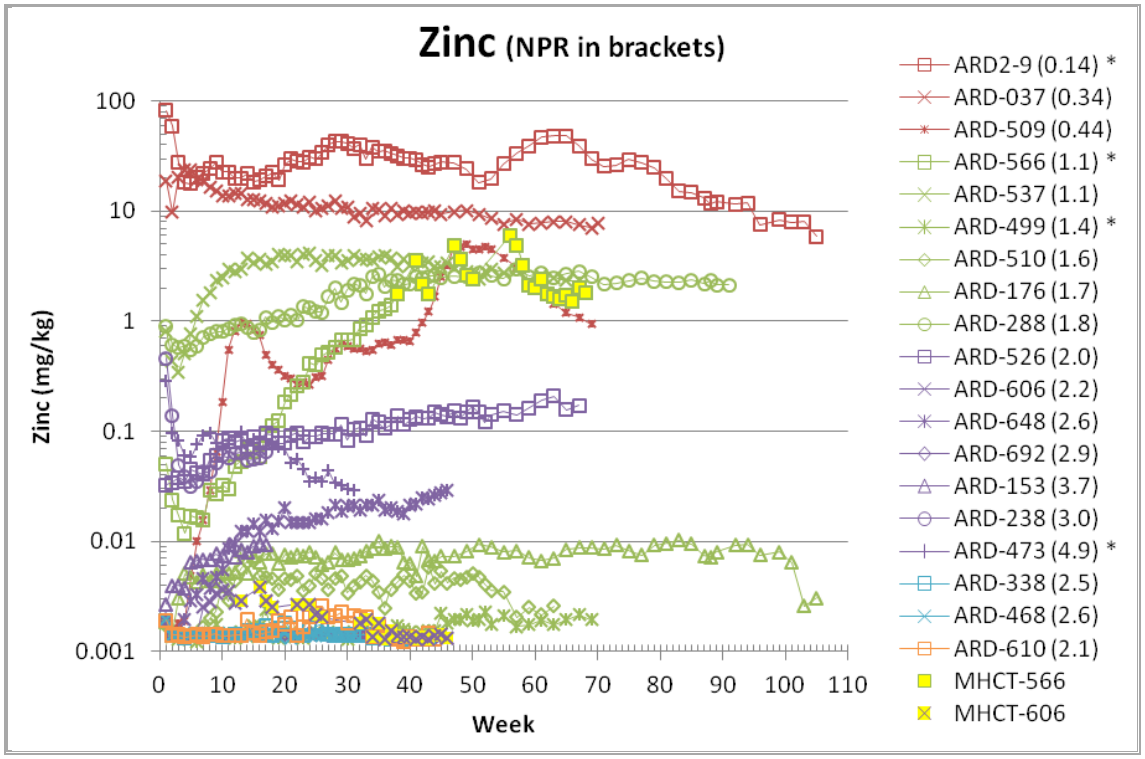


Figure 3-39: Waste Rock Humidity Cell Zinc Loads

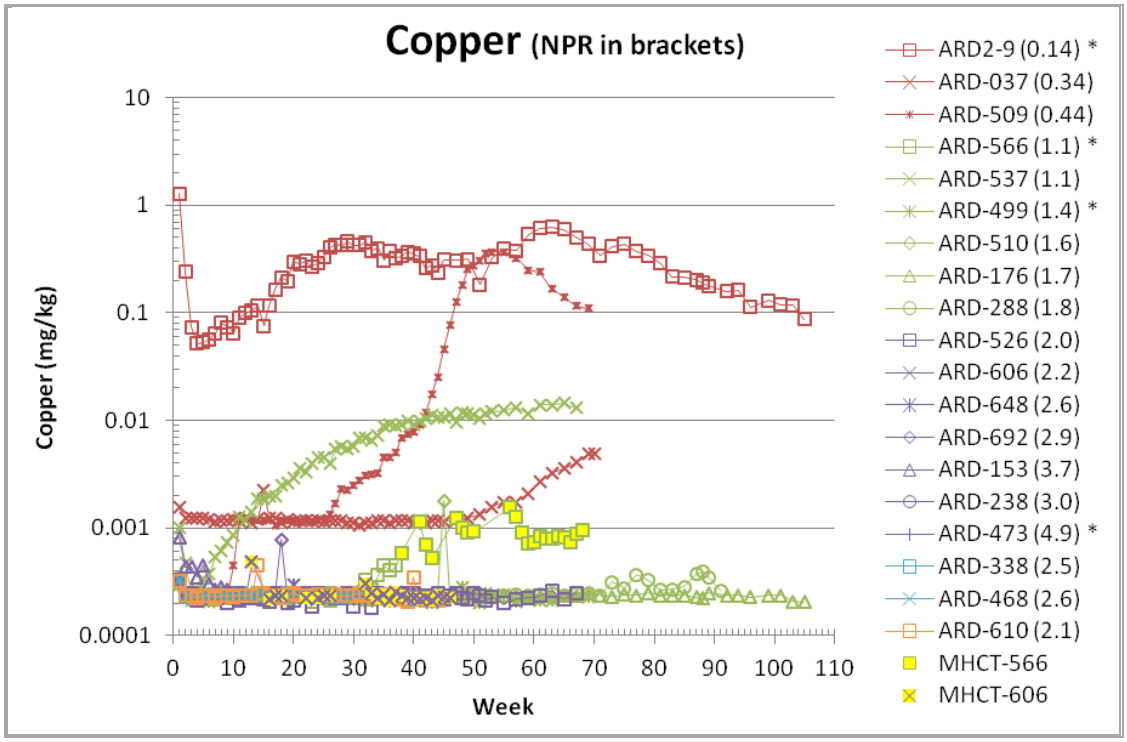


Figure 3-40: Waste Rock Humidity Cell Copper Loads

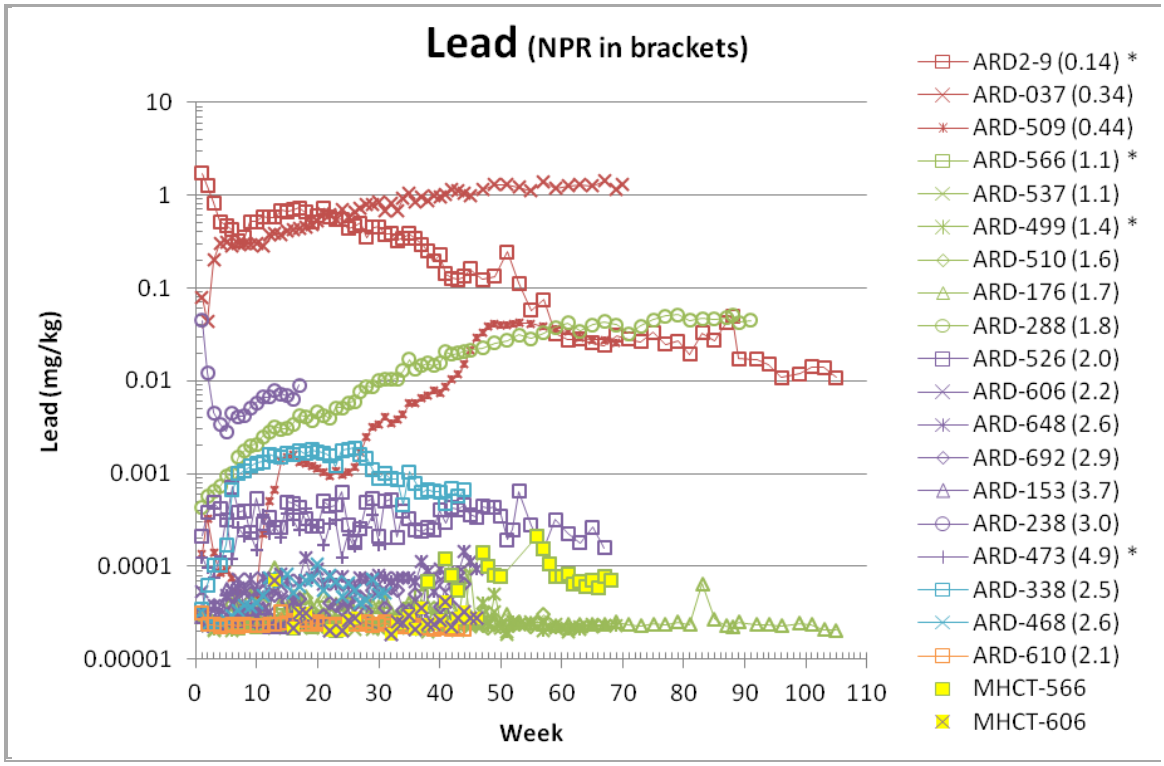


Figure 3-41: Waste Rock Humidity Cell Lead Loads

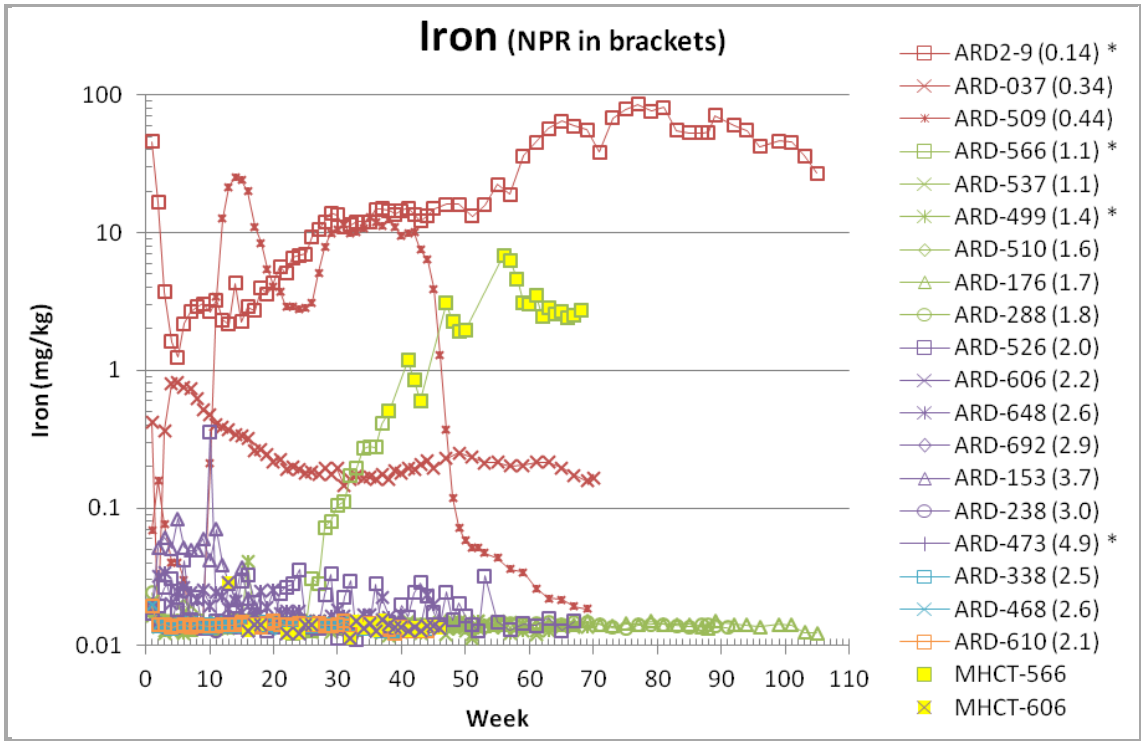


Figure 3-42: Waste Rock Humidity Cell Iron Loads

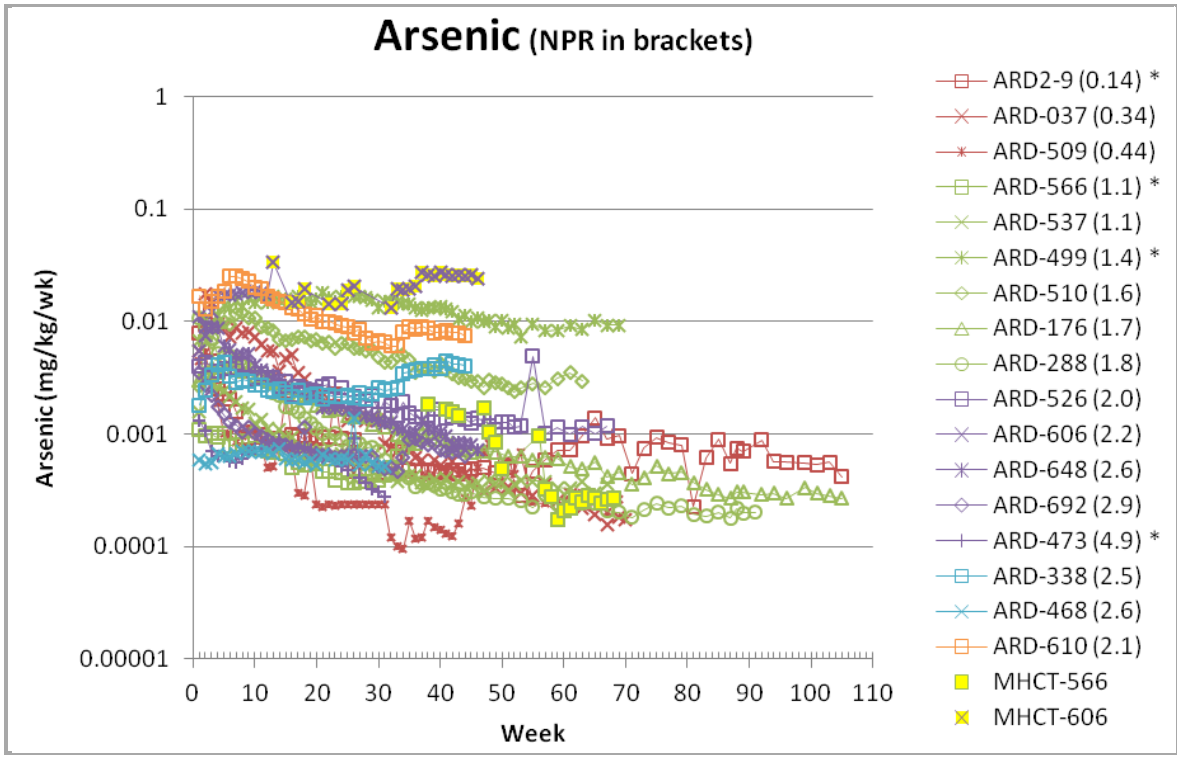


Figure 3-43: Waste Rock Humidity Cell Arsenic Loads

Table 3-30: Waste Rock Humidity Cell Loads (Average of All Weeks)

	Average Load (mg/kg/wk)																	
	ARD2-9		ARD-037		ARD-509		ARD-176		ARD-288		ARD-537		ARD-499		ARD-566		ARD-510	
Parameter	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks
Acidity	270	325	22	16	24	20	2	2	5	5	7	6	1	2	2	3	1	1
Alkalinity	0.9	0.9	1.0	1.0	1.2	0.9	17.3	10.1	1.0	0.9	1.1	0.9	21.1	14.0	2.7	0.9	13.0	0.9
Sulphate	312	339	26	14	42	25	18	23	9	7	21	9	14	12	19	26	13	12
Al	9.8	15.7	0.017	0.015	0.490	1.946	0.020	0.015	0.003	0.002	0.003	0.007	0.016	0.011	0.016	0.004	0.048	0.044
Sb	0.001	0.001	0.0009	0.0004	0.0039	0.00005	0.01100	0.00170	0.00290	0.00053	0.00043	0.00012	0.01800	0.00724	0.00270	0.00091	0.02200	0.00460
As	0.0011	0.0005	0.0028	0.0002	0.0007	0.0002	0.0016	0.0003	0.0015	0.0002	0.0009	0.0003	0.0140	0.0093	0.0007	0.0006	0.0062	0.0030
Cd	0.30	0.06	0.046	0.044	0.003	0.007	0.001	0.001	0.006	0.009	0.013	0.015	0.000	0.000	0.003	0.007	0.000	0.000
Ca	4.90	5.08	0.80	0.15	2.10	1.75	12.60	13.39	1.10	0.57	2.50	0.62	12.10	10.22	6.10	8.22	8.40	8.10
Cr	0.009	0.025	0.0011	0.0006	0.0007	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Co	0.19	0.04	0.053	0.019	0.026	0.009	0.0001	0.0001	0.0086	0.0065	0.0260	0.0161	0.0001	0.0001	0.0007	0.0018	0.0002	0.0001
Cu	0.31	0.11	0.0015	0.0039	0.0120	0.1550	0.0002	0.0002	0.0003	0.0003	0.0050	0.0139	0.0002	0.0002	0.0003	0.0003	0.0003	0.0002
Fe	20.9	35.0	0.27	0.19	7.10	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.07	0.20	0.01	0.01
Pb	0.36	0.01	0.76	1.28	0.01	0.03	0.00003	0.00002	0.01700	0.04647	0.00002	0.00002	0.00003	0.00002	0.00003	0.00003	0.00003	0.00002
Li	0.02	0.03	0.0038	0.0015	0.0068	0.0050	0.0055	0.0023	0.0017	0.0008	0.0110	0.0034	0.0032	0.0020	0.0012	0.0017	0.0036	0.0013
Mg	5.5	6.6	0.72	0.13	0.64	0.35	0.45	0.16	0.36	0.14	0.60	0.10	0.44	0.30	0.50	0.55	0.41	0.13
Mn	42.2	5.2	1.0	0.3	8.1	1.0	0.1	0.05	0.5	0.6	2.1	1.2	0.1	0.2	0.7	1.6	0.2	0.2
Mo	0.0004	0.0001	0.0001	0.0001	0.0004	0.00002	0.00061	0.00059	0.00003	0.00002	0.00013	0.00002	0.00160	0.00048	0.00024	0.00003	0.00048	0.00039
Ni	0.28	0.10	0.10	0.03	0.03	0.01	0.0002	0.0002	0.0110	0.0077	0.0240	0.0166	0.0003	0.0002	0.0003	0.0004	0.0003	0.0002
P	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.14	0.14	0.14	0.13	0.14	0.13	0.14	0.14	0.14	0.14
K	0.56	0.05	3.30	1.56	5.50	1.42	3.90	2.01	1.70	0.65	5.20	1.70	3.30	1.56	2.70	2.01	3.70	1.30
Se	0.0007	0.0001	0.00026	0.00012	0.00014	0.00005	0.00005	0.00004	0.00005	0.00005	0.00006	0.00004	0.00005	0.00004	0.00005	0.00005	0.00005	0.00005
Si	6.10	10.05	1.60	1.02	3.70	4.41	1.10	0.49	0.80	0.51	2.90	1.83	1.80	1.25	2.50	2.77	1.20	1.07
Ag	0.00032	0.00017	0.000023	0.000012	0.000016	0.000045	0.000005	0.000004	0.000005	0.000005	0.000005	0.000005	0.000005	0.000004	0.000005	0.000005	0.000005	0.000005
Na	0.42	0.13	0.16	0.06	0.21	0.03	0.40	0.05	0.12	0.04	0.19	0.02	0.45	0.06	0.67	0.20	0.39	0.10
Sr	0.045	0.127	0.008	0.003	0.012	0.005	0.071	0.040	0.008	0.005	0.030	0.010	0.032	0.020	0.024	0.033	0.026	0.014
Tl	0.0003	0.0000	0.0002	0.0000	0.0001	0.0002	0.00001	0.00000	0.00001	0.00001	0.00023	0.00014	0.00004	0.00004	0.00002	0.00002	0.00002	0.00001
Sn	0.001	0.0001	0.0002	0.0001	0.0001	0.00005	0.00005	0.00004	0.00005	0.00005	0.00005	0.00004	0.00005	0.00004	0.00005	0.00005	0.00005	0.00005
Ti	0.005	0.005	0.0047	0.0048	0.0048	0.0046	0.0047	0.0044	0.0048	0.0046	0.0047	0.0044	0.0047	0.0045	0.0048	0.0047	0.0047	0.0046
U	0.005	0.002	0.0001	0.0001	0.0038	0.0048	0.00002	0.00000	0.00001	0.00000	0.00001	0.00001	0.00052	0.00020	0.00003	0.00004	0.00010	0.00003
V	0.007	0.001	0.002	0.001	0.001	0.0005	0.0009	0.0004	0.0005	0.0005	0.0005	0.0004	0.0012	0.0006	0.0005	0.0005	0.0007	0.0006
Zn	29.9	7.0	11.6	7.7	0.8	1.3	0.007	0.005	1.800	2.241	3.100	2.444	0.002	0.002	0.350	0.936	0.004	0.003

	ARD-526		ARD-606		ARD-648		ARD-692		ARD-473		ARD-338		ARD-468		ARD-610	
	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks	all wks	last 10 wks
Acidity	2	1	1	1	1	1	2	2	1	1	1	1	2	1	1	1
Alkalinity	1.5	4.8	14.8	13.8	5.7	1.3	9.0	5.8	5.6	3.9	18.0	11.7	15.2	11.2	16.8	9.9
Sulphate	7	4	14	13	6	6	2	2	10	2	16	8	38	12	13	13
Al	0.031	0.014	0.053	0.049	0.046	0.030	0.115	0.135	0.041	0.031	0.024	0.028	0.033	0.034	0.041	0.032
Sb	0.00230	0.00114	0.05700	0.05171	0.00566	0.00190	0.02359	0.00678	0.00390	0.00137	0.01500	0.00741	0.00860	0.00402	0.00870	0.00274
As	0.0025	0.0011	0.0150	0.0172	0.0029	0.0010	0.0010	0.0008	0.0008	0.0005	0.0027	0.0040	0.0006	0.0007	0.0160	0.0083
Cd	0.003	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	2.00	1.14	10.10	9.76	2.68	2.11	3.66	2.82	2.50	1.06	11.70	7.08	15.30	8.17	9.10	8.51
Cr	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002
Co	0.0008	0.0013	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0012	0.0016	0.0001	0.0000	0.0005	0.0001	0.0001	0.0000
Cu	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002	0.0003	0.0002	0.0003	0.0002
Fe	0.03	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01
Pb	0.00037	0.00023	0.00004	0.00003	0.00007	0.00009	0.00004	0.00006	0.00018	0.00024	0.00110	0.00068	0.00003	0.00006	0.00003	0.00002
Li	0.0040	0.0023	0.0050	0.0045	0.0029	0.0019	0.0016	0.0006	0.0078	0.0017	0.0067	0.0030	0.0024	0.0011	0.0058	0.0032
Mg	0.32	0.18	0.39	0.38	0.17	0.13	0.07	0.05	0.50	0.22	0.20	0.11	2.00	0.63	0.11	0.09
Mn	0.2	0.3	0.1	0.1	0.2	0.3	0.0	0.0	1.1	0.9	0.0	0.0	0.5	0.2	0.0	0.0
Mo	0.00230	0.00049	0.00140	0.00091	0.00019	0.00012	0.00037	0.00032	0.00120	0.00042	0.00059	0.00090	0.00075	0.00019	0.00078	0.00088
Ni	0.0011	0.0011	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0015	0.0006	0.0003	0.0002	0.0008	0.0004	0.0002	0.0002
P	0.14	0.14	0.15	0.14	0.14	0.13	0.14	0.13	0.15	0.14	0.14	0.13	0.15	0.14	0.14	0.13
K	2.40	1.12	2.20	1.86	1.48	0.86	0.75	0.40	3.50	0.94	1.50	0.85	4.30	1.03	2.40	1.58
Se	0.00005	0.00005	0.00005	0.00005	0.00005	0.00004	0.00005	0.00004	0.00006	0.00005	0.00006	0.00004	0.00005	0.00005	0.00007	0.00004
Si	3.60	2.34	1.10	1.09	0.89	0.81	0.80	0.67	1.10	0.56	1.20	0.71	0.88	0.50	1.30	0.75
Ag	0.000005	0.000005	0.000005	0.000005	0.000005	0.000004	0.000005	0.000004	0.000005	0.000005	0.000006	0.000024	0.000005	0.000005	0.000005	0.000004
Na	0.27	0.03	1.80	1.26	0.21	0.06	0.48	0.15	0.92	0.03	2.90	1.04	2.60	0.03	2.30	0.54
Sr	0.014	0.009	0.072	0.070	0.012	0.008	0.009	0.006	0.012	0.005	0.066	0.035	0.045	0.019	0.050	0.041
Tl	0.00005	0.00004	0.00001	0.00001	0.00001	0.00001	0.00001	0.00000	0.00003	0.00001	0.00001	0.00001	0.00001	0.00001	0.00002	0.00002
Sn	0.00005	0.00005	0.00005	0.00005	0.00005	0.00004	0.00005	0.00005	0.00005	0.00005	0.00005	0.00004	0.00005	0.00005	0.00005	0.00004
Ti	0.0046	0.0047	0.0048	0.0047	0.0047	0.0045	0.0047	0.0045	0.0050	0.0045	0.0047	0.0044	0.0050	0.0047	0.0048	0.0044
U	0.00001	0.00000	0.00036	0.00033	0.00005	0.00000	0.00039	0.00008	0.00002	0.00001	0.00010	0.00002	0.00050	0.00016	0.00004	0.00001
V	0.0005	0.0005	0.0009	0.0009	0.0006	0.0004	0.0005	0.0004	0.0005	0.0005	0.0006	0.0004	0.0005	0.0005	0.0023	0.0008
Zn	0.091	0.178	0.002	0.002	0.015	0.023	0.001	0.001	0.100	0.038	0.002	0.001	0.002	0.001	0.002	0.001

Note: Highlighted colors correspond to plots. PAG 1 samples are red; PAG 2 samples are green; NAG 3 samples are purple; NAG 4 samples are blue; NAG 5 sample is orange.

3.2.10 Modified Humidity Cell Tests

Modified humidity cell testing using increasing durations of time between leaching (2, 3, and 5 weeks) was conducted to examine metal release rates with longer exposure times. Three active humidity cells were selected for the modification to the standard weekly procedure as described in Section 2.3.2.2:

- BW- ARD 566 (PAG 2 waste rock);
- BW- ARD 606 (NAG 3 waste rock);
- BW- ARD 468 (NAG 4 waste rock).

Sample BW-ARD-468 has been active for nine weeks at the time of writing, and will not be modified until 15 weeks of the regular humidity cell testing have elapsed. The results for humidity cell samples BW-ARD-566 and BW-ARD-606 are presented in **Figure 3-34** through **Figure 3-43**. Samples were labelled as MHCT-566 and MHCT-606, respectively, to distinguish the modified phase of the experiment from the regular humidity cell testing. Results are preliminary and require more time for the modified cycle to complete. Generally, the trends in pH, alkalinity, sulphate, and dissolved metals are consistent with the observed results of the regular humidity cell testing. Complete results to date at the time of writing are given in **Annex 6**.

3.2.11 Subaqueous Column Tests

Subaqueous column testing was initiated to assess the release of metals from PAG 1 and PAG 2 waste rock under submerged, low oxygen conditions similar to what is expected in the tailings storage facility.

Table 3-31 provides a summary of results for the two waste rock samples (BW-ARD-611 and BW-ARD-672). Complete results are given in **Annex 8**.

Weekly analysis of submerged waste rock column leachate included pH, conductivity, alkalinity, acidity, sulphate, and dissolved metals. **Figure 3-44** through **Figure 3-53** plot the pH, alkalinity, sulphate, cadmium, zinc, copper, iron, lead and arsenic results for the seven weeks of testing that have been completed. The average subaqueous waste rock column leaching rates for all samples are presented in **Table 3-32**.

The waste rock samples used for sub-aqueous testing did not have corresponding humidity cell tests. Comparison of the pH and relative rates of sulphate and metal production was facilitated by comparison against waste rock humidity cells with ABA and solid phase metal concentrations similar to those in the submerged column test samples. This was necessary to compare leaching rates and acid production in a submerged, oxygen-limited environment to those in a sub-areal, fully-oxidizing environment. In general, the submerged waste rock column results reported neutral to alkaline pH, and low sulphate and metals loads relative to the comparable humidity cells over the same period.

Table 3-31: Subaqueous Waste Rock Leachate Column Samples

ARD Class	ARD Sample No.	Test Duration (weeks)	Facies	NP	Total Sulphur (%)	NPR	Zn (ppm)	Cd (ppm)
PAG 2	BW-ARD-611	28	S	10.0	0.26	1.2	1,900	7.3
PAG 1	BW-ARD-672	28	S	10.0	0.69	0.5	2,520	13

3.2.11.1 pH, Acidity and Alkalinity

The pH of the submerged waste rock column varied between slightly alkaline (maximum of 7.8) to slightly acidic (minimum of 5.3). (**Figure 3-44**). The average pH values were 6.5 for PAG 2 column ARD-611 and 6.0 for the PAG 1 column ARD-672.

Acidity on both submerged columns was slightly elevated when compared to the humidity cell tests (**Figure 3-45**). Both submerged columns had long term steady state values near 100 mg/kg/wk (approximately 25 mg/L).

The alkalinity trends were similar to the acidity, although the PAG 2 column ARD-611 had more alkalinity than the PAG 1 column ARD-672 (**Figure 3-46**). Alkalinity loads at the end of testing ranged from about 350 mg/kg/wk to 650 mg/kg/wk (approximately 100-200 mg/L). The submerged column leachate had more alkalinity compared to the humidity cells.

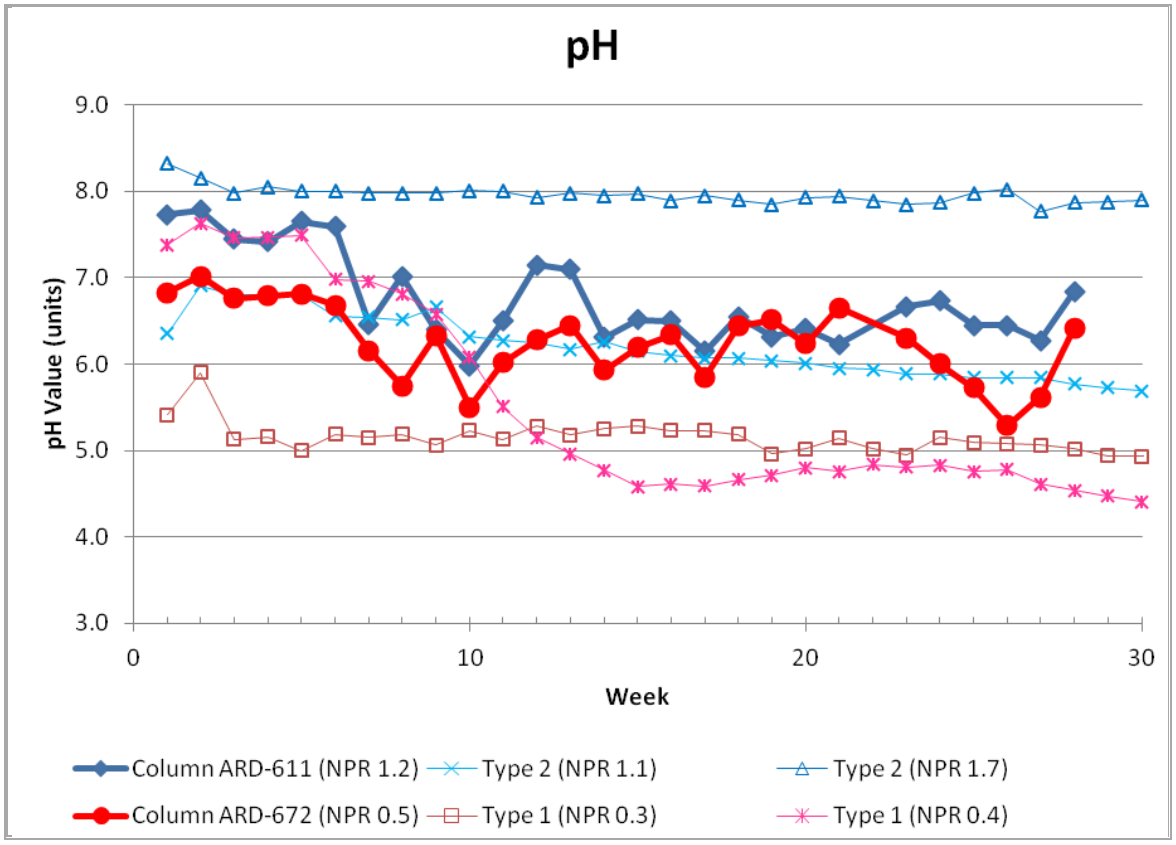


Figure 3-44: Subaqueous Waste Rock Leachate Column pH values

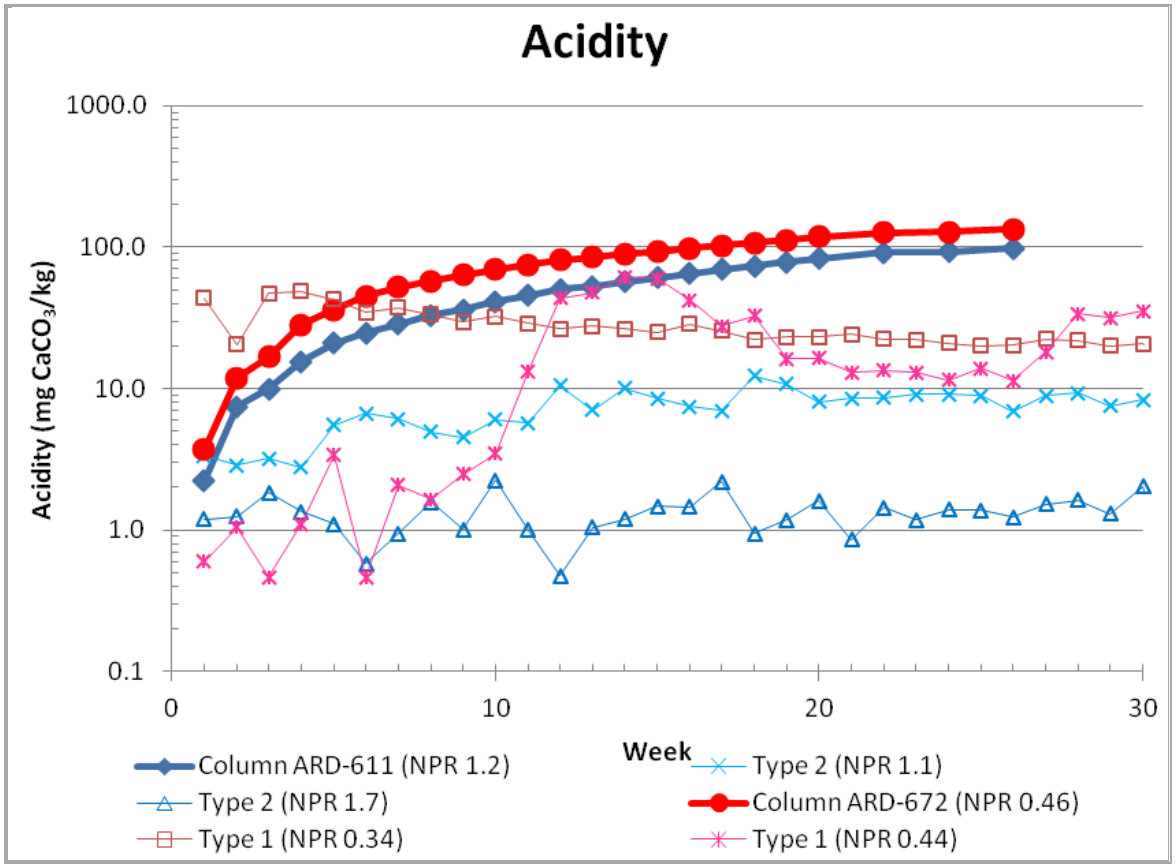


Figure 3-45: Subaqueous Waste Rock Leachate Column Acidity Loads

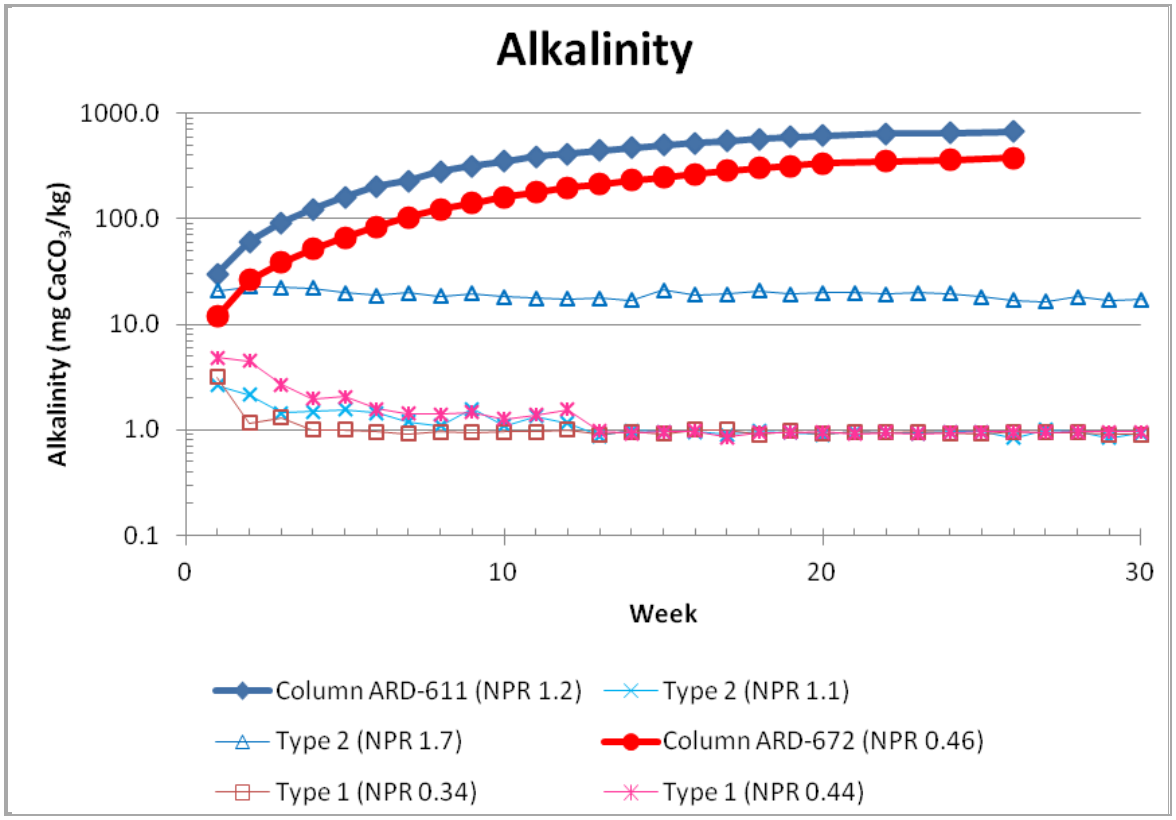


Figure 3-46: Subaqueous Waste Rock Leachate Column Alkalinity Loads

3.2.11.2 Sulphate

Sulphate loads in both submerged columns rapidly increased over the first 7 weeks of testing quickly reaching steady state values of 600 mg/kg/wk for the PAG 1 column ARD-672 and 100 mg/kg/wk for PAG 2 column ARD-611 (**Figure 3-47**).

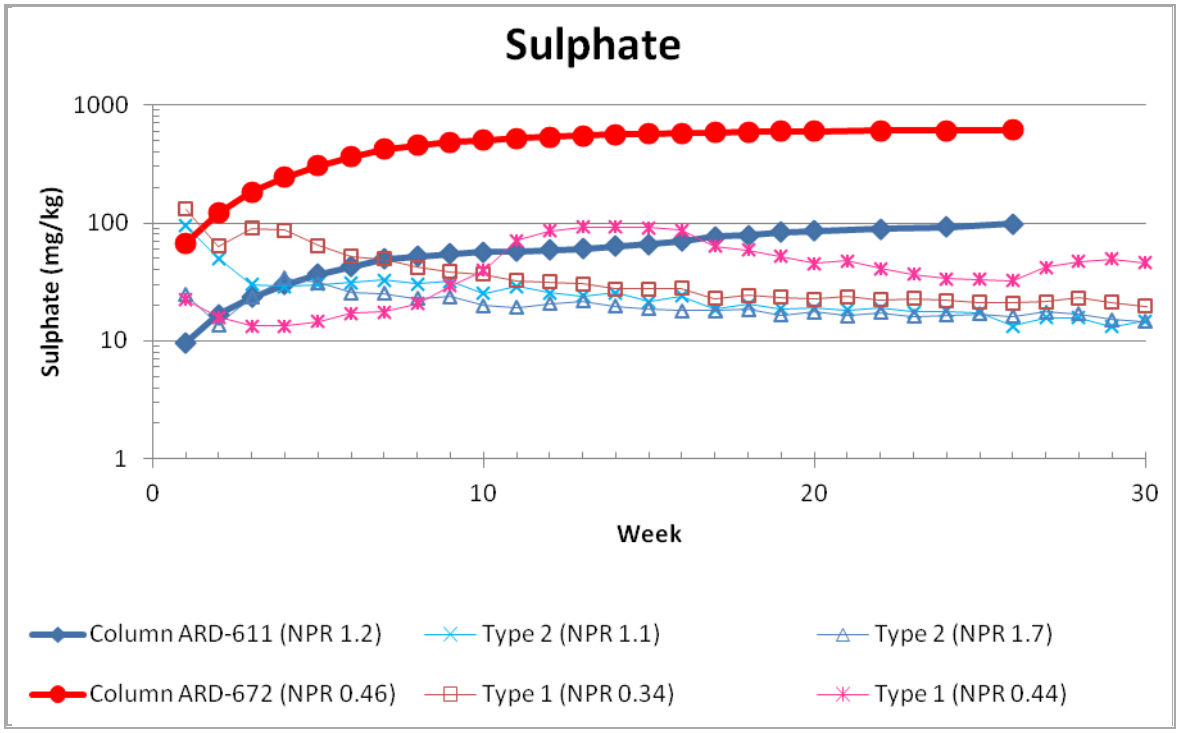


Figure 3-47: Subaqueous Waste Rock Leachate Column Sulphate Loads

3.2.11.3 Dissolved Metals

In general, column BW-ARD-672 reported higher metal loads than column BW-ARD-611 for all but copper and arsenic (**Figure 3-48** through **Figure 3-53**). Metal loads in the sub-aqueous column tests were consistently low relative to those in the humidity cell tests.

Cadmium in both submerged columns was low and loads did not exceed 0.001 mg/kg/wk for either column test (**Figure 3-48**). The submerged columns had lower cadmium loads than the humidity cells.

The zinc loads were higher in PAG 1 column BW-ARD-672 than in PAG 2 column BW-ARD-611 (**Figure 3-49**). The zinc loads in both submerged columns were intermediate to the humidity cell results (i.e. the steady-state PAG 1 submerged column zinc load was approximately 3.2 mg/kg/wk, where as the humidity cells had long-term loads of 10 mg/kg/wk and approximately 0.5 mg/kg/wk.).

Copper loads were generally less than 0.01 mg/kg for both column tests (**Figure 3-50**) and were greater than the humidity cell loads.

Steady-state iron loads were obtained for both column tests (**Figure 3-51**). PAG 1 column BW-ARD-672 (steady state approximately 5.5 mg/kg/wk) reported higher loads than PAG 2 column BW-ARD-611 (steady state approximately 0.3 mg/kg/wk).

Lead loads were slightly increasing for both submerged columns with maximum values at the end of testing of approximately 0.004 mg/kg/wk (**Figure 3-52**).

Both column tests obtained steady state arsenic loads (**Figure 3-53**). The PAG 1 column BW-ARD-672 (steady state approximately .2 mg/kg/wk) reported lower loads than PAG 2 column BW-ARD-611 (steady state approximately 0.3 mg/kg/wk).

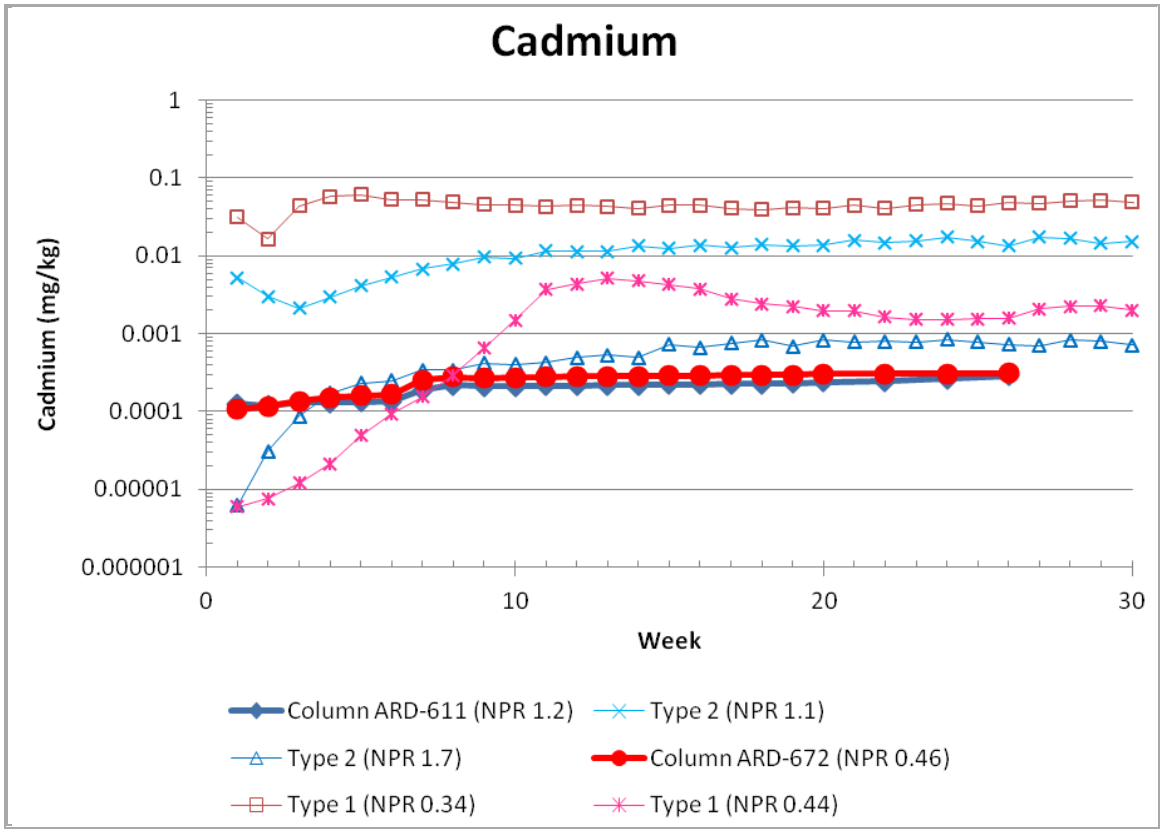


Figure 3-48: Subaqueous Waste Rock Leachate Column Cadmium Loads

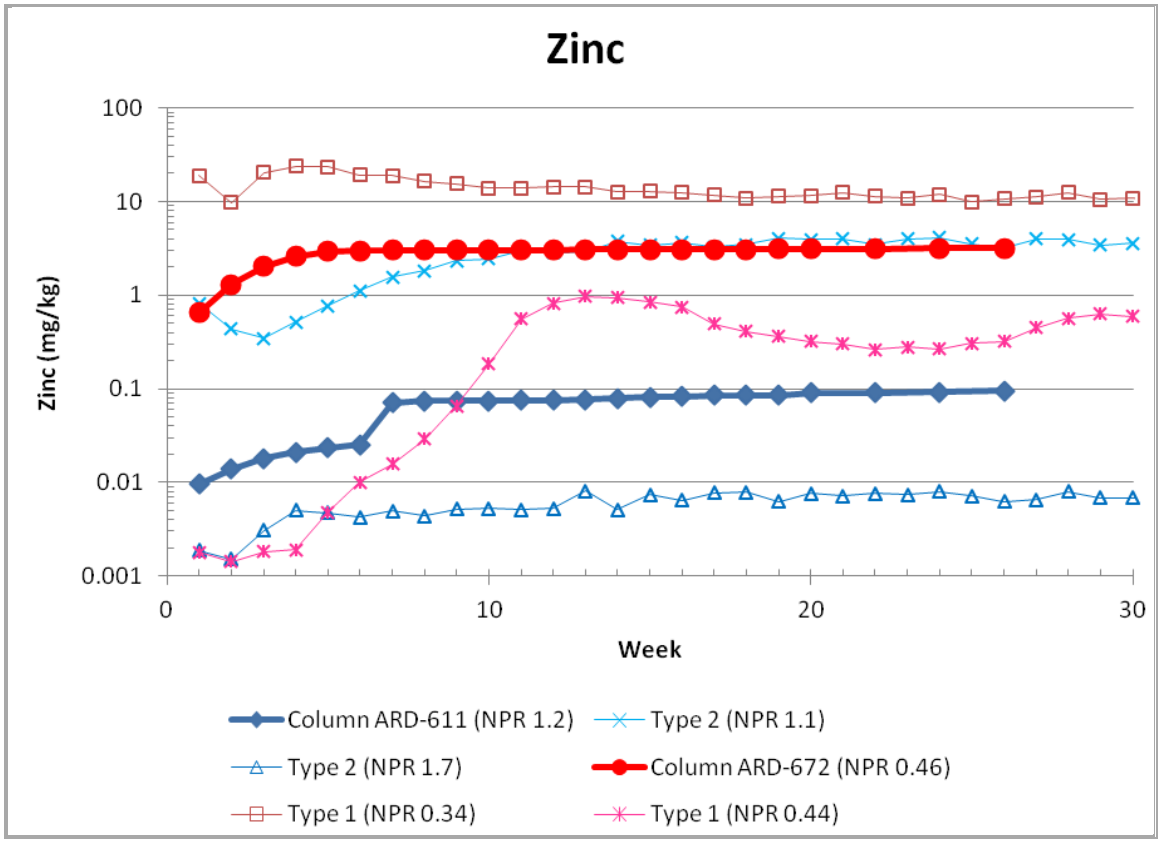


Figure 3-49: Subaqueous Waste Rock Leachate Column Zinc Loads

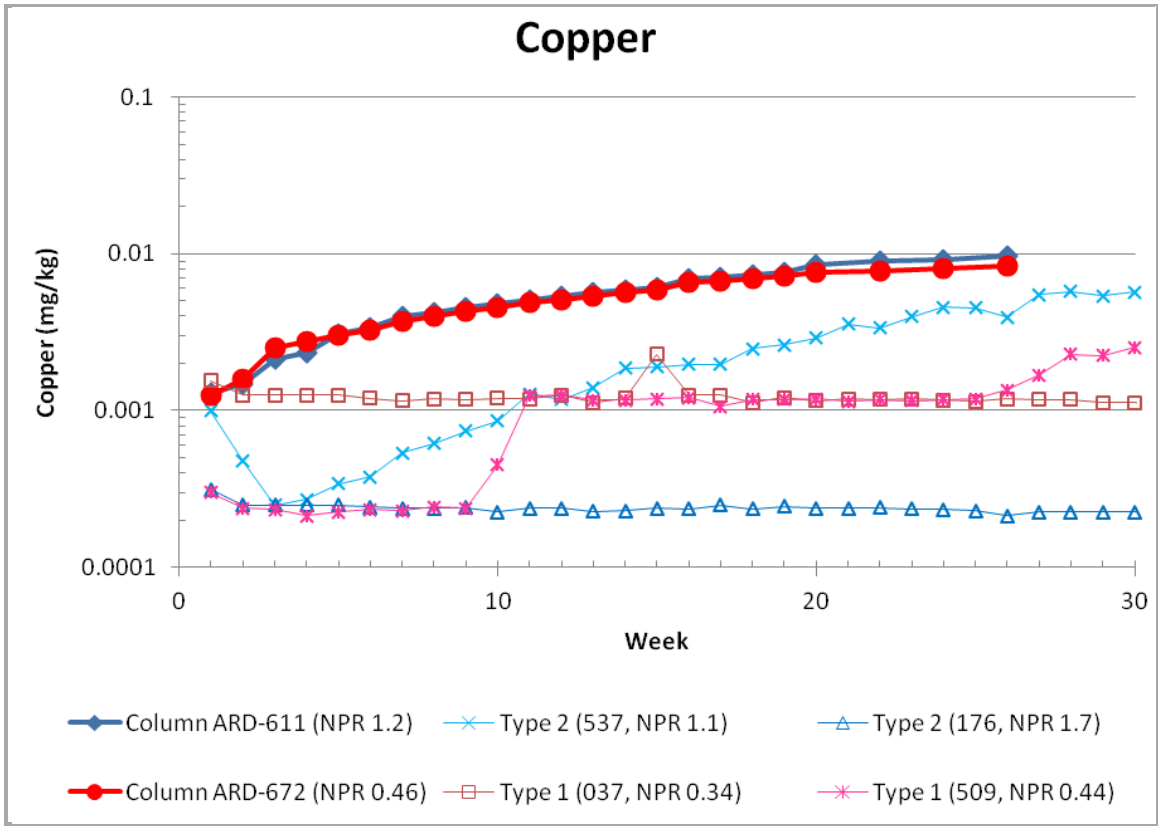


Figure 3-50: Subaqueous Waste Rock Leachate Column Copper Loads

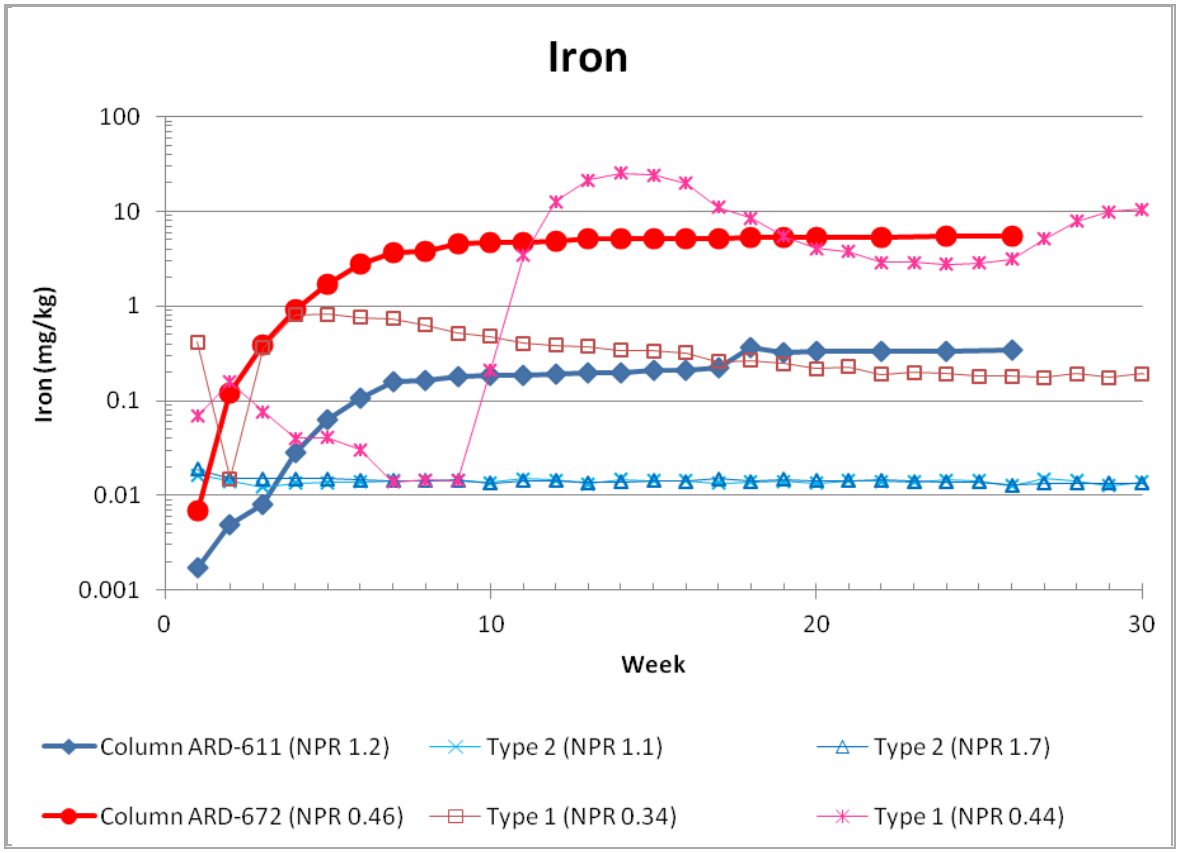


Figure 3-51: Subaqueous Waste Rock Leachate Column Iron Loads

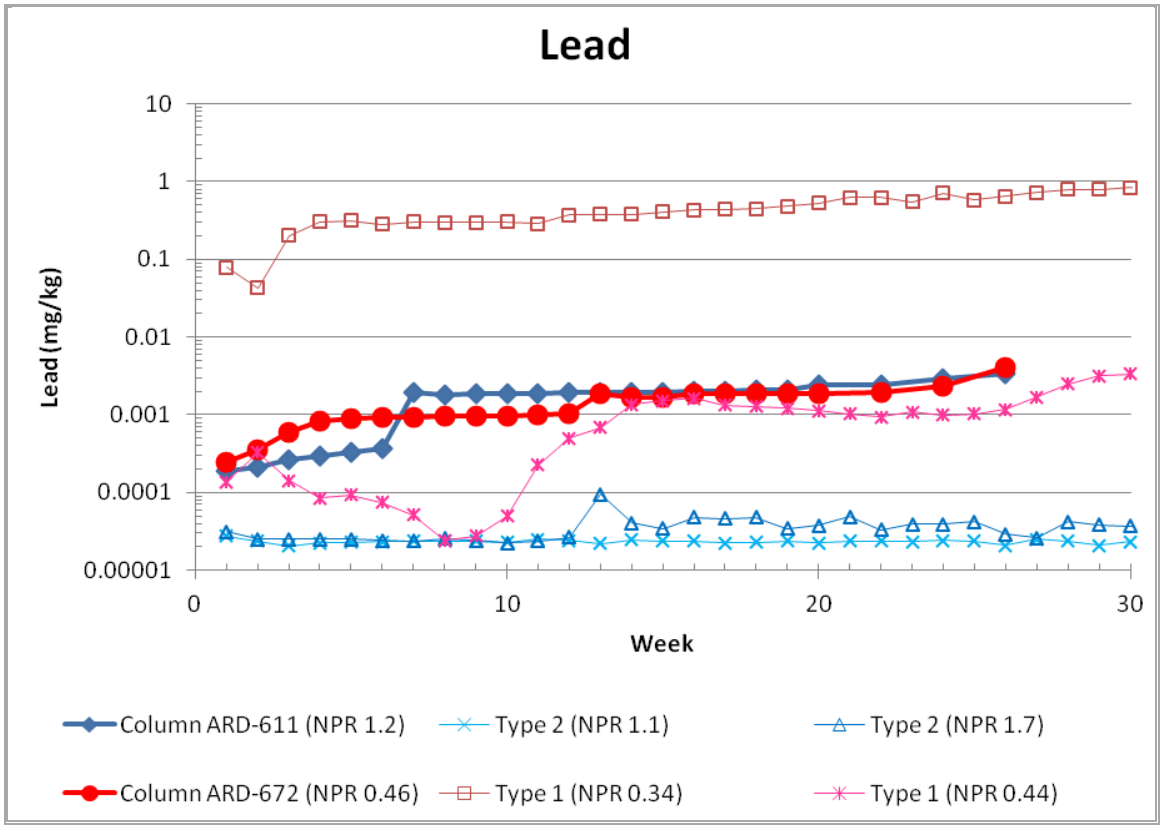


Figure 3-52: Subaqueous Waste Rock Leachate Column Lead Loads

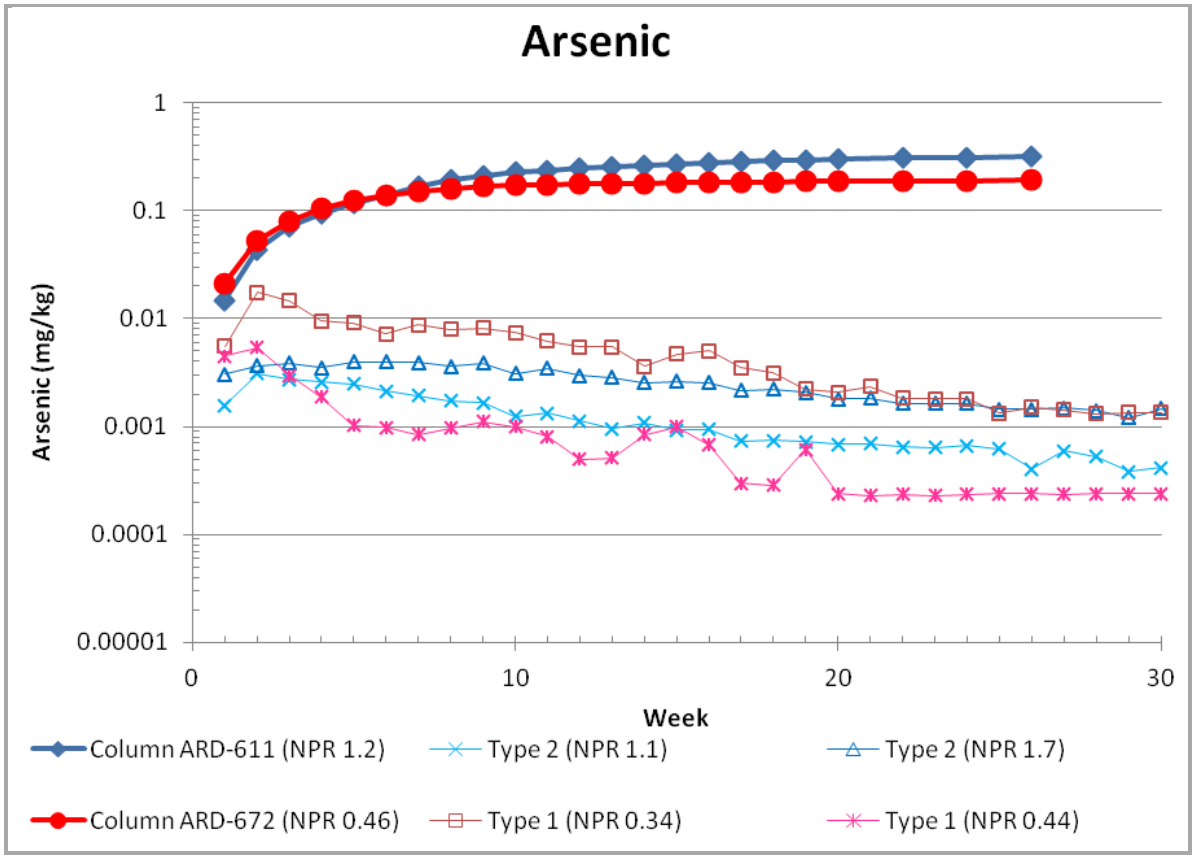


Figure 3-53: Subaqueous Waste Rock Leachate Column Arsenic Loads

Table 3-32: Average Subaqueous Waste Rock Column Leaching Rates

Parameter	Rates (mg/kg/wk)	
	BW-ARD-611	BW-ARD-672
Duration	28 weeks	28 weeks
Acidity	0.39	0.69
Alkalinity	3.1	1.4
Sulphate	0.67	5.6
Al	0.0016	0.00059
Sb	0.0082	0.00036
As	0.0023	0.0022
Ba	0.00081	0.0026
Be	0.0000010	0.0000027
Bi	0.00000060	0.00000051
B	0.0011	0.0010
Cd	0.0000022	0.0000027
Ca	0.66	1.1

Parameter	Rates (mg/kg/wk)	
	BW-ARD-611	BW-ARD-672
Cr	0.000026	0.000027
Co	0.000011	0.0021
Cu	0.000055	0.000054
Fe	0.0017	0.044
Pb	0.0000060	0.000015
Li	0.001	0.0006
Mg	0.023	0.18
Mn	0.011	0.20
Mo	0.00044	0.000024
Ni	0.000043	0.0029
P	0.00046	0.00047
K	0.28	0.66
Se	0.0000025	0.0000027
Si	6.7	8.3
Ag	0.0000011	0.0000011
Na	0.59	0.65
Sr	0.0026	0.010
Tl	0.0000010	0.0000016
Sn	0.0016	0.0012
Ti	0.0000068	0.000019
U	0.00037	0.0000065
V	0.000048	0.000020
Zn	0.00042	0.049

3.2.12 Field Bin Tests

Six field bin tests were started using duplicate samples of humidity cell samples BW-ARD-2-9 (PAG 1), BW-ARD-037 (PAG 1), BW-ARD-537 (PAG 2), and BW-ARD-176 (PAG 2), BW-ARD-606 (NAG 3) and BW-ARD-610 (NAG 5). Complete results are given in **Annex 9**.

Field bin leachate was analyzed for pH, conductivity, alkalinity, acidity, sulphate, and dissolved metals. A summary of the field bin sample descriptions is provided in **Table 3-33**. The results are compared with corresponding humidity cell tests to examine the differences in acid production, loading rates, and lag times to acid generation for waste rock under field conditions as compared to those for laboratory testing. Field bin testing results are often considered to produce leachate quality that is more similar to expected site drainage than humidity cell testing. The results are suitable for use in predictive water quality modelling, although the models use, the generally more conservative, humidity cell rates (Section 6.0).

3.2.12.1 pH, Acidity and Alkalinity

Field bin and humidity cell leachate pH values are compared in **Figure 3-54**. PAG 1 field bin BW-ARD-2-9 had acidic leachate pH throughout the entire testing period. PAG 1 field bin BW-ARD-037 pH declined from 6 to 5 during testing. Both PAG 2 field bins (BW-ARD-537 and BW-ARD-176) had alkaline leachate pH values of approximately 8.0. The field bin leachate pH results compared well with the humidity cell test results, except for PAG 2 sample BW-ARD-537 (NPR 1.1): the corresponding laboratory humidity cell developed acidic pH leachate after approximately 20 weeks of testing, while the field bin leachate remains alkaline.

PAG 1 sample BW-ARD-2-9 reported acidic pH for both the humidity cell and the field bin from the start of testing; however, the pH was almost 2 pH units lower in the humidity cell at week 69 (pH 2.5) compared to the field bin (pH 4.2). From the start of testing, PAG 1 sample BW-ARD-037 was more acidic for the humidity cell than for the field bin, which saw a 16 week delay before acidic conditions were reached (final pH 5 in both tests). PAG 2 sample BW-ARD-176 was alkaline in both the humidity cell and the field bin for the duration of testing. This suggests that the lag time to acid generation may be longer under field conditions than laboratory conditions.

Field bin acidity loads are plotted **Figure 3-55**. The field bin acidity loads were generally less than the humidity cell loads for the two tests that had measurable amounts of acidity (ARD2-9 and ARD-037). None of the remaining four field bins had measureable acidity.

Alkalinity results for the field bin samples are compared with humidity cell test results in **Figure 3-56**. The alkalinity was low and declining in both PAG 1 field bin samples. Higher alkalinity loads were reported in the neutral pH PAG 2, NAG 3 and NAG 5 field bins than in the PAG 1 field bins.

Table 3-33: Waste Rock Field Bin Samples

ARD Class	Sample No.	Description	Test Duration (weeks)	Facies	NPR	NP	Total S (%)	Zn (ppm)	Cd (ppm)
PAG 1	ARD2-9	PAG, high S, low NP	69	T	0.1	9	2.11	3,000	23.8
PAG 1	BW-ARD-037	PAG, average S, Avg NP, high Zn	69	S	0.3	6	0.51	4,690	26.8
PAG 2	BW-ARD-537	PAG, median metals	69	S	1.1	12	0.39	285	2.05
PAG 2	BW-ARD-176	PAG, moderate Zn	69	S	1.7	24	0.45	2,160	18.2
NAG 3	BW-ARD-606	NAG, moderate Zn	10	S	2.2	13	0.19	1,580	6.5
NAG 5	BW-ARD-610	NAG, very low Zn	10	S	2.1	8	0.12	378	1.3

Note: NPR - NP/MPA, NP is modified Sobek NP

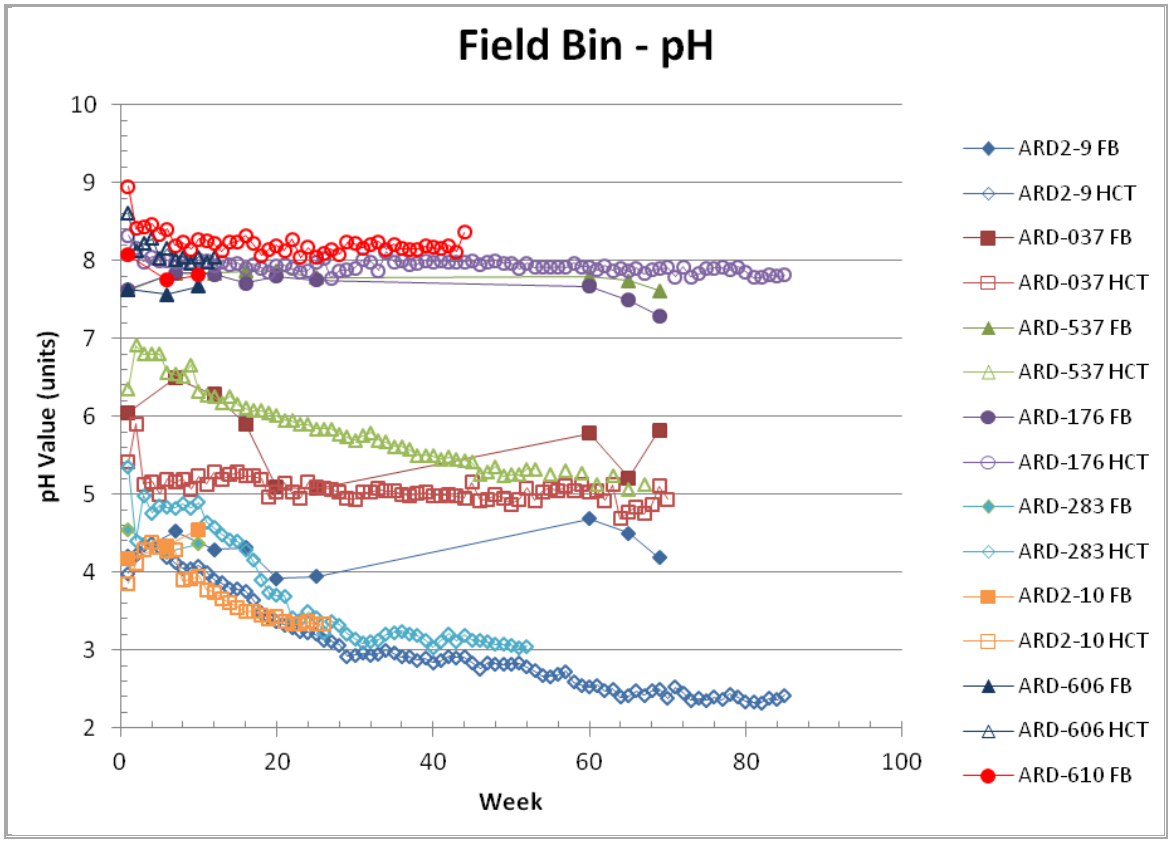


Figure 3-54: Waste Rock Kinetic Field Bin pH values

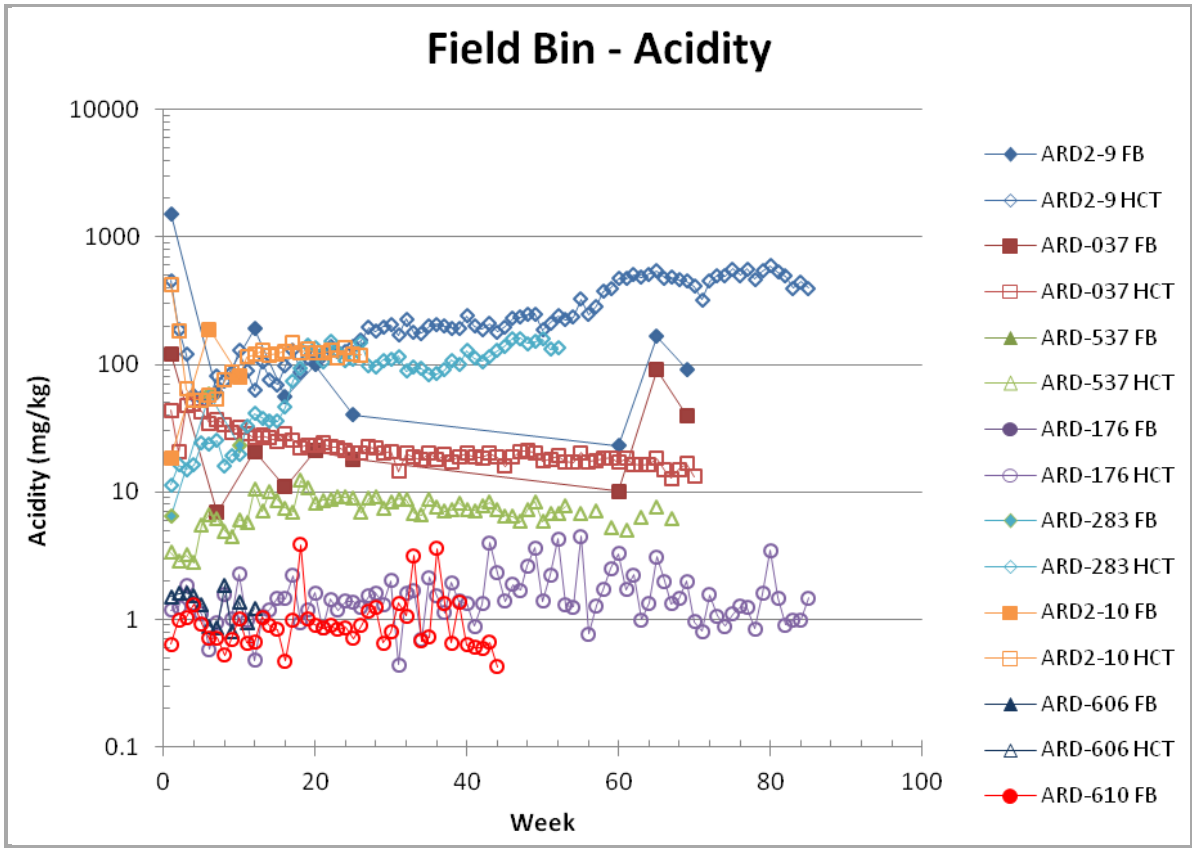


Figure 3-55: Waste Rock Kinetic Field Bin Acidity Loads

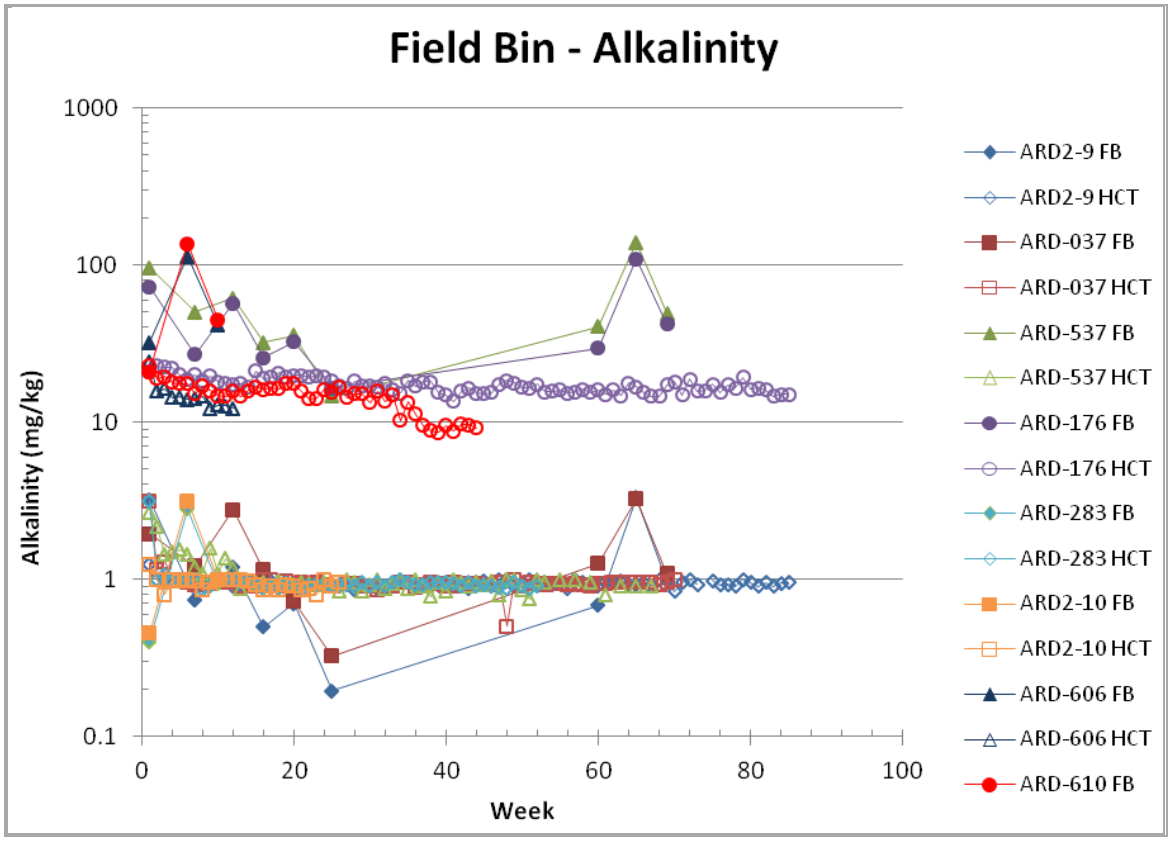


Figure 3-56: Waste Rock Kinetic Field Bin Alkalinity Loads

3.2.12.2 Sulphate

Most sulphate trends reported for the field bin tests were similar to their corresponding humidity cell samples, but with greater weekly variability (**Figure 3-57**). All field bins and humidity cell tests had similar sulphate loads.

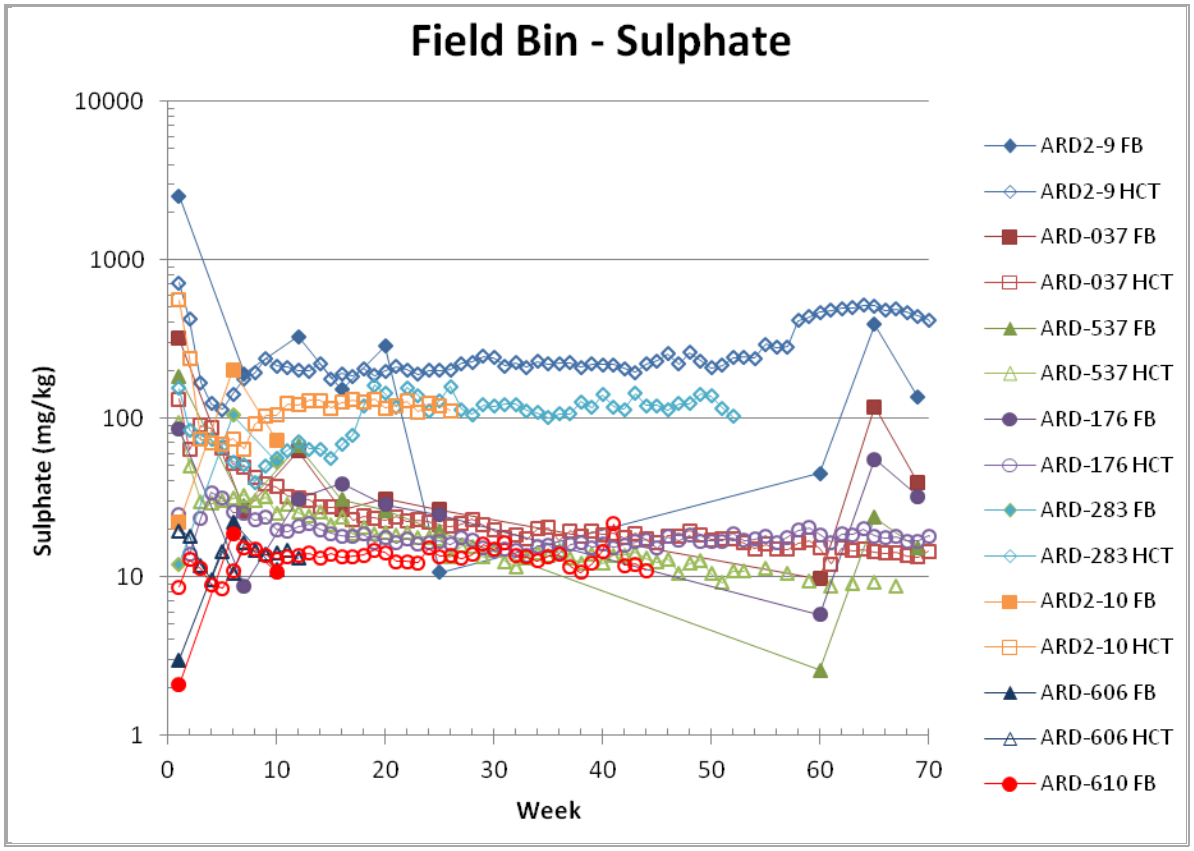


Figure 3-57: Waste Rock Kinetic Field Bin Sulphate Loads

3.2.12.3 Dissolved Metals

Field bin leachate concentrations of cadmium, zinc, copper, iron, lead, and arsenic are compared with humidity cell test results in **Figure 3-58**through **Figure 3-63**.

Higher leachate cadmium loads were reported for both PAG 1 field bins (BW-ARD-2-9 and BW-ARD-037) compared to the PAG 2, NAG 3 and NAG 5 field bins (**Figure 3-58**). The field bin sample reported cadmium loading trends similar to those for their corresponding humidity cell sample, except for BW-ARD-537. The lower cadmium loads in field bin BW-ARD-537 compared to the humidity cell test was likely related to the more alkaline pH values in the field bin leachate.

Field bin and humidity cell zinc loads are presented in **Figure 3-59**. Field bin zinc loads were higher in both PAG 1 samples compared to the two PAG 2, NAG 3 and NAG 5 bins. The field bin samples had relatively similar zinc loads to their corresponding humidity cell tests, except for BW-ARD-537. The lower zinc loads in field bin BW-ARD-537 compared to the corresponding humidity cell test was likely related to the more alkaline pH values in the field bin leachate.

Copper loads for field bins and humidity cells are presented in **Figure 3-60**. Higher copper loads were reported in PAG 1 sample BW-ARD-2-9 compared to all other field bins. Copper loads in the field bins were highly variable, except for those in BW-ARD-2-9. The field bin and humidity cell loads for BW-ARD2-9 were similar, whereas all other field bin loads were less than their corresponding humidity cell loads.

Field bin and humidity cell iron loads are presented in **Figure 3-61**. Higher iron loads were reported in PAG 1 sample BW-ARD-2-9 (greater than 1 mg/kg Fe) compared to the other field bin samples (less than 0.2 mg/kg Fe). For BW-ARD-2-9, the field bin iron load was very similar to the humidity cell load throughout the testing. The other field bin tests had lower iron loads compared to the corresponding humidity cells.

Lead loads for field bin tests are compared with those in humidity cell tests in **Figure 3-62**. PAG 1 field bin samples reported higher lead loads than the PAG 2 samples. The PAG 1 field bin and humidity cell tests had similar loads, whereas the PAG 2 field bins had lower loads compared to the corresponding humidity cell tests. Field bin and humidity cell loads decreased for PAG 1 sample BW-ARD-2-9, and increased for PAG 1 sample BW-ARD-037.

Both the field bins and the humidity cells had low arsenic loads for all four samples (**Figure 3-63**).

With the exception of BW-ARD2-9, the field bins tended to have lower metal concentrations and loads than the corresponding humidity cell tests.

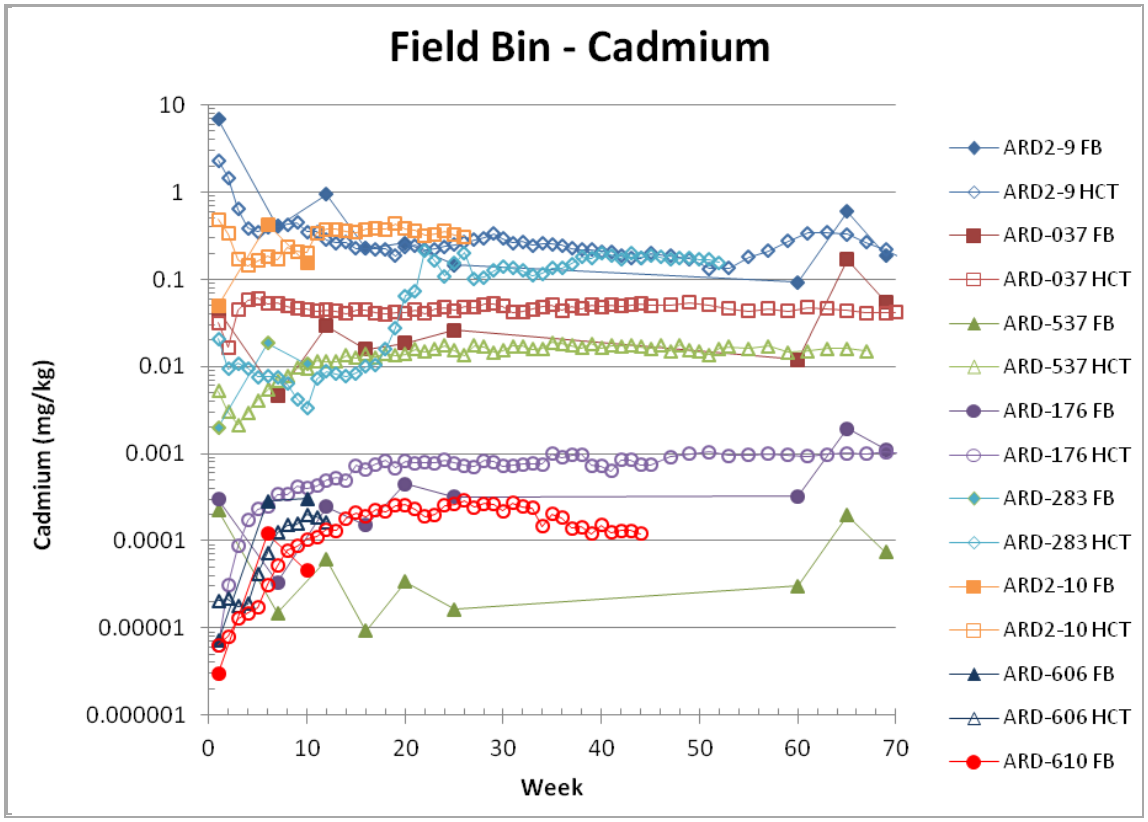


Figure 3-58: Waste Rock Kinetic Field Bin Cadmium Loads

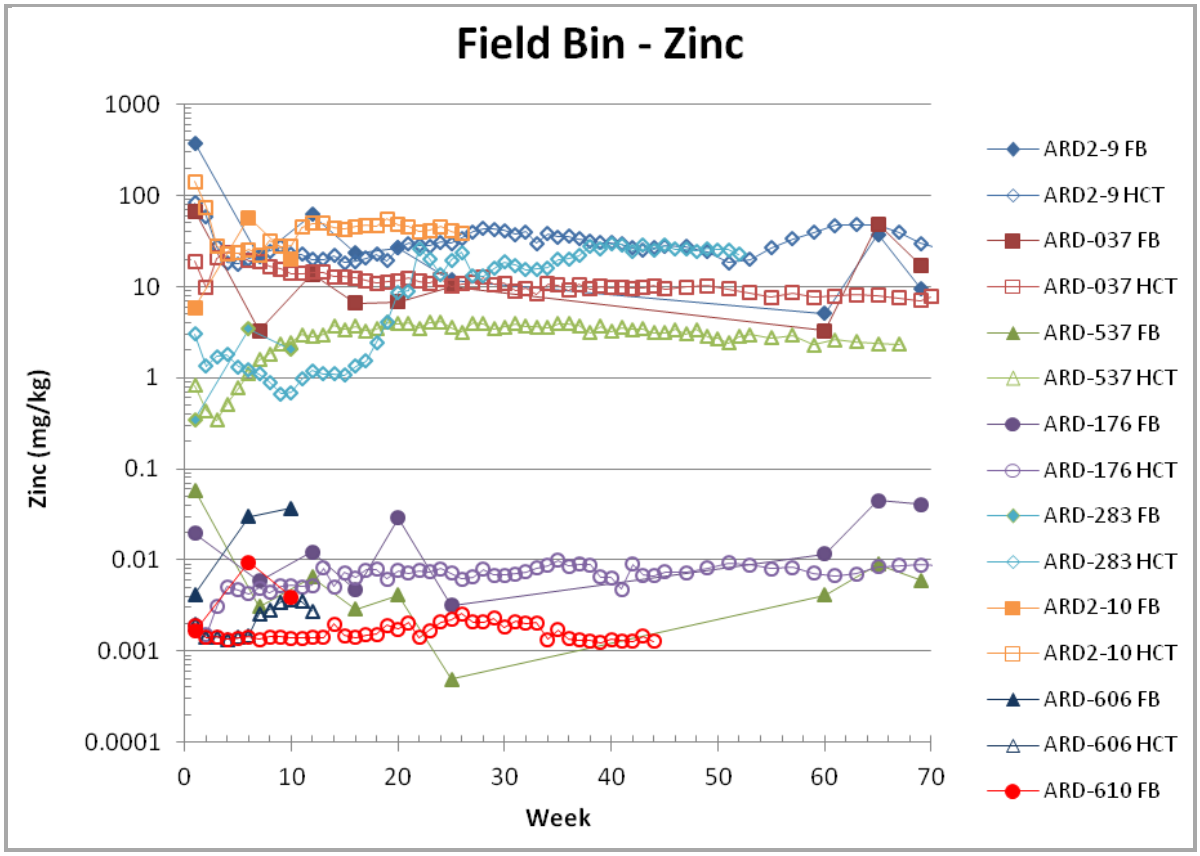


Figure 3-59: Waste Rock Kinetic Field Bin Zinc Loads

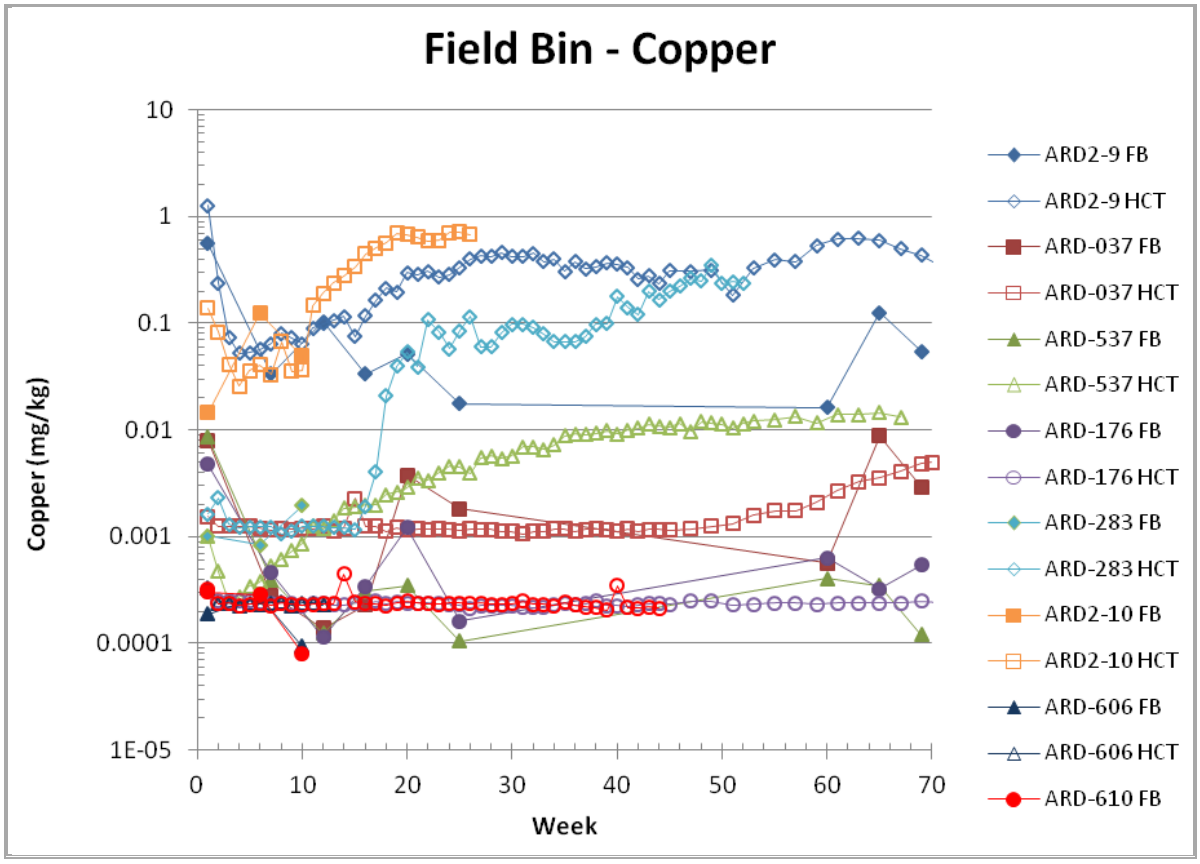


Figure 3-60: Waste Rock Kinetic Field Bin Copper Loads

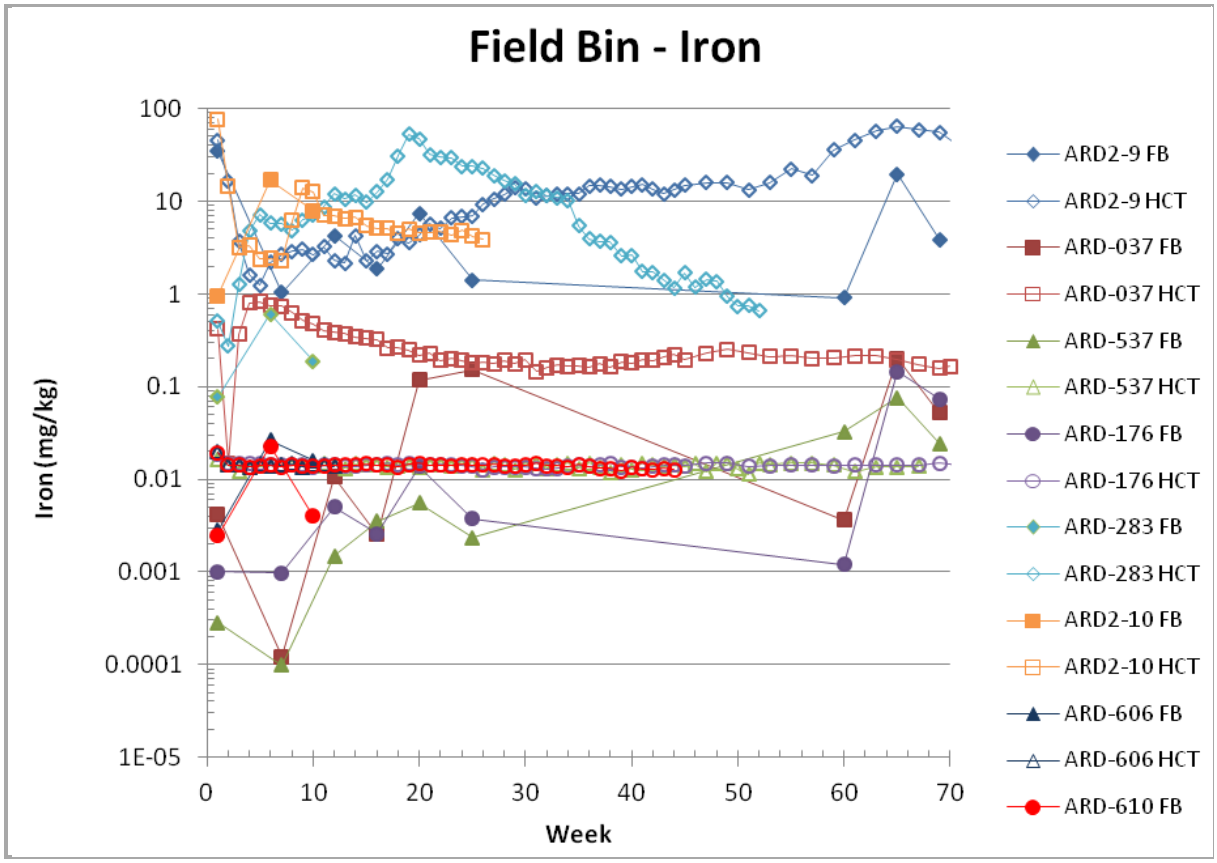


Figure 3-61: Waste Rock Kinetic Field Bin Iron Loads

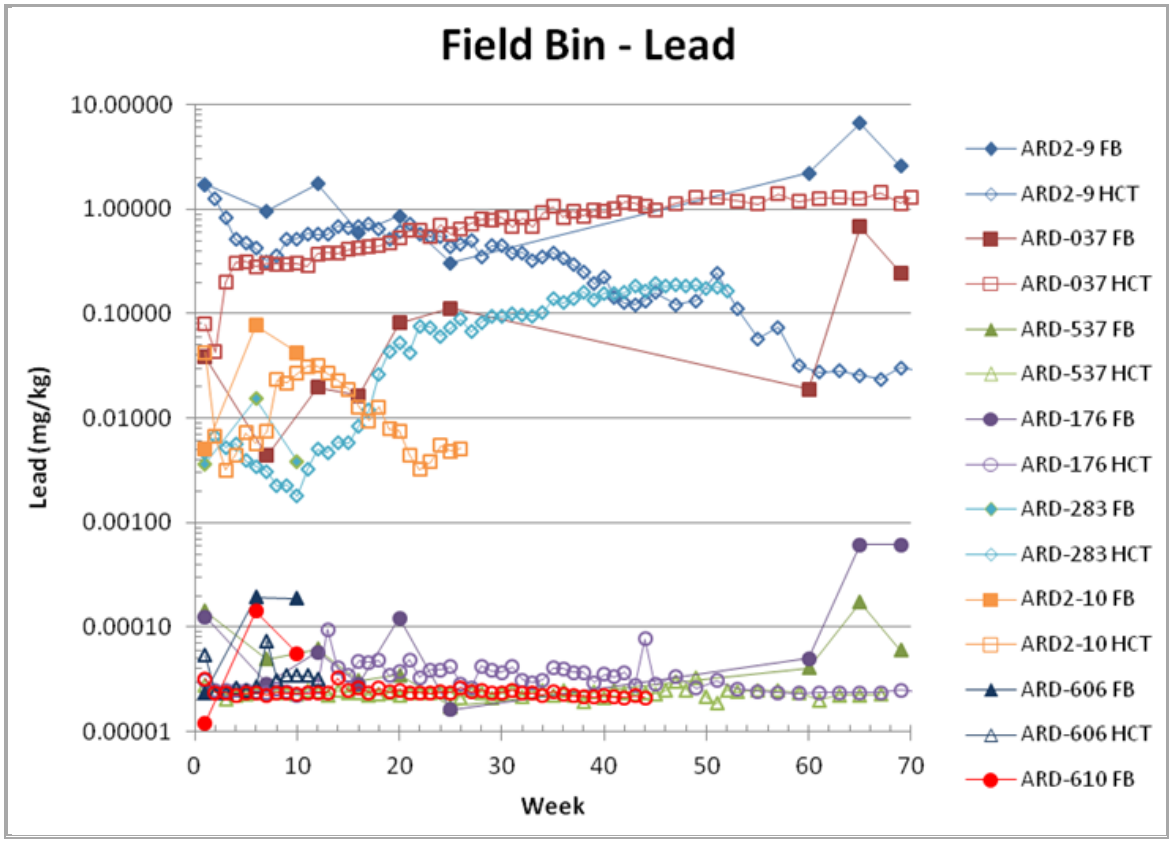


Figure 3-62: Waste Rock Kinetic Field Bin Lead Loads

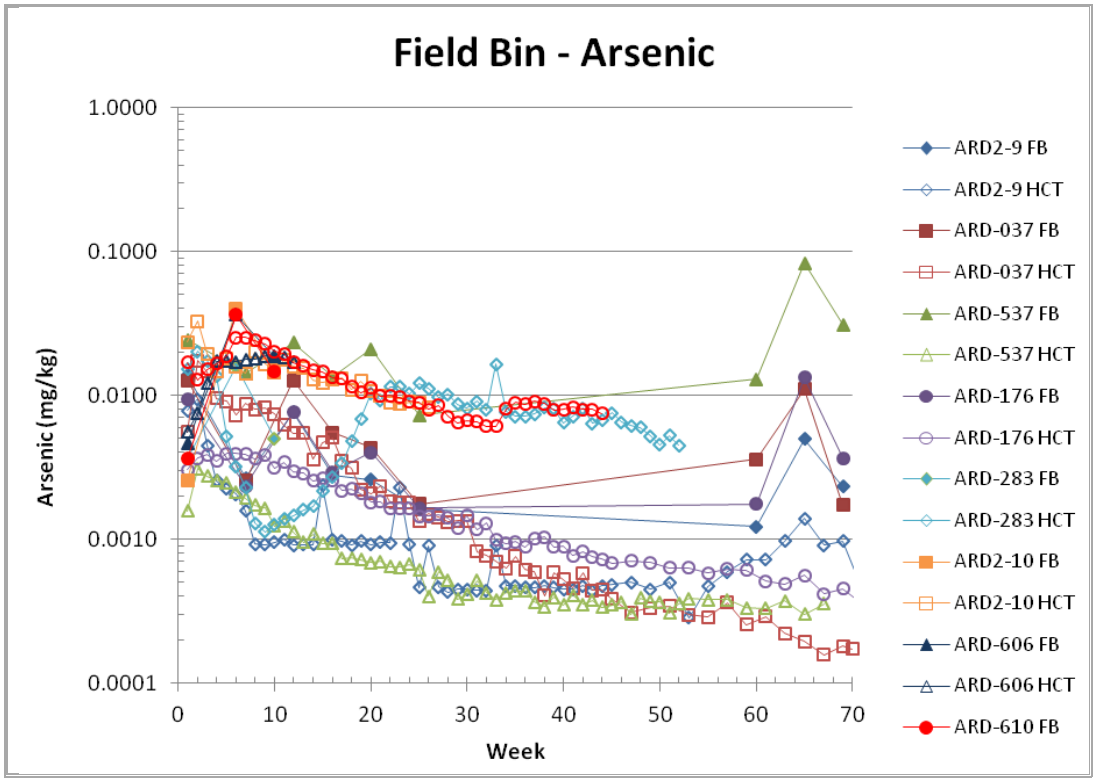


Figure 3-63: Waste Rock Kinetic Field Bin Arsenic Loads

3.2.13 Sulphide and NP Depletion

The time to sulphide depletion was predicted for each humidity cell test using the average sulphate release rate from the last 10 weeks of testing after correcting for the presence of zinc sulphide and the cumulative sulphate production during humidity cell testing.

The time to deplete the initial sulphide concentration in the laboratory tests ranged from approximately one year to greater than 100 years (**Table 3-34**). The short depletion times were generally for the PAG 1 cells reflected their relatively high sulphide oxidation rate, the exception being BW-ARD-037, which had a low average sulphate release rate, and showed a steady pH near 5 for the entire testing period. There was a wide range of sulphide depletion times for the other humidity cells, although they generally all had low sulphate release rates.

The waste rock humidity cell test samples had low amounts of both NP and CNP. The time to depletion of NP and CNP was calculated using the average calcium + magnesium release rates for the last 10 weeks of testing after accounting for NP already consumed during testing (**Table 3-35**).

Table 3-36 summarizes the depletion time results for all the waste rock humidity cell tests and presents the 'lag time' based on laboratory results. For humidity cells that are currently generating acid, the lag time was the number of weeks of testing prior to the generation of acidic leachate. For all other humidity cell tests, if the sulphide depletion time was greater than the NP

depletion, then the lag time was equivalent to the NP depletion. It is expected that actual lag times in the field will be longer than those found on laboratory testing, due to factors such as lower waste rock flushing rates in dumps than in humidity cell testing, and reduced reaction rates in colder temperatures (**Table 3-37**).

Table 3-34: Sulphate Release Rates and Calculated Depletion Times for Acid Potential

ID	ARD Class	NPR	Sulphide Sulphur (%)	Avg SO_4 Release Rate (mg/kg/wk)	Sulphide Depletion Time Years
ARD- 037	**PAG 1**	**0.3**	**0.55**	**14.0**	**11.5**
ARD- 2-9	**PAG 1**	**0.1**	**1.97**	**338.6**	**3.6**
ARD- 509	**PAG 1**	**0.4**	**0.19**	**25.1**	**4.2**
ARD- 176	PAG 2	1.7	0.44	22.9	7.2
ARD- 288	PAG 2	1.8	0.32	7.1	9.5
ARD- 499	PAG 2	1.4	0.05	12.4	1.3
ARD- 510	PAG 2	1.6	0.37	11.8	16.2
ARD- 537	PAG 2	1.1	0.33	9.0	21
ARD- 566	PAG 2	1.1	0.69	26.1	14.3
ARD- 526	NAG 3	2	0.06	4.3	15.9
ARD- 606	NAG 3	2.2	0.19	13.3	4.9
ARD- 648	NAG 3	2.6	0.45	5.9	38.6
ARD- 692	NAG 3	2.9	0.47	1.6	139.2
ARD-153	NAG 3	2.3	0.1	6.1	6.5
ARD-238	NAG 3	3.3	0.1	5.6	5.3
ARD- 473	NAG 3	4.9	0.32	2.0	89.2
ARD- 338	NAG 4	2.5	0.34	8.3	21.3
ARD- 468	NAG 4	2.6	0.14	11.7	5.4
ARD- 610	NAG 5	2.1	0.11	13.2	4

Note: Highlighted cells indicate acidic pH leachate in at least final week of test (pH < 6)
Highlighted **bold** cells indicate acid pH leachate less than 5 in at least 1 week of testing
Predicted depletion times adjusted for the presence of ZnS and sulphide consumed during testing

All PAG 1 tests are currently acid generating, and all but one test generated acidic leachate since the start of testing. This indicates that there might be very little to no lag time for some of the low NPR PAG 1 waste rock, likely on the order of the time between sample collection and the initiation of the testing program, or about 2 to 4 months. Results of field bin testing indicated that, under field conditions, a portion of the PAG 1 waste rock with low NPR values (less than 0.3) will have little lag time, but rock with higher NPR values (over 0.3) will have a lag time on the order of 2 to 4 months before acidic conditions prevail.

The PAG 2 waste rock (NPR of 1 to 2) had theoretical lag times ranging from 20 weeks to 20 years. Lag time values calculated using CNP were slightly shorter, between 20 weeks and 7 years. Comparison of the field test bin pH values to the humidity cell values for the two PAG 2 samples

(BW-ARD-537 and BW-ARD-176) showed that, as with the PAG 1 samples, there was a longer lag time to acid generation under field conditions. Conservatively, the laboratory and field results suggest that low NPR PAG 2 samples will have a shorter lag time, on the order of 6 months, and higher NPR PAG 2 samples (such as BW-ARD-510 and BW-ARD-176) may not generate acidic leachate.

For NAG 3 waste rock, the results of the NP depletion calculations generally supported the non-PAG classification with the exception of BW-ARD-692, which showed sulphide outlasting both the NP and CNP. It should be noted that BW-ARD-692 had a very low sulphate release rate of 2 mg/kg/wk, resulting in the very long time needed to burn out the sulphide. It is suspected that the high flushing rate of the humidity cells was removing the NP faster than would be expected under the lower flushing rates expected in the field. Given the very low sulphate release rate and the higher flushing in the humidity cells, it is not expected that this sample will generate acid leachate. The shortest CNP lag time based on the four laboratory tests was one year, but two samples were not predicted to deplete CNP at all. Overall, the NAG 3 samples are not expected to be acid generating based on NP depletion.

Neither NAG 4 or NAG 5 waste rock is expected to be acid generating.

Table 3-35: Calcium and Magnesium Release Rates and Calculated Neutralization Potential Depletion Times

ID	ARD Class	NPR	NP (kg $CaCO_3$/t)	TIC (%)	Avg Ca + Mg Release Rate (mg/kg/week)	Mod. Sobek NP Depletion (years)	CNP Depletion (years)
ARD- 037	**PAG 1**	**0.3**	**6**	**0.03**	**0.3**	**234**	**44**
ARD- 2-9	**PAG 1**	**0.1**	**9**	**0.18**	**11.7**	**4**	**7**
ARD- 509	**PAG 1**	**0.4**	**3**	**0.03**	**2.1**	**10**	**7**
ARD- 176	PAG 2	1.7	24	0.14	13.6	19	7
ARD- 288	PAG 2	1.8	18	0.07	0.7	174	56
ARD- 499	PAG 2	1.4	4	0.03	10.5	3	1
ARD- 510	PAG 2	1.6	19	0.09	8.2	13	7
ARD- 537	PAG 2	1.1	12	0.09	0.7	109	74
ARD- 566	PAG 2	1.1	9	0.09	8.8	3	6
ARD- 526	NAG 3	2	5	0.03	1.3	27	11
ARD- 606	NAG 3	2.2	13	0.05	10.1	10	3
ARD- 648	NAG 3	2.6	37	0.3	2.2	123	83
ARD- 692	NAG 3	2.9	43	0.35	2.9	114	77
ARD-153	NAG 3	2.3	15	0.07	1.8	60	23
ARD-238	NAG 3	3.3	13	0.06	1.4	64	25
ARD- 473	NAG 3	4.9	54	0.52	1.3	292	234
ARD- 338	NAG 4	2.5	27	0.23	7.2	29	20
ARD- 468	NAG 4	2.6	13	0.27	8.8	11	19
ARD- 610	NAG 5	2.1	8	0.07	8.6	7	5

Note: Highlighted cells indicate acidic pH leachate in at least final week of test (pH < 6)
Highlighted **bold** cells indicate acid pH leachate less than 5 in at least 1 week of testing
Predicted depletion times adjusted NP consumed during testing

Table 3-36: Theoretical Waste Rock Depletion and Lag Times Based on Laboratory Humidity Cell Tests

ID	ARD Class	NPR	NP (kg $CaCO_3$/t)	CNP (%)	Sx (%)	Sx Deplete (yrs)	NP Deplete (yrs)	CNP deplete (yrs)	Lag Time - NP (yrs)	Lag Time - CNP (yrs)
ARD-037	**PAG 1**	**0.3**	**6**	**4**	**0.55**	**11.5**	**234**	**44**	**0 wk**	**0 wk**
ARD-2-9	**PAG 1**	**0.1**	**9**	**15**	**1.97**	**3.6**	**4**	**7**	**0 wk**	**0 wk**
ARD-509	**PAG 1**	**0.4**	**3**	**4**	**0.19**	**4.2**	**10**	**7**	**10 wk**	**10 wk**
ARD-176	PAG 2	1.7	24	11	0.44	7.2	19	7	not AG	7 years
ARD-288	PAG 2	1.8	18	6	0.32	9.5	174	56	27 wk	27 wk
ARD-499	PAG 2	1.4	4	4	0.05	1.3	3	1	not AG	1 year
ARD-510	PAG 2	1.6	19	7	0.37	16.2	13	7	13 years	7 years
ARD-537	PAG 2	1.1	12	8	0.33	21	109	74	20 wk	20 wk
ARD-566	PAG 2	1.1	9	7	0.69	14.3	3	6	30 wk	30 wk
ARD-526	NAG 3	2	5	4	0.06	15.9	27	11	not AG	11 years
ARD-606	NAG 3	2.2	13	4	0.19	4.9	10	3	not AG	3 years
ARD-648	NAG 3	2.6	37	25	0.45	38.6	123	83	not AG	not AG
ARD-692	NAG 3	2.9	43	29	0.47	139.2	114	77	114 years	77years
ARD-153	NAG 3	2.3	15	5	0.1	6.5	60	23	not AG	not AG
ARD-238	NAG 3	3.3	13	4.2	0.1	5.3	64	25	not AG	not AG
ARD-338	NAG 4	2.5	27	19	0.32	89.2	292	234	not AG	not AG
ARD-468	NAG 4	2.6	13	22	0.34	21.3	29	20	not AG	not AG
ARD-473	NAG 3	4.9	54	43	0.14	5.4	11	19	not AG	not AG
ARD-610	NAG 5	2.1	8	6	0.11	4	7	5	not AG	Not AG

Note: Highlighted cells indicate acidic pH leachate in at least final week of test (pH < 6)
Highlighted **bold** cells indicate acid pH leachate less than 5 in at least 1 week of testing

Table 3-37: Comparison of the Number of Weeks until Acidic Leachate between Humidity Cell and Field Bin Tests

ID	ARD Class	NPR	Number of weeks until acidic leachate	
			humidity cell	Field Bin
humidity cell 2-9	PAG 1	0.1	0	0
humidity cell 037	PAG 1	0.3	0	16
humidity cell 537	PAG 2	1.1	21	no acid pH (69 weeks)
humidity cell 176	PAG 2	1.7	no acid pH (84 weeks)	no acid pH (69 weeks)

3.2.14 Oxygen Consumption

The oxygen consumption test measured the rate of O_2 consumption by sulphide oxidation. This test was completed to provide direct measurements of sulphide oxidation rates comparable to the rates calculated from sulphate production in kinetic testing. Complete results are given in **Annex 10**.

PAG 1 waste rock humidity cell BW-ARD-037 was shut down after 70 weeks of testing, and the sample was submitted for the oxygen consumption test at EGi. This sample had a total sulphur value of 0.5%, an NP of 6 kg $CaCO_3$/t, and an NPR of 0.3, all of which are close to the median values for PAG 1 waste rock. The pH of the humidity cell leachate was approximately 5.0 for the duration of testing. The results of the test are assumed to provide an indication of the sulphide oxidation rate for the Project's PAG 1 waste rock.

A 400 g sample was added to the sulphide oxidation chamber (SOC) for the oxygen consumption test. Over a 2-week period, the oxygen content of the SOC decreased from 20.8% to 20.3%, amounting to a net consumption of 0.5% O_2. The calculated oxidation rate based on cumulative oxygen consumption was 1.0 x 10^{-8} kg O_2/m^3/sec. The rate was calculated using an assumed particle density of 2.7 g/cm^3 (from continental volcaniclastic material), and an approximate sample depth of 1.2 cm in the column. The test confirmed that the sulphides in sample BW-ARD-037 are only slowly reactive (EGI 2013). It is possible that the sample had partially oxidized during humidity cell testing; these results may be more indicative of a long-term oxidation.

3.2.15 Acid Base Consumption Curve

Acid base consumption curve (ABCC) testing was performed by EGi in 2013 on ten PAG (PAG 1 and 2) waste rock samples, with NP values spanning a representative range of the overall site conditions (NP from about 5 to 30 kg $CaCO_3$/t) (**Table 3-38**). The ABCC curve was generated by slow acid titration of samples. The resulting titration curve was compared with standardized titration curves for common carbonate minerals. The comparison allows for interpretation as to the forms and availability of carbonate neutralization in a sample. Detailed results are presented in **Annex 10**.

Table 3-38: Samples used for the Acid Base Consumption Curve Tests

ARD Class	ARD Sample No.	Facies	NP	TS	NPR (TS)
PAG 1	BW-ARD-608	S	6	0.7	0.3
PAG 1	BW-ARD-619	S	10	0.5	0.7
PAG 1	BW-ARD-671	S	10	0.8	0.4
PAG 1	BW-ARD-672	S	10	0.7	0.5
PAG 1	BW-ARD-650	S	20	1.3	0.5
PAG 2	BW-ARD-655	S	15	0.5	1.1
PAG 2	BW-ARD-651	S	25	0.7	1.1
PAG 2	BW-ARD-653	S	27	0.7	1.3
PAG 2	BW-ARD-695	S	32	0.9	1.1
PAG 2	BW-ARD-652	S	34	0.7	1.5

In general, the ABCC test results indicated that, in all but one of the samples (BW-ARD-672), about 80% to 100% of the measured NP was readily available, and the NP was dominated by calcite and dolomite. EGi reported that the samples that have relatively higher NP at the Project tend to have more calcite NP, and lower NP samples are more dolomitic. This is supported by the mineralogy results discussed in Section 3.2.1.

3.2.16 pH Neutralization Experiments

These tests were designed to react acidic, metal-rich waste rock drainage with higher pH solutions containing excess alkalinity, as expected in the milling process. The experiments were intended to quantitatively measure the removal of metals that precipitate out of various solutions at alkaline pH values.

Acidic leachate samples from humidity cell tests were titrated with hydrated lime to examine the reduction in metal concentrations at neutral and alkaline pH values (**Figure 3-64** through **Figure 3-69**). The metal removal percentages for cadmium, zinc, and iron at each end point pH are presented in **Table 3-39**. Complete results are given in **Annex 11**. As expected, the general trends are lower cadmium and zinc concentrations with increasing pH; raising the pH by adding lime resulted in a higher percentage of metal removal. In general, samples with higher initial iron concentrations showed greater metal removal.

Humidity cell leachate from PAG 1 sample BW-ARD-2-9 was extremely acidic (pH 2.4), with high dissolved metal concentrations. The addition of lime to reach each of the target pH end points resulted in 98% to 100% removal of cadmium, and 100% removal of zinc (**Figure 3-64** and **Table 3-39**).

Humidity cell leachate collected from PAG 1 sample BW-ARD-037 was acidic (pH 5.9) with low iron and high zinc concentrations. The addition of lime to reach each of the target pH endpoints resulted in 63% to 97% cadmium removal, and 94% to 97% zinc removal (**Figure 3-65** and **Table 3-39**).

Humidity cell leachate from PAG 1 sample BW-ARD-509 was acidic (pH 4.3) with high iron and low cadmium and zinc concentrations. The addition of lime to reach each of the five target pH end points resulted in 95% to 100% cadmium removal, and 98 to 100% zinc removal (**Figure 3-66** and **Table 3-39**).

A mixed leachate solution was prepared from humidity cells BW-ARD-283 (low-grade ore) and BW-ARD-288 (PAG 2 WR), and the resultant solution was acidic (pH 4), with moderate iron and zinc and low cadmium concentrations. The mixed test was conducted to examine the change in metal reduction with higher starting iron concentrations. The addition of lime to reach each of the five target pH endpoints resulted in 61% to 100% cadmium removal, and 92% to 100% zinc removal (**Figure 3-67** and **Table 3-39**).

A mixed leachate solution was prepared from humidity cells BW-ARD-509 (PAG 1 WR) and BW-ARD-288 (PAG 2 WR), and the resultant solution was acidic (pH 5.1), with relatively low

iron, zinc, and cadmium concentrations. The addition of lime to reach each of the five target pH endpoints resulted in 26% to 100% cadmium removal, and 40% to 99% zinc removal (**Figure 3-68** and **Table 3-39**).

Samples were initially filtered using a 0.45 µm pore size membrane, and the presence of colloidal iron was suspected. To confirm this, the experiments were repeated using ultra-fine filtration (0.2 µm pore size membrane) on sample BW-ARD-283 for targeted pH endpoints of 7 and 11 (labelled as BW-ARD-283-UF). A fraction of iron was removed by ultra-fine filtration at endpoint pH 11, confirming the presence of colloidal iron. Comparatively lower concentrations of dissolved cadmium and zinc were also observed at endpoint pH 11 as a result of ultra-fine filtration (**Figure 3-69** and **Table 3-39**).

The results of the pH neutralization experiments indicate that lime addition to acidic, metal-leaching waste rock leachate can reduce dissolved metals concentrations. There is value in adding excess iron to promote higher metals removal from lime-treated solutions by the formation through iron hydroxides.

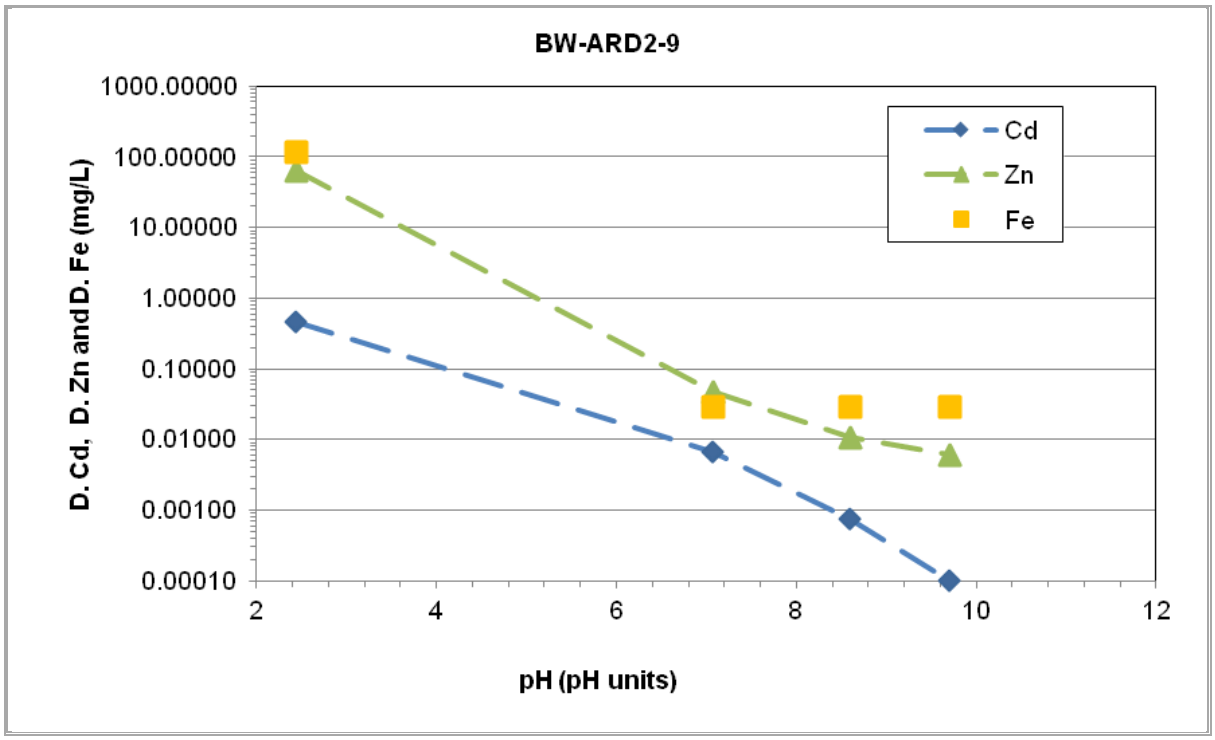


Figure 3-64: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD2-9)

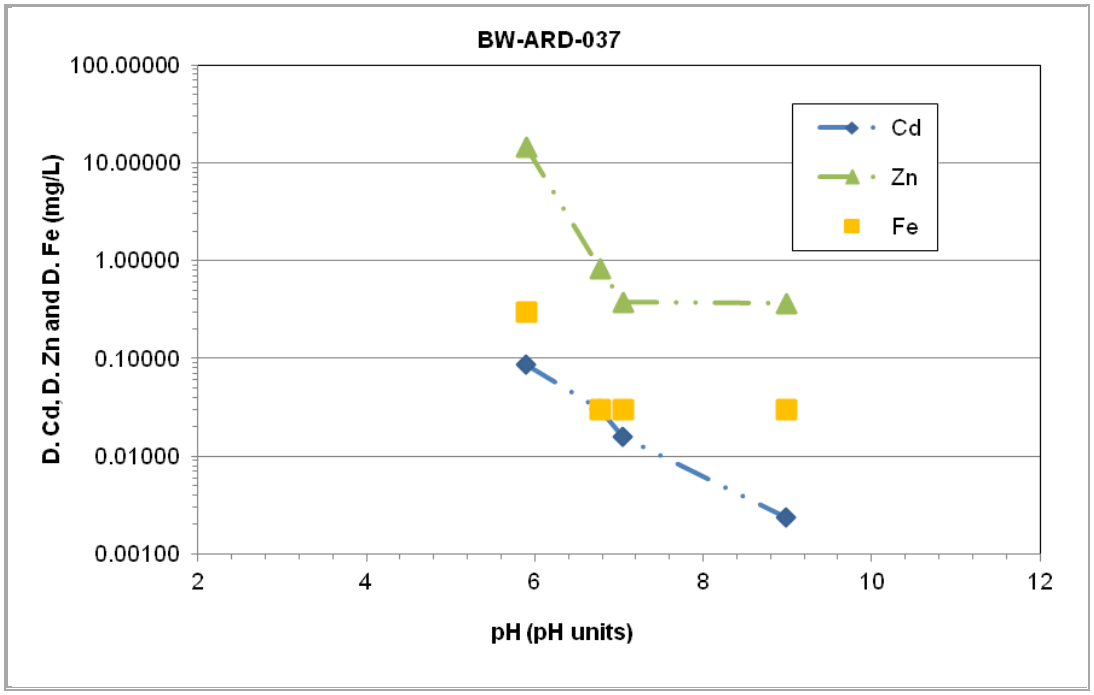


Figure 3-65: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD-037)

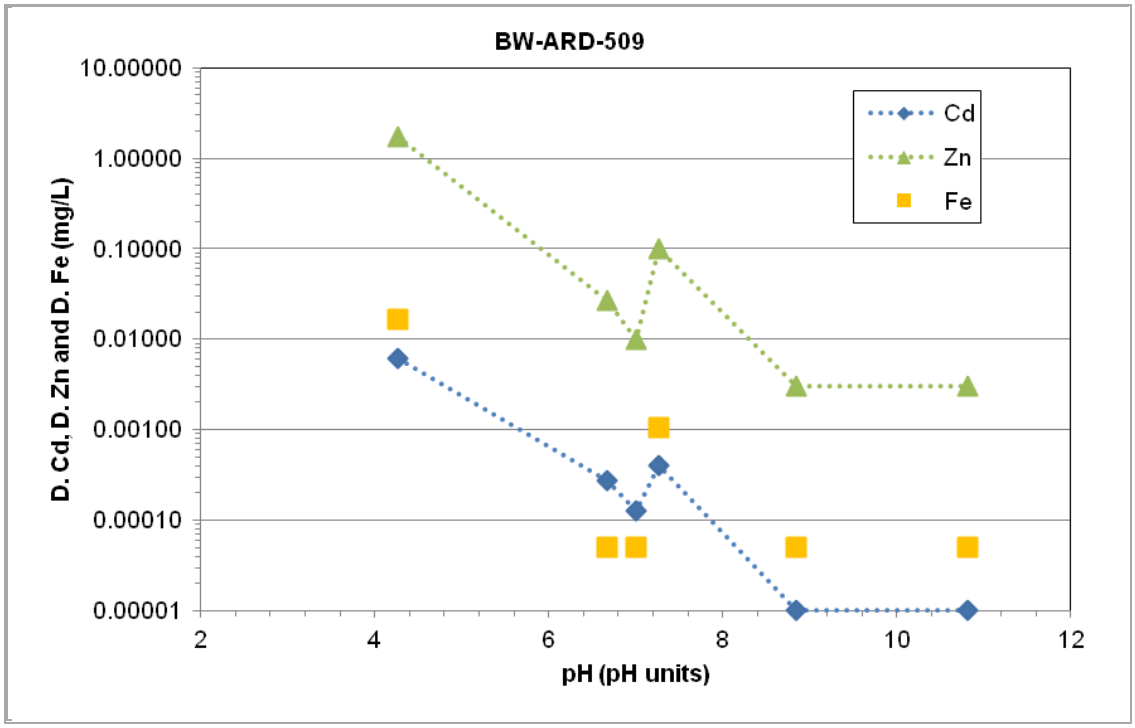


Figure 3-66: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD-509)

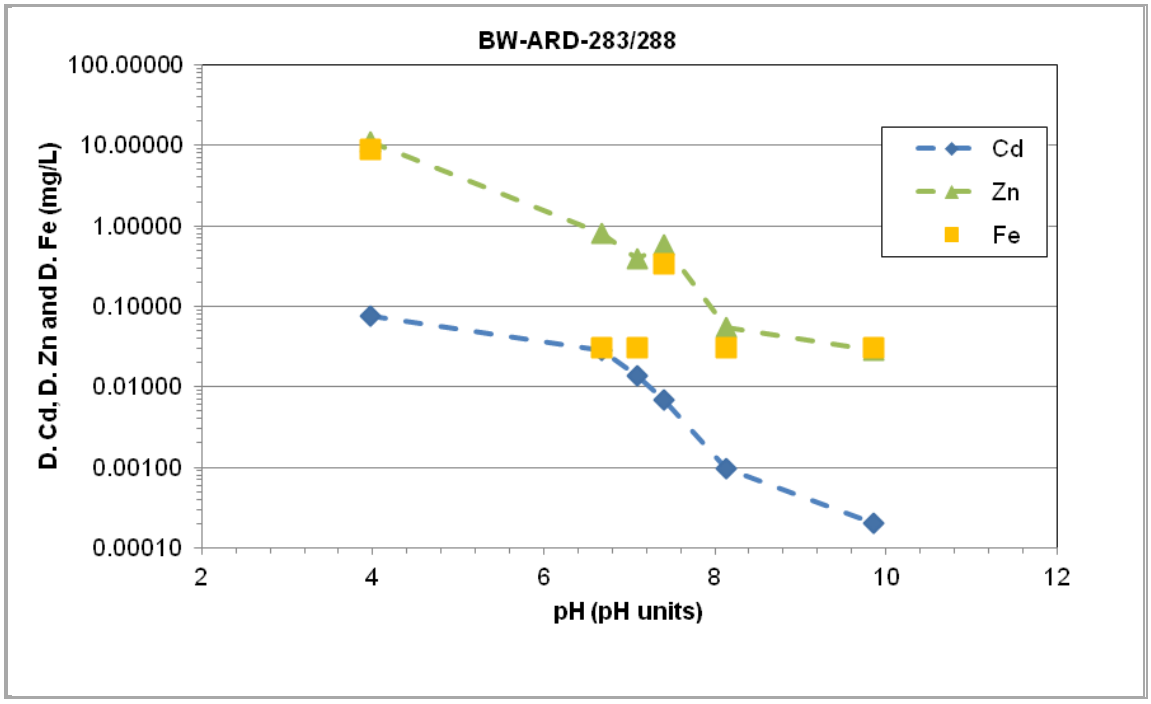


Figure 3-67: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD-283/288)

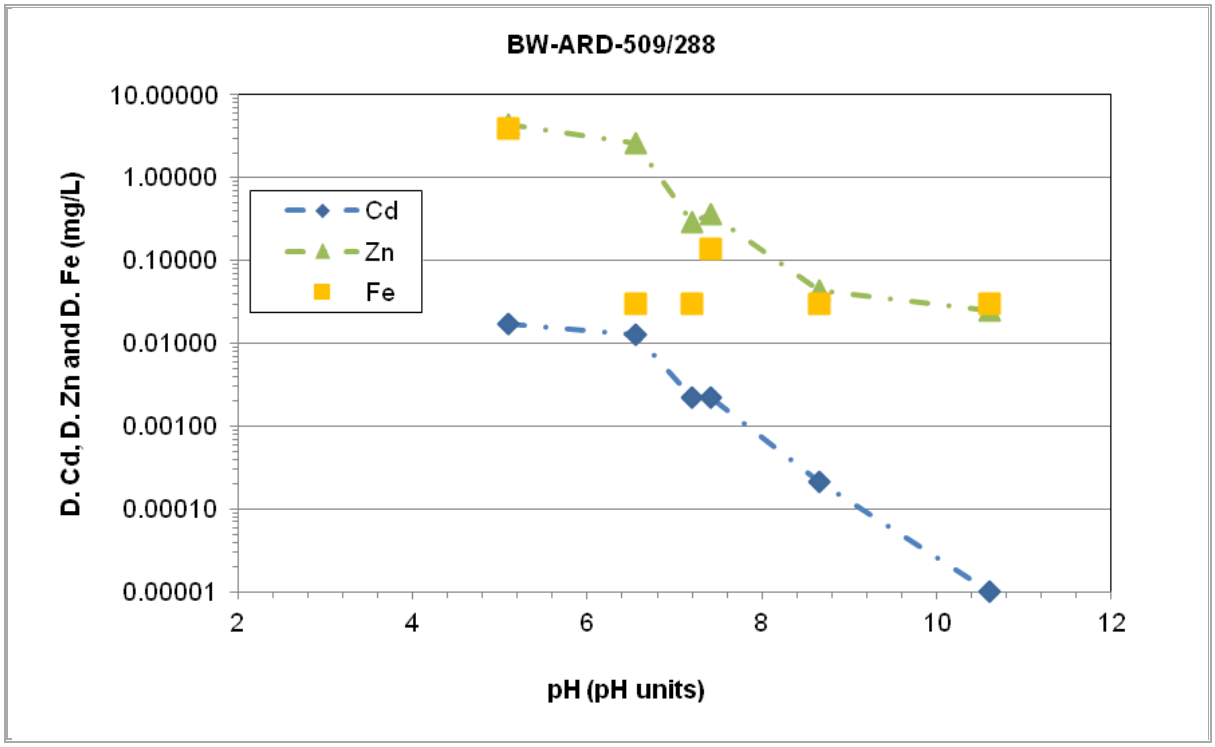


Figure 3-68: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD-509/288)

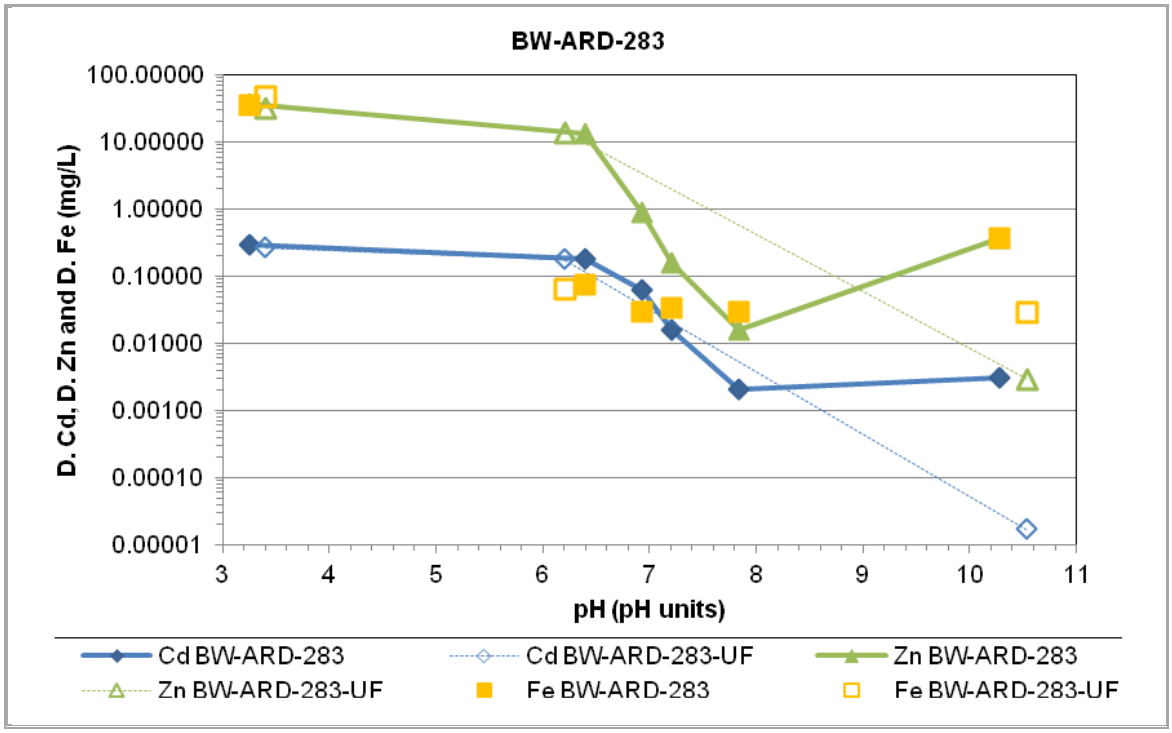


Figure 3-69: Results of pH Neutralization Experiments for Dissolved Cd and Zn Compared to Fe (BW-ARD-283)

Table 3-39: pH Neutralization Experiments Iron, Cadmium and Zinc Percent Removed

Sample		Initial						End Point pH 7			End Point pH 8			End Point pH 9			End Point pH 10			End Point pH 11		
		Units	mmoles			Molar Ratio		% Removed			% Removed			% Removed			% Removed			% Removed		
		pH	Fe	Cd	Zn	Fe/Cd	Fe/Zn	Fe	Cd	Zn	Fe	Cd	Zn	Fe	Cd	Zn	Fe	Cd	Zn	Fe	Cd	Zn
ID	Description																					
BW-ARD-037	Leachate from PAG 1 WR humidity cell	5.9	0.54	0.08	23	7.1	0.02	-	-	-	90	63	94	90	80	97	89	97	97	-	-	-
BW-ARD-509/288	Mixed leachate from PAG 1 and PAG 2 WR humidity cells	5.1	7.0	0.02	6.8	469	1.0	99	26	40	99	87	93	96	87	92	99	99	99	99	100	99
BW-ARD-283/288	Mixed leachate from Ore and PAG 2 WR humidity cells	4.0	15.7	0.07	16.8	234	0.93	100	61	92	100	81	96	96	91	95	100	99	99	100	100	100
BW-ARD-509	Leachate from PAG 1 WR humidity cell	4.3	39	0.006	2.6	7036	14.7	100	95	98	100	98	99	94	93	94	100	100	100	100	100	100
BW-ARD-283 UF	Leachate from Ore humidity cell	3.4	48	0.27	33	179	1.5	100	33	51	-	-	-	-	-	-	-	-	-	100	100	100
BW-ARD-283	Leachate from Ore humidity cell	3.3	86	0.24	51	359	1.7	100	34	60	100	76	97	100	94	99	100	99	100	99	99	99
BW-ARD2-9	Leachate from PAG 1 WR humidity cell	2.4	211	0.42	97	503	2.2	-	-	-	100	98	100	100	100	100	100	100	100	-	-	-

3.2.17 Conclusions

Overall, the waste rock has low sulphur concentrations and low NP. A portion of the waste rock is likely to be acid generating and metal-leaching. Waste rock will be segregated on these criteria by using the NPR and zinc concentrations of the waste rock (**Table 3-40**).

Table 3-40: Waste Rock Classification Based on NPR and Zn Concentrations

Classification	NPR	Metal Content
PAG 1	NPR ≤ 1	
PAG 2	NPR 1- ≤ 2	
NAG 3	NPR > 2	zinc ≥ 1,000 mg/kg
NAG 4	NPR > 2	zinc 600 to 1,000 mg/kg
NAG 5	NPR > 2	zinc < 600 mg/kg

Of the waste rock samples submitted for mineralogical analysis, 56% contained pyrite, pyrrhotite, and / or sphalerite, and 60% contained carbonate minerals, most commonly calcite and siderite. Siderite was identified in some PAG 1, PAG 2 and NAG 3 samples. Calcite was the most common calcite mineral found in NAG 4 and NAG 5 waste rock. No siderite was identified in NAG 4 and NAG 5 samples.

Concentrations of several metals, including zinc, cadmium, arsenic, lead, and selenium, were elevated above ten times the crustal abundance levels in the waste rock. Static leaching tests indicated that zinc, cadmium, arsenic, and aluminium may leach from the waste rock.

The ABA results showed that the waste rock had low sulphur concentrations. The median total sulphur value for all waste rock samples was 0.3%, and 88% of all samples had a total sulphur concentration under 1.0%. The oxide facies had less sulphur than the transition and sulphide facies, and the total sulphur concentrations consistently decrease from the PAG 1 to NAG 5 waste rock types. Sulphur content measured by aqua regia digestion ICP analysis is shown to be a good surrogate for total sulphur as determined by Leco furnace.

The waste rock has low NP and CNP values. The median NP value for all samples was 10 kg $CaCO_3$/t and the median CNP was 4.2kg $CaCO_3$/t. In general, the NP was greater than the CNP, suggesting that non-carbonate minerals are a potential NP source. In addition to calcite and dolomite, mineralogical testing has shown the presence of siderite in PAG 1, PAG 2 and NAG 3 waste rock that may cause the CNP to overestimate the actual NP. However, all PAG 1, PAG 2 and NAG 3 waste rock will be permanently submerged in the TSF. Results from the ABCC indicate that what NP occurs in the waste rock is 80% to 100% readily available.

Forty-seven percent of all waste rock samples had an NPR less than 1 (PAG 1), and 13% had an NPR between 1 and 2 (PAG 2), meaning a total of 59% of all waste rock samples are classified as PAG. Oxide waste rock samples had higher NPR values than the transition or

sulphide facies waste rock; only 25% of the oxide samples were PAG 1 or PAG 2, compared with 49% and 65% for the transition and sulphide facies, respectively.

The median NPR, shown below, increased across each of the five waste rock types:

- PAG 1 = 0.3;
- PAG 2 = 1.4;
- NAG 3 = 3.8;
- NAG 4 = 6.0; and
- NAG 5 = 9.0.

Results of the NAG testing supported the ABA results, and indicated a threshold between PAG and non-PAG of 1.7.

The acid-generating and metal-leaching potential of the waste rock was measured in several kinetic tests. The humidity cell tests showed that PAG 1 samples with low NPR are acid-generating with little to no lag time. Three of the PAG 2 humidity cell tests had a 20 to 30 week delay to acid onset, and three of the tests have not yet generated an acidic pH leachate by the time of writing. The NAG 3, 4, and 5 samples have maintained neutral to alkaline pH values to date. Cadmium, Zn, Fe, and Pb loads are higher in the tests with acidic pH values compared to those with neutral or alkaline values. The results of the field bin tests are similar to those for the humidity cell tests, but indicated a longer lag time until acid generation occurs. Metal loads from the sub-aqueous waste rock columns are significantly lower (often by an order of magnitude) than comparable humidity cell tests, due to oxygen-deficient conditions inhibiting sulphide mineral oxidation. Taken together, the results of kinetic testing indicate time until acid generation will be longer under field conditions than in laboratory testing, metal loads under neutral pH conditions are lower than under acidic conditions, and underwater storage of waste rock significantly reduces metal leaching.

Finally, the pH neutralization experiments showed that metal loads in acidic humidity cell leachate can be significantly reduced by increasing to alkaline pH values through lime addition and co-precipitation or adsorption onto iron hydroxides. This suggests that adding alkaline water generated during the milling process to acidic, metal-rich drainage from any on-land dumps, or to interstitial PAG waste rock water in the TSF should reduce metal concentrations in those waters.

3.3 Ore

3.3.1 Mineralogy

Mineralogical analysis using petrography was conducted on forty-three ore samples. Petrographic thin sections were prepared from exploration drill core at discrete depths. John G. Payne analyzed 22 samples (Payne, 2010), and Vancouver Petrographics analyzed 21 samples (Vancouver Petrographics, 2011).

Petrographic analysis of the forty-three samples visually identified percentage-level amounts of sulphide minerals in the majority of samples, including pyrite, pyrrhotite, sphalerite, chalcopyrite, and arsenopyrite. Pyrite was the most commonly observed sulphide mineral. Calcite, dolomite, and ankerite were rarely observed, usually occurring as replacement minerals or within veinlets.

Five ore samples were selected for quantitative mineralogical analysis using Rietveld-XRD. Pyrite (1.2% to 15%) and sphalerite (0.5% to 1.6%) were each detected in three of the five samples. Three of the five samples also had detectable concentrations of siderite, calcite, or dolomite, with total carbonate concentrations less than 1.0% (**Table 3-41**). Complete results are included in **Annex 1**.

Table 3-41: Results of XRD-Rietveld Quantitative Phase Analysis - Ore

	#1 BW-ARD-001 Ore	**#2 BW-ARD-258 Ore**	**#3 BW-ARD-007 Ore**	**#4 BW-ARD-009 Ore**	**#5 BW-ARD-200 Ore**
Quartz	54.6	52.1	63.1	34.9	48.5
Muscovite	31.4	20.7	33.5	27.9	31.8
Biotite	2.3			15.5	
Kaolinite	3.5			2.0	
K-feldspar	7.7	24.1	3.4	13.1	2.5
Diopside		1.3			
Pyrite		1.2		2.5	15.1
Sphalerite		0.6		1.6	0.5
Pyrrhotite				1.9	
Calcite					1.0
Dolomite	0.4				
Siderite				0.6	0.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

3.3.2 Elemental Content

The results of aqua regia ICP multi-element geochemistry analysis for 72 ore samples are summarized in **Table 3-42**. Complete results are given in **Annex 2**. The results were considered elevated if they were greater than ten times the crustal average.

More than 50% of the ore samples had elevated concentrations of silver, arsenic, bismuth, cadmium, lead, sulphur, phosphorus, antimony, or zinc. Selenium was elevated in 36% of the samples. Higher selenium values occurred in samples with zinc concentrations greater than 1000 mg/kg (**Figure 3-70**).

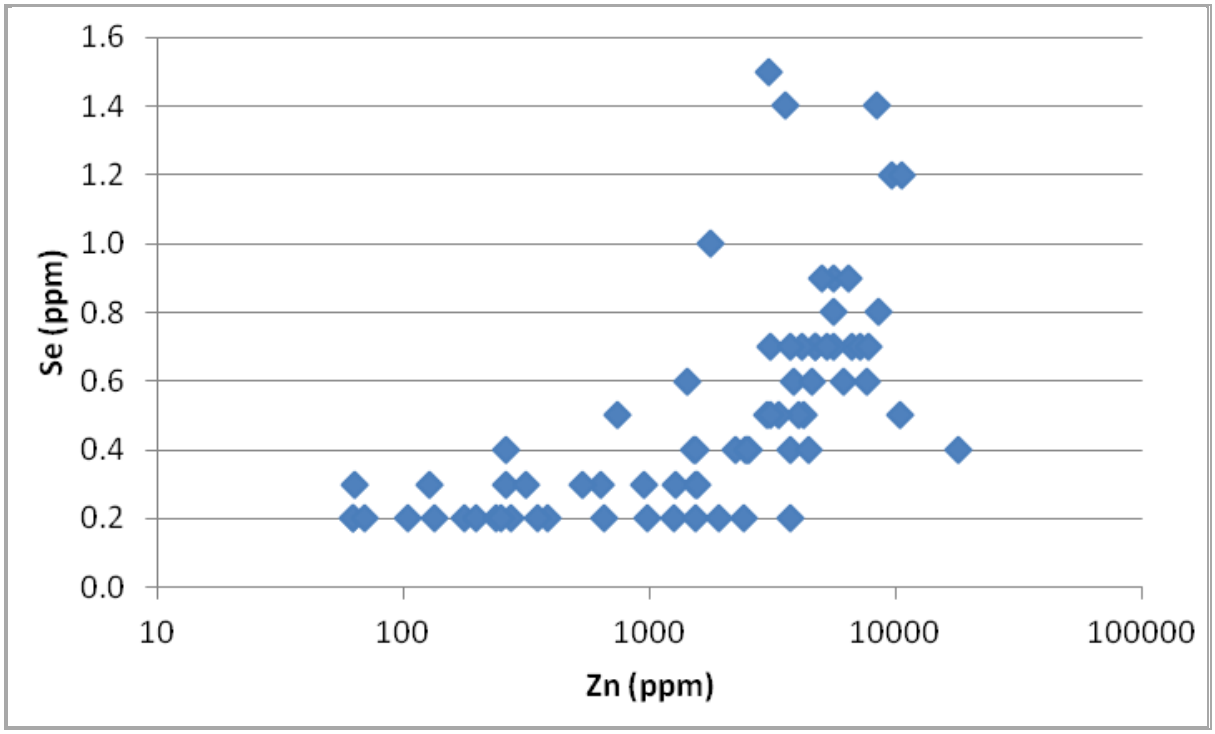


Figure 3-70: Solid Phase Selenium and Zinc Concentrations in Ore Samples

3.3.3 Acid Base Accounting

ABA results for the 72 ore samples are summarized in

Table 3-43. Complete results are given in **Annex 3**.

3.3.3.1 Paste pH

Paste pH values ranged from 4.3 to 8.2, with a median pH of 6.60. Twenty-eight (39%) of the samples reported acidic paste pH values less than 6.0.

3.3.3.2 Sulphur and Acid Potential

Total sulphur concentrations in ore samples ranged from 0.01% to 8.9%, with a median value of 1.3%. Sulphate concentrations in the ore samples were under 0.1%. Sulphide sulphur concentrations ranged from 0.01% to 8.9%, with a median of 1.3%. The majority of sulphur in the ore samples occurred as sulphide (**Figure 3-71**).

Table 3-42: Statistical Summary of Elemental Content - Ore (n=72)

	Ag	Al	As	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Li	Mg	Mn	Mo	Na
	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	%
Maximum	44.5	5.88	4090	1.86	82.1	2.08	1000	38.3	44	2370	8.51	0.21	2.12	74	1.49	6120	13.05	0.09
95th Percentile	14.67	3.04	2884	1.07	15.08	0.38	95.9	28.38	40.5	457	7.27	0.09	1.73	49.78	1.12	3681	7.51	0.02
75th Percentile	7.77	0.82	543	0.59	8.53	0.15	41.4	11.75	11.3	228	3.87	0.05	0.47	8.65	0.1	2208	3.67	0.01
Median	4.59	0.43	188	0.43	4.17	0.03	22.1	3.1	6.5	121	2.1	0.02	0.26	1.8	0.02	772	3.02	0.01
25th Percentile	2.25	0.37	65	0.29	0.83	0.02	4.7	0.8	2	65	1.47	0.01	0.23	1.08	0.01	271	2.49	0.01
Minimum	0.26	0.25	10	0.14	0.14	0.01	0.2	0.2	1	3	0.37	0.01	0.13	0.4	0.01	34	1.16	0.01
Average	5.98	0.92	565	0.5	6.8	0.13	44.4	7.58	10.6	202	2.94	0.03	0.51	10.52	0.19	1386	3.58	0.01
Stnd Dev	6.4	1.05	918	0.34	12.64	0.28	120.9	9.13	12.6	323	2.2	0.04	0.53	17.92	0.37	1396	2.07	0.01
	Ni	P	Pb	S	Sb	Sc	Se	Sn	Sr	Te	Th	Ti	Tl	U	V	W	Y	Zn
	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
Maximum	45.4	1780	4360	8.8	44.2	9.6	1.5	1.2	93.1	3.92	11.2	0.27	3.23	10.7	86	3.77	14.25	18000
95th Percentile	34.6	1663	1706	2.9	30.5	3.99	1.2	0.9	34.5	1.59	9.64	0.24	2.37	4.73	63.3	2.29	8.73	9049
75th Percentile	13	613	591	1.9	17.1	1.23	0.7	0.5	17.3	0.32	8.1	0.04	1.34	3.64	10.8	0.31	6.6	4700
Median	2.4	90	145	1.4	10.6	0.7	0.4	0.3	6.7	0.11	7.25	0.01	0.43	3.02	1	0.15	5.43	2480
25th Percentile	0.9	58	47	0.6	6.4	0.4	0.2	0.2	3	0.06	5.98	0.01	0.2	1.83	1	0.1	4.25	611
Minimum	0.3	20	5	0	1.8	0.1	0.2	0.2	1.5	0.01	2.4	0.01	0.06	0.25	1	0.06	2.11	62
Average	8.6	419	473	1.4	13.2	1.26	0.5	0.4	12.5	0.36	6.8	0.05	0.8	2.86	12.6	0.38	5.57	3257
Stnd Dev	11.8	570	790	1.3	9	1.52	0.32	0.3	14.5	0.69	2.15	0.08	0.77	1.74	22.3	0.7	2	3287

Table 3-43: Statistical Summary of Acid Base Accounting Analysis Results - Ore (n=72)

	Paste pH	Fizz Rating	Total C (%)	CO_2 C (%)	Mod. Sobek NP (kg $CaCO_3$/t)	CNP (kg $CaCO_3$/t)	NNP (kg $CaCO_3$/t)
Maximum	8.2	2	1.15	1.15	22	95.9	20
95th Percentile	8	1	0.3	0.3	14.9	21	1.5
75th Percentile	7.4	1	0.1	0.1	8	8.3	-12
Median	6.6	1	0.05	0.05	4	4.2	-34
25th Percentile	5.5	1	0.1	0.1	1.8	4.2	-48
Minimum	4.3	1	0.05	0.05	0	4.17	-274
Average	6.5	1	0.1	0.1	5.3	8.3	-35
Standard Deviation	1.1	0	0.1	0.1	4.9	12	39.2
	Total S (%)	Sulphate S[1] (%)	Sulphate S[2] (%)	Sulphide S (%)	MPA (kg $CaCO_3$/t)	AP (kg $CaCO_3$/t)	NPR (NP/MPA)
Maximum	8.9	0.1	0.05	8.9	278	278	16
95th Percentile	2.6	0	0	2.7	81	84	3.7
75th Percentile	1.8	0	0	1.8	56	55	0.4
Median	1.3	0.02	0.01	1.3	41	39	0.1
25th Percentile	0.5	0	0	0.5	16	14	0.1
Minimum	0	0.01	0.01	0.01	0.3	0.31	0
Average	1.3	0	0	1.3	41	40	0.9
Standard Deviation	1.3	0	0	1.3	40	40	2.8

Notes: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by humidity celll leach.

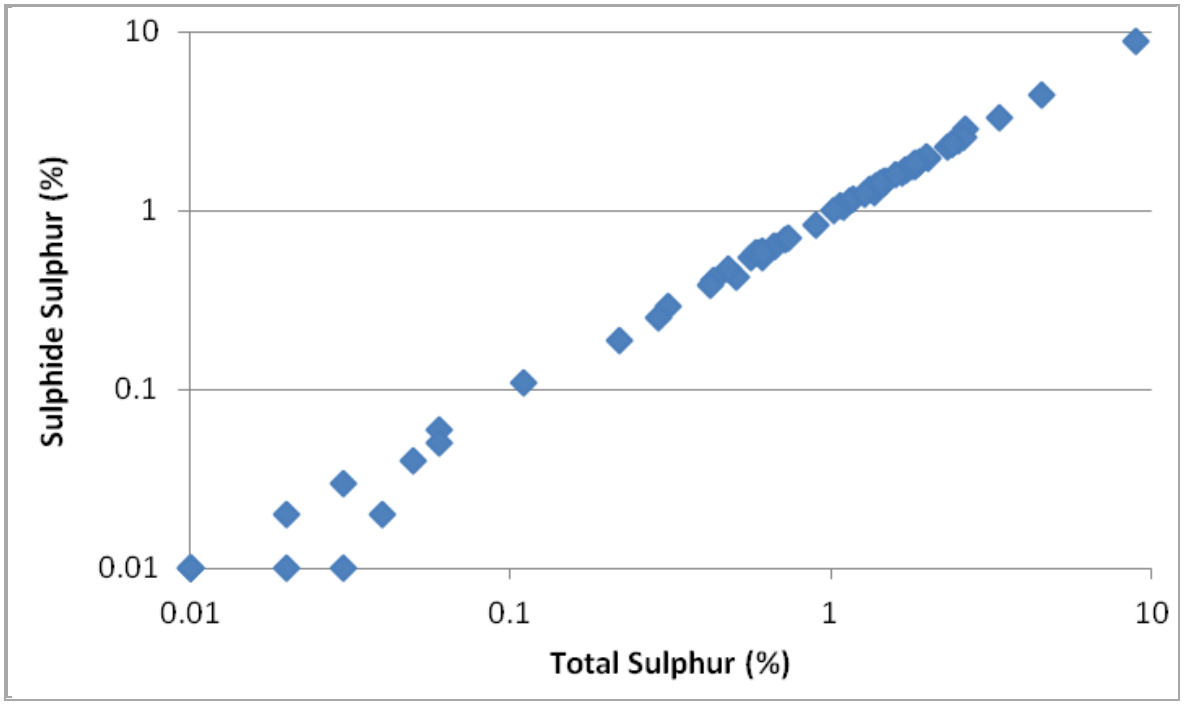


Figure 3-71: Comparison of Sulphide Sulphur and Total Sulphur for Ore Samples (n=7)

MPA ranged from 0.3 to 278 kg $CaCO_3$/t, with a median value of 40 $CaCO_3$/t. Calculated AP values ranged from 0.31 kg $CaCO_3$/t to 278 kg $CaCO_3$/t, with a median of 39 kg $CaCO_3$/t. Adjusted AP, corrected for the presence of sphalerite, reported a similar range, from 0.2 to 272 kg $CaCO_3$/t, with a median of 33 kg $CaCO_3$/t (**Table 3-43**).

3.3.3.3 Neutralization Potential

Ore samples had low NP values, ranging from 0 to 22 kg $CaCO_3$/t, with a median of 4 kg $CaCO_3$/t. The CNP was also low in the majority of samples with a median of 4.2 kg $CaCO_3$/t. The relationship between NP and CNP was poorly defined given the low concentrations of carbonate NP (**Figure 3-72**).

ICP-Ca NP was also calculated for the ore samples, with values ranging from 0.25 to 10 kg $CaCO_3$/t (**Table 3-43**). When compared against modified Sobek-NP, ICP-Ca NP underestimated NP (**Figure 3-73**).

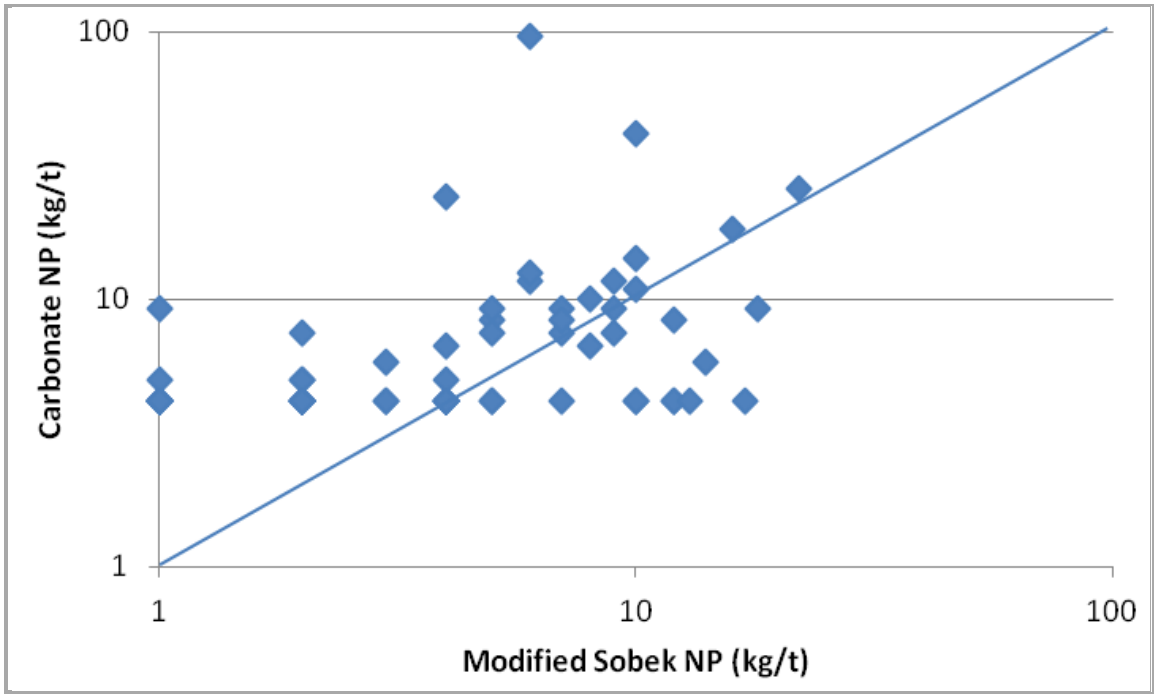


Figure 3-72: Comparison of Modified Sobek NP and Carbonate NP for Ore Samples

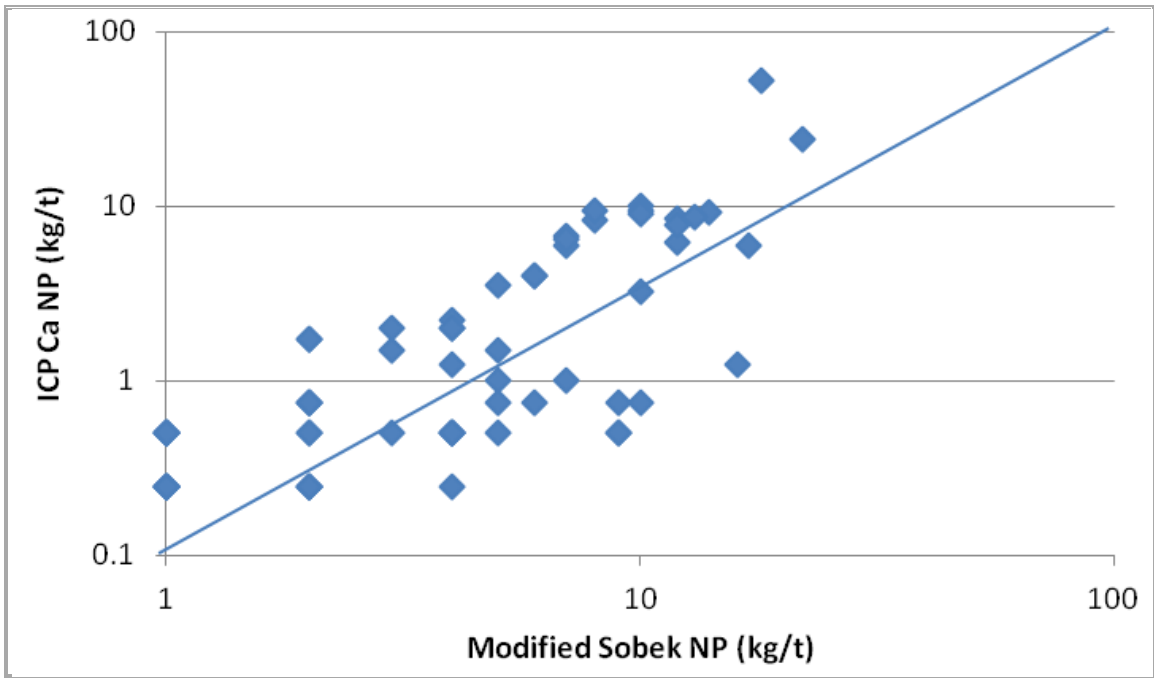


Figure 3-73: Comparison of Modified Sobek NP and ICP Ca NP for Ore Samples

3.3.3.4 Neutralization Potential Ratios

NPR values ranged from 0 to 16 (**Figure 3-74**). The median NPR value based on MPA was 0.13, respectively. Ninety-two percent of the ore samples reported an NPR less than 2. Ore is classified as PAG.

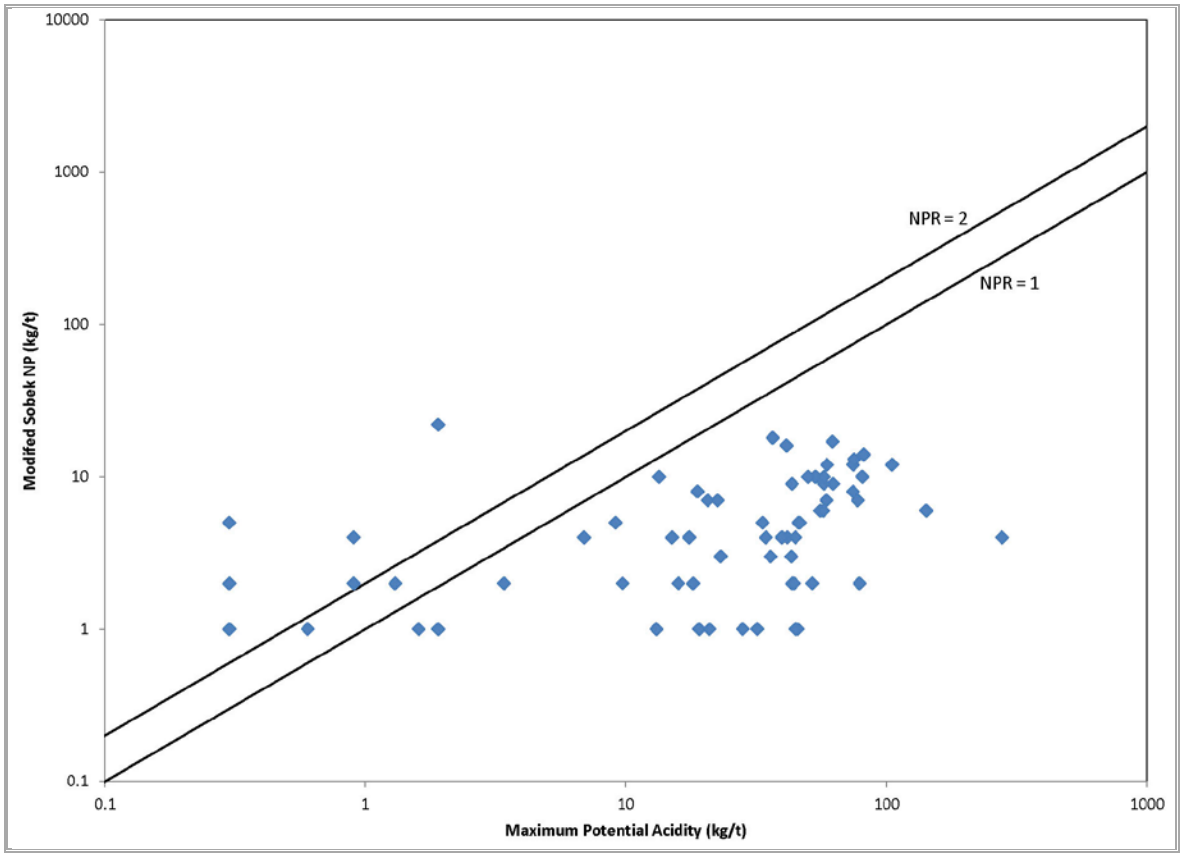


Figure 3-74: Comparison of AP vs. NP for Ore Samples

3.3.4 Net Acid Generation

NAG testing was completed on thirty-six ore samples (**Table 3-34**). Complete results are given in **Annex 3**.

Table 3-44: Statistical Summary of NAG Test Results – Ore (n=36)

	NAG @ pH 4.5 (kg H_2SO_4/t)	NAG @ pH 7.0 (kg H_2SO_4/t)	NAG pH
Maximum	112	132	9
95th Percentile	71.8	89.7	6.2
75th Percentile	37.4	53.9	3.1
Median	29.6	38.4	2.9
25th Percentile	14.8	21.5	2.8
Minimum	0.01	0.01	2.4
Average	30.2	41.5	3.2
Standard Deviation	24.2	28.3	1.3

Ninety-two percent of the ore samples reported final NAG pH values under 4.5, indicating that these samples are likely PAG. All ore samples reporting a NAG pH under 4.5 also reported NPR values less than two (**Figure 3-75**). The NAG test reported net acidity at both pH 4.5 and pH 7.0, indicating the presence of free acidity and acidity associated with metal hydroxides.

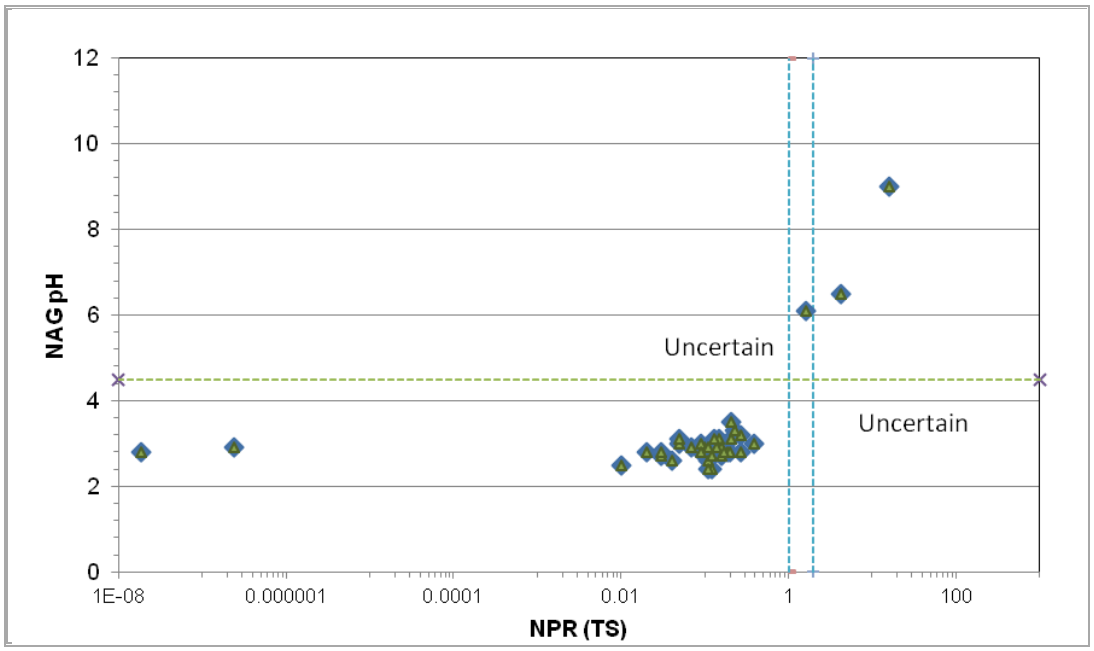


Figure 3-75: Comparison of NAG pH and NPR for Ore Samples

After completion of the NAG test, the leachates from a seven-sample subset were selected for multi-element analysis of total metals. The results of leachate analysis are summarized in **Table 3-45.** Complete results are given in **Annex 4**. The results were compared against ten times the guideline values in the MMER and BCWQO FWAL for reference purposes only and are not a direct measure of expected drainage quality.

Table 3-45: Statistical Summary of NAG Test Leachate Analysis Results – Ore (n=7)

	Unit	MMER	BCWQO FWAL	10 x BCWQO FWAL	Max.	95th percentile	75th percentile	Med.	25th percentile	Min.	Avg.
Hardness	(mg/)	-	-		45.7	35.7	11.7	8.3	3.6	1.1	12.2
pH	Units	**6.0-9.5**	**6.5-9.0**		7.1	6.9	**4.6**	**2.5**	**2.3**	**2.2**	**3.7**
Sulphate	(mg/L)	-	**100**	**1000**	781	733	611	386	167	0.62	389
Al	(mg/L)	-	**0.02-0.05****	**0.2-0.5***	**24.4**	**23.5**	**17.5**	**13**	**9.9**	**2.1**	**13.5**
Sb	(mg/L)	-	**0.02**	**0.2**	0.013	0.011	0.0044	0.002	0.001	0.0005	0.0037
As	(mg/L)	**0.5**	**0.005**	**0.05**	**0.26**	0.21	0.039	0.002	0.0017	0.0005	0.05
Ba	(mg/L)	-	**1**		0.1	0.1	0.067	0.042	0.02	0.013	0.047
Be	(mg/L)	-	**0.0053**	**0.053**	0.01	0.01	0.0075	0.005	0.0025	0.0005	0.0051
B	(mg/L)	-	**1.2**	**12**	0.2	0.2	0.15	0.1	0.049	0.034	0.1
Cd	(mg/L)	-	**0.00006+**	**0.0006+**	**0.79**	**0.69**	**0.4**	**0.27**	**0.06**	0.00084	**0.28**
Cr	(mg/L)	-	**0.001**		**0.01**	**0.01**	0.0085	0.0055	0.005	0.0036	0.0066
Co	(mg/L)	-	**0.004**	**0.04**	**0.19**	**0.17**	**0.13**	0.03	0.013	0.00012	**0.072**
Cu	(mg/L)	**0.3**	**0.002-0.019***	**0.02-0.19***	**12.1**	**9.3**	**2.5**	**2.1**	**0.73**	0.01	**3**
Fe	(mg/L)	-	**0.35**	**3.5**	**37.6**	**29.7**	**10.4**	**8.1**	2.7	1.3	**10.5**
Pb	(mg/L)	**0.2**	**0.003-0.026***	**0.03-0.26***	**1.9**	**1.8**	**1.2**	**0.54**	**0.03**	0.0087	**0.7**
Mn	(mg/L)	-	**0.64-2.68***	**6.4-26.8***	**11.8**	**11.6**	**6.9**	**1.9**	**1**	0.031	**4.2**
Mo	(mg/L)	-	**2**	**20**	0.006	0.0052	0.003	0.001	0.0005	0.0003	0.0019
Ni	(mg/L)	**0.5**	**0.025***	**0.25-1.5***	**0.31**	**0.27**	0.11	0.014	0.0052	0.0016	0.08
Se	(mg/L)	-	**0.002**	**0.02**	**0.02**	**0.02**	0.015	0.01	0.003	0.001	0.0096
Ag	(mg/L)	-	**0.00005-0.0015***	**0.0005-0.015***	**0.007**	**0.0066**	**0.0036**	**0.0015**	**0.0011**	0.00029	**0.0026**
Th	(mg/L)	-	**0.0003**	**0.003**	0.0021	0.0021	0.0015	0.001	0.00087	0.00016	0.0011
Ti	(mg/L)	-	**4.6**	**46**	0.17	0.13	0.018	0.01	0.01	0.01	0.035
V	(mg/L)	-	**0.006**	**0.06**	0.02	0.02	0.015	0.01	0.0075	0.0025	0.011
Zn	(mg/L)	**0.5**	**0.008-0.294***	**0.08-2.94***	**85.3**	**75.2**	41.4	31.1	7.1	0.023	30.5

Note: **Bold** values are 10x higher than BCWQO for freshwater aquatic life (30 days); ** pH dependent; + site specific objective at hardness 50 mg/L.

All samples but one had copper and zinc concentrations greater than MMER guideline values. Lead concentrations were also higher than MMER values in all but two samples. Concentrations of silver, aluminum, cadmium, copper, iron, manganese, lead, and zinc were higher than ten times the BCWQO FWAL guideline for the majority of samples. At least one sample was elevated in arsenic and nickel. The detection limit for selenium concentrations in NAG test leachates was generally higher than the BCWQO FWAL value.

3.3.5 Shake Flask Extraction

SFE testing was conducted on eight ore samples. Results are summarized in **Table 3-51**. Complete results are given in **Annex 5**. Test results were compared against the BCWQO values for comparison purposes only, and are not a direct measure of drainage quality.

Five out of the seven samples reported zinc concentrations over MMER guideline values. One sample had lead concentrations above the MMER value. Four ore samples had pH values outside the BCWQO FWAL and DW ranges. Elevated metal concentrations (greater than ten times the BCWQO FWAL guidelines) were observed for silver, aluminum, arsenic, cadmium, cobalt, copper, lead, and zinc in the majority of samples; iron and manganese exceedances were observed in some samples. All samples had manganese concentrations that were ten times higher than BCWQO DW guideline values. Aluminum and cadmium were elevated in four samples, and iron was elevated in two samples. Mercury and selenium concentrations reported MDL values that were above the BCWQO values.

3.3.6 Humidity Cell Testing

Humidity cell testing is currently underway on two low-grade ore samples. **Table 3-47** provides descriptions of both samples. Complete results are given in **Annex 6**. The average humidity cell loading rates are presented in **Table 3-48**.

Humidity cell leachate was analyzed weekly for pH, conductivity, alkalinity, acidity, sulphate, and dissolved metals. Humidity cell test results up to week 36 are presented in **Figure 3-76** through **Figure 3-84**.

Table 3-46: Statistical Summary of Shake Flask Extraction Results – Ore (n=8)

	Unit	MMER	BCWQO FWAL	10 x BCWQO FWAL	Max.	95th Percentile	75th Percentile	Median	25th Percentile	Min.	Avg.
Hardness	(mg/L $CaCO_3$)	-	-		122	111	77.3	56.6	25.2	21.4	58.7
pH	Units	6.0-9.5	**6.5-9.0**		7.5	7.3	6.7	**6.3**	**5.9**	**5**	**6.3**
Conductivity	(uS/cm)	-			264	254	228	154	63	17.9	145
Sulphate	(mg/L)	-	**100**	**1000**	173	150	84	55.9	21.1	5	63.5
Acidity	(mg/L $CaCO_3$)	-			45	35.5	8.4	1.8	1.6	1.4	9.7
Alkalinity	(mg/L $CaCO_3$)	-			6.3	6.3	5.6	4.7	2.8	2	4.3
Aluminum	(mg/L)	-	**0.02-0.05****	**0.2-0.5***	**13.8**	**11.5**	**3.4**	0.34	0.015	0.0097	**3**
Antimony	(mg/L)	-	**0.02**	**0.2**	0.05	0.05	0.027	0.016	0.0065	0.003	0.021
Arsenic	(mg/L)	**0.5**	**0.005**	**0.05**	***0.6***	***0.41***	***0.089***	0.036	0.0072	0.004	***0.11***
Boron	(mg/L)	-	**1.2**	**12**	0.05	0.04	0.026	0.021	0.018	0.014	0.024
Cadmium	(mg/L)	-	**0.00006+**	**0.0006+**	**0.7**	**0.47**	**0.073**	**0.013**	0.0022	0.0004	**0.11**
Chromium	(mg/L)	-	**0.001**		0.01	0.0075	0.0026	0.0015	0.00088	0.0005	0.0025
Copper	(mg/L)	**0.3**	**0.002-0.019***	**0.02-0.19***	**0.21**	**0.2**	**0.082**	**0.024**	0.0012	0.001	**0.06**
Iron	(mg/L)	-	**0.35**	**3.5**	**5.7**	**5.2**	2.6	0.37	0.076	0.037	1.6
Lead	(mg/L)	**0.2**	**0.003-0.026***	**0.03-0.26***	**0.28**	**0.24**	**0.1**	0.031	0.0074	0.0054	**0.076**
Manganese	(mg/L)	-	**0.64-2.68***	**6.4-26.8***	**13.2**	**12.5**	**5.4**	**2.6**	**1.1**	0.34	**4.4**
Mercury	(mg/L)	-			5E-05	0.00005	0.00005	0.00005	0.00005	0.00005	5E-05
Molybdenum	(mg/L)	-	**2**	**20**	0.03	0.021	0.003	0.001	0.00019	0.00014	0.0049
Nickel	(mg/L)	**0.5**	**0.025***	**0.25-1.5***	0.2	0.16	0.071	0.018	0.0051	0.0012	0.05
Selenium	(mg/L)	-	**0.002**	**0.02**	**0.05**	**0.033**	0.0014	0.00075	0.0005	0.0005	0.0071
Silver	(mg/L)	-	**0.00005-0.0015***	**0.0005-0.015***	**0.01**	**0.0075**	**0.0017**	**0.00018**	**0.000073**	**0.00005**	**0.0018**
Thallium	(mg/L)	-	**0.0003**	**0.003**	**0.2**	**0.13**	0.00081	0.00037	0.00018	0.0001	**0.025**
Zinc	(mg/L)	**0.5**	**0.008-0.294***	**0.08-2.94***	**22**	**21.4**	**10.2**	**0.63**	**0.13**	0.09	**6.3**

Note: **Bold** values are 10x higher than BCWQO for freshwater aquatic life (30 days); ** pH dependent; + site specific objective at hardness 50 mg/L

Table 3-47: Low-Grade Ore Stockpile Humidity Cell Samples

ARD Class	ARD Sample No.	Test Duration (weeks)	Facies	NP	Total S (%)	NPR (TS)	Solid Phase Zn (ppm)	Solid Phase Cd (ppm)
PAG 1	ARD-2-10	26	S	2	1.1	0.1	7210	51
PAG 1	ARD-283	51	S	7	1.9	0.2	4700	40

.

Table 3-48: Average Low-Grade Ore Humidity Cell Leaching Rates

Parameter	ARD2-10	ARD-283
pH	3.7	3.7
Conductivity	592	599
Acidity	120	90
Alkalinity	0.9	1.0
Sulphate	131	106
Aluminum	2.8	3.4
Antimony	0.001	0.0004
Arsenic	0.015	0.007
Barium	0.003	0.009
Beryllium	0.004	0.002
Bismuth	0.004	0.001
Boron	0.070	0.029
Cadmium	0.308	0.101
Calcium	2.4	3.8
Chromium	0.004	0.001
Cobalt	0.09	0.05
Copper	0.33	0.09
Iron	8.5	10.8
Lead	0.014	0.084
Lithium	0.004	0.004
Magnesium	1.6	1.5
Manganese	12.5	13.4
Mercury	0.000005	0.000005
Molybdenum	0.0004	0.002
Nickel	0.06	0.08
Phosphorus	0.14	0.14
Potassium	0.6	2.3
Selenium	0.001	0.0003
Silicon	3.9	4.0
Silver	0.0001	0.0001
Sodium	0.5	0.5
Strontium	0.01	0.02
Sulphur	48	39
Thallium	0.0001	0.0001
Tin	0.0007	0.0003
Titanium	0.005	0.005
Uranium	0.021	0.002
Vanadium	0.007	0.003
Zinc	44.1	14.1

In general, the low grade ore humidity cell leachate results were similar to the PAG 1 waste rock with acidic pH and high dissolved metal loads and concentrations.

3.3.6.1 pH and Alkalinity

Both cells had acidic pH values for the duration of testing and average pH values of approximately 3.7 (**Figure 3-76**).

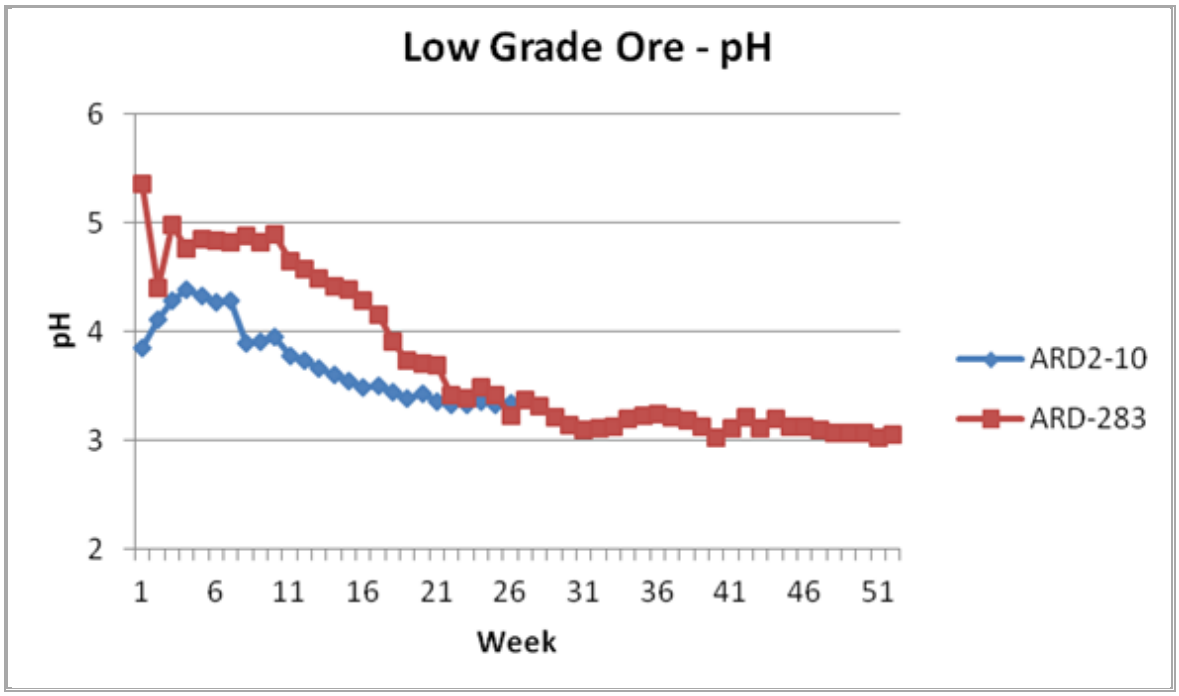


Figure 3-76: Low-Grade Ore Humidity Cell pH

The acidity loads in both cells increased over approximately the first 20 weeks of testing before reaching a steady load of approximately 100-150 mg/kg/wk (about 300 mg/L) (**Figure 3-77**).

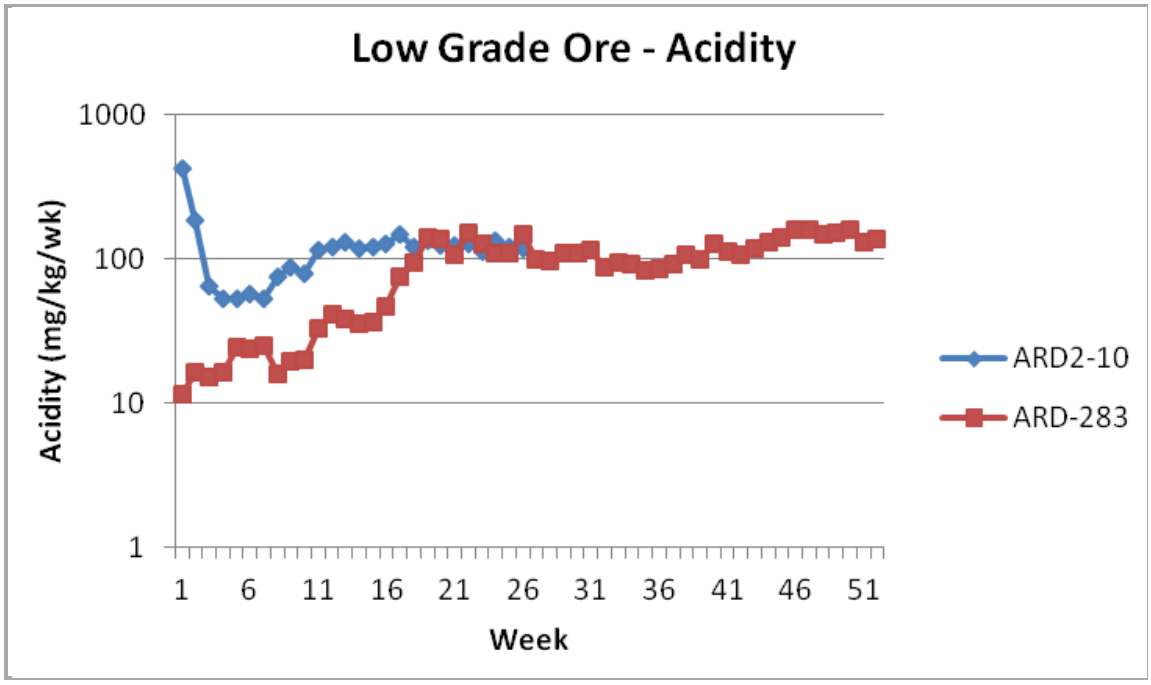


Figure 3-77: Low-Grade Ore Humidity Cell Acidity Loads

Alkalinity was less than detection limit for all weeks except the first week's leach from ARD-283.

3.3.6.2 Sulphate

Both cells showed a rapid decrease in sulphate loads during the initial weeks of testing, followed by a more gradual increase in loads (**Figure 3-78**). Both cells had sulphate loads of approximately 100 to 150 mg/kg/wk (about 275 mg/L) since the 26th week of testing.

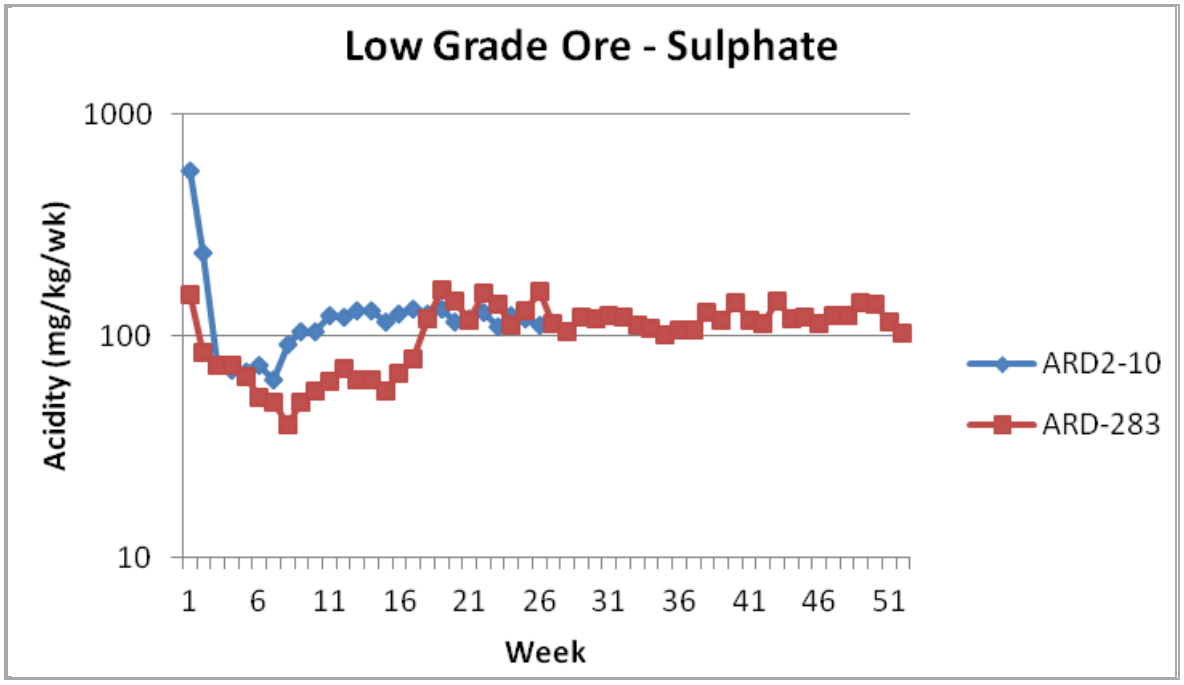


Figure 3-78: Low Grade Ore Humidity Cell Sulphate Loads

3.3.6.3 Dissolved Metals

Results of seven metals (cadmium, zinc, copper, lead, iron, arsenic and selenium) are presented here based on the deposit type and elevated solid phase concentrations. Cadmium and zinc in particular were identified as elements of interest at the Project site. Full results are contained in **Annex 5**.

Cadmium loadings are presented in **Figure 3-79**. Both humidity cells had an initial decrease in loads before reaching longer-term steady state loads. BW-ARD2-10 produced cadmium loads of approximately 0.4 to 0.3 mg/kg/wk (approximately 0.7 mg/L) since week 11. Loads in BW-ARD-283 increased between even to twenty-two to a maximum of 0.2 mg/kg/wk before reaching a steady-state rate of approximately 0.16 mg/kg/wk (approximately 0.4 mg/L).

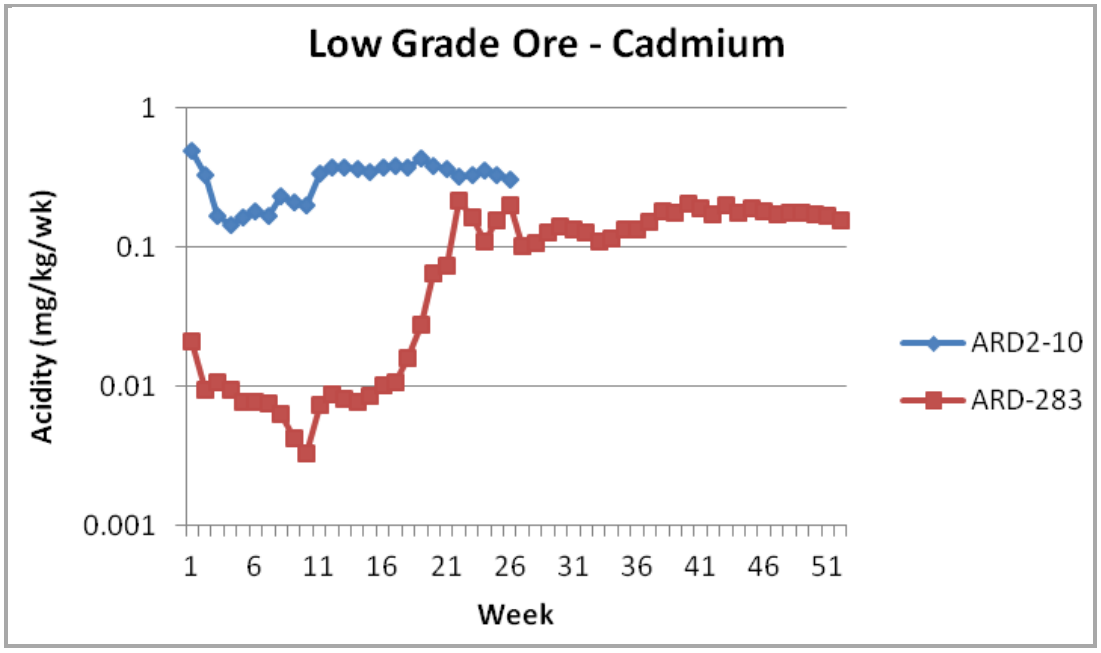


Figure 3-79: Low Grade Ore Humidity Cell Cadmium Loads

Zinc loads were similar to those for cadmium (**Figure 3-80**). Both humidity cells had an initial decrease in loads before reaching longer-term steady state loads. BW-ARD2-10 produced zinc loads of approximately 40 to 45 mg/kg/wk (approximately 90 mg/L) since week 11. Loads in BW-ARD-283 increased between even to twenty-two to a maximum of 0.7 mg/kg/wk before reaching a steady-state rate of approximately 26 mg/kg/wk (approximately 55 mg/L).

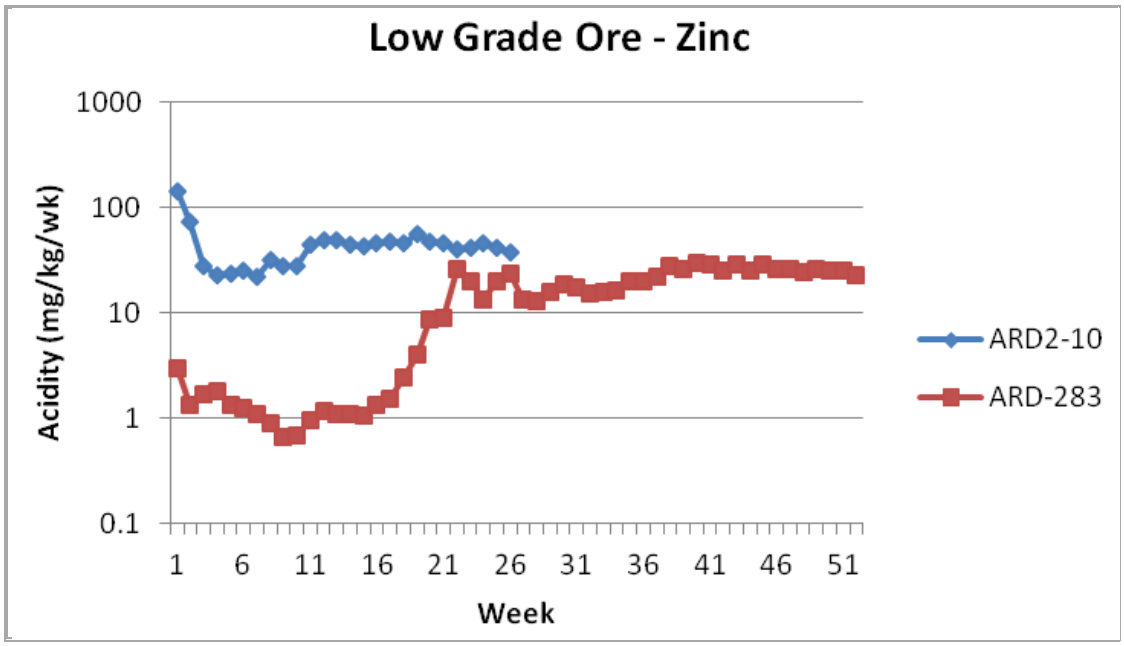


Figure 3-80: Low Grade Ore Humidity Cell Zinc Loads

Both low-grade ore humidity cells had increasing copper loads (Figure 3-81). BW-ARD-2-10 reported copper loads that ranged from 0.026 to 0.72 mg/kg/wk, with an average rate of 0.64 mg/kg/wk in the last 10 cycles. BW-ARD-283 had very low copper loads the first sixteen weeks of testing before a rapid increase to 0.35 mg/kg/wk (0.7 mg/L) at week 49.

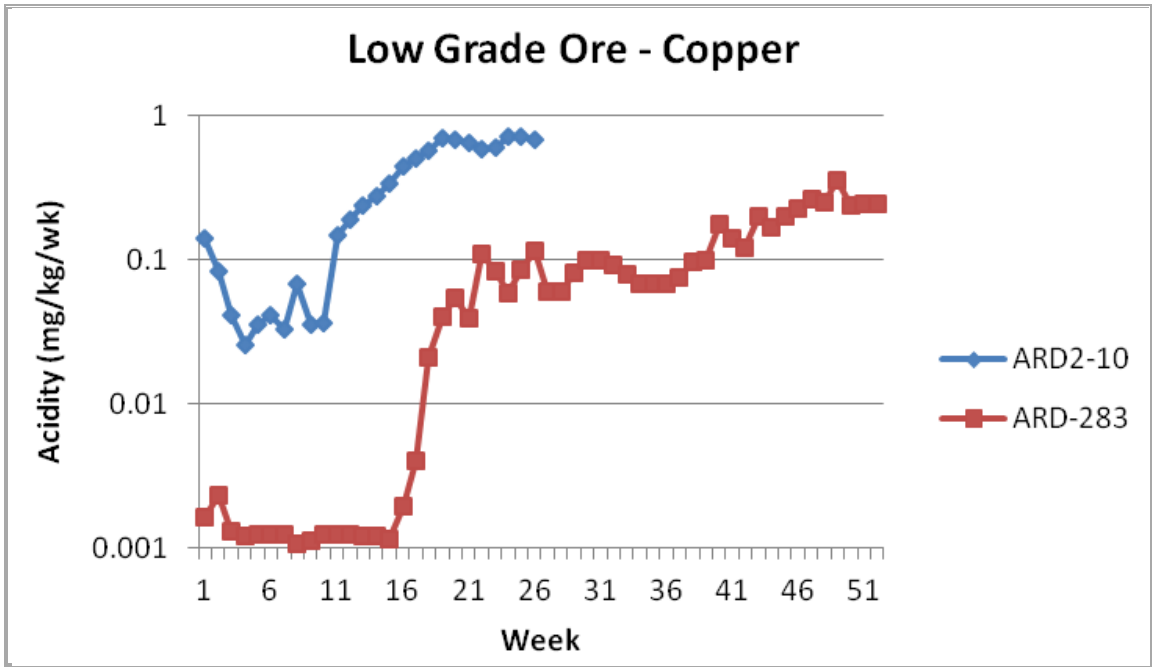


Figure 3-81: Low Grade Ore Humidity Cell Copper Loads

For iron, BW-ARD-2-10 had a rapid decrease in loads from weeks 1 to 10, to approximately 13 mg/kg/wk (**Figure 3-82**). Loads then slightly decreased and stabilized at approximately 4 mg/kg/w (approximately 8.5 mg/L). Humidity cell BW-ARD-283 had a rapid decrease in iron loads during weeks 2 to 19 of testing, to a maximum of 53 mg/kg/wk. Since week 20, iron loads in BW-ARD-037 decreased to less than 1 mg/kg/wk (approximately 2 mg/L).

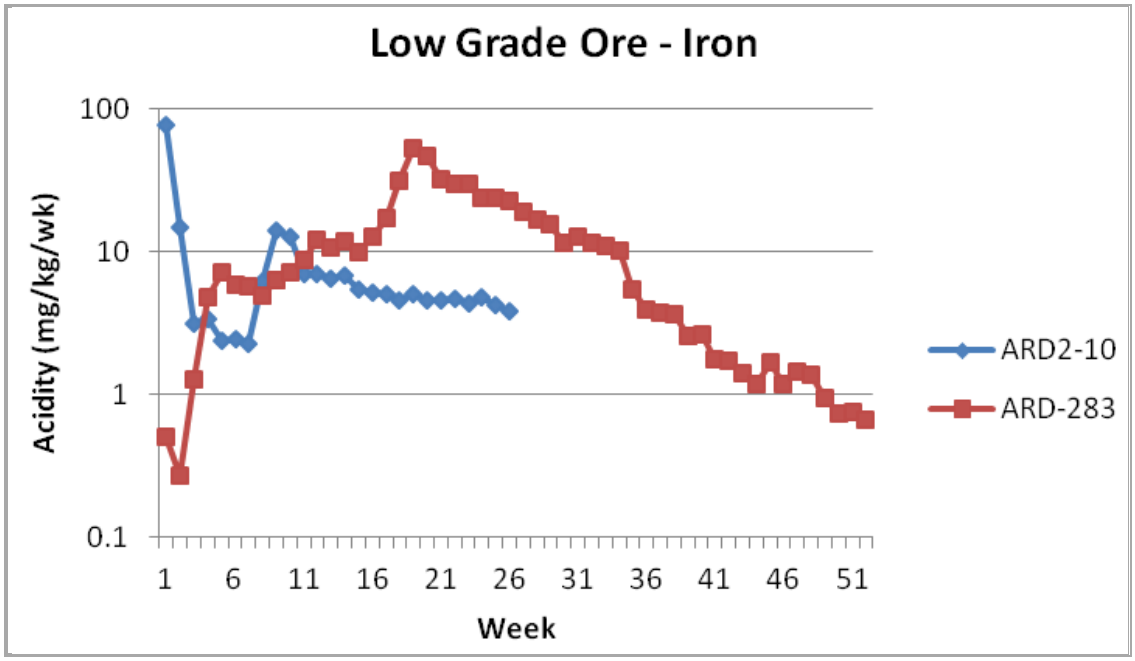


Figure 3-82: Low Grade Ore Humidity Cell Iron Loads

Lead loads steadily increased for BW-ARD-283 from a minimum of 0.002 mg/kg/wk at week 10 to stable rate of approximately 0.18 mg/kg/wk (approximately 0.4 mg/L) by week 45. BW-ARD-2-10 decreased from a maximum load of 0.03 mg/kg/wk (excluding the first flush) at week 12 to loads less than 0.01 mg/kg/wk since week 19 (approximately 0.03mg/L) (**Figure 3-83).**

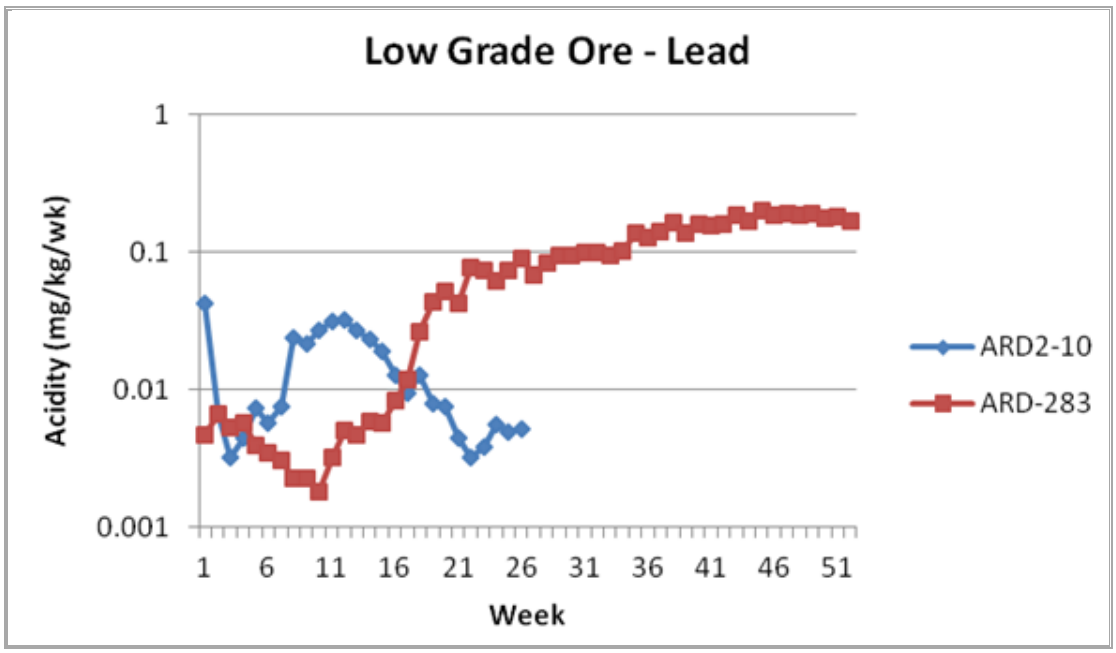


Figure 3-83: Low Grade Ore Humidity Cell Lead Loads

Arsenic loads are presented in **Figure 3-84**. BW-ARD-2-10 reported arsenic loads that decreased steadily throughout the test period (max = 0.03 mg/kg/wk, min = 0.01 mg/kg/wk; average = 0.015 mg/kg/wk). BW-ARD-283 decreased to a minimum of 0.001 mg/kg/wk at week 9 before increasing to approximately 0.01 mg/kg/wk by week 19. Since week 19, arsenic loads have slowly decrease in BW-ARD-283 to less than 0.01 mg/kg/wk (approximately 0.02 mg/L)

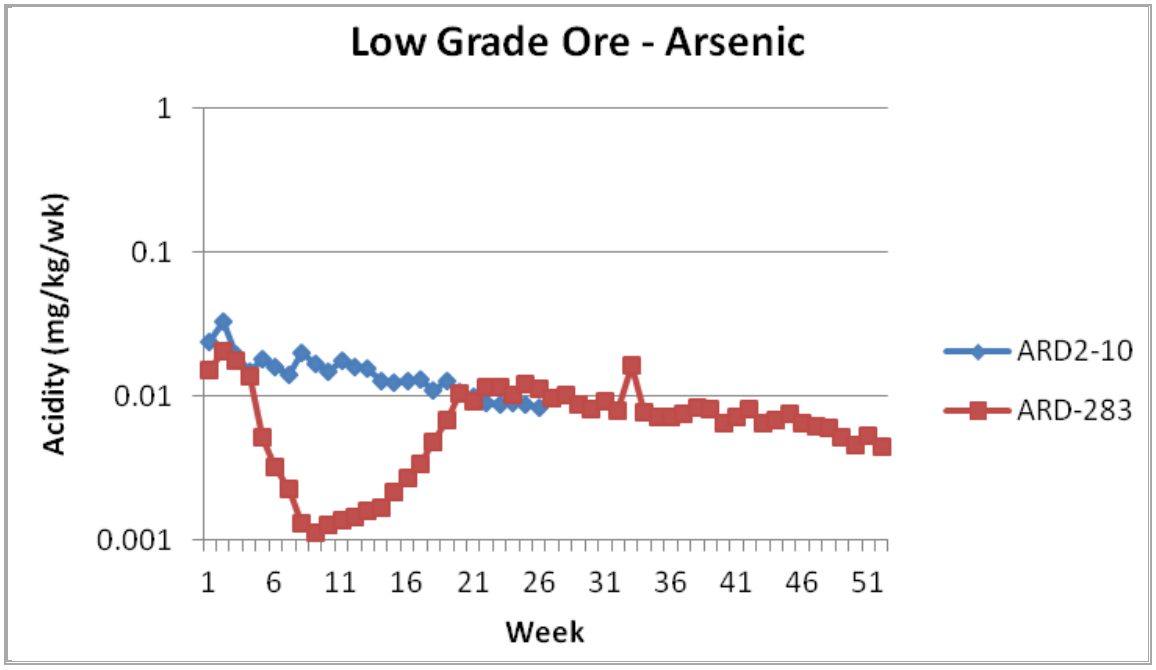


Figure 3-84: Low-Grade Ore Humidity Cell Arsenic Loads

Selenium and mercury concentrations were less than the analytical detection limit for all weeks of testing in both humidity cells.

3.3.7 pH Neutralization Experiments

As with the waste rock (Section 3.2.16), a series of neutralization experiments was conducted using acidic, metal-rich leachate from the ore humidity cell tests. Leachate samples from ore sample BW-ARD-283 were titrated to alkaline pH endpoints to examine the reduction in metal concentrations at higher pHs. Results are presented along with those for waste rock in **Figure 3-64** through **Figure 3-69** and **Table 3-39**. Complete results are given in **Annex 10**.

Humidity cell leachate collected from ore sample BW-ARD-283 was acidic (pH 3.3), with high iron and zinc contents. The targeted pH endpoints were 7, 8, 9, 10, and 11, although pH reductions were observed following a 24-hour equilibration period. The addition of lime to reach each of the five target pH endpoints resulted in 34% to 99% cadmium removal, and 60% to 100% zinc removal (**Table 3-39**).

3.3.8 Conclusions

Ore samples are PAG with high metal concentrations and low NP values. Pyrite was the most commonly observed sulphide mineral, although pyrrhotite, sphalerite, chalcopyrite, and arsenopyrite were also identified. Carbonate minerals were rarely identified.

In general, sulphide content was higher in ore samples than in waste rock samples. The median total sulphur concentration for ore samples (1.3%) was greater than the median for waste rock. The ore samples had little to no NP or CNP. Ninety-five percent of ore samples reported NPR values less than 2. This was supported by the NAG test, by which 92% of the samples were classified as PAG.

Humidity cell testing of low-grade ore showed that low grade sulphidic ore with low NPR is likely to be acid generating with little to no lag time prior to ARD onset, with subsequent high metal loads including zinc, cadmium, iron, and arsenic.

3.4 Metallurgical Test Tailings

Twenty-one tailings samples underwent ML/ARD characterization during metallurgical testing of numerous ore materials. The tailings samples were generated from a range of tests and represent material from heap leach, whole ore leach, flotation, and cyanidation testing. Based on metallurgical work, whole ore leach with cyanidation has been selected as the processing methodology for the Project and will be the focus of the characterization.

3.4.1 Mineralogy

Mineralogical analysis was completed for four metallurgical test samples:

- Whole Ore Leach Cyanidation (KM# 2885 Blend Composite 1));
- Bulk Sulphide Concentrate (DML35-37);
- Rougher / Scavenger Tailings (DML35-37); and,
- BW-59 Drill Core Composite.

Of these tests, the whole leach sample KM#2885 is expected to be the most representative. Results are provided in **Table 3-49**. Complete results are given in **Annex 1**.

The whole ore leach sample had 3.0% pyrite, 1% pyrrhotite and 0.5% sphalerite. There were also trace amounts of chalcopyrite, galena and arsenopyrite detected. Only trace amounts of carbonate minerals were identified.

Pyrite was not detected in the rougher / scavenger tailings sample, but was abundant in the bulk sulphide concentrate sample (34%). The KM# 2885 blend composite sample and the BW-59 drill core composite each reported pyrite at 3.0% and 4.0%, respectively. The bulk sulphide concentrate also contained a large proportion of arsenopyrite (15%), sphalerite (10%), pyrrhotite

(2%), and galena (1%). Pyrrhotite and sphalerite were the next most abundant sulphides identified in the blend composite and drill core composite samples (~1%). Other sulphide minerals (chalcopyrite, galena, arsenopyrite, cubanite, and sphalerite) made up less than 1% of each of the blend composite and drill core composite samples.

Table 3-49: Results of Mineralogical Analysis – Metallurgical Samples

	DML35-37 Rougher/ Scavenger Tailings*	DML35-37 Bulk Sulphide Concentrate*	KM# 2885 Blend Composite 1 (WOL)**	BW-59 Drill Core Composite***
Quartz	65	25	58.7	35.2
Sericite/Mica	20	10	27.9	25.1
K-feldspar	10	3	5	15.3
Pyrophyllite	-	-	Trace	-
Garnet	4	Trace	0.8	-
Tourmaline	-	-	Trace	-
Chlorite	1	-	0.5	-
Kaolinite/Clays	-	-	Trace	7.5
Au	Trace	Trace	-	Trace
Pyrite	-	34	3.0	4.0
Chalcopyrite/Cu sulphides	Trace	Trace	0.06	0.23
Galena	Trace	1	0.04	-
Arsenopyrite	Trace	15	0.03	-
Cubanite	-	-	-	0.03
Tetrahedrite/Freibergite	Trace	Trace	-	Trace
Sphalerite	Trace	10	0.54	0.77
Pyrrhotite	Trace	2	1.1	1.1
Calcium Sulphates	-	-	-	1.6
Carbonates	-	-	Trace	0.45
Iron Oxides	-	-	1.1	3.9
Apatite	-	-	Trace	-
Chromite	-	-	Trace	-
Other	-	-	-	0.01
Total	**100**	**100**	**99**	**95**

Note: *Petrographic/Scanning Electron Microscopy/X-Ray Diffraction Analysis
**Particle Mineral Analysis (PMA) function in Quantitative Evaluation of Minerals by scanning electron microscopy (QEMSCAN)
***Combined analysis via reflected light microscopy (Petrographic Microscope) and semi-quantitative X-ray diffraction (XRD)

Carbonate minerals were only identified in the blend composite and drill core composite samples, with each reporting less than 0.5%. Other gangue minerals included quartz (25% to 65%), mica (10% to 28%), potassium feldspar (3.0% to 15%), and kaolinite (trace to 7.5%).

Lorax Environmental completed a detailed study on two tailings samples using optical mineralogy and scanning electron microscopy (Lorax, 2013a). The mineralogical investigation concluded:

- Tailings generally showed the same gangue mineralogy as the waste rock units (quartz-feldspar matrix with replacement by sericite-biotite assemblages).

- Cadmium and zinc distribution patterns were comparable to those seen in waste rock with cadmium residing in a wider range of non-sphalerite phases, while zinc was largely restricted to sphalerite.
- Analysis revealed only minor amounts of oxide/hydroxide phases that may be prone to reductive dissolution in the permanently saturated setting of the TSF.

3.4.2 Elemental Content

Aqua regia ICP-MS results are summarized in **Table 3-50**. Complete results are given in **Annex 2**. The following elements were higher than ten times the crustal average in all tailings samples: silver, arsenic, cadmium, and phosphorus and antimony. The majority of samples also reported elevated concentrations of zinc, bismuth, lead, sulphur, and selenium. Copper and molybdenum were elevated in one tailings sample each.

3.4.3 Acid Base Accounting

ABA results are presented in **Table 3-51**. Complete results are given in **Annex 3**.

3.4.4 Paste pH

Paste pH values ranged from a minimum of 5.3 to a maximum of 10.0. Only one sample (Test 12 cyanide tails) reported a paste pH value less than 6 (**Table 3-51**).

3.4.4.1 Sulphur and Acid Potential

Total sulphur concentrations ranged from a minimum of 0.18% (rougher tailings) to a maximum of 1.8 %. Sulphate sulphur concentrations ranged from 0.01% to 0.9%. Sulphide sulphur concentrations ranged from 0.07% to 1.8%. The majority of the sulphur in the tailings samples occurred as sulphide (**Figure 3-85**); although the heap leach tailings samples had higher concentrations of sulphate sulphur than the whole ore leach samples (**Table 3-51**).

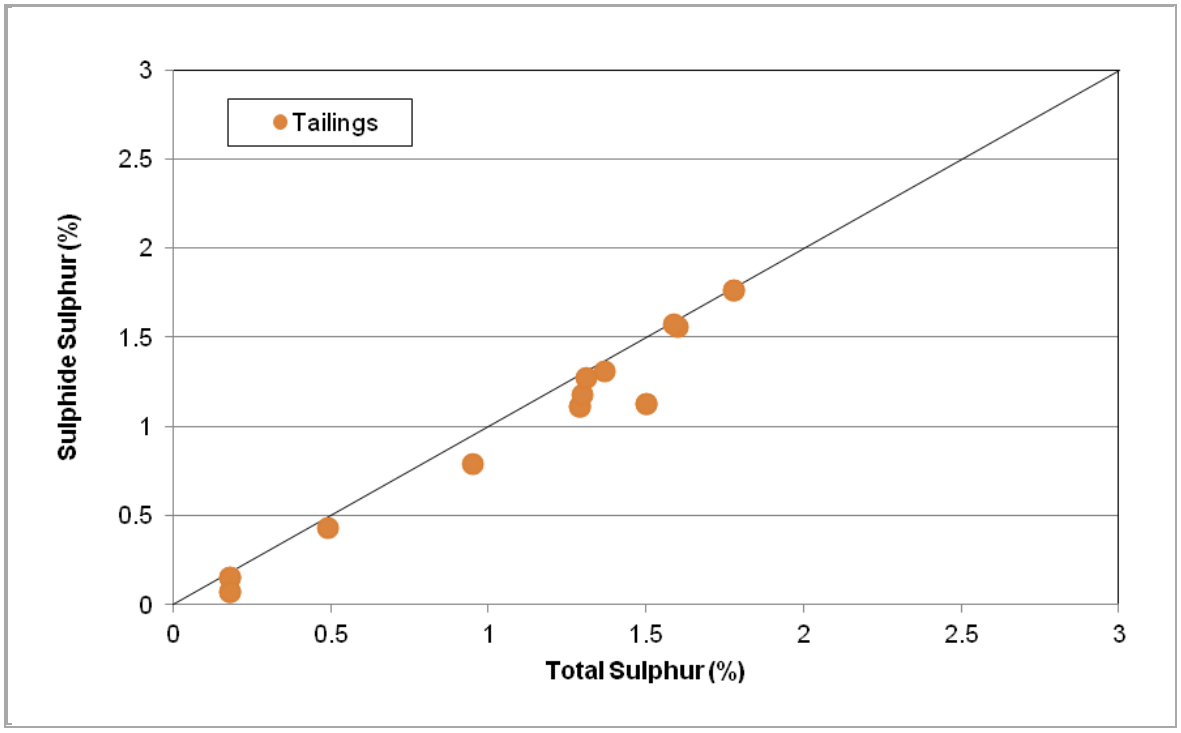


Figure 3-85: Comparison of Sulphide Sulphur and Total Sulphur for Tailings

The whole ore leach samples had similar sulphur concentrations as the cleaner tailings and higher concentrations than the heap leach samples. Acid potential was also higher in the whole ore leach samples compared to the heap leach samples.

Table 3-50: Elemental Content Analysis Results – Metallurgical Test Samples

Name	Description	Ag ppm	Al %	As ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %
	Crustal Average	0.075	8.23	1.8	0.085	4.15	0.15	25	102	60	5.6
KM# 2885 Test 1, 2 Rougher Tailings	Rougher Tails Flotation Cyanidation (-150µm)	**2.2**	0.76	**57**	**2.2**	0.27	**8.9**	3	9	46	1.9
KM# 2885 Test 13,14,15 Cleaner tailings	Cleaner Tails Flotation Cyanidation (-150µm)	**5.3**	0.93	**201**	**6.7**	0.65	**23**	13.7	26	178	4.2
KM# 2885 Test 8,9 Cyanide Tails	WOL Cyanidation	**2.8**	0.81	**200**	**6.7**	0.25	**36**	10.9	9	310	3.6
KM# 2885 Blend Comp 1 Whole Ore	WOL Cyanidation	**7**	0.89	**199**	**7**	0.16	**40.1**	11.6	8	268	4.0
P_{80}-6.3 mm Cyanidation Tail	Coarse grained heap leach	**5**	6.6	**415**	**3.5**	0.31	**24**	6.0	15	2	3.3
P_{80}-6.3 mm Cyanidation Tail_Dup	Coarse grained heap leach	**5**	6.6	**415**	**3.5**	0.31	**24**	6.0	15	127	3.3
P_{80}-150 µm Cyanidation Tail	Fine grained WOL Cyanidation	**3.7**	6.6	**381**	**3.3**	0.31	**25**	4.8	24	2.1	3.2
P_{80}-150 µm Cyanidation Tail_Dup	Fine grained WOL Cyanidation	**3.7**	6.6	**381**	**3.3**	0.31	**25**	4.8	24	134.5	3.2
WOL-S comp	Heap Leach (mislabelled as WOL)	**5**	6.9	**393**	**8.5**	0.21	**36.8**	9.6	21	138	3.9
WOL-S comp_Dup	Heap Leach (mislabelled as WOL)	**8.7**	9	**306**	**3.2**	0.2	**26.3**	4.7	11	152	2.8
WOL-T comp	Heap Leach (mislabelled as WOL)	**7**	7.3	**270**	**4.5**	0.21	**69.4**	10.7	28	151	4.0
WOL-T comp_Dup	Heap Leach (mislabelled as WOL)	**2.2**	2.5	**477**	**2.7**	0.23	**15.9**	11.3	50	159	3.7
		Hg ppm	**In ppm**	**K %**	**Mg %**	**Mn ppm**	**Mo ppm**	**Na %**	**Ni ppm**	**P ppm**	**Pb ppm**
	Crustal Average	0.085	0.25	2.1	2.33	950	1.2	2.36	84	0.015	14
KM# 2885 Test 1, 2 Rougher Tailings	Rougher Tails Flotation Cyanidation (-150µm)	0.01	0.32	0.41	0.13	1120	3.8	0.01	6.3	**640**	**145**
KM# 2885 Test 13,14,15 Cleaner tailings	Cleaner Tails Flotation Cyanidation (-150µm)	0.03	0.6	0.46	0.2	1740	**26**	0.01	44	**770**	**327**
KM# 2885 Test 8,9 Cyanide Tails	WOL Cyanidation	0.06	0.77	0.44	0.13	1210	7.7	0.01	15	**610**	**414**
KM# 2885 Blend Comp 1 Whole Ore	WOL Cyanidation	0.06	0.7	0.51	0.14	1260	8	0.01	15	**620**	**393**
P_{80}-6.3 mm Cyanidation Tail	Coarse grained heap leach	--	0.8	3.6	0.2	5890	3.1	0.1	8.2	**390**	**462**
P_{80}-6.3 mm Cyanidation Tail_Dup	Coarse grained heap leach	--	0.8	3.6	0.2	5890	0.0003	0.1	0.0008	**390**	**462**
P_{80}-150 µm Cyanidation Tail	Fine grained WOL Cyanidation	--	0.77	3.7	0.2	4740	3.9	0.1	8.3	**380**	**490**
P_{80}-150 µm Cyanidation Tail_Dup	Fine grained WOL Cyanidation	--	0.77	**3.7**	0.2	4740	3.9	0.1	8.3	380	**490**
WOL-S comp	Heap Leach (mislabelled as WOL)	0.08	1.2	3.8	0.23	2850	4.1	0.09	10.9	**600**	**511**
WOL-S comp_Dup	Heap Leach (mislabelled as WOL)	0.02	0.82	3.6	0.15	4040	3.4	0.08	6.7	**280**	**500**
WOL-T comp	Heap Leach (mislabelled as WOL)	0.02	1.2	3.9	0.43	3590	3.7	0.13	16.6	**620**	**370**
WOL-T comp_Dup	Heap Leach (mislabelled as WOL)	0.05	0.66	4.2	0.39	2970	3.6	0.07	21.3	**960**	**164**
		S %	**Sb ppm**	**Se ppm**	**Sn ppm**	**Sr ppm**	**Th ppm**	**Ti %**	**Tl ppm**	**W ppm**	**Zn ppm**
	Crustal Average	0.03	0.2	0.05	2.3	370	9.6	0.57	0.85	1.25	70
KM# 2885 Test 1, 2 Rougher Tailings	Rougher Tails Flotation Cyanidation (-150µm)	0.19	**5.4**	0.3	0.4	19	6.3	0.05	0.53	0.35	596
KM# 2885 Test 13,14,15 Cleaner tailings	Cleaner Tails Flotation Cyanidation (-150µm)	**1.6**	**16**	0.5	0.7	33	8.6	0.06	1.1	0.4	**1480**
KM# 2885 Test 8,9 Cyanide Tails	WOL Cyanidation	**1.8**	**13**	**0.7**	0.4	18	6.4	0.04	0.79	0.35	**2940**
KM# 2885 Blend Comp 1 Whole Ore	WOL Cyanidation	**1.9**	**13**	**0.7**	0.3	16	6.7	0.05	0.8	0.38	**3070**
P_{80}-6.3 mm Cyanidation Tail	Coarse grained heap leach	**1.4**	**31**	**1.0**	2.5	57	10.8	0.16	2.1	3.1	**3080**
P_{80}-6.3 mm Cyanidation Tail_Dup	Coarse grained heap leach	**1.4**	**31**	**1.0**	2.5	57	10.8	0.16	2.1	3.1	**3080**
P_{80}-150 µm Cyanidation Tail	Fine grained WOL Cyanidation	**1.3**	**28**	**1.0**	2.6	57	10.4	0.16	1.8	3.1	**3270**
P_{80}-150 µm Cyanidation Tail_Dup	Fine grained WOL Cyanidation	**1.3**	**28**	**1.0**	2.6	57	10.4	0.16	1.8	3.1	**3270**
WOL-S comp	Heap Leach (mislabelled as WOL)	**1.8**	**22.4**	**1.0**	2.2	52.7	9.5	0.22	2.1	3.6	**4280**
WOL-S comp_Dup	Heap Leach (mislabelled as WOL)	**1.3**	**28.2**	**1.0**	2.6	52.6	11.2	0.13	1.8	2.6	**3530**
WOL-T comp	Heap Leach (mislabelled as WOL)	**0.92**	**21.8**	**1.0**	2.6	59.3	9.8	0.28	3	4.1	**3100**
WOL-T comp_Dup	Heap Leach (mislabelled as WOL)	**0.49**	**27.6**	**1.0**	2.6	53.9	8.3	0.42	2.5	8.4	**2360**

Note: **Bold** values are greater than 10x the crustal average

Table 3-51: Acid Base Accounting Analysis Results – Metallurgical Test Samples

Sample ID	Description	Paste pH	Fizz Rating	Total C (%)	Mod. Sobek NP (kg $CaCO_3$/t)	CNP (kg $CaCO_3$/t)	ICP Ca NP (kg $CaCO_3$/t)	NNP (kg $CaCO_3$/t)
KM# 2885 Test 1, 2 Rougher Tailings	Rougher Tails Flotation Cyanidation (-150µm)	8.5	1	-	7	-	6.7	1
KM# 2885 Test 13,14,15 Cleaner Tailings	Cleaner Tails Flotation Cyanidation (-150µm)	10	2		17	-	16.2	-33
KM# 2885 Test 8,9 Cyanide Tails	WOL Cyanidation	7.7	1	-	7	-	6.2	-49
KM# 2885 Blend Comp 1 Whole Ore	WOL Cyanidation	6.4	1	-	6	-	4	-50
P_{80}-6.3 mm Cyanidation Tail	Coarse grained heap leach	8	-	-	6.9	-	7.7	-28.4
P_{80}-6.3 mm Cyanidation Tail_Dup	Coarse grained heap leach	8	-	-	6.9	-	7.7	-28.4
P_{80}-150 µm Cyanidation Tail	Fine grained WOL Cyanidation	8.4	-	-	8.9	-	7.7	-25.8
P_{80}-150 µm Cyanidation Tail_Dup	Fine grained WOL Cyanidation	8.4	-	-	8.9	-	7.7	-25.8
WOL-S comp	Heap Leach (mislabelled as WOL)	8.2	1	-	6	-	5.2	-44
WOL-S comp_Dup	Heap Leach (mislabelled as WOL)	-	-	-	5	-	5	-31.9
WOL-T comp	Heap Leach (mislabelled as WOL)	8.5	1	-	6	-	5.2	-24
WOL-T comp_Dup	Heap Leach (mislabelled as WOL)	-	-	-	10	-	5.7	-3.4
		Total S (%)	**Sulphate S[1] (%)**	**Sulphate S[2] (%)**	**Sulphide S (%)**	**MPA (kg $CaCO_3$/t)**	**AP (kg $CaCO_3$/t)**	**NPR**
KM# 2885 Test 1, 2 Rougher Tailings	Rougher Tails Flotation Cyanidation (-150µm)	0.18	0.03	0.01	0.15	5.6	4.7	1.2
KM# 2885 Test 13,14,15 Cleaner Tailings	Cleaner Tails Flotation Cyanidation (-150µm)	1.6	0.04	0.03	1.6	50	49	0.34
KM# 2885 Test 8,9 Cyanide Tails	WOL Cyanidation	1.8	0.02	0.01	1.8	55.6	55	0.13
KM# 2885 Blend Comp 1 Whole Ore	WOL Cyanidation	1.8	0.02	0.01	1.8	55.6	55	0.11
P_{80}-6.3 mm Cyanidation Tail	Coarse grained heap leach	1.5	0.35	0.88	1.1	35.3	35	0.2
P_{80}-6.3 mm Cyanidation Tail_Dup	Coarse grained heap leach	1.5	0.35	0.88	1.1	35.3	35	0.2
P_{80}-150 µm Cyanidation Tail	Fine grained WOL Cyanidation	1.3	0.18	0.73	1.1	34.7	35	0.26
P_{80}-150 µm Cyanidation Tail_Dup	Fine grained WOL Cyanidation	1.3	0.18	0.73	1.1	34.7	35	0.26
WOL-S comp	Heap Leach (mislabelled as WOL)	1.6	0.01	-	1.6	50.3	49	0.12
WOL-S comp_Dup	Heap Leach (mislabelled as WOL)	1.3	0.01	-	1.2	36.9	37	0.14
WOL-T comp	Heap Leach (mislabelled as WOL)	0.95	0.03	-	0.79	30	25	0.2
WOL-T comp_Dup	Heap Leach (mislabelled as WOL)	0.49	0.03	-	0.43	13.4	13	0.75

Notes: [1] Sulphate sulphur determined by hot sodium carbonate leach; [2] Sulphate sulphur determined by HCl leach

3.4.4.2 Neutralization Potential

The NP of the tailings materials was generally low, ranging from 6.9 to 17 kg $CaCO_3$/t. The whole ore leach samples had low NP values generally around 7 kg $CaCO_3$/t.

ICP-Ca NP ranged from 5.0 to 16.2 kg $CaCO_3$/t (**Figure 3-86**). A significant correlation (r^2 = 0.8) exists between ICP-Ca NP and modified Sobek NP.

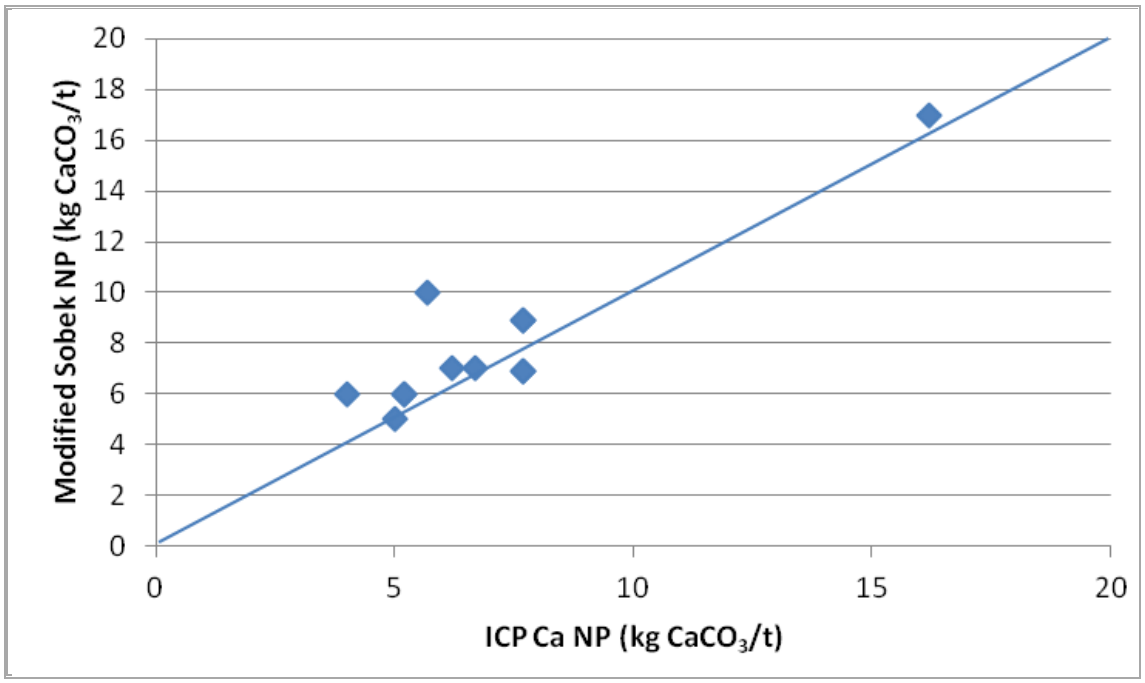


Figure 3-86: Comparison of Modified Sobek NP and ICP Ca NP for Tailings Samples

3.4.4.3 Neutralization Potential Ratios

NPR values ranged from a minimum of 0.13 to a maximum of 1.2 for the rougher tailings, indicating that, apart from the rougher tailings, the tailings are PAG. The whole ore leach tailings all had NPR values of approximately 0.2.

3.4.5 Net Acid Generation Test

The NAG test was performed on eight tailings samples. Results for the whole ore leach and rougher/cleaner cyanidation tailings are given in **Table 3-52**. Complete results are given in **Annex 3**.a

The rougher tailing sample reported NAG pH value of 6.6, greater than the threshold value of 4.5. The remaining three tailings samples reported NAG pH values less than 3.0 indicating that these samples are PAG based on the NAG test (**Table 3-52**). The rougher tailing sample with

NAG pH values greater than 4.5 had an NPR value of 1.2 (**Figure 3-87**). There was generally good agreement between the NPR and NAG test, with the results suggesting that ABA may be more conservative than the NAG test.

After completion of the NAG test, the leachates were analyzed for dissolved metals. The results of the leachate analysis for the rougher and cleaner tailings and the whole ore leach tailings samples are given in **Table 3-53**. Complete results are given in **Annex 4**. The results were compared against BCWQO guideline values for reference purposes only and are not a direct measure of drainage quality.

The Blend Composite whole ore leach sample reported a pH value outside of the range for MMER and BCWQO FWAL guideline values. The same sample also had zinc concentrations that exceeded MMER guidelines, and elevated cadmium, cobalt, and zinc concentrations when compared to times the BCWQO FWAL objectives. Mercury and selenium were not detected in any samples.

Table 3-52: Metallurgical Test Tailings NAG Test Results

Sample ID	Description	NAG @ pH 4.5	NAG @ pH 7.0	NAG pH
		(kg H_2SO_4/t)		
KM# 2885 Test 1, 2 Rougher Tails	Rougher Tails Flotation Cyanidation (-150µm)	<0.01	0.21	6.6
KM# 2885 Test 13,14,15 Cleaner Tails	Cleaner Tails Flotation Cyanidation (-150µm)	20	28	2.6
KM# 2885 Test 8,9 Cyanide Tails	WOL Cyanidation	30	41	2.7
KM# 2885 Blend Comp 1 Whole Ore	WOL Cyanidation	30.7	41.8	2.4

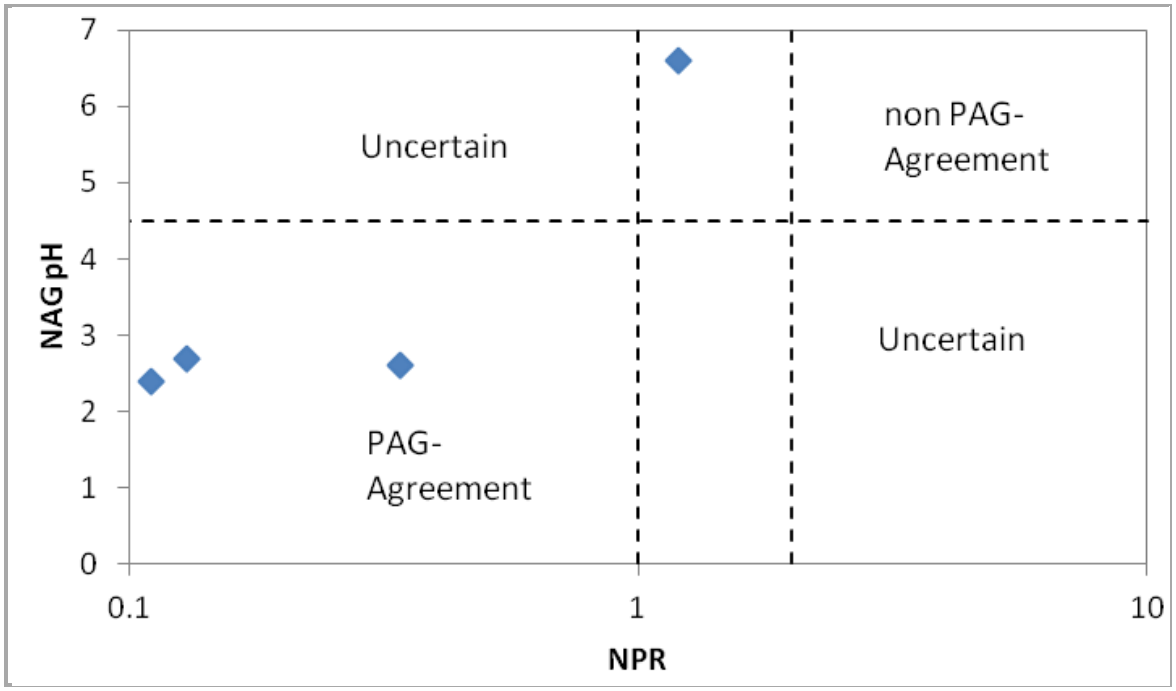


Figure 3-87: Comparison of NAG pH and NPR for Metallurgical Test Samples

Table 3-53: Summary of NAG Test Leachate Results – Metallurgical Tailings

Sample ID	MMER	BCWQO FWAL	10 x BCWQO FWAL	KM# 2885 Test 1, 2 Rougher Tails Rougher Tails Flotation Cyanidation (-150µm)	KM# 2885 Test 13,14,15 Cleaner Tails Cleaner Tails Flotation Cyanidation (-150µm)	KM# 2885 Test 8,9 Cyanide Tails WOL Cyanidation	KM# 2885 Blend Comp 1 Whole Ore WOL Cyanidation
Hardness				135	504	174	122
pH	**6.0-9.5**	**6.5-9.0**		8.8	8.7	8.3	**5.9**
Sulphate		**100**	**1000**	108	300	122	173
Aluminum		**0.02-0.05****	**0.2-0.5***	<0.20	<0.20	<0.20	<0.20
Antimony		**0.02**	**0.2**	<0.050	<0.050	<0.050	<0.050
Arsenic	**0.5**	**0.005**	**0.05**	**<0.050**	**<0.050**	**<0.050**	**<0.050**
Barium		**1**		<0.010	0.02	<0.010	0.022
Beryllium		**0.0053**	**0.053**	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium		**0.00006+**	**0.0006+**	<0.010	<0.010	<0.010	**0.67**
Calcium				52.3	196	65.5	18
Chromium		**0.001**		**<0.010**	**<0.010**	**<0.010**	**<0.010**
Cobalt		**0.004**	**0.04**	<0.010	<0.010	<0.010	**0.16**
Copper	**0.3**	**0.002-0.019***	**0.02-0.19***	<0.010	0.021	<0.010	0.036
Iron		**0.35**	**3.5**	<0.030	<0.030	0.033	0.089
Lead	**0.2**	**0.003-0.026***	**0.03-0.26***	<0.050	<0.050	<0.050	<0.050
Magnesium				0.66	3	2.3	5
Manganese		**0.64-2.68***	**6.4-26.8***	<0.0050	0.0065	0.064	13.2
Mercury				<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum		**2**	**20**	<0.030	0.057	<0.030	<0.030
Nickel	**0.5**	**0.025***	**0.25-1.5***	<0.050	<0.050	<0.050	0.2
Selenium		**0.002**	**0.02**	<0.050	<0.050	<0.050	<0.050
Silver		**0.00005-0.0015***	**0.0005-0.015***	<0.010	**0.018**	<0.010	<0.010
Thallium		**0.0003**	**0.003**	**<0.20**	**<0.20**	**<0.20**	**<0.20**
Titanium		**4.6**	**46**	<0.010	0.013	<0.010	<0.010
Vanadium		**0.006**	**0.06**	<0.030	<0.030	<0.030	<0.030
Zinc	**0.5**	**0.008-0.294***	**0.08-2.94***	<0.020	<0.020	<0.020	**20.4**

Note: **Bold** values are 10x higher than BCWQO for freshwater aquatic life (30 days); ** pH dependent; + site specific objective at hardness 50 mg/L.

3.4.6 Shake Flask Extraction

Four metallurgical samples were tested for leachable metals using the SFE test (**Table 3-54**). Complete results are given in **Annex 5**. The results were evaluated against MMER values and ten times the BCWQO values for comparative purposes only. The whole ore leach blend composite sample reported pH values outside of the range in MMER and BCWQO FWAL guideline values, as well as elevated zinc concentrations relative to MMER, and elevated concentrations of cadmium, cobalt, manganese, and zinc (greater than 10 times BCWQO FWAL).

Table 3-54: Shake Flask Extraction Analysis Results – Metallurgical Tailings Sample

	Unit	MMER	BCWQO FWAL	10 x BCWQO FWAL	KM# 2885 Test 1, 2 Rougher Tails	KM# 2885 Test 13,14,15 Cleaner Tails	KM# 2885 Test 8,9 Cyanide Tails	KM# 2885 Blend Comp 1 Whole Ore
					Rougher Tails Flotation Cyanidation (-150µm)	Cleaner Tails Flotation Cyanidation (-150µm)	WOL Cyanidation	WOL Cyanidation
					Rougher Tailings	Cleaner Tailings	Cyanide Tails	Whole Ore
Hardness	(mg/L)	-	-		135	504	174	122
pH	Units	**6.0-9.5**	**6.5-9.0**		8.8	8.7	8.3	**5.9**
Sulphate	(mg/L)	-	**100**	**1000**	108	300	122	173
Aluminum	(mg/L)	-	**0.02-0.05****	**0.2-0.5***	<0.2	<0.2	<0.2	<0.2
Antimony	(mg/L)	-	**0.02**	**0.2**	<0.05	<0.05	<0.05	<0.05
Arsenic	(mg/L)	**0.5**	**0.005**	**0.05**	<0.05	<0.05	<0.05	<0.05
Barium	(mg/L)	**-**	**1**		<0.01	0.02	<0.01	0.022
Beryllium	(mg/L)	**-**	**0.0053**	**0.053**	<0.005	<0.005	<0.005	<0.005
Bismuth	(mg/L)	**-**			<0.1	<0.1	<0.1	<0.1
Cadmium	(mg/L)	**-**	**0.00006+**	**0.0006+**	<0.01	<0.01	<0.01	**0.67**
Calcium	(mg/L)	**-**			52.3	196	65.5	18
Chromium	(mg/L)	**-**	**0.001**		**<0.01**	**<0.01**	**<0.01**	**<0.01**
Cobalt	(mg/L)	**-**	**0.004**	**0.04**	<0.01	<0.01	<0.01	**0.16**
Copper	(mg/L)	**0.3**	**0.002-0.019***	**0.02-0.19***	<0.01	0.021	<0.01	0.036
Iron	(mg/L)	**-**	**0.35**	**3.5**	<0.03	<0.03	0.033	0.089
Lead	(mg/L)	**0.2**	**0.003-0.026***	**0.03-0.26***	<0.05	<0.05	<0.05	<0.05
Magnesium	(mg/L)	**-**			0.66	3	2.3	5
Manganese	(mg/L)	**-**	**0.64-2.68***	**6.4-26.8***	<0.005	0.0065	0.064	**13.2**
Mercury	(mg/L)	**-**			<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	(mg/L)	**-**	**2**	**20**	<0.03	0.057	<0.03	<0.03
Nickel	(mg/L)	**0.5**	**0.025***	**0.25-1.5***	<0.05	<0.05	<0.05	0.2
Selenium	(mg/L)	**-**	**0.002**	**0.02**	**<0.05**	**<0.05**	**<0.05**	**<0.05**
Silver	(mg/L)	**-**	**0.00005-0.0015***	**0.0005-0.015***	<0.01	**0.018**	<0.01	<0.01
Thallium	(mg/L)	**-**	**0.0003**	**0.003**	<0.2	<0.2	<0.2	<0.2
Titanium	(mg/L)	**-**	**4.6**	**46**	<0.01	0.013	<0.01	<0.01
Vanadium	(mg/L)	**-**	**0.006**	**0.06**	<0.03	<0.03	<0.03	<0.03
Zinc	(mg/L)	**0.5**	**0.008-0.294***	**0.08-2.94***	<0.02	<0.02	<0.02	**20.4**

Note: **Bold** values are 10x higher than BCWQO for freshwater aquatic life (30 days); ** pH dependent; + site specific objective at hardness 50 mg/L Humidity Cell Test
Five Metallurgical tailings samples were chosen for humidity cell testing.

3.4.7 Humidity Cell Testing

Five metallurgical tailings samples were chosen for humidity cell testing.

Table 3-55 provides summary descriptions of the samples and pre-test ABA results.

Sample P_{80} -6.3 mm (CN heap leach tailing) represents a potential cyanide heap leach scenario. The material was coarse grained, similar to the grain size of the waste rock humidity cell tests. The sample has high sulphur, low NP, and was classified as PAG. The sample was bottle-rolled and rinsed to 0 mg/L free CN, and air-dried. The humidity cell tests started 16 days after bottle roll testing.

Sample P_{80} -150 µm (CN whole ore leach tailing) represents tailings from a whole-ore leach (WOL) milling process. The sample was a fine-grained, high sulphur, low NP PAG ,sample. Tailings were bottle-rolled and rinsed to 0 mg/L free CN, and air-dried. The humidity cell tests started 16 days after bottle roll testing. This sample is the most representative of the whole ore leach tailings expected during mining.

The rougher / scavenger tails sample was a flotation tailings. This sample was not leached with CN, and is a non-PAG, low sulphur, low NP sample.

The sulphide composite sample was a PAG, coarse-grained, heap leach representative of the sulphide ore facies. This sample was leached with CN and has high sulphur, and low NP. Columns were leached with CN, rinsed to less than 1 mg/L WAD CN, and air-dried. Humidity cell tests started 24 days after column testing.

Table 3-55: Metallurgical Tailings Humidity Cell Samples

Sample ID	Description	Test Duration (weeks)	NP (kg $CaCO_3$/t)	Total S (%)	NPR	Zn (ppm)	Cd (ppm)
P_{80}-150 µm	Fine grained whole ore CN leach sample	85	8.9	1.3	0.2	3,270	24.8
P_{80} – 6.3 mm	Coarse grained CN heap leach sample	85	6.9	1.5	0.2	3,080	24
S comp	Coarse grained float/con tails sulphide ore	50	6	1.6	0.1	4,280	36.8
T comp	Coarse grained float/con tails transition ore	50	6	0.96	0.2	3,100	69.4
Ro/Scav Tails	Rougher floatation tails	85	4.9	0.18	0.9	1,140	7.6

The transition composite was a PAG, coarse-grained, heap leach representative within the transition facies (between oxide and sulphide). This sample was leached with CN, and has medium sulphur, and low NP. Columns were leached with CN, then rinsed to less than 1 mg/L WAD CN, and air-dried. Humidity cell tests started 24 days after column testing.

Weekly analysis of humidity cell leachate included pH, conductivity, alkalinity, acidity, sulphate, total iron, and dissolved metals. The metallurgical tailings humidity cell leaching rates for all samples are presented in **Table 3-56.** Complete results are given in **Annex 7**.

Table 3-56: Average Metallurgical Tailings Humidity Cell Leaching Rates

Parameter	Average Loading Rate (mg/kg/wk)				
	Whole Ore Leach Tailings (P_{80}-150 µm)	**Heap Leach Tailings (P_{80} – 6.3 mm)**	**Sulphide Ore Float Tailings**	**Transition Ore Float Tailings**	**Rougher Flotation Tailings**
Sulphate	46.3	80.6	30.0	13.2	20.2
Acidity	8.3	34.4	0.51	0.17	1.19
Alkalinity	1.9	2.1	6.0	6.2	2.4
Aluminum	0.02	1.23	0.02	0.02	0.02
Antimony	0.001	0.003	0.005	0.004	0.002
Arsenic	0.002	0.004	0.006	0.013	0.002
Bismuth	0.04	0.05	0.05	0.05	0.05
Boron	0.04	0.05	0.05	0.05	0.05
Cadmium	0.01	0.07	0.002	0.0005	0.002
Calcium	10.7	15.1	14.0	6.4	6.7
Chromium	0.002	0.002	0.002	0.002	0.002
Cobalt	0.01	0.02	0.005	0.005	0.005
Copper	0.02	0.08	0.03	0.02	0.02
Iron	0.06	1.17	0.05	0.01	0.01
Lead	0.01	0.10	0.00	0.00	0.00
Lithium	0.04	0.05	0.05	0.05	0.05
Magnesium	0.48	1.26	0.90	0.58	0.42
Manganese	1.8	6.3	0.21	0.01	0.44
Mercury	0.00005	0.00006	0.00008	0.00008	0.00005
Molybdenum	0.004	0.005	0.005	0.005	0.005
Nickel	0.01	0.02	0.005	0.005	0.005
Phosphorus	0.22	0.24	0.23	0.24	0.23
Selenium	0.002	0.002	0.004	0.004	0.002
Sulphur	14.8	36.1	13.9	5.7	6.6
Thallium	0.0005	0.0005	0.0007	0.0005	0.0005
Tin	0.04	0.05	0.05	0.05	0.05
Titanium	0.04	0.05	0.05	0.05	0.05
Vanadium	0.004	0.005	0.005	0.005	0.005
Zinc	2.9	9.2	0.21	0.01	0.15

3.4.7.1 pH, Acidity and Alkalinity

Figure 3-88 shows the leachate pH values for the metallurgical tailings humidity cell test. The heap leach sample pH values decreased from 8.4 to 3.2 over the 85 weeks of testing. The whole ore leach sample had pH values at or near 7.0 for the first 35 weeks of testing. pH values declined after week 35 to a minimum of 4.6 at week 85. The pH of the rougher flotation, sulphide ore and transition ore samples was neutral to slightly alkaline.

The acidity loads from the metallurgical tailings tests are shown in **Figure 3-89**. The heap leach sample had the highest acidity loads. Acidity in this sample increased rapidly after about 15 weeks of testing to a maximum of 62 mg/kg/wk (approximately 130 mg/L) at week 85. The whole ore leach sample had low acidity until week 50 when loads began to rapidly increase to a maximum of 74 mg/kg/wk (approximately 240 mg/L) at week 84. Acidity loads in the other tests were low with values less than 5 mg/kg/wk.

Aside from the first flush, alkalinity loads in all samples were load (**Figure 3-90**). The heap leach sample had the lowest alkalinity loads and the transition ore tailings had the highest loads.

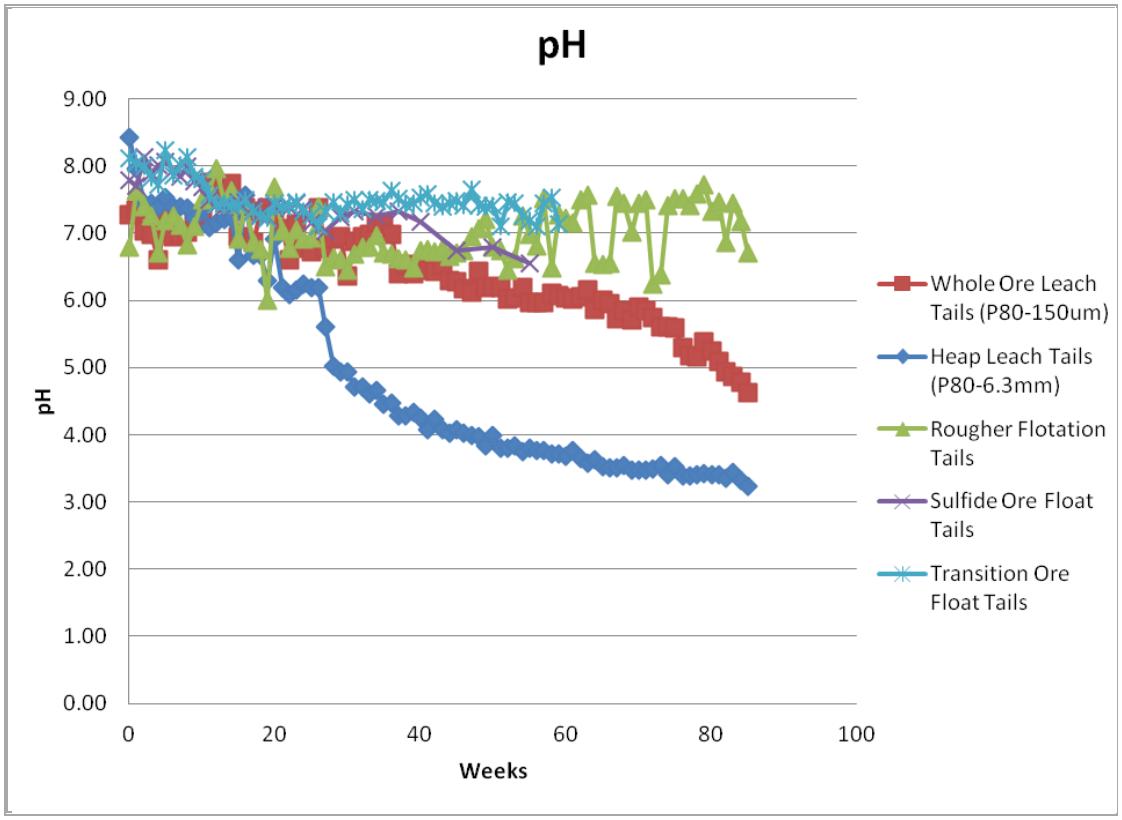


Figure 3-88: Metallurgical Tailings Humidity Cell pH

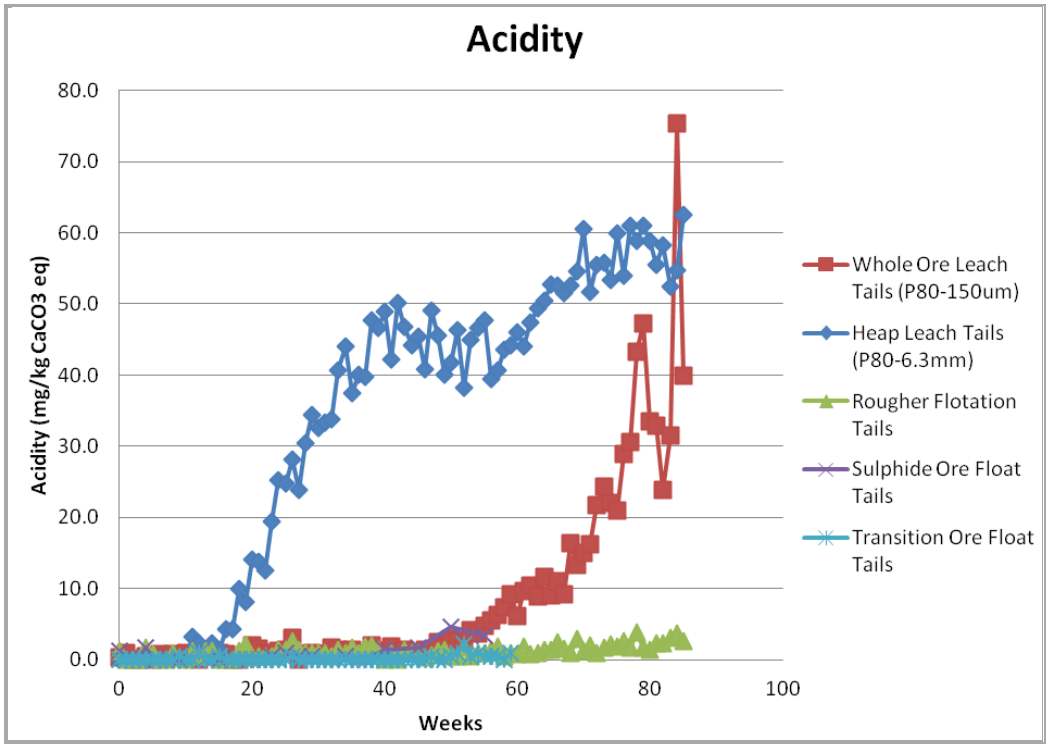


Figure 3-89: Metallurgical Tailings Humidity Cell Acidity

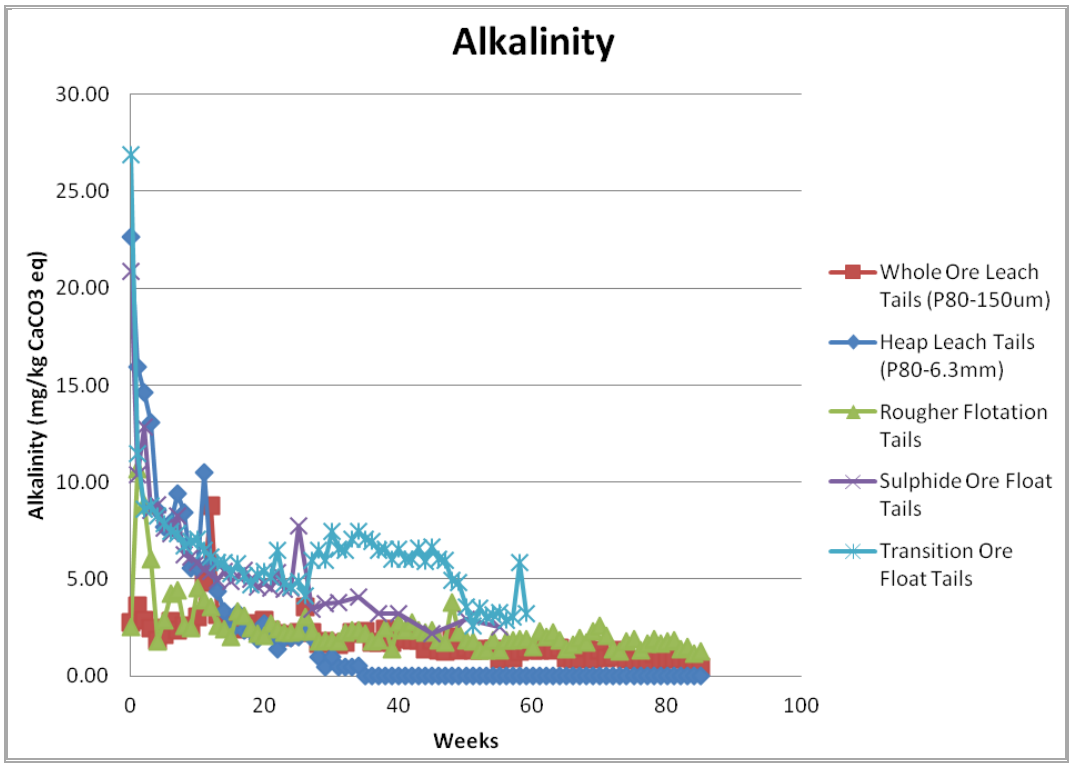


Figure 3-90: Metallurgical Tailings Humidity Cell Alkalinity

3.4.7.2 Sulphate

Sulphate loads were generally between 10 and 100 mg/kg/wk for all tailings humidity cells (**Figure 3-91**). The heap leach tailings tended to have the highest loads with values between 50 and 100 mg/kg/wk (approximately 150 to 200 mg/L). The whole ore leach tailing sulphate loads increased over the duration of the test reaching a maximum of about 150 mg/kg/wk (approximately 490 mg/L) at week 84. The sulphide ore tailings sample had loads similar to the whole ore leach. The transition ore and rougher tailings sulphate loads were low.

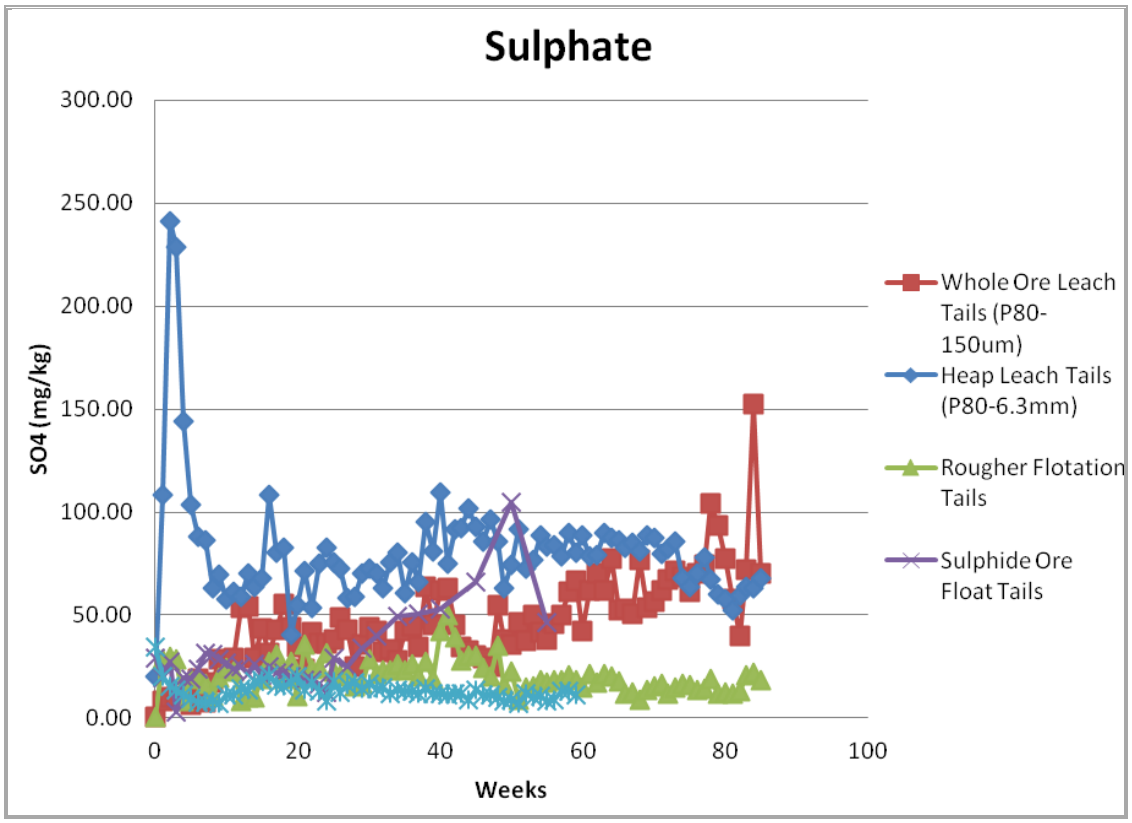


Figure 3-91: Metallurgical Tailings Humidity Cell Sulphate Loads

3.4.7.3 Dissolved Metals

The six metals presented for discussion in this section were chosen based on the deposit type and elevated solid phase concentrations (cadmium, zinc, copper, lead, iron and arsenic). Cadmium and zinc in particular were identified as elements of interest at the Project site. Full results are contained in **Annex 6**.

Four metallurgical tailings samples had increasing cadmium loads during the test period (heap leach, whole ore leach, sulphide ore and rougher flotation tailings) (**Figure 3-92**). The heap leach sample reported the highest cadmium loads, with a maximum of 0.18 mg/kg/wk (0.13 mg/L) at week 40, which decreased for remainder of the test. The whole ore leach and the

sulphide ore tailings had similar cadmium loads that increased after 20-30 weeks of testing (**Figure 3-92**). The maximum cadmium load in the whole ore leach was 0.1 mg/kg/wk at week 85 (approximately 0.27 mg/L). The maximum load in the sulphide ore tailings was 0.012 mg/kg/wk at week 50. The rougher tailings also had increasing cadmium loads that reached a maximum of 0.006 mg/kg/wk (0.014 mg/L) at week 85. Cadmium in the transition ore tailings sample was low for all weeks of testing.

The trend of zinc loads was similar to cadmium for all the metallurgical tailings humidity cells **(Figure 3-93**). The heap leach tailings had the highest loads. The whole ore leach and sulphide ore leach had increasing loads throughout testing. The maximum whole ore leach zinc load was 18 mg/kg/wk (about 20 mg/L) at the end of 85 weeks of testing, whereas the sulphide ore had loads of 1.8 mg/kg/wk (approximately 4 mg/L) at the end of 50 weeks of testing. The rougher flotation tails zinc load also increased throughout the 85-week test reaching a maximum value of 0.7 mg/kg/wk (1.6 mg/L) at the end of testing. Zinc loads in the transition ore sample generally remained less than 0.01 mg/kg/wk.

Copper, iron, lead, and arsenic loads were generally low in all tests except for the heap leach and the whole ore leach samples (**Figure 3-94** to **Figure 3-96**). The heap leach had increasing loads after 20-30 weeks of testing for copper, iron and lead; arsenic loads remained low. The iron and lead loads in the whole ore leach test also increased after 50-60 weeks of testing, although the values remained less than the heap leach test.

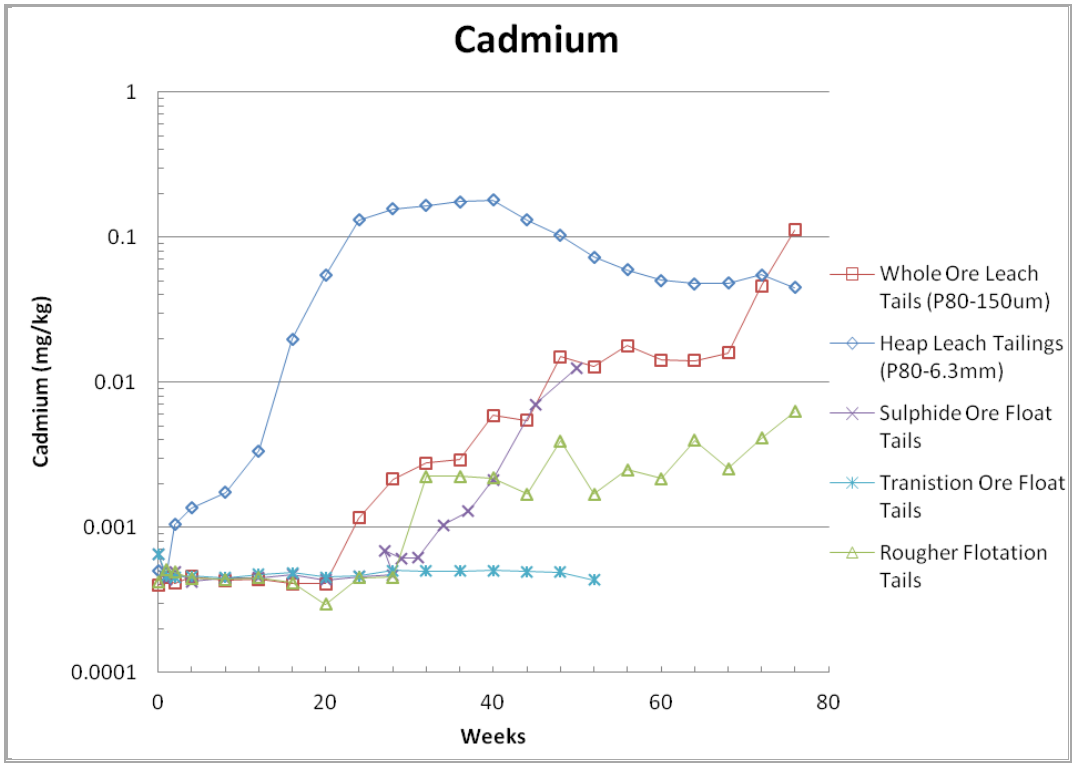


Figure 3-92: Metallurgical Tailings Humidity Cell Cadmium Loads

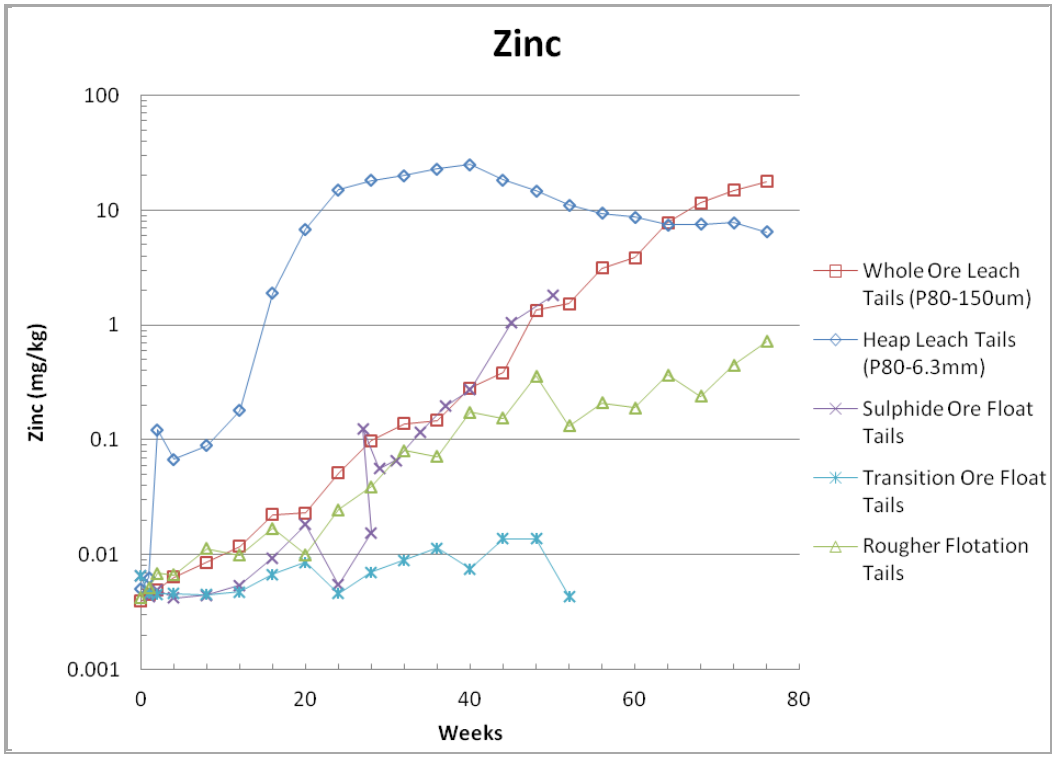


Figure 3-93: Metallurgical Tailings Humidity Cell Zinc Loads

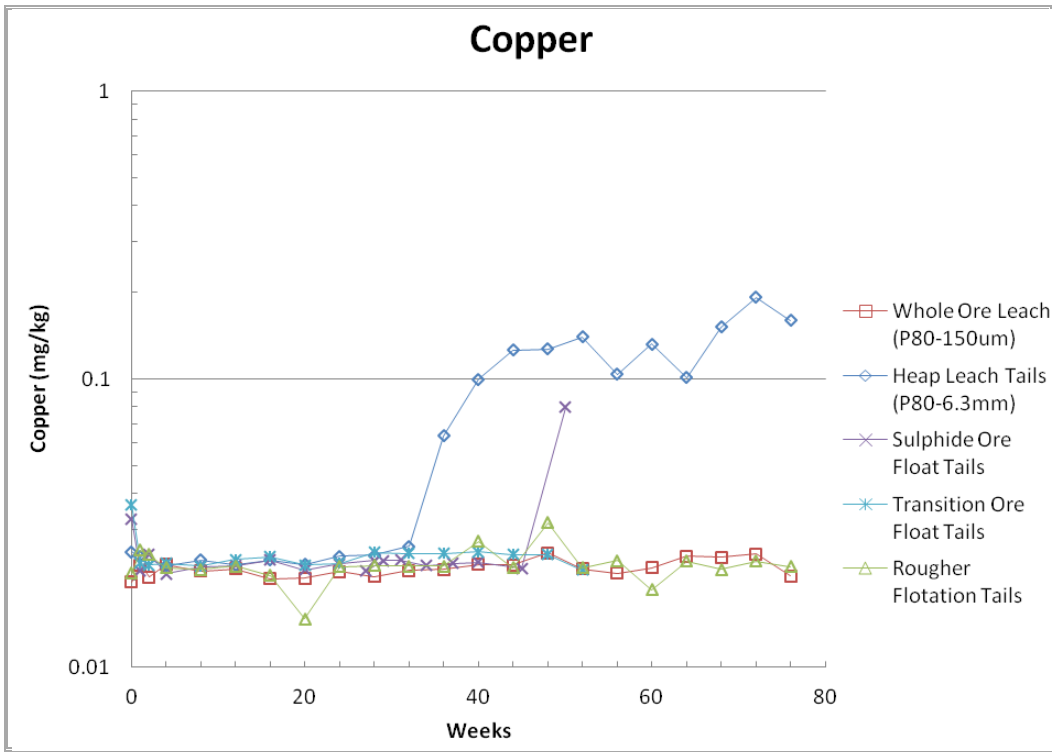


Figure 3-94: Metallurgical Tailings Humidity Cell Copper Loads

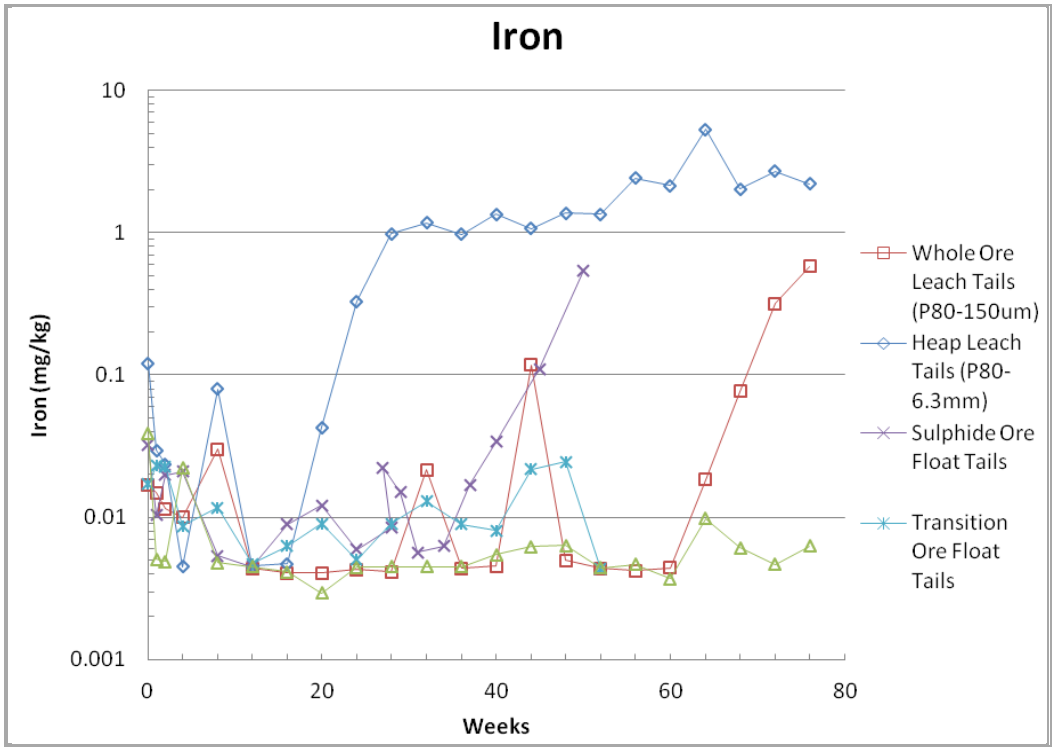


Figure 3-95: Metallurgical Tailings Humidity Cell Iron Loads

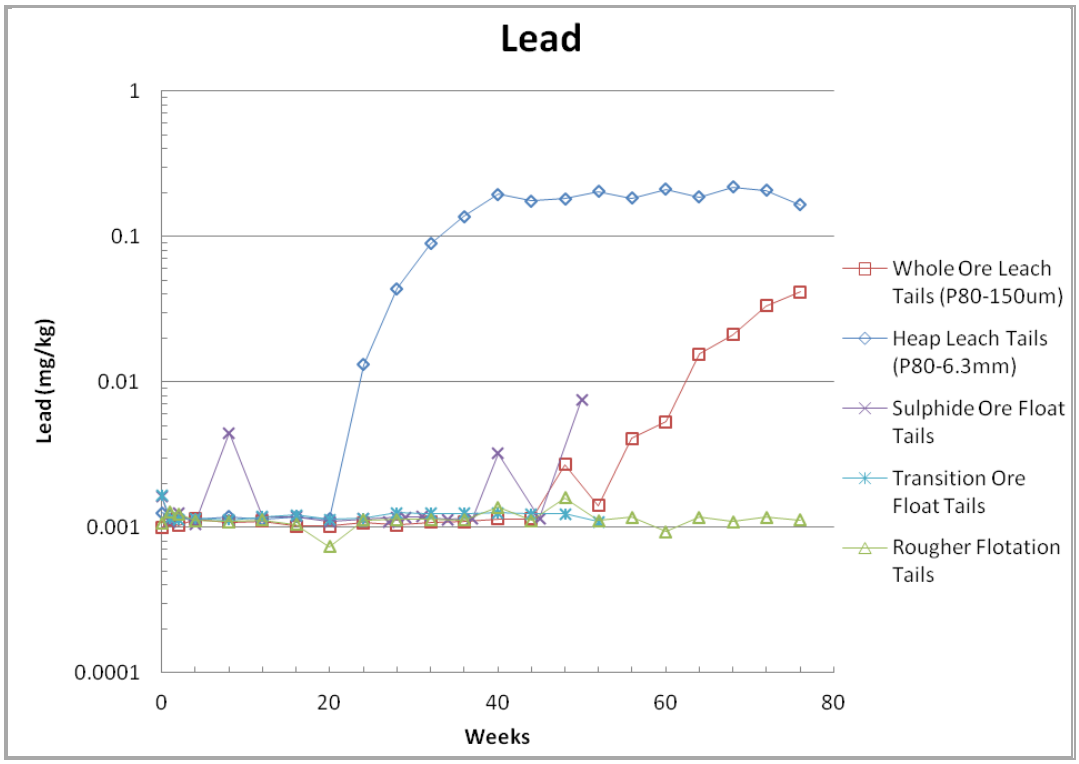


Figure 3-96: Metallurgical Tailings Humidity Cell Lead Loads

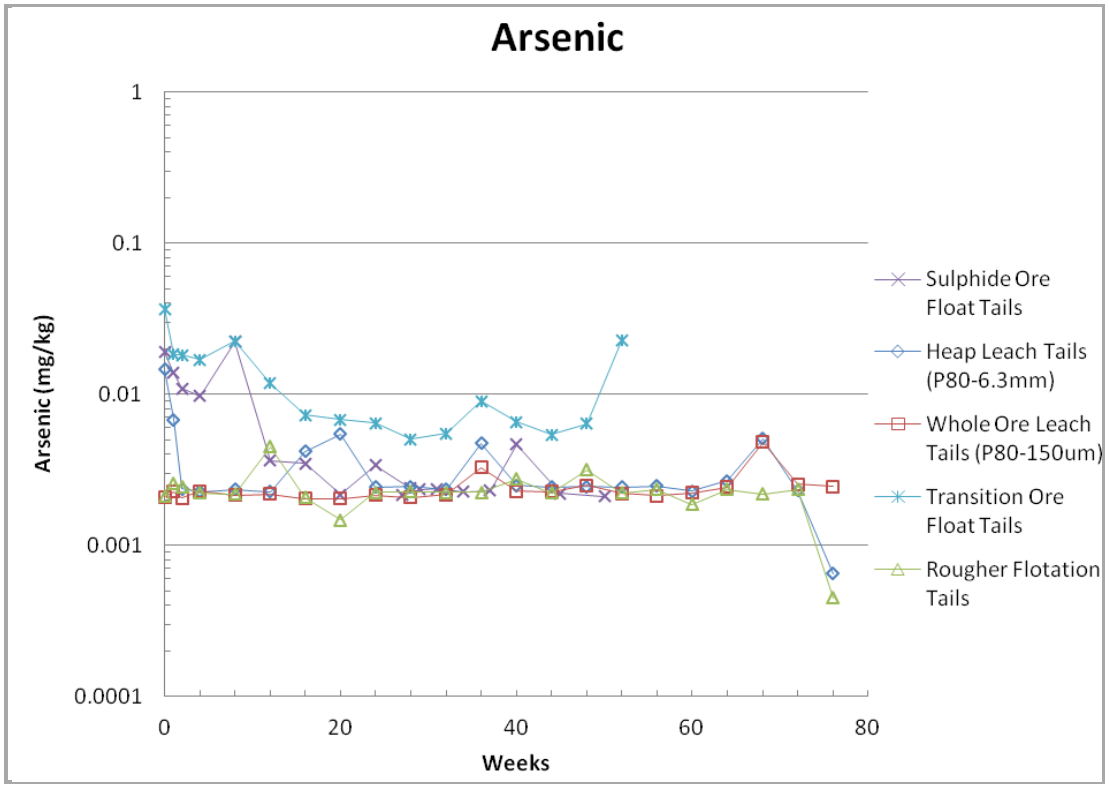


Figure 3-97: Metallurgical Tailings Humidity Cell Arsenic Loads

3.4.8 SO_2/ Air Cyanide Destruction and Aging Test

During mine operations the SO_2/air cyanide destruction process will be used on tailings to reduce cyanide and metal concentrations. Results of the SO_2/air are given in **Table 3-57** and **Annex 1**. The results show the with the exception of copper, which is used as a catalyst, the SO_2/air process reduces the total and weak acid dissociable cyanide (CN_{WAD}), and dissolved metals to low concentrations in solution. As seen in tailings ponds at operating gold mines and demonstrated in lab tests of Blackwater SO_2/air treated tailings, the copper concentrations reduce further with “aging”.

Table 3-57: Results from SO_2/air Cyanide Destruction Tests

Cyanide Destruction Discharge Solution					
Ore Type/Statistic	**Transition**		**Sulphide**		
Test No./Ore type	**Untreated**	**Treated (n=3)**	**Untreated**	**Treated (n=8)**	**All**
pH units	9.81	8.51	9.98	9.02	8.75
Alkalinity mg/L	208	65	223	67	66
SO4 mg/L	180	890	100	900	895
NH3+NH4 as N mg/L	0.48	2.30	0.38	1.70	1.75
CN(T) mg/L	183	0.43	171	0.49	0.46
CNWAD mg/L	129	*0.01*	116	*0.01*	*0.01*
CNO mg/L	5.7	110	6.4	91	93
CNS mg/L	6	73	65	64	69
Hg (diss) mg/L	0.00001	0.00001	0.00001	0.00001	0.00001
Ag (diss) mg/L	0.0276	0.00007	0.0175	0.00006	0.00007
Al (diss) mg/L	1.09	0.16	2.05	0.16	0.16
As (diss) mg/L	0.16	0.010	0.226	0.008	0.008
Cd (diss) mg/L	0.027	0.00361	0.0047	0.00026	0.00045
Cu (diss) mg/L	27.4	1.29	19.1	3.92	3.65
Fe (diss) mg/L	8.04	0.05	9.71	0.24	0.20
Pb (diss) mg/L	0.00052	0.0050	0.0011	0.0008	0.0011
Sb (diss) mg/L	0.113	0.059	0.248	0.106	0.102
Se (diss) mg/L	0.003	0.002	0.002	0.002	0.002
Zn (diss) mg/L	26.1	0.013	25.1	0.034	0.034

Note: Untreated are single samples, treated are medians.

An ageing test for sample CND 6-1 sulphide ore SO_2/air tailings was completed and results for the 30-day ageing test are presented in **Table 3-58**. The results show that, with the exception of cadmium, concentrations tend to decrease over the first 7 days with increases over the 30 day test (**Figure 3-98**).

Table 3-58: Tailings Supernatant Ageing Test Results

Parameter	Unit	CND 8 Comp Short Term Day 0	CND 8 Comp Short Term Day 1	CND 8 Comp Short Term Day 7	CND 8 Comp Short Term Day 14	CND 8 Comp Short Term Day 30
pH	units	8.93	7.93	7.51	7.64	8.13
Hardness	mg/L as $CaCO_3$	436	422	**432**	502	510
Acidity	mg/L as $CaCO_3$	< 2	< 2	< 2	< 2	< 2
Alkalinity	mg/L as $CaCO_3$	67	59	67	78	99
Conductivity	µS/cm	2700	2820	2830	2760	3050
TDS	mg/L	2050	2050	2240	2260	2340
F	mg/L	0.30	0.30	0.31	0.33	0.34
NH_3+NH_4	as N mg/L	3.7	3.4	4.7	2	14.4
TKN	as N mg/L	50.9	64.0	75.1	54.5	82.7
Tot.Reactive P	mg/L	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
SO_4	mg/L	1000	1000	1000	1100	1200
CN(T)	mg/L	1.94	1.57	0.48	< 0.1	0.02
CN_{WAD}	mg/L	0.13	< 0.01	0.34	< 0.1	0.01
CNO	mg/L	150	160	150	150	150
CNS	mg/L	93	96	99	100	110
Dissolved Metals						
Ag	mg/L	< 0.0001	< 0.0001	0.0002	0.0005	0.0019
Al	mg/L	0.19	0.15	0.12	0.06	< 0.01
As	mg/L	0.010	0.006	0.008	0.006	< 0.002
Ba	mg/L	0.0302	0.0288	0.0336	0.0443	0.0469
Be	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
B	mg/L	0.020	0.019	0.040	0.024	0.025
Bi	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Ca	mg/L	171	166	169	197	199
Cd	mg/L	< 0.00003	< 0.00003	0.00016	0.00139	0.00326
Co	mg/L	0.0641	0.0628	0.0671	0.0682	0.0581
Cr	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Cu	mg/L	0.153	0.135	0.165	0.097	0.046
Fe	mg/L	0.898	0.542	0.036	102	0.046
K	mg/L	131	130	150	110	118
Li	mg/L	0.007	0.007	0.010	0.01	0.015
Mg	mg/L	2.04	1.98	2.20	2.26	3.06
Mn	mg/L	0.0234	0.0205	0.0472	0.107	0.233
Hg	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.0001
Mo	mg/L	0.170	0.165	0.172	0.19	0.192
Na	mg/L	436	426	379	450	496
Ni	mg/L	0.175	0.171	0.148	0.069	0.017
P	mg/L	0.019	0.011	0.009	0.026	0.029
Pb	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0026
S	mg/L	482	---	---	---	---
Sb	mg/L	0.0749	0.075	0.078	0.08800	0.074
Se	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Si	mg/L	1.34	1.26	1.36	1.65	1.86
Sn	mg/L	0.0156	0.0323	0.0151	0.0587	0.0709
Sr	mg/L	0.440	0.435	0.462	0.546	0.547
Ti	mg/L	< 0.001	< 0.001	0.003	0.002	0.002
Tl	mg/L	< 0.0002	< 0.0002	< 0.002	< 0.002	< 0.002
U	mg/L	0.00415	0.00265	0.00325	0.00331	0.00418
V	mg/L	< 0.0003	< 0.0003	0.0004	< 0.0003	< 0.0003
Zn	mg/L	0.009	0.002	0.010	0.037	0.139

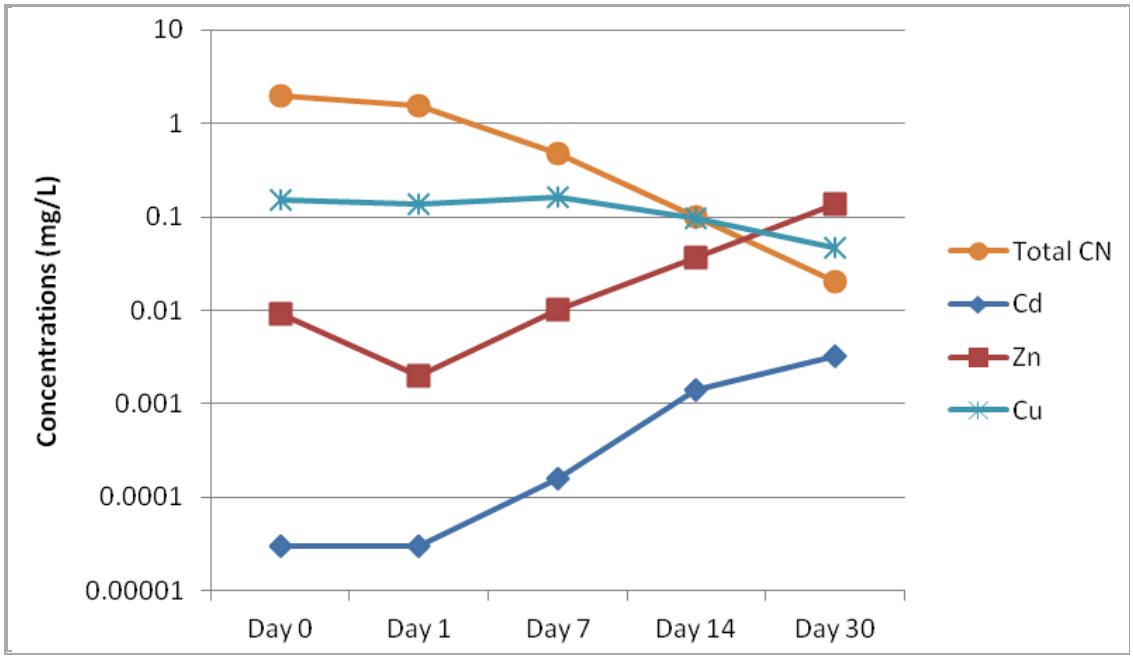


Figure 3-98: Copper, Zinc and Cadmium Concentrations in 30 Day Ageing Test

3.4.9 Conclusions

Test results indicate that the majority of metallurgical test tailings samples are PAG, with the exception of the rougher and flotation tailings samples, which reported NPR values of 1.5 and 2.2, respectively, and are considered non-PAG.

Metallurgical samples had elevated concentrations of several elements in the solid phase including arsenic, cadmium, antimony, and zinc. SFE tests showed that samples with acidic leachate pH values generally reported higher leachable metals concentrations than samples with alkaline leachate pH values.

Humidity cell testing results indicate that the whole ore leach tailings tends to have lower metal loads than the heap leach tailings and similar loads to sulphide ore flotation tailings and the rougher flotation tailings. The whole ore leach tailings sample typically also had a lag time between the start of testing, development of slightly acidic leachate (pH less than 6.0) and the increase in metal loads. Given the similar loads between the rougher tailings and the whole ore leach tailings, this suggests that there would have to be very high removal of metal sulphides to produce a ‘clean’ rougher tailings with low metal loads. Metallurgical testing showed sufficient removal of sulphide minerals by flotation is not feasible.

The WOL tailings are expected to be PAG, and with prolonged exposure, elevated metal concentrations in leachates. Results from the humidity cell test suggest a lag time of up to 1 year (based on lab conditions) until acidic drainage and metal leaching may occur in exposed, non-saturated conditions as might be found in a dry tailings beach after closure. The continuous

additional of alkaline saturated tailings during mine operations is expected to prevent ARD and significant metal leaching during that period.

Tailings supernatant quality is expected to be neutral pH to slightly alkaline with generally relatively low metal concentrations during operations.

4.0 ML/ARD SEGREGATION CRITERIA

As previously described, the waste rock types were defined by neutralization potential ratios (NPR) and aqua regia zinc concentrations (**Table 4-1**).

Table 4-1: ARD Waste Rock Segregation Criteria

	NPR	Zinc (mg/kg)
PAG 1	≤ 1	NA
PAG 2	1- ≤2	NA
NAG 3	> 2	≥ 1000
NAG 4	> 2	600-1000
NAG 5	> 2	< 600

ML/ARD segregation criteria for the Project were initially developed by applying industry guidelines and conventions (Price, 1998, 2009), but evolved as more site-specific data became available, especially with respect to metal leaching from non-PAG wastes. The solid phase zinc values used define the non-PAG waste categories were chosen based on values that are about 5 to 10 times greater than the global average crustal abundance of 70 mg/kg, and were subsequently supported by the ML/ARD characterization results described below.

Figure 4-1 plots the average zinc concentrations from the most recent three weeks of humidity cell testing against the NPRs for waste rock, low-grade ore, and tailings. The results show a general trend of zinc concentrations in leachate increasing as NPR values decrease. With only one exception, the zinc concentration for non-PAG samples was less than 10 times the BCWQO FWAL values, with an NPR greater than 2.

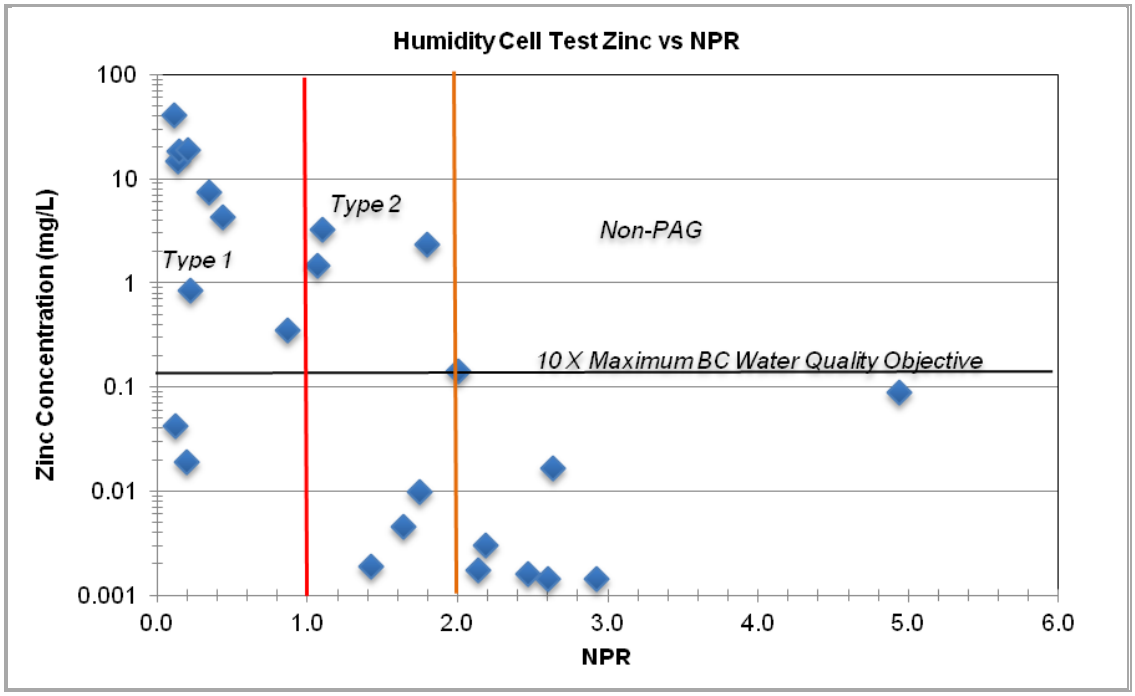


Figure 4-1: Humidity Cell Test Zn vs. Neutralization Potential Ratio for Waste Rock, Ore and Tailings Samples (n=24)

Figure 4-2 shows the same relationship in cadmium leachate concentrations (increasing with decreasing NPR values). Similar to zinc, only one sample with an NPR greater than 2.0 had a cadmium concentration greater than 10 times the suggested site specific objective of 0.00006 mg/L.

Figure 4-3 is a plot that captures the relationship between the solid phase zinc concentrations, humidity cell leachate zinc concentrations, and leachate pH. The plot shows the relationship between higher leachate zinc concentrations and lower pH values, and the relationship between higher solid phase zinc and higher leachate concentrations. In general, there is more zinc leached from samples with higher solid phase zinc concentrations. At pH values greater than approximately 6.8 and solid phase zinc concentrations under 3,000 ppm, leachate zinc concentrations were generally under 10 times BCWQO values. This suggests that, if neutral drainage conditions are maintained, waste rock with solid phase zinc concentrations under 3,000 ppm will leach less zinc than waste rock with higher solid phase concentrations, or waste rock under acidic pH conditions.

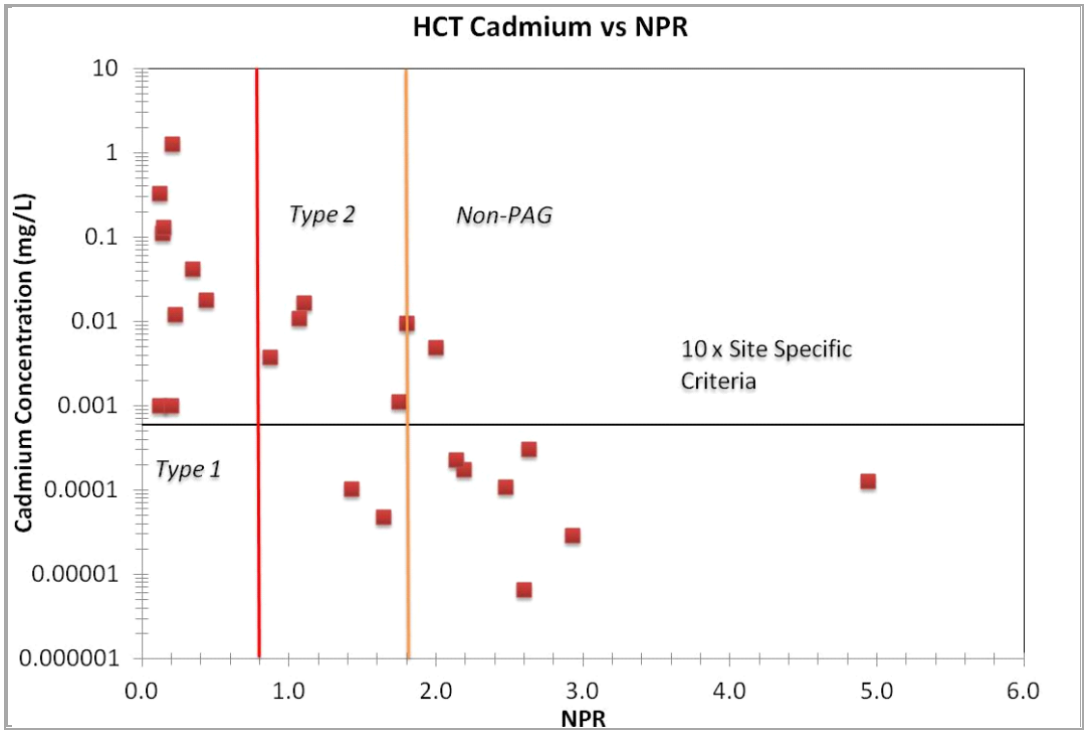


Figure 4-2: Humidity Cell Test Cd vs. Neutralization Potential Ratio for Waste Rock, Ore and Tailings Samples (n=24)

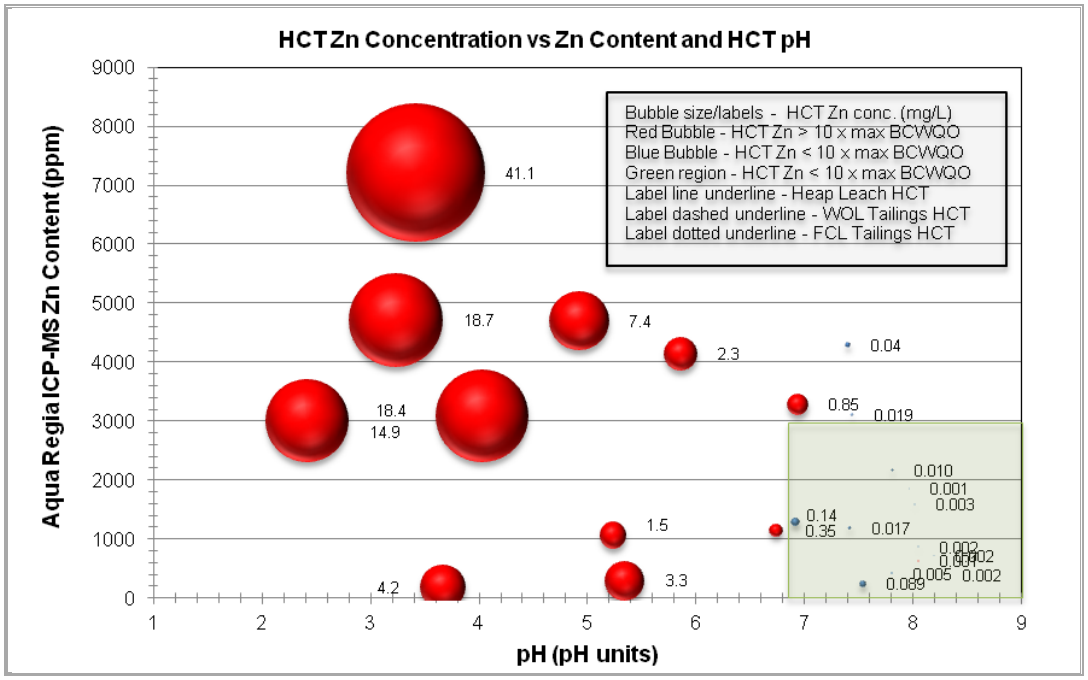


Figure 4-3: Humidity Cell Test Zn Concentration vs. Zn Content and Humidity Cell Test pH

Figure 4-4 is the analogous plot for cadmium to that shown for Zn in Figure 4-3. The plot shows the same general relationships of cadmium concentrations in humidity cell leachate decreasing with increasing pH values, and higher cadmium in humidity cell leachate for samples with higher solid phase cadmium concentrations. This Figure suggests that, if neutral conditions are maintained, waste rock with solid phase cadmium under about 18 mg/kg will leach less cadmium than waste rock with higher solid phase concentrations, or waste rock under acidic conditions.

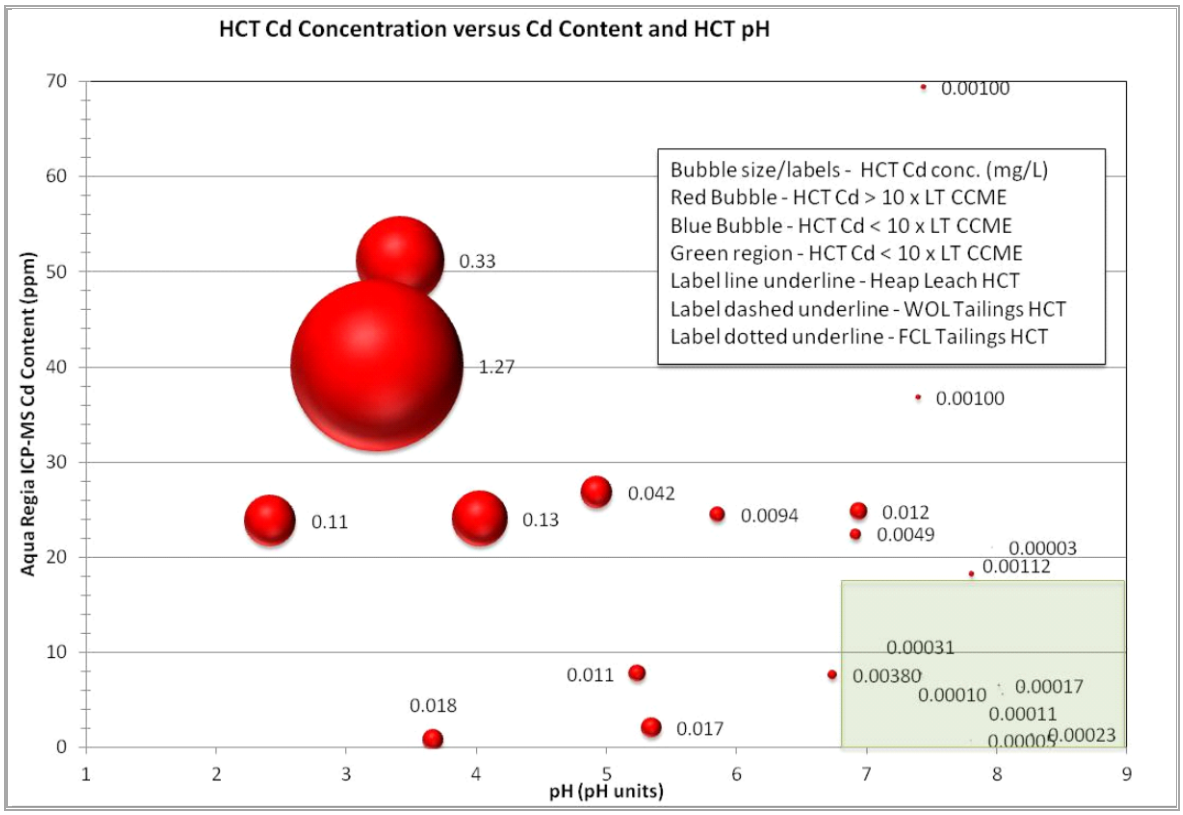


Figure 4-4: Humidity Cell Test Cd Concentration vs. Cd Content and Humidity Cell Test pH

The solid phase zinc and cadmium concentrations for the waste rock, low-grade ore and tailings humidity cell tests are plotted in **Figure 4-5**. As expected, there was a significant correlation between zinc and cadmium, likely relating to trace substitution of cadmium in sphalerite. The zinc concentration of 3,000 mg/kg from **Figure 4-3** corresponds to a cadmium concentration of 24 mg/kg, whereas the cadmium concentration of 18 mg/kg in **Figure 4-4** corresponds to a zinc concentration of approximately 2,000 mg/kg.

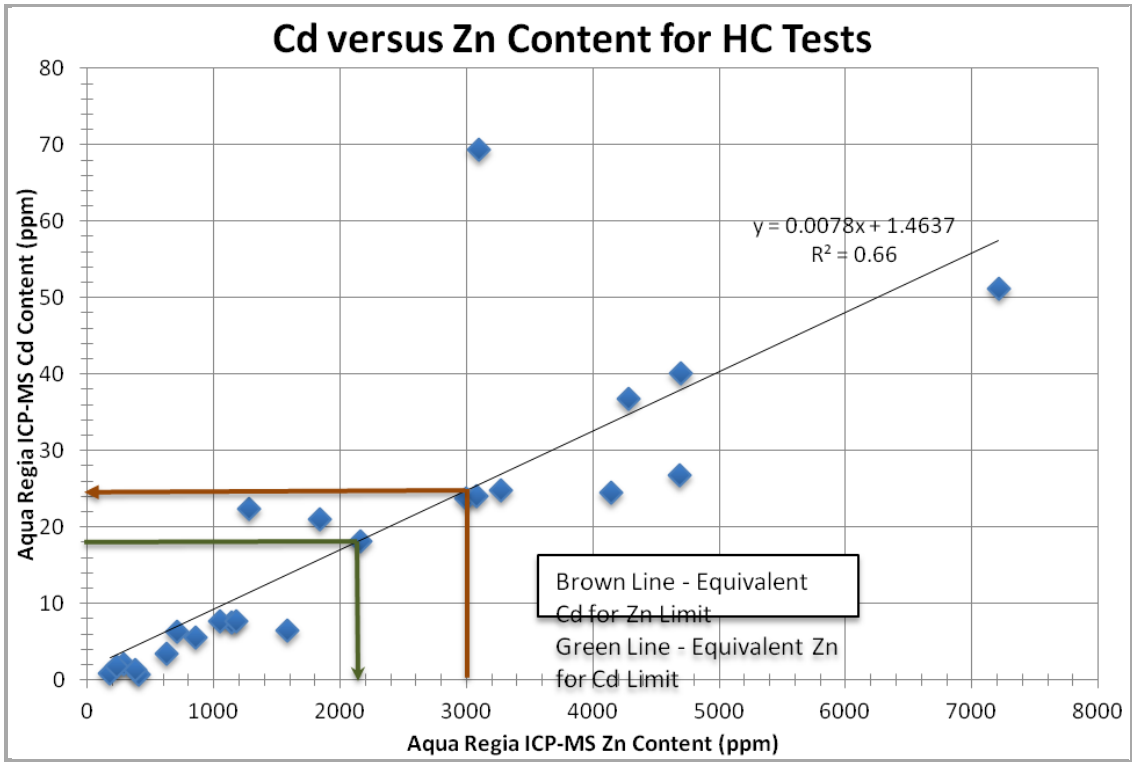


Figure 4-5: Cd vs. Zn Content for Humidity Cell Tests

Taken together, these three plots indicate that for neutral pH conditions, samples with a solid phase zinc concentration below 2,000 mg/kg are likely to have leachable zinc and cadmium concentrations less than 10 times their respective water quality objectives; the ten times values being the screening threshold used to compare leaching test results. Therefore, the proposed zinc thresholds of 1,000 and 600 mg/kg used to segregate and manage non-PAG waste rock from PAG waste rock are expected to be conservative and their use is expected to reduce the potential for neutral metal leaching.

5.0 ARD BLOCK MODEL

GeoSim Services Inc. used the large ABA and exploration drill core ICP results to build an ARD block model. The model was built using results from 890 ABA samples and greater than 200,000 exploration samples.

The acid generation potential of the waste and ore was estimated using the calculated NPR values derived from total sulphur and neutralization potential assays and estimates. Sulphur from the geological metal dataset was found to be consistent with sulphur measured by Leco Furnace for ABA and therefore both datasets were combined. Sulphur concentrations were converted to AP values for use in the NPR calculation. Values for NP were determined directly in ABA or estimated from the calcium assay from the larger geological metal dataset; the latter assumed calcium was only present as calcium carbonate and the sole source of acid neutralization capacity. Separate sulphur and NP block models were prepared and then estimates combined to determine the NPR for ore and waste rock blocks.

Overburden was classified as NAG based on ABA testing. Overburden blocks were identified from the overburden/rock interface mapped during the exploration program.

ABA data were available for 805 samples of drill core, mainly representing 10 m intervals. Three duplicate intervals were excluded. A total of 281,826 1 metre intervals were analyzed by ICP for calcium (Ca) and sulphur (S). These data were composited into 12 m (bench height) down hole intervals and the resulting Ca and S composite concentrations used to calculate NP and AP values.

In drill holes with continuous ABA data, results were used in place of the calculated NPR values (representing 386 samples). In drill holes with isolated ABA analyses, NPR data from 434 of the samples were merged with 15,636 calculated NPR composites. Duplicates of the merged ABA data were inserted in order to give double the weight to these samples.

AP and NP values were estimated using the inverse distance squared method in three passes. The first pass used a 50 m isotropic search with no hard boundaries. A minimum of three and maximum of eight composites from at least two drill holes were required to estimate a block. The second pass treated the main N-S fault structure as a hard boundary and used a 200 m isotropic search for blocks not estimated in the first pass. The minimum and maximum number of composites required was the same as used in the first pass. A third pass also treated the fault as a hard boundary and used a 500 m isotropic search for blocks not estimated in the first two passes. A minimum of two and maximum of eight composites were required to estimate a block with no restriction on the number of holes required.

NPR values were calculated from the estimated AP and NP values. In three areas of very low Ca and S (< 0.02%) a value of three was assigned for NPR.

A separate zinc block model was developed. Samples from core drilling from 2010 to January 2013 were analyzed by ICP methods for 36 elements including zinc characterizing a total of 291,437 metres of drill core.

Zinc concentrations were estimated using the inverse distance squared in three passes. Search parameters were identical to the NPR block model runs described above.

Each 12 m x 12 m x 12 m block of waste rock from the ARD and zinc block models was assigned an ARD class using the NPR from ABA results or the calculated NPR from ICP calcium and sulphur concentrations and from zinc concentrations (for NAG classes).

Calculated ABA and metals parameters for ore by oxide facies from the ARD block model are shown in **Table 5-1**. In general, all parameters except NPR, NNP and lead are lower in the oxide ore compared to transition and sulphide ore. Although lead was more elevated this metal is not mobile at neutral pH. The oxide ore therefore exhibits lower ARD potential (given low total sulphur) and metal leaching than the other ore facies.

Total sulphur and metal parameters for low grade ore from the ARD block model are shown in **Table 5-2**. In general, sulphur and metals (except for lead) are somewhat lower in the low grade ore blocks compared to the sulphide ore blocks.

Table 5-1: Comparison of ABA and Metal Parameters for Ore by Oxide Facies – Feasibility Study Block Model

Statistic	S (%)			AP (kg/t)			Ca %			NP (kg/t)			NPR			NNP (kg/t)		
	Oxide	Transition	Sulphide	Oxide	Transition	Sulphide	Oxide	Transition	Sulphide	Oxide	Transition	Sulphide	Oxide	Transition	Sulphide	Oxide	Transition	Sulphide
count	1892	6403	60075	1892	6403	60075	1892	6403	60007	1892	6403	60075	1892	6403	60075	1892	6403	60075
maximum	2.4	3.5	5	74	110	156	1.4	2.6	4.1	48	66	102	13	26	31	43	53	59
90th	0.49	1.23	1.79	15	38	55.6	0.08	0.32	0.72	2.4	8.3	18	3	0.7	0.7	0.3	-1.2	-5.8
75th	0.26	0.88	1.44	8	27.2	44.8	0.03	0.14	0.32	0.9	4	8.1	1.7	0.3	0.3	-0.1	-5.5	-18.8
median	0.08	0.55	1.11	2.3	16.9	34.4	0.01	0.06	0.11	0.4	1.6	2.9	0.3	0.1	0.1	-1.3	-13.4	-29.9
25th	0.02	0.29	0.82	0.5	8.6	25.3	0.01	0.02	0.04	0.3	0.5	0.9	0.1	0.04	0.03	-6.4	-24.2	-40.9
10th	0.01	0.14	0.57	0.3	4.1	17.7	0.01	0.01	0.02	0.2	0.2	0.5	0.003	0.041	0.01	-13.4	-35.1	-51.7
minimum	0.01	0.01	0.008	0.2	0.2	2.1	0	0	0	0.1	0.1	0	0	0	0	-71.6	-107	-155.3
average	0.19	0.63	1.16	5.7	19.4	36.1	0.04	0.14	0.27	1.3	3.6	6.8	1.0	0.3	0.3	-4.5	-15.8	-29.2
stnd dev	0.27	0.44	0.5	8.3	13.6	15.6	0.11	0.23	0.41	3.1	5.9	10.2	1.5	0.9	0.6	8.2	14.6	19.9
Statistic	**Fe (%)**			**As (ppm)**			**Cd (ppm)**			**Cu (ppm)**			**Pb (ppm)**			**Zn (ppm)**		
	Oxide	**Transition**	**Sulphide**	**Oxide**	**Transition**	**Sulphide**	**Oxide**	**Transition**	**Sulphide**	**Oxide**	**Transition**	**Sulphide**	**Oxide**	**Transition**	**Sulphide**	**Oxide**	**Transition**	**Sulphide**
count	1892	6403	60075	1892	6403	60075	1892	6403	60075	1892	6403	60075	1892	6403	60075	1892	6403	60075
maximum	8.07	8.86	9.88	2426	3486	6406	269	516	394	1008	3067	5197	6833	5745	7773	7718	10837	18232
90th	3.5	4.98	5.22	344	519	795	61	98	58	148	252	287	2613	2235	1068	2217	5546	6914
75th	2.55	3.96	4.06	226	261	438	32	54	42	99	153	187	1900	1282	490	1075	3748	5220
median	1.58	2.65	2.77	140	156	207	8	26	25	70	102	120	1235	591	164	390	1999	3294
25th	1.16	1.71	1.83	90	95	112	2	8	10	46	68	78	799	164	68	141	973	1573
10th	0.98	1.21	1.43	61	62	71	0	3	4	36	44	53	442	44	41	99	569	755
minimum	0.5	0.44	0.58	23	10	8	0	0	0	13	9	9	8	6	7	62	76	59
average	1.98	2.93	3.07	192	269	366	23	41	29	85	144	189	1422	896	402	837	2580	3617
stnd dev	1.09	1.47	1.47	208	374	470	34	49	23	69	195	167	914	922	577	1084	1986	2422

Note: values less than the detection limit were set to 0 in the block model

Table 5-2: Comparison of ABA and Metal Parameters for Low Grade Ore by Oxide Facies – Feasibility Study Block Model

Statistic	S (%)	Zn (ppm)	Cd (ppm)	Fe (%)	NPR	Pb (ppm)	Cu (ppm)	Ca (%)	As (ppm)
count	10237	10237	10237	10237	10237	10237	10237	10237	10237
maximum	3.79	14315	489	9.1	26	5284	1980	3.56	3843
90th	1.39	6187	54	5.2	0.97	1574	164	0.48	462
75th	1.09	4730	38	4.1	0.32	854	111	0.22	246
median	0.81	28424	23	2.6	0.11	319	74	0.07	133
25th	0.47	1181	8	1.6	0.03	75	49	0.02	80
10th	0.17	480	3	1.22	0.01	35	35	0.01	55
minimum	0.01	56	0	0.5	0	8	7	0	10
average	0.81	3136	27	2.9	0.39	601	93	0.2	221

Note: values less than the detection limit were set to 0 in the block model

The proportion of waste rock and overburden in each ARD class based on the Feasibility Study block model is shown in **Figure 5-1** and **Figure 5-2**. About 13% of the total amount of waste for the Project will be overburden (**Figure 5-1**). PAG 1 and PAG 2 comprise 53% of the total amount of waste and 33% is non-acid generating, with 11% NAG but elevated zinc (NAG 3) (**Figure 5-2**).

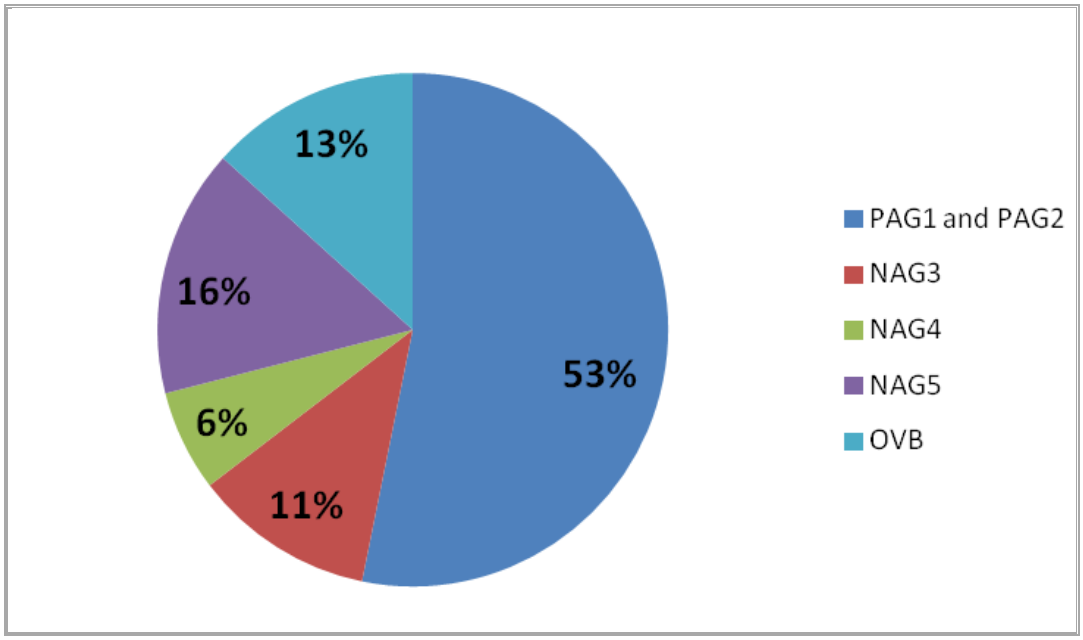


Figure 5-1: Feasibility Study Block Model – Distribution of Waste Rock and Overburden

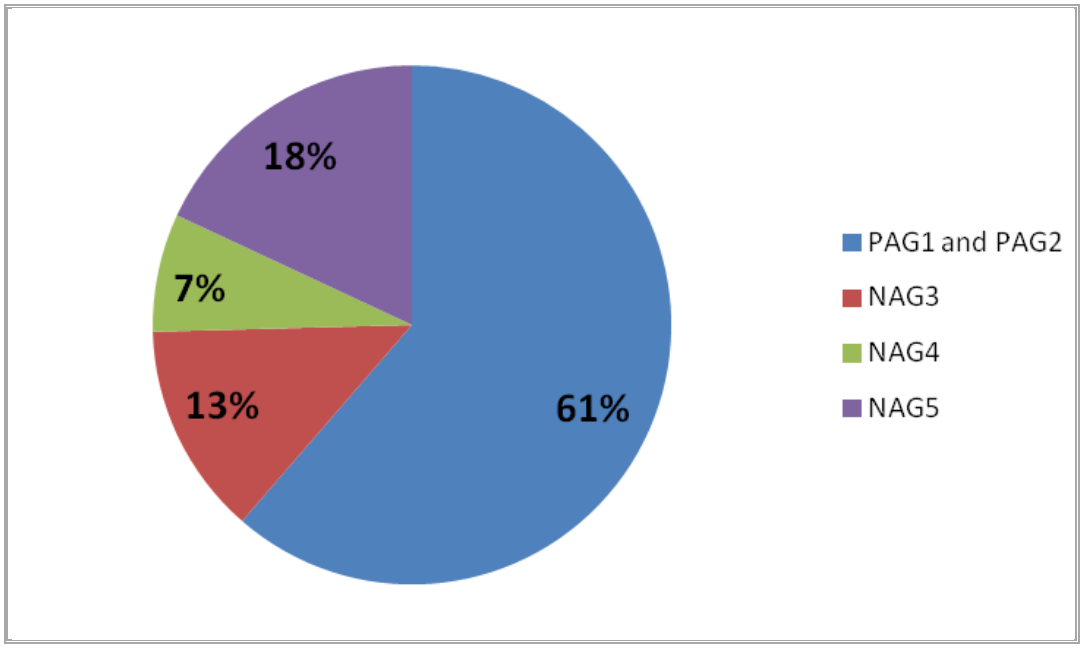


Figure 5-2: Feasibility Study Block Model – Distribution of Waste Rock

Statistics for calculated ABA and metals for the 5 classes of waste rock are shown in **Table 5-3**. These results also show decreasing sulphur and metal concentrations across the ARD classes, except for zinc. Zinc in the NAG 3 waste rock had higher average and median concentrations than the PAG 2 waste rock. The NPR and Ca increase across the ARD classes. The block model results are similar to the ABA database results, where segregating and managing by ARD class will also tend to manage by metal concentrations.

A cross section of the ARD block model shows that there is an overall gradation from PAG rock in the central zone of the pit to greater amounts of NAG 4 and NAG 5 waste rock towards the periphery (**Figure 5-3**). This overall zonation can also be seen in **Figure 5-4** that shows the ARD classification of the ultimate pit walls. Both Figures also show that blocks of the same waste rock types tend occur together with few singleton blocks. This indicates that segregation of NAG 4 and NAG 5 waste rock should be relatively straightforward.

The ARD classification of the high wall after flooding of the open pit is shown in **Figure 5-5**. The flooding of the open pit reduced the exposed area of PAG 1 and PAG 2 waste rock from 32% of the ultimate pit walls to 16% (**Table 5-4**), and reduced the area of the NAG 3 waste rock from 11% to 5%. Most of the exposed high wall will be overburden.

Table 5-3: ABA and Metal Parameters for Waste Rock – Feasibility Study Block Model

	NPR					Total S (%)					Ca (ppm)				
	PAG 1	**PAG 2**	**NAG 3**	**NAG 4**	**NAG 5**	**PAG 1**	**PAG 2**	**NAG 3**	**NAG 4**	**NAG 5**	**PAG 1**	**PAG 2**	**NAG 3**	**NAG 4**	**NAG 5**
Count	41524	12642	15355	11887	18436	41524	12642	15355	11887	18436	41524	12642	15355	11887	18436
Max	1	2	254	354	484	4.0	1.7	1.2	0.9	1.3	2.6	3.1	4.2	4.2	4.5
95th	0.9	2	20	21	63	1.3	0.9	0.7	0.5	0.6	0.8	1.7	3.1	3.4	3.8
75th	0.6	2	7	10	17	0.7	0.6	0.4	0.3	0.3	0.3	1.1	2.4	2.6	3.2
Median	0.3	1.4	4.0	5.6	8.2	0.5	0.4	0.3	0.2	0.1	0.1	0.7	1.7	1.7	2.4
25th	0.1	1.2	2.8	3.4	4.3	0.3	0.2	0.2	0.1	0.1	0.1	0.4	1.2	1.0	1.5
Min	0.0	1.0	2.0	2.0	2.0	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00
Avg.	0.4	1.5	6.4	8.5	19	0.6	0.4	0.3	0.2	0.2	0.2	0.8	1.8	1.8	2.3
Stnd Dev	0.3	0.3	7.8	12	42	0.39	0.25	0.18	0.12	0.18	0.26	0.50	0.81	0.95	1.06
	Zn (ppm)					**Cd (ppm)**					**As (ppm)**				
	PAG 1	**PAG 2**	**NAG 3**	**NAG 4**	**NAG 5**	**PAG 1**	**PAG 2**	**NAG 3**	**NAG 4**	**NAG 5**	**PAG 1**	**PAG 2**	**NAG 3**	**NAG 4**	**NAG 5**
Count	41524	12642	15355	11887	18436	41524	12642	15355	11887	18436	41524	12642	15355	11887	18436
Max	11634	6321	5886	999	499	223	49	43	25	14	3239	3180	1477	1562	3436
95th	5007	3885	2994	965	470	39	26	20	6	2	698.85	558	246	259	373
75th	2995	2358	1994	841	359	20.0	15	11	4	1	298.0	193	96	88	91
Median	1680	1367	1518	710	244	10.0	7.0	7.0	3.0	1.0	151.0	107.0	50.0	47.0	41.0
25th	882	693	1240	597	147	4.0	3.0	4.0	2.0	0.0	81.0	58.0	29.0	28.0	22.0
Min	41	50	1000	500	43	0.0	0.0	0.0	0.0	0.0	7.0	10.0	6.0	5.0	3.0
Avg.	2087	1634	1708	723	256	14.0	9.5	8.3	3.0	1	231.4	170.9	81.3	80.8	98
Stnd Dev	1532.1	1158.4	629.6	143	125	14.7	8.2	5.8	2	1	231.9	211.3	99.5	105	189

Note: values less than the detection limit were set to zero in the block model.

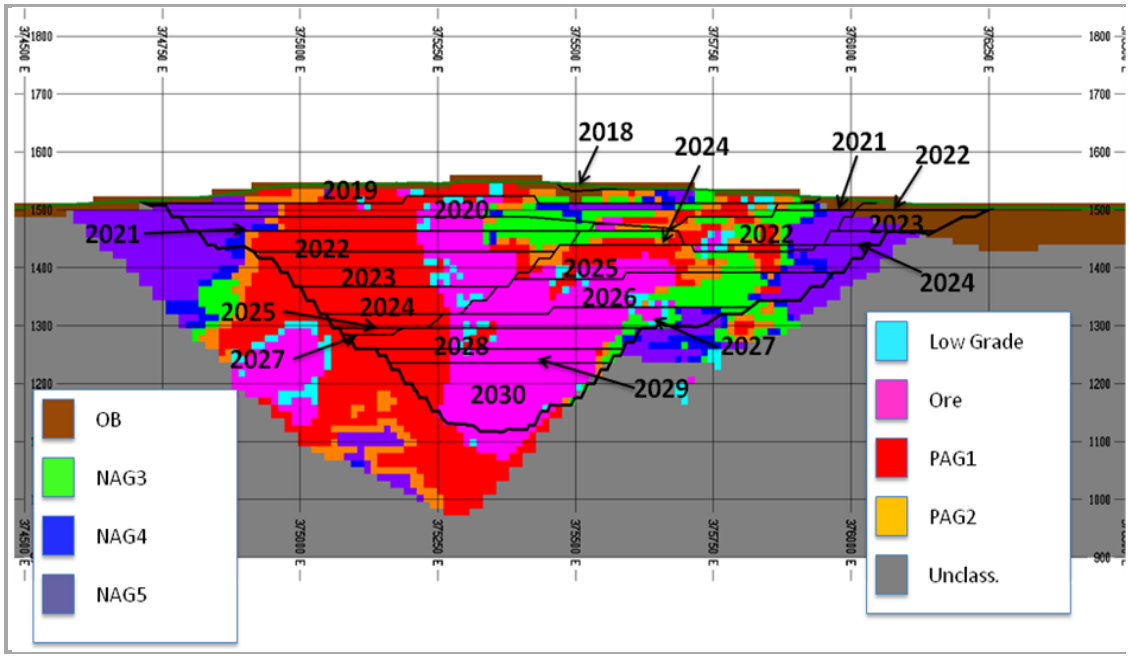


Figure 5-3: Block Model – Cross Section 5893300N

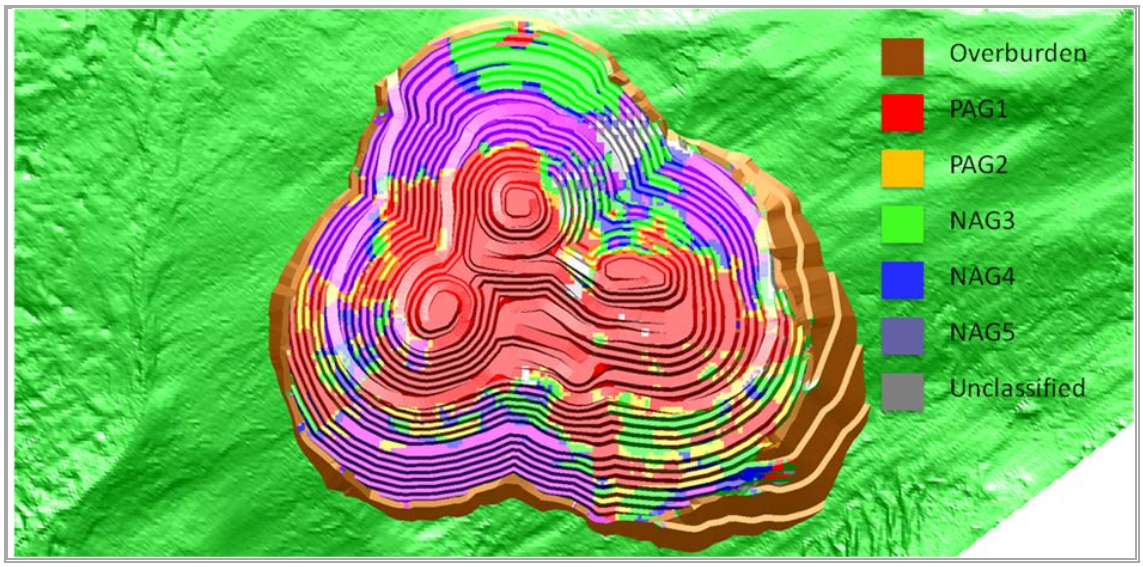


Figure 5-4: Block Model – ARD Classification of Ultimate Pit Walls

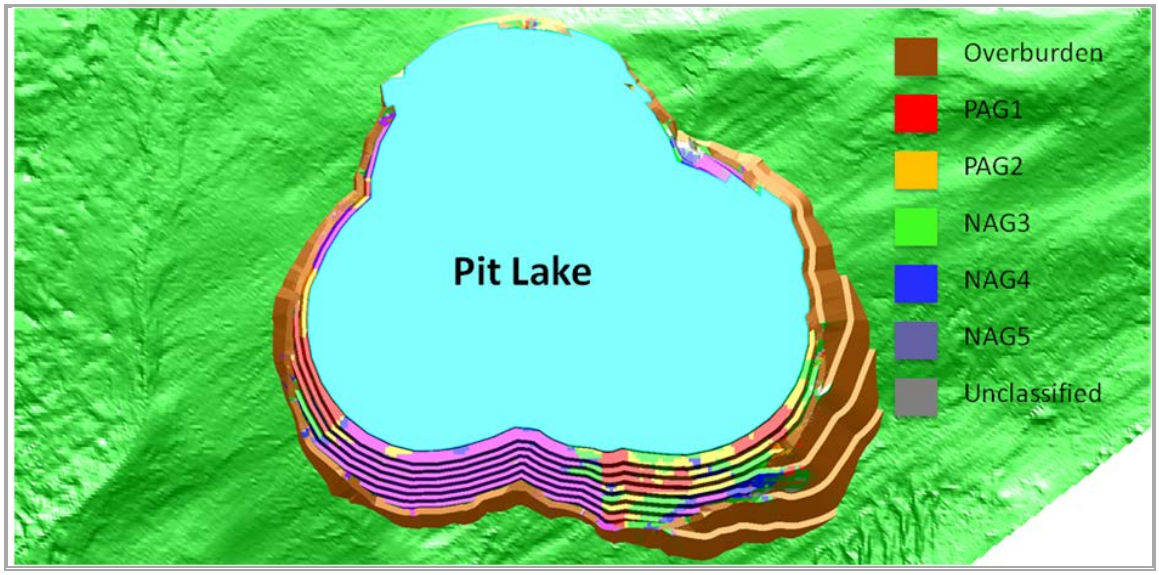


Figure 5-5: Block Model – ARD Classification of High Wall after Flooding of Open Pit

Table 5-4: Wall Rock Exposure ARD Classification

	PAG 1	PAG 2	NAG 3	NAG 4	NAG 5	OVB
Ultimate Walls	32%	10%	11%	6%	23%	16%
High Walls*	8%	8%	5%	5%	25%	48%

Note: *Area exposed after flooding of the pit lake

The location of waste rock blocks with less than 0.2% total sulphur is shown in **Figure 5-6**. In general total sulphur is lowest in upper and peripheral areas of the pit. Overburden is not plotted and is thickest in the southeast (bottom of the Figure).

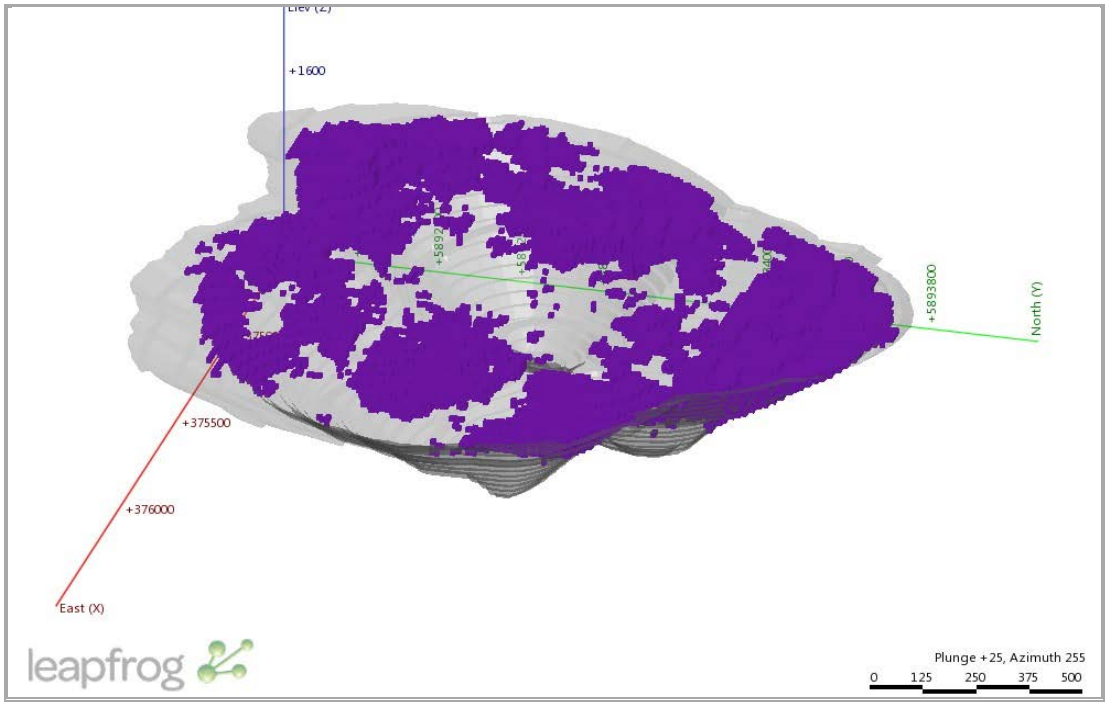


Figure 5-6: Waste Rock Blocks with <0.2 Total Sulphur

The location of waste rock blocks with NP greater than 10 total is shown in **Figure 5-7**. In this figure blocks with NP between 10 and 25, 25 and 50, and greater than 50 kg $CaCO_3$/t are green, yellow and purple respectively. As with total sulphur, these higher NP blocks tend to be in peripheral zones of the pit but do extend to greater depths than for total sulphur. The pit narrows with depth and waste rock blocks are closer to ore blocks that have higher total sulphur.

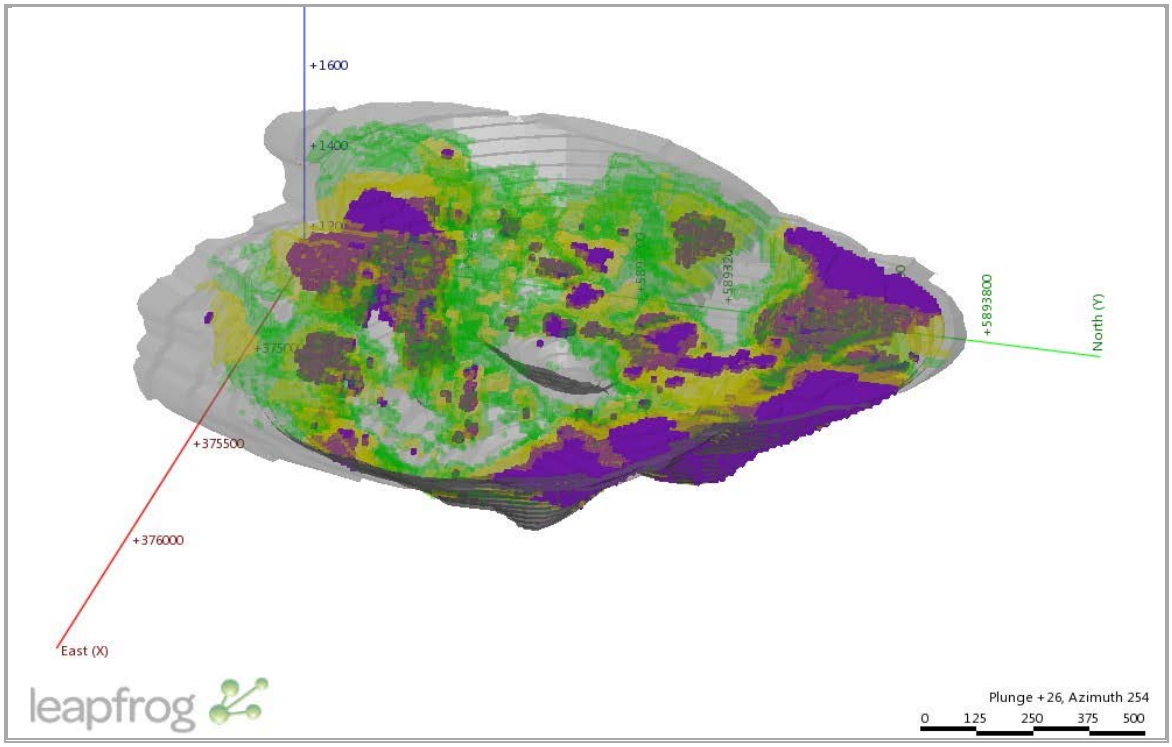


Figure 5-7: Waste Rock Blocks with > 10 kg CaCO3/t NP

Figure 5-8 shows the location of andesite (green) blocks and **Figure 5-9** shows andesite superimposed by NAG 4 (blue) and NAG 5 (purple) waste rock blocks. As expected NAG 4 and NAG 5 waste rock blocks generally correspond with low S and high NP blocks shown in the previous Figures. Also NAG 4 and NAG 5 waste rock blocks tend to be associated with andesite lithology suggesting identification of that lithology while mining will assist in waste segregation. The presence of calcite stringers was identified by New Gold geologists as characteristic of that lithology.

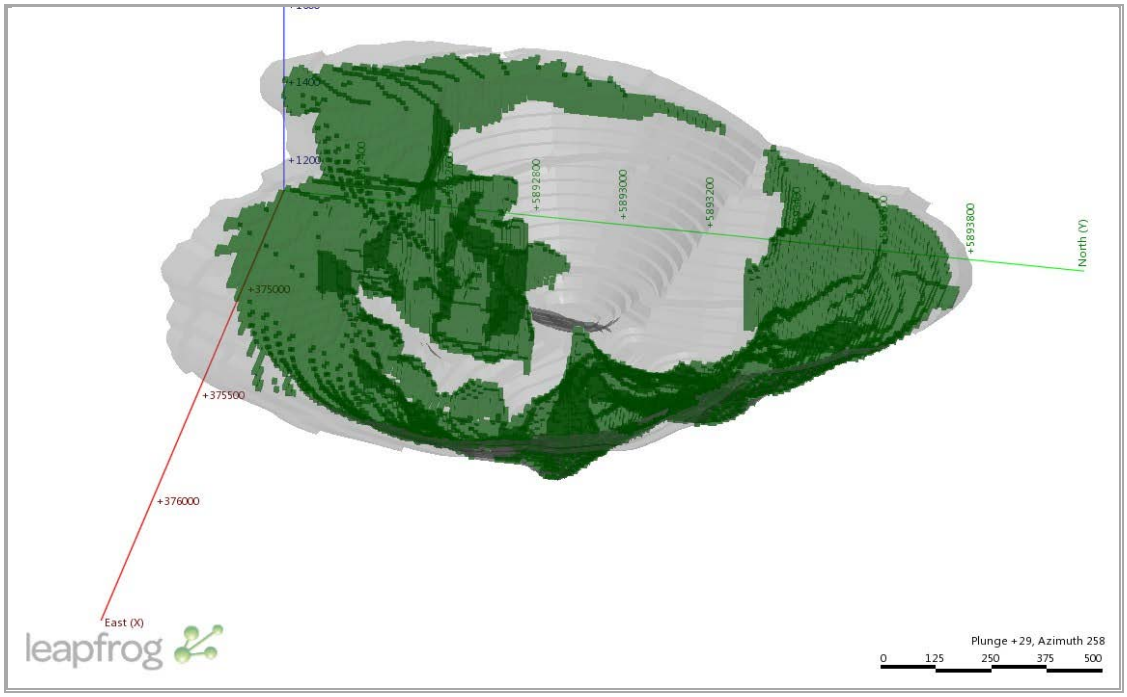


Figure 5-8 : Andesite Waste Rock Blocks

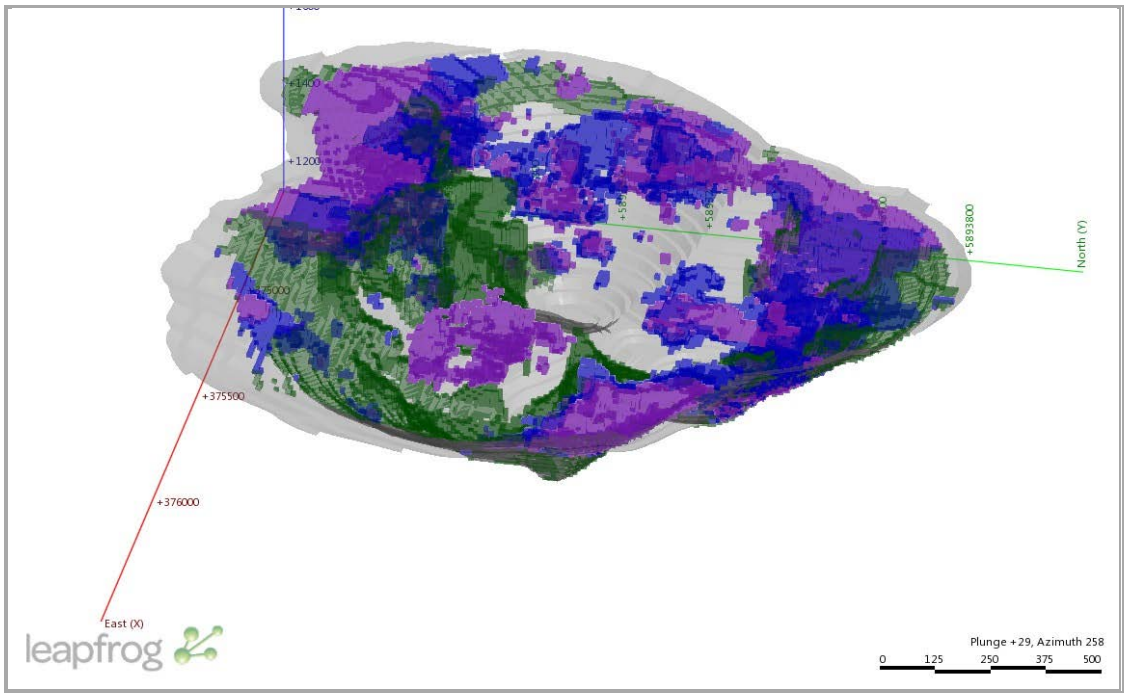


Figure 5-9: Andesite, NAG 4 and NAG 5 Waste Rock Blocks

In general, the location and largely contiguous nature of NAG 4 and NAG 5 blocks and tendency to associate with andesite lithology indicates that segregation should be relatively straight-forward during mining. Singleton NAG 4 and NAG 5 blocks should be handled as PAG and confirmatory testing of NAG 4 and NAG 5 blocks near boundaries with PAG 1, PAG 2 and NAG 3 blocks should be conducted. Confirmatory testing should involve ABA analyses with the NAG test substituted if a good correlation is established.

6.0 WATER QUALITY MODELLING

Predictive water quality models were developed to provide estimates for the drainage quality from several prominent mine features:

- Low-grade ore stockpile;
- Temporary ore stockpile;
- PAG and NAG 3 waste rock seepage from TSF;
- Combined East and West dump; and,
- Open pit

All water quality estimates were mass balance models and annual results were used as inputs to the overall Project water quality model. The models were built using tonnages and areas as reported in the environmental assessment (EA). There may be small differences between the EA and feasibility study tonnages and areas.

The following sections present results for acidity, alkalinity, sulphate, zinc, cadmium and iron concentrations. Complete results are given in **Annex 12**.

6.1 Assumptions Common to All Models

A number of assumptions were common to all the models. First, the surface area of ore and waste rock placed stockpiles, dumps or in the TSF was scaled up from the particle size measured in humidity cell testing to the surface area of waste rock based on the predicted fragmentation distribution. **Table 6-1** gives the calculated waste rock surface area for different types of waste rock. The average surface area of the waste rock was 0.065 m2/kg (65 m2/t).

Table 6-1: Calculated Waste Rock Surface Area

	Wet Weak Waste	Dry Weak Waste	Wet Strong Waste	Dry Strong Waste
Surface Area (m^2/kg)	0.066	0.060	0.066	0.066
Surface Area (m^2/t)	66	60	66	66

Second, the oxidation rate as measured by loadings rates from humidity cell tests were adjusted by a weighted annual average field temperature (Arrhenius correction). When the average monthly temperature was less than zero Celsius, the reaction rate was reduced to 20%. No reduction in rates was applied when the average monthly temperature was greater than zero Celsius. This resulted in a weighted annual rate of 66%.

Third, the density of waste rock was 2.08 t/m^3 and the overburden was 1.91 t/m^3 and had a swell ratio of 30% and 10%, respectively (Norwest, 2013a).

Finally, there was no ‘burn-out’ of sulphide minerals that drive oxidation.

6.2 Low Grade Ore Stockpile

At the end of mining the low grade ore stockpile will contain 57.7 Mt of low grade ore (the feasibility study tonnages in 50 Mt, and, thus, this model maybe considered conservative) . The cumulative tonnage in the stockpile is shown in **Figure 6-1**. The low grade ore will be processed during the final three years of operations at a rate of 19.2 Mt per year.

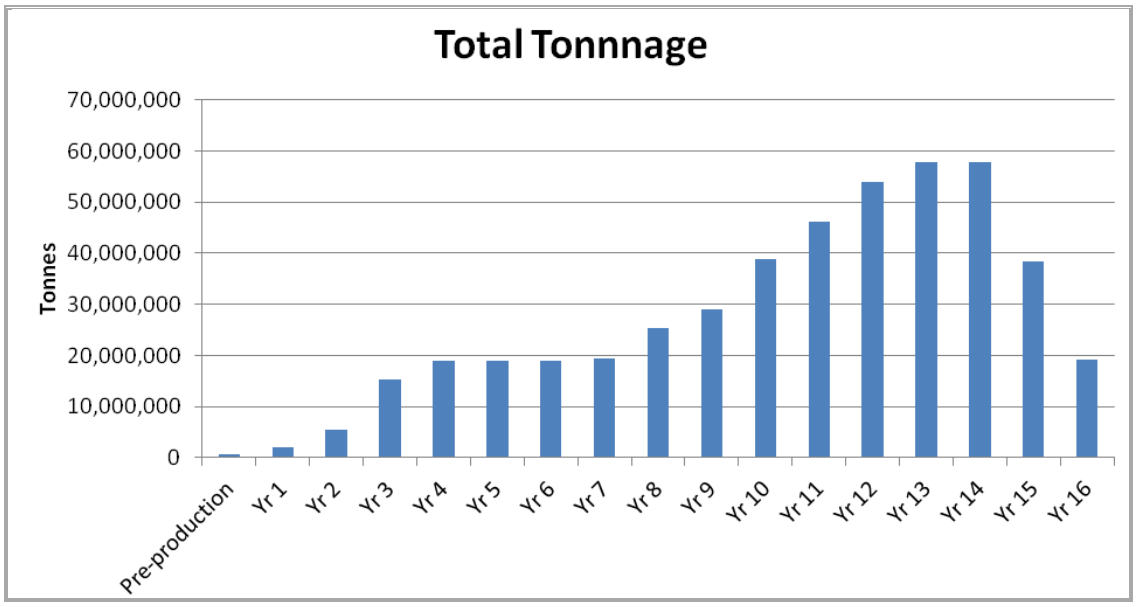


Figure 6-1: Low Grade Ore Stockpile Tonnage

The long-term average monthly runoff and infiltration volumes were obtained from the Preliminary Feasibility Study Water Balance Model report (Knight Piesold, 2013b).

Norwest Corp. provided the plan area of the stockpile for pre-production (years -1 and 0), and years 8 and 13 of operations. The final footprint will be 0.79 km^2. The annual plan area of the stockpile was extrapolated from these four data points.

6.2.1 Geochemical Source Term

The two low grade ore humidity cells (ARD2-10 and ARD-283) were used to calculate the source term for the model.

The low grade ore source term was calculated using the average load, as $mg/m^2/wk$, from both humidity cell tests after 20 weeks of testing. A summary of rates (in $mg/m^2/wk$) for each parameter measured is presented in **Table 6-2**. Values below the method detection limit were reported as the detection limit. Many parameters were less than detection limit including antimony, mercury, and selenium.

Table 6-2: Low Grade Ore Loading Rates (mg/m^2/wk)

Parameter	ARD 2-10 AVG (Wks 20-27)	ARD 283 AVG (Wks 20-52)
pH	3.4	3.2
Acidity	4.4	4.2
Alkalinity	0.04	0.03
Sulphate	4.3	4.3
Aluminum	0.17	0.18
Antimony	0.00002	0.00001
Arsenic	0.0003	0.0003
Barium	0.0001	0.0003
Beryllium	0.0001	0.0001
Bismuth	0.0001	0.0001
Boron	0.002	0.001
Cadmium	0.01	0.01
Calcium	0.01	0.08
Chromium	0.0001	0.00004
Cobalt	0.001	0.002
Copper	0.02	0.005
Iron	0.15	0.38
Lead	0.0002	0.0045
Lithium	0.0001	0.0002
Magnesium	0.02	0.05
Manganese	0.22	0.37
Mercury	0.0000002	0.0000002
Molybdenum	0.000012	0.00013
Nickel	0.0003	0.0027
Phosphorus	0.005	0.005
Potassium	0.01	0.05
Selenium	0.00002	0.00001
Silicon	0.16	0.18
Silver	0.000003	0.000005
Sodium	0.01	0.02
Strontium	0.0001	0.0005
Sulphur	1.5	1.6
Thallium	0.000003	0.000004
Tin	0.000024	0.000011
Titanium	0.0002	0.0002
Uranium	0.0004	0.0001
Vanadium	0.0002	0.0001
Zinc	1.5	0.8

6.2.2 Model Structure and Assumptions

The following assumptions represent the base case assumptions for the low grade ore stockpile:

- The only contribution to drainage quality was from the low grade ore.
- The drainage quality was a combination of loads from both infiltration and runoff of the stockpile.

6.2.3 Low Grade Ore Stockpile Results

Annual drainage quality results for acidity, alkalinity, sulphate, zinc, cadmium, and iron are presented in **Table 6-3**. Complete results are in **Annex 12**. Since results are reported annually, the variability related to monthly changes in precipitation are not shown. Maximum drainage concentrations would likely occur in early spring and fall when precipitation events follow an extended dry period (summer and winter).

Although pH was not modelled, there was an excess of acidity compared to alkalinity. Drainage is expected to be acidic, based on the lab testing. The predicted unequilibrated concentration of zinc ranged from 364 to 876 mg/L (**Figure 6-2**), whereas cadmium ranged from 2.8 to 6.8 mg/L. Iron concentrations ranged from 85 to 192 mg/L (**Figure 6-3**).

Overall, drainage from the low grade ore stockpile is expected to be acidic with elevated metals. During operations, all drainage will be collected and neutralized, prior to pumping into the TSF. There will be no low grade ore stockpile at the end of operations.

Table 6-3: Annual Predicted Low Grade Ore Stockpile Drainage Quality

Year	Zn (mg/L)	Cd (mg/L)	Fe (mg/L)	Acidity (mg/L)	Alkalinity (mg/L)	Sulphate (mg/L)
Pre-prod	0	0	0	0	0	0
Yr 1	668	5.2	157	2547	20	2527
Yr 2	540	4.2	127	2059	16	2043
Yr 3	876	6.8	206	3340	26	3314
Yr 4	690	5.3	162	2632	21	2612
Yr 5	534	4.1	126	2038	16	2022
Yr 6	436	3.4	102	1663	13	1650
Yr 7	364	2.8	85	1387	11	1376
Yr 8	433	3.3	102	1653	13	1640
Yr 9	423	3.3	99	1613	13	1600
Yr 10	523	4	123	1994	16	1979
Yr 11	549	4.2	129	2095	17	2078
Yr 12	584	4.5	137	2227	18	2210
Yr 13	639	4.9	150	2438	19	2419
Yr 14	818	6.3	192	3120	25	3095
Yr 15	763	5.9	179	2911	23	2888
Yr 16	640	4.9	151	2442	19	2422

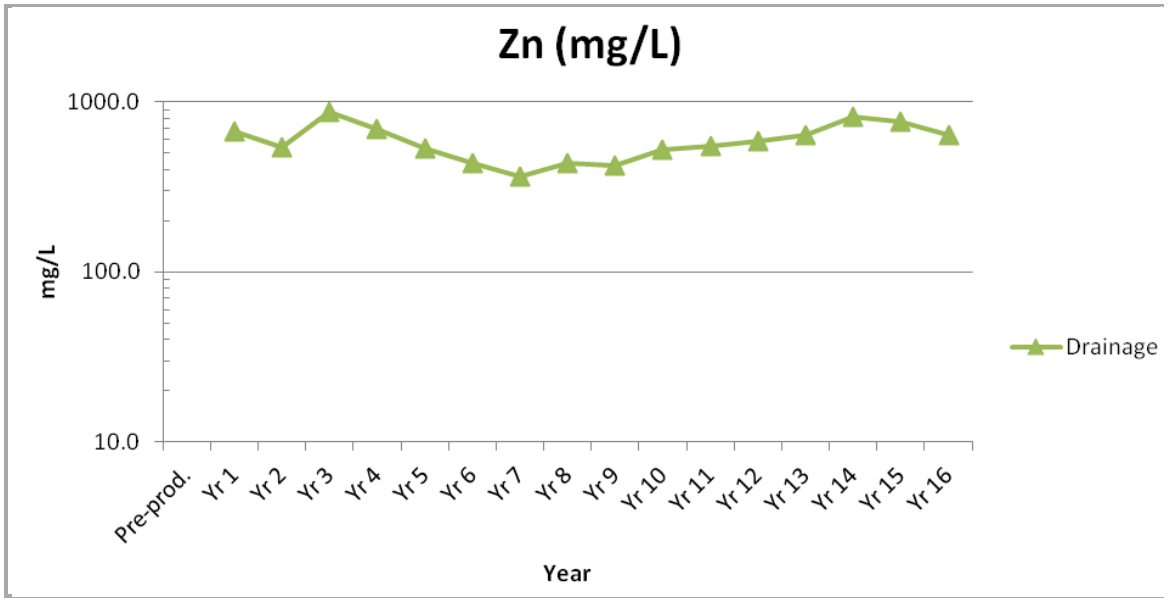


Figure 6-2: Predicted Low Grade Ore Stockpile Zinc Concentrations

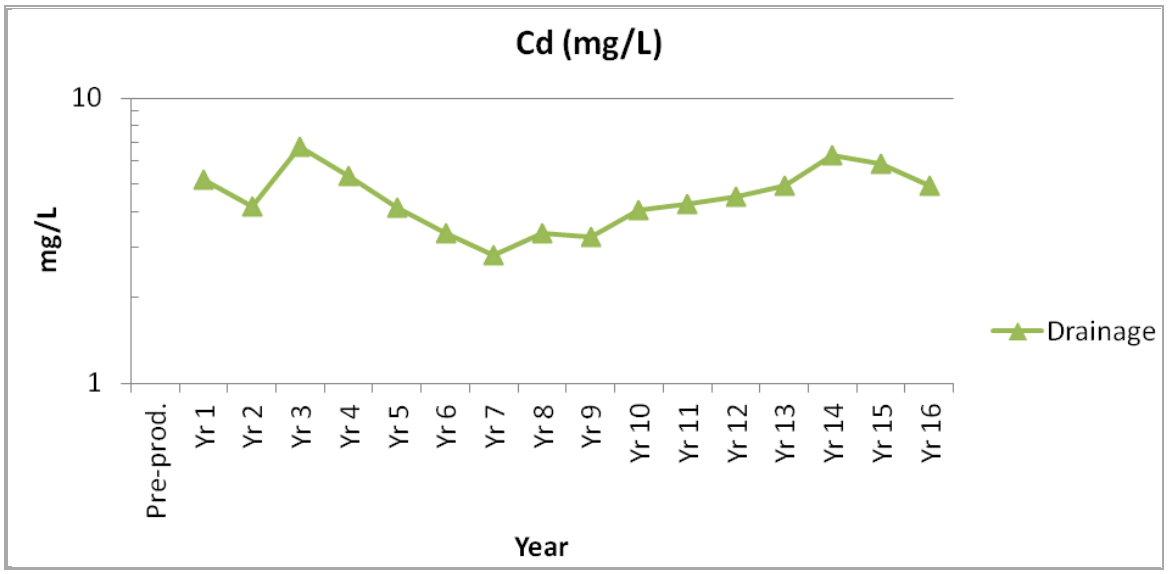


Figure 6-3: Predicted Low Grade Ore Stockpile Cadmium Concentrations

6.3 Temporary Ore Stockpile

During operations, the temporary ore stockpile will contain an average of 1.8 Mt of ore. The ore will have an average residence time up to 6 months in the stockpile before it is processed. NorWest Corp. provided the annual production of ore reporting to the temporary stockpile

(Norwest, 2013a). The monthly ore production rate changes three times throughout the life of mine operations as follows:

- Pre-production rate = 0.18 Mt/month
- Year 1 production rate = 1.3 Mt/month
- Year 2-13 production rate = 1.8 Mt/month

Processing of the ore begins in Year 1 at 80% of mill capacity to allow for a ramp-up period. Stockpiled ore from the pre-production years will be processed during the ramp-up period. During years 2-13 of operations, the ore will be processed at maximum mill capacity.

The total monthly tonnage of stockpiled ore is presented in **Figure 6-4** for pre-production, Years 1 through 3 and Year 13. During pre-production, no milling occurs and ore accumulates. From Year 2 until Year 13, the monthly rate of ore production equals the monthly rate of processing (e.g., 1.8 Mt/month) and the tonnage of the temporary ore stockpile is constant.

Unlike the low grade ore stockpile, the feasibility study water balance did not include the temporary ore stockpile. The long-term average monthly precipitation values were provided on the Preliminary Engineering Hydrometeorology Report (Knight Piésold, 2013). AMEC calculated a monthly water balance for the temporary ore stockpile that assumed 80% of the monthly precipitation was available to infiltrate or runoff the stockpile.

The approximate plan area of the temporary ore stockpile is 13.3 ha (J. Horton, pers. Comm.).

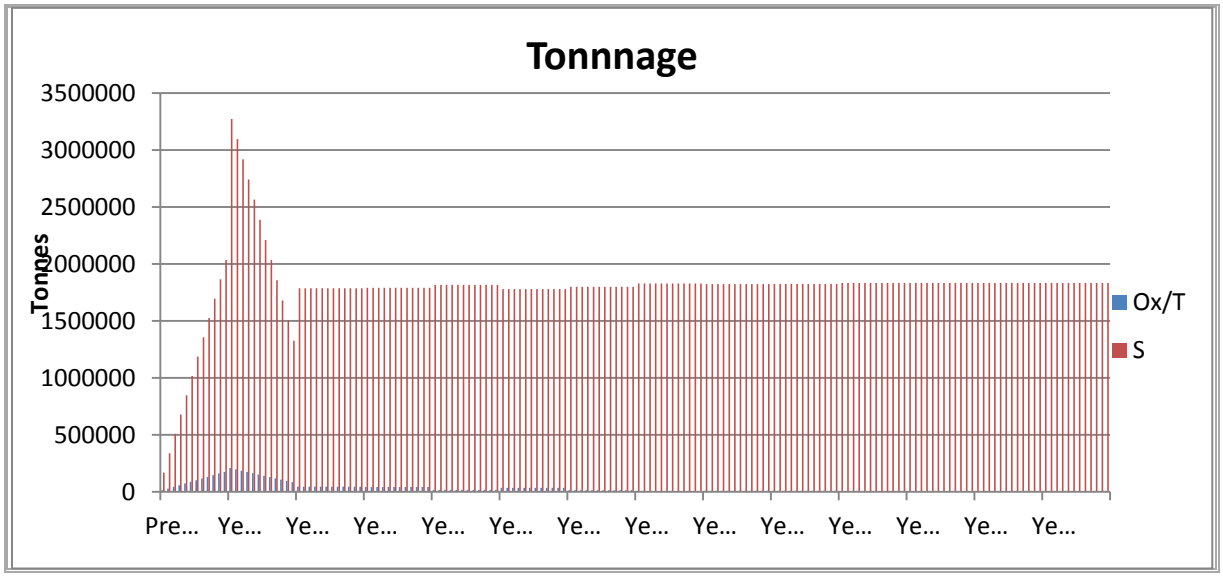


Figure 6-4: Monthly Tonnage of Ore in the Temporary Stockpile

6.3.1 Geochemical Source Term

The ore source term was calculated using the average first flush load (first five weeks) from the low grade ore humidity cell tests (ARD2-10 and ARD 283). A summary of rates (in mg/m^2/wk) for each parameter measured is presented in **Table 6-4**. Values less that method detection limits were reported as the detection limit. Parameters less than detection included mercury, molybdenum, selenium, and silver.

6.3.2 Model Structure and Assumptions

The following assumptions represent the base case assumptions for the temporary ore stockpile:

- The average annual footprint of the stockpile was constant throughout operations;
- The monthly water balance was constant from year to year;
- During operations the stockpiled ore has a 6-month residence time before reporting to the mill for processing;
- Sulphides minerals were assumed to be readily available and not depleted during the model period;
- No discharge of seepage occurred from the pile during months with temperatures less than zero degrees Celsius.

Table 6-4: Source Term Loading Rates from Low Grade Ore Humidity Cells

Parameter	Units	ARD 2-10	ARD 283
		AVG (Weeks 1-5)	AVG (Weeks 1-5)
pH		4.2	4.9
Acidity	mg/m2/wk	5.5	0.6
Alkalinity	mg/m2/wk	0.04	0.05
Sulphate	mg/m2/wk	7.1	3.2
Aluminum	mg/m2/wk	0.08	0.00
Antimony	mg/m2/wk	0.00007	0.00003
Arsenic	mg/m2/wk	0.0008	0.0005
Barium	mg/m2/wk	0.0001	0.0006
Beryllium	mg/m2/wk	0.0002	0.0000
Bismuth	mg/m2/wk	0.0002	0.0000
Boron	mg/m2/wk	0.004	0.001
Cadmium	mg/m2/wk	0.01	0.00
Calcium	mg/m2/wk	0.33	0.47
Chromium	mg/m2/wk	0.0002	0.00005
Cobalt	mg/m2/wk	0.013	0.002
Copper	mg/m2/wk	0.00	0.000
Iron	mg/m2/wk	0.71	0.10

Parameter	Units	ARD 2-10	ARD 283
		AVG (Weeks 1-5)	AVG (Weeks 1-5)
Lead	mg/m2/wk	0.0005	0.0002
Lithium	mg/m2/wk	0.0002	0.0002
Magnesium	mg/m2/wk	0.20	0.09
Manganese	mg/m2/wk	0.63	0.72
Mercury	mg/m2/wk	0.0000002	0.0000002
Molybdenum	mg/m2/wk	0.000019	0.00001
Nickel	mg/m2/wk	0.0085	0.0035
Phosphorus	mg/m2/wk	0.005	0.006
Potassium	mg/m2/wk	0.03	0.27
Selenium	mg/m2/wk	0.00004	0.00001
Silicon	mg/m2/wk	0.12	0.08
Silver	mg/m2/wk	0.000004	0.000001
Sodium	mg/m2/wk	0.03	0.08
Strontium	mg/m2/wk	0.0011	0.0029
Sulphur	mg/m2/wk	2.6	1.4
Thallium	mg/m2/wk	0.000005	0.000001
Tin	mg/m2/wk	0.000039	0.000009
Titanium	mg/m2/wk	0.0002	0.0002
Uranium	mg/m2/wk	0.0009	0.0000
Vanadium	mg/m2/wk	0.0004	0.0001
Zinc	mg/m2/wk	2.0	0.1

6.3.3 Temporary Ore Stockpile Results

Annual drainage quality results for acidity, alkalinity, sulphate, zinc, cadmium, and iron are presented in **Table 6-5**. Complete results are in **Annex 12**.

Although pH was not modelled, model results indicated an excess of acidity compared to alkalinity that suggests the stockpile drainage will be acidic. The predicted zinc concentrations ranged from 34 to 1093 mg/L (**Figure 6-5**). Cadmium concentrations ranged from 0.15 to 5.0 mg/L (**Figure 6-6**). Both zinc and cadmium concentrations were greater than the BCWQO. Iron concentrations in the seepage ranged from 13 to 422 mg/L. Maximum concentrations are predicted to occur in April associated with the freshet and release of metal loads that accumulated during the winter months.

Overall, drainage from the temporary ore stockpile is expected to be acidic with elevated metals. During operations, all drainage will be collected and neutralized, prior to pumping into the TSF. The ore stockpile will be fully processed by the end of milling.

Table 6-5: Predicted Monthly Concentrations from the Temporary Ore Stockpile

Year	Month	Acidity (mg/L)	Alkalinity (mg/L)	Sulphate (mg/L)	Cd (mg/L)	Fe (mg/L)	Zn (mg/L)
Pre-prod.	April	829	6.2	868	1.7	58	221
	May	174	1.3	182	0.4	12	46
	June	146	1.1	153	0.3	10.2	39.0
	July	216	1.6	227	0.4	15	58
	Aug	254	1.9	266	0.5	18	68
	Sept	313	2.3	328	0.6	22	83
	Oct	531	4.0	556	1.1	37	141
Year 1	April	4687	35	4911	9.5	325	1248
	May	631	4.7	661	1.3	44	168
	June	367	2.8	384	0.7	25	98
	July	410	3.1	430	0.8	28	109
	Aug	379	2.8	397	0.8	26	101
Year 2	April	1115	8.4	1168	2.3	77	297
	May	290	2.2	304	0.6	20	77
	June	220	1.6	230	0.4	15	58
	July	279	2.1	292	0.6	19	74
	Aug	284	2.1	298	0.6	20	76
	Sept	308	2.3	323	0.6	21	82
	Oct	468	3.5	490	0.9	32	125
Year 3	April	1115	8.4	1168	2.3	77	297
	May	290	2.2	304	0.6	20	77
	June	220	1.6	230	0.4	15	58
	July	279	2.1	292	0.6	19	74
	Aug	284	2.1	298	0.6	20	76
Year 4	April	1115	8.4	1168	2.3	77	297
	May	290	2.2	304	0.6	20	77
	June	220	1.6	230	0.4	15	58
	July	279	2.1	292	0.6	19	74
	Aug	284	2.1	298	0.6	20	76
	Sept	308	2.3	323	0.6	21	82
	Oct	468	3.5	490	0.9	32	125
Year 5	April	1103	8.3	1156	2.2	77	294
	May	287	2.2	301	0.6	20	76
	June	217	1.6	228	0.4	15	58
	July	276	2.1	289	0.6	19	73
	Aug	281	2.1	295	0.6	20	75
Year 6	April	1103	8.3	1156	2.2	77	294
	May	287	2.2	301	0.6	20	76
	June	217	1.6	228	0.4	15	58
	July	276	2.1	289	0.6	19	73
	Aug	281	2.1	295	0.6	20	75
	Sept	305	2.3	320	0.6	21	81
	Oct	463	3.5	485	0.9	32	123
Year 7	April	1115	8.4	1168	2.3	77	297
	May	290	2.2	304	0.6	20	77
	June	220	1.6	230	0.4	15	58
	July	279	2.1	292	0.6	19	74
	Aug	284	2.1	298	0.6	20	76
Year 8	April	1115	8.4	1168	2.3	77	297
	May	290	2.2	304	0.6	20	77
	June	220	1.6	230	0.4	15	58
	July	279	2.1	292	0.6	19	74
	Aug	284	2.1	298	0.6	20	76
	Sept	308	2.3	323	0.6	21	82
	Oct	468	3.5	490	0.9	32	125
Year 9	April	1115	8.4	1168	2.3	77	297
	May	290	2.2	304	0.6	20	77
	June	220	1.6	230	0.4	15	58
	July	279	2.1	292	0.6	19	74
	Aug	284	2.1	298	0.6	20	76
Year 10	April	1115	8.4	1168	2.3	77	297
	May	290	2.2	304	0.6	20	77
	June	220	1.6	230	0.4	15	58
	July	279	2.1	292	0.6	19	74
	Aug	284	2.1	298	0.6	20	76
	Sept	308	2.3	323	0.6	21	82
	Oct	468	3.5	490	0.9	32	125
Year 11	April	1115	8.4	1168	2.3	77	297
	May	290	2.2	304	0.6	20	77
	June	220	1.6	230	0.4	15	58
	July	279	2.1	292	0.6	19	74
	Aug	284	2.1	298	0.6	20	76
Year 12	April	1115	8.4	1168	2.3	77	297
	May	290	2.2	304	0.6	20	77
	June	220	1.6	230	0.4	15	58
	July	279	2.1	292	0.6	19	74
	Aug	284	2.1	298	0.6	20	76
	Sept	308	2.3	323	0.6	21	82
	Oct	468	3.5	490	0.9	32	125
Year 13	April	1115	8.4	1168	2.3	77	297
	May	290	2.2	304	0.6	20	77
	June	220	1.6	230	0.4	15	58
	July	279	2.1	292	0.6	19	74
	Aug	284	2.1	298	0.6	20	76
	Sept	308	2.3	323	0.6	21	82
	Oct	468	3.5	490	0.9	32	125

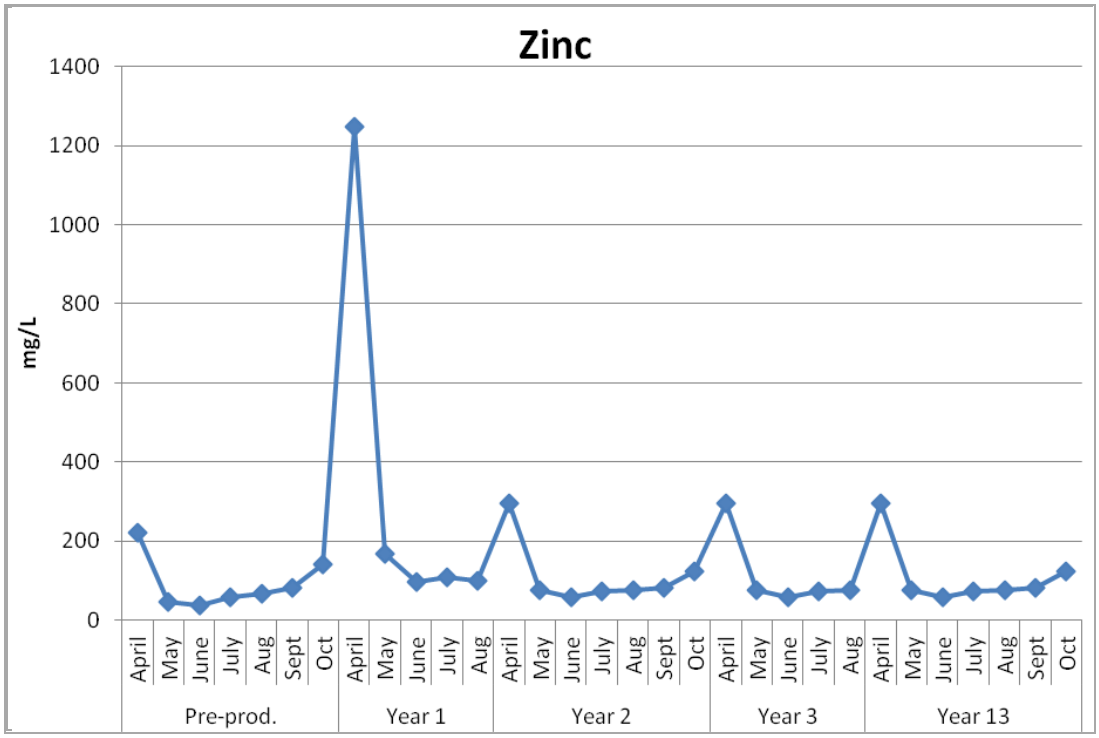


Figure 6-5: Predicted Temporary Ore Stockpile Zinc Concentrations

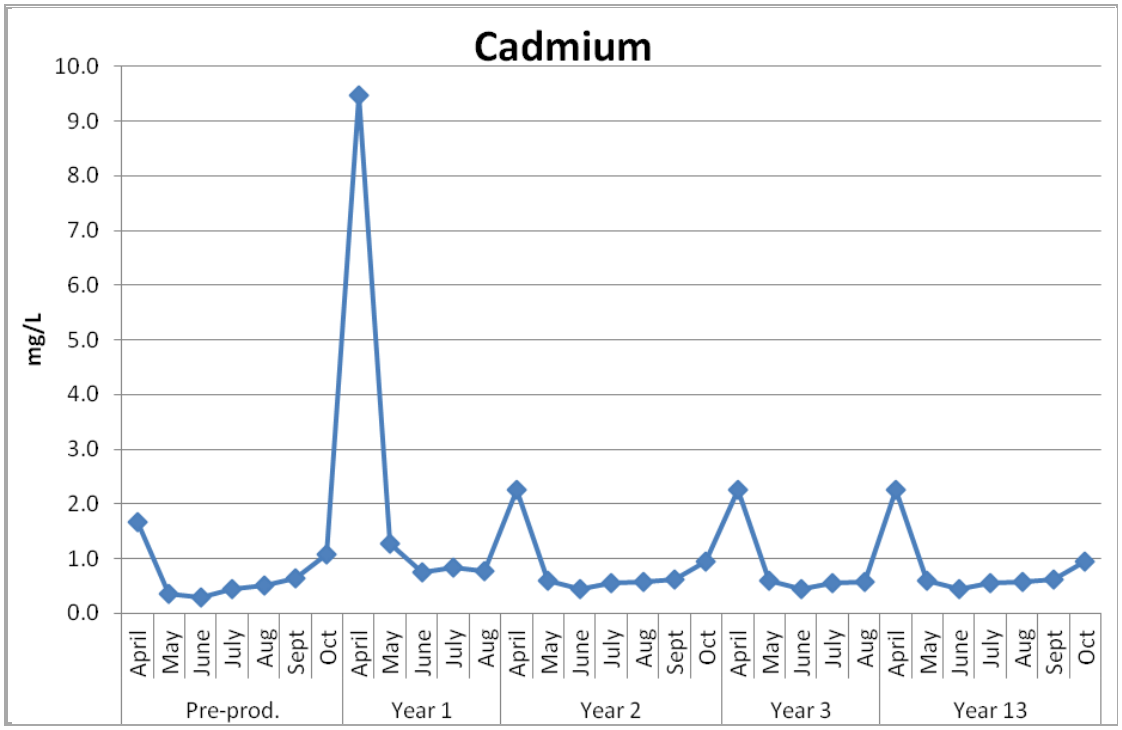


Figure 6-6: Predicted Temporary Ore Stockpile Cadmium Concentrations

6.4 Combined East and West Dump

The East and West Dumps will contain a mixture of NAG waste rock and overburden. The West Dump will contain NAG 4, NAG 5 and overburden. The East Dump will contain only NAG 5 and overburden. For simplicity, the dumps were modelled together and consequently, the results may be considered conservative for the East Dump. The West Dump will be progressively reclaimed during operations by placement of an overburden cover to reduce infiltration.

Norwest (2013a) provided the annual production of NAG 4 and NAG 5 waste rock and overburden reporting to both the East and West dumps. At the end of operations, the East Dump will contain 30.4 Mt of NAG 5 waste rock and 26.3 Mt of overburden. The West Dump will contain 30.4 Mt of NAG 4, 8.87 Mt of NAG 5 waste rock, and 38.7 Mt of overburden.

Norwest also provided the East and West Dumps plan areas for pre-production years, and years 8 and 13 of operations. The final footprint of the East and West dumps are 1.5 km^2 and 1.6 km^2. The annual plan area of the dumps was interpolated between these four data points. It was assumed that annual progressive reclamation of the West Dump would begin two years after the initial placement of waste rock.

The long-term average monthly runoff and infiltration volumes were provided from the Preliminary Feasibility Study Water Balance Model (Knight Piesold, 2013c).

6.4.1 Geochemical Source Terms

The East and West Dump model required three source terms; NAG 4, NAG 5 and overburden (**Table 6-6**).

Table 6-6: Geochemical Tests Used to Calculate Source Terms

Material	Source Term Testing
NAG 4	HC ARD-338 HC ARD-468
NAG 5	HC ARD-610
Overburden	Monitoring Station WQ10

The waste rock source terms were calculated using the average load from the humidity cell tests excluding the first five weeks of testing (i.e., the first flush). A summary of rates for the waste rock for each parameter measured is presented in **Table 6-7**.

Values less than the method detection limits (MDLs) were reported as the detection limit. Parameters with results less than detection limit for the waste rock include copper, iron, lead, mercury, nickel, selenium and silver.

Table 6-7: Summary of Humidity Cell Loading Rates for NAG 4 and NAG 5 Waste Rock (mg/m^2/wk)

	Type 4 WR		Type 5 WR
Parameter	**HC 338 (n=41)**	**HC 468 (n=28)**	**HC 610 (n=41)**
Acidity	0.04	0.05	0.04
Alkalinity	0.59	0.44	0.52
Sulphate	0.36	0.47	0.48
Aluminum	0.0008	0.0014	0.0011
Antimony	0.0004	0.0002	0.0002
Arsenic	0.0001	0.0000	0.0004
Barium	0.00002	0.0001	0.00003
Beryllium	0.000002	0.000002	0.000002
Bismuth	0.00001	0.00001	0.00001
Boron	0.0002	0.0002	0.0002
Cadmium	0.0000	0.0000	0.0000
Calcium	0.33	0.31	0.34
Chromium	0.00001	0.00001	0.00001
Cobalt	0.00000	0.00001	0.00000
Copper	0.00001	0.00001	0.00001
Iron	0.00049	0.00050	0.00049
Lead	0.00005	0.00000	0.00000
Lithium	0.00016	0.00004	0.00017
Magnesium	0.01	0.03	0.004
Manganese	0.0005	0.0091	0.0001
Mercury	0.0000002	0.0000002	0.0000002
Molybdenum	0.00002	0.00001	0.00002
Nickel	0.00001	0.00001	0.00001
Phosphorus	0.005	0.005	0.005
Potassium	0.04	0.05	0.07
Selenium	0.000002	0.000002	0.000002
Silicon	0.03	0.02	0.04
Silver	0.0000005	0.0000002	0.0000002
Sodium	0.06	0.003	0.04
Strontium	0.002	0.001	0.002
Sulphur	0.12	0.17	0.17
Thallium	0.0000002	0.0000002	0.000001
Tin	0.000002	0.000002	0.000002
Titanium	0.0002	0.0002	0.0002
Uranium	0.000002	0.000009	0.000001
Vanadium	0.00002	0.00002	0.00004
Zinc	0.0001	0.00005	0.0001

There was no kinetic testing of overburden material as part of the ML/ARD characterization. In the absence of kinetic testing, it was assumed that the leachate quality of the overburden was represented by the average water quality results at monitoring station WQ10 (n = 32, March 2011 through April 2013, **Table 6-8**). Station WQ10 is located in the drainage basin hosting the Blackwater ore deposit that has had extensive surface disturbances including site clearing and drilling during the monitoring period. Water tested at that location is assumed to represent drainage from overburden.

Table 6-8: Average Water Quality Results from Monitoring Station WQ10

Parameter	Units	Count	Average
Alkalinity	mg/L	32	31.5
Sulphate	mg/L	32	1.6
Aluminum	mg/L	22	0.1
Antimony	mg/L	17	0.00005
Arsenic	mg/L	22	0.0004
Barium	mg/L	22	0.006
Beryllium	mg/L	17	0.0001
Boron	mg/L	18	0.001
Cadmium	mg/L	17	0.00002
Calcium	mg/L	22	8.6
Chromium	mg/L	18	0.0003
Cobalt	mg/L	17	0.00003
Copper	mg/L	20	0.0003
Iron	mg/L	22	0.07
Lead-D	mg/L	17	0.00006
Lithium	mg/L	17	0.001
Magnesium	mg/L	22	1.7
Manganese	mg/L	22	0.002
Mercury	mg/L	17	0.000007
Molybdenum	mg/L	22	0.0004
Nickel	mg/L	19	0.0002
Phosphorus	mg/L	17	0.01
Potassium	mg/L	20	0.5
Selenium	mg/L	17	0.0006
Silicon	mg/L	22	5.5
Silver	mg/L	17	0.00005
Sodium	mg/L	22	2.4
Strontium	mg/L	22	0.06
Thallium	mg/L	17	0.00005
Tin	mg/L	17	0.0001
Titanium	mg/L	21	0.001
Uranium	mg/L	22	0.0002
Vanadium	mg/L	18	0.0002
Zinc	mg/L	22	0.003

6.4.2 Model Structure and Assumptions

The following assumptions represent the base case assumptions for the East and West Dumps:

- Load was from NAG 4, NAG 5 and overburden.
- During closure and post-closure, runoff from the reclaimed waste rock dumps was assumed to equal surface water quality monitoring station WQ10.
- Reclamation of the dumps would decrease infiltration to 65%.
- The model assumed constant oxidation rates and that placement of the fine grained overburden cover would not inhibit oxidation of the waste rock.

6.4.3 East and West Dump Results

Annual drainage quality results for acidity, alkalinity, sulphate, zinc, cadmium, and iron are presented in **Table 6-9**. Complete results are in **Annex 12**.

This model is for a combined East and West Dumps that contain NAG 4, NAG 5 and overburden. The feasibility study plans will have only NAG 5 and overburden placed in the East Dump. During operations, all drainage from the East/West waste rock dumps will be directed to the TSF. Drainage during post-closure from the West Dump will flow to the TSF. Drainage from the NAG 5 and overburden East Dump might be directed to Creek 661 if the water quality is found to be accepTable. The modelled results for the combined East and West Dumps are likely higher than the results expected for the East Dump which will contain only NAG 5 and overburden.

This annual model does not capture the monthly variations due to changes in precipitation. It is expected that maximum concentrations in the early spring and fall, when precipitation follows a dry (or frozen) period may be higher than the results presented here. The drainage had greater concentrations of alkalinity compared to acidity. Drainage is expected to be neutral or slightly alkaline pH, in line with laboratory testing of the NAG 4 and NAG 5 waste rock.

Table 6-9: Predicted Annual Drainage Chemistry from Combined East and West Dumps

Year	Zn (mg/L)	Cd (mg/L)	Fe (mg/L)	Acidity (mg/L)	Alkalinity (mg/L)	Sulphate (mg/L)
Yr 1	0.005	0.0002	0.08	3.4	54	29
Yr 2	0.01	0.0005	0.12	7.3	99	69
Yr 3	0.014	0.0008	0.15	11	138	105
Yr 4	0.011	0.0006	0.13	8.2	110	78
Yr 5	0.01	0.0006	0.12	7.7	103	73
Yr 6	0.012	0.0007	0.13	9.2	120	89
Yr 7	0.011	0.0006	0.13	8.3	110	79
Yr 8	0.01	0.0005	0.12	7.4	101	70
Yr 9	0.012	0.0007	0.13	8.8	115	85
Yr 10	0.015	0.0008	0.15	11.2	142	109

Year	Zn (mg/L)	Cd (mg/L)	Fe (mg/L)	Acidity (mg/L)	Alkalinity (mg/L)	Sulphate (mg/L)
Yr 11	0.014	0.0008	0.15	10.3	134	100
Yr 12	0.013	0.0007	0.14	9.5	125	92
Yr 13	0.012	0.0007	0.13	8.9	118	85
Yr 14	0.011	0.0006	0.13	8.3	111	79
Yr 15	0.01	0.0006	0.12	7.7	104	73
Yr 16	0.01	0.0005	0.12	7.3	98	69
Yr 17	0.009	0.0005	0.11	6.9	93	65
Closure Yr 1	0.009	0.0005	0.11	6.6	91	62
Closure Yr 10	0.009	0.0005	0.11	6.6	91	62
Closure Yr 25	0.009	0.0005	0.11	6.6	91	62
Closure Yr 50	0.009	0.0005	0.11	6.6	91	62

During operations, the predicted zinc concentrations ranged from 0.005 to 0.015 mg/L (**Figure 6-7**). During closure, the zinc drainage concentration was 0.009 mg/L following reclamation of the dump surfaces. The BCWQO FWAL is hardness dependant. Assuming a hardness of 100 mg/L (the average carbonate hardness during operations), modelled zinc concentrations in the drainage were below the guideline value (Zn = 0.015 mg/L) throughout operations and closure.

Cadmium drainage concentrations increased from 0.0002 to 0.0008 mg/L (**Figure 6-8**). During closure, the cadmium concentration was 0.0005 mg/L.

The concentration of iron in the seepage ranged from 0.08 to 0.15 mg/L. Following year 3 of operations, the iron concentrations in the seepage were below the BCWQO FWAL maximum guideline value for Fe (0.35 mg/L).

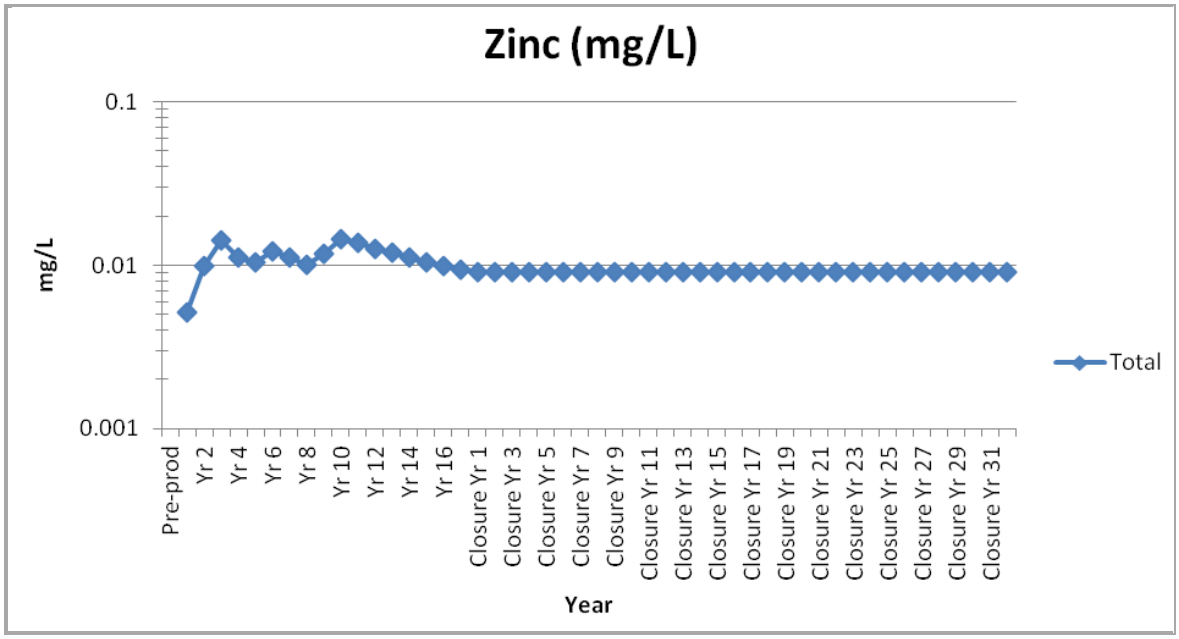


Figure 6-7: Predicated Zinc Concentrations in East and West Dump Drainage

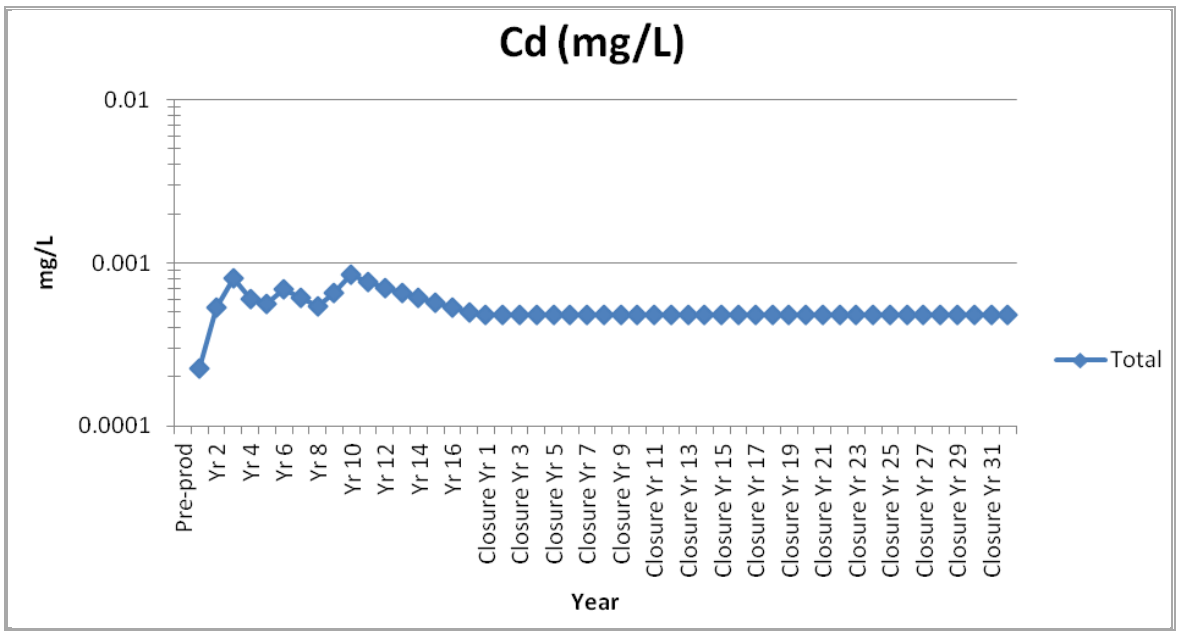


Figure 6-8: Predicated Cadmium Concentrations in East and West Dump Drainage

6.5 Waste Rock in the Tailings Storage Facility

PAG 1, PAG 2, NAG 3 waste rock and a small amount of low grade ore (below LGS stockpile cut-off) will be permanently submerged in the tailings storage facility (TSF). The waste rock TSF model was developed to calculate the water quality of PAG and NAG waste rock exposed to the atmosphere and then submerged in the TSF. The predicted quality for the mixed tailings and the waste rock interstitial water is presented in the surface water quality section of this report.

6.5.1 Material Balance

NorWest provided the annual production of waste rock and low grade ore reporting to the TSF (Norwest, 2013a). The annual distributions of waste rock and low grade ore are presented in **Figure 6-9** and the total tonnages and percentage distributions are shown in **Table 6-10**. As with the previous models, the feasibility study tonnages are slightly different than the ones used in this model and the results are not expected to affect the results. Additionally, the feasibility study does not have any low grade ore reporting to the TSF, therefore, having low grade ore in the this model may be considered conservative.

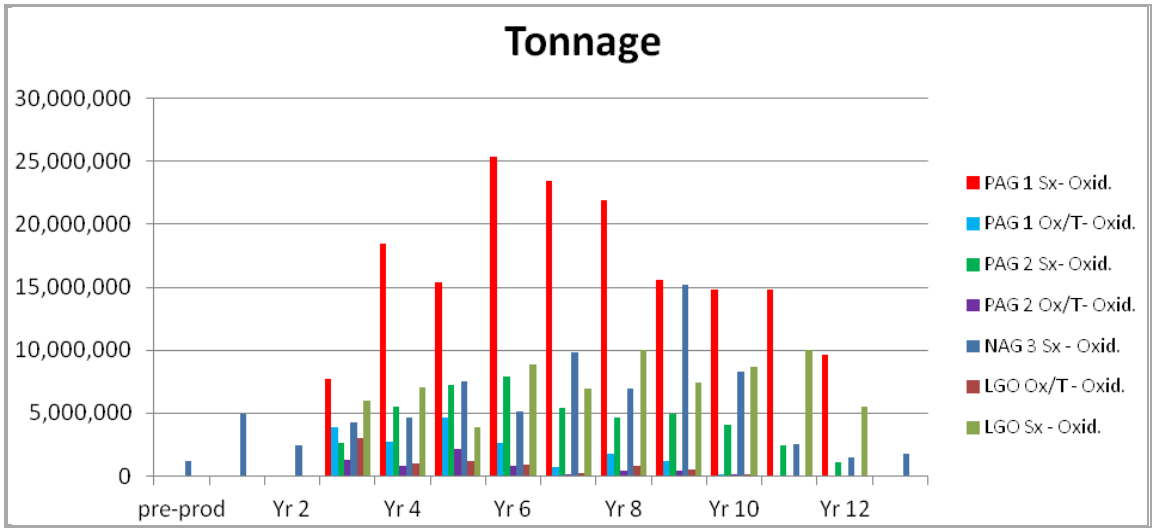


Figure 6-9: Annual Tonnages of Waste Rock and Low Grade Ore in the TSF

Table 6-10: Total Tonnage and Percent of Waste Rock and Low Grade Ore in the TSF

Material	Facies	Tonnes	Percent
PAG 1	Ox/Trans	17,558,989	4%
	Sx	166,941,011	42%
PAG 2	Ox/Trans	6,062,089	2%
	Sx	45,937,911	12%
Low Grade Ore	Ox/Trans	7,722,948	2%
	Sx	74,307,052	19%
NAG 3	Ox/Trans	-	-
	Sx	76,200,000	19%

The interstitial water was assumed to fill 100% of the waste rock voids. The water volume was calculated from annual tonnages of all material in the TSF multiplied by the waste rock void ratio. For this model calculation, the void ratio was assumed to be 30%. The model assumed that waste rock and low grade ore in the TSF were exposed for one year and then completely submerged instantaneously.

6.5.2 Geochemical Source Terms

Waste rock and low grade ore humidity cell results were used to calculate source terms for this model. A summary of the humidity cell tests used to develop the source terms is given in **Table 6-11**. The resulting source terms are shown in **Table 6-12**. As mentioned above, the feasibility study does not call for the placement of any low grade ore in the TSF and therefore the use of the low grade ore source term may be considered conservative.

Table 6-11: Humidity Cell Tests Used to Develop Waste Rock and Low Grade Ore Source Terms

Type	Facies	Test ID
PAG 1	Sx	HC 037
		HC 509
	Ox/T	HC 2-9
		HC 037
PAG 2	Sx	HC 566
		HC 499
	Ox/T	HC 176
		HC 537
		HC 510
		HC 288
Low Grade Ore	Sx	HC 2-10
		HC 283
	Ox/T	HC 2-10
		HC 283
NAG 3	Sx	HC 526
		HC 606
		HC 648
		HC 692
		HC 473
		HC 153
		HC 238
	Ox/T	NA

Table 6-12: Summary of Humidity Cell Loads (mg/m²/wk) from the PAG 1, PAG 2, NAG 3 and Low Grade Ore Humidity Cells

	Ox/Trans				Sx							Sx							Ox/Trans/Sx	
	Type 1 HC		Type 2 HC		Type 1 HC			Type 2 HC				Type 3 HC							LGO	
	HC 037 (n=70)	HC 509 (n=59)	HC 566 (n=38)	HC 499 (n=59)	HC 2-9 (n=96)	HC 037 (n=70)	HC 509 (n=59)	HC 176 (n=96)	HC 537 (n=59)	HC 510 (n=58)	HC 288 (n=92)	HC 526 (n=58)	HC 606 (n=30)	HC 648 (n=41)	HC 692 (n=39)	HC 473 (n=26)	HC 153 (n=17)	HC 238 (n=17)	HC 2-10 (n=27)	HC 283 (n=52)
Base Case Weighting	**50%**	**50%**	**50%**	**50%**	**10%**	**80%**	**10%**	**40%**	**25%**	**20%**	**15%**	**14%**	**14%**	**14%**	**14%**	**14%**	**14%**	**14%**	**50%**	**50%**
Acidity	0.8	0.9	0.08	0.04	10.1	0.8	0.9	0.1	0.3	0.05	0.2	0.1	0.1	0.1	0.1	0.05	0.04	0.07	4.4	4.2
Alkalinity	0.03	0.04	0.10	0.71	0.03	0.03	0.04	0.6	0.04	0.43	0.04	0.06	0.45	0.15	0.33	0.16	0.19	0.05	0.04	0.03
Sulphate	0.9	1.5	0.69	0.50	11.4	0.9	1.5	0.7	0.7	0.5	0.3	0.2	0.5	0.2	0.1	0.2	0.3	0.5	4.3	4.3
Aluminum	0.001	0.04	0.0006	0.0005	0.4	0.001	0.04	0.001	0.0001	0.002	0.001	0.001	0.002	0.002	0.004	0.0013	0.001	0.0005	0.2	0.2
Antimony	0.00003	0.0001	0.00010	0.0006	0.00003	0.00003	0.0001	0.0004	0.00001	0.0007	0.0001	0.00007	0.001	0.0002	0.0009	0.00011	0.00004	0.0001	0.00002	0.00001
Arsenic	0.0001	0.00002	0.00002	0.0005	0.00004	0.0001	0.00002	0.00005	0.00003	0.0002	0.0001	0.0001	0.0007	0.0001	0.00003	0.00003	0.0001	0.00003	0.0003	0.0003
Barium	0.0004	0.0005	0.0002	0.00004	0.0001	0.0004	0.0005	0.0001	0.00004	0.00003	0.0003	0.00002	0.00004	0.00002	0.00001	0.00014	0.00004	0.0003	0.0001	0.0003
Beryllium	0.00001	0.0001	0.000002	0.000002	0.0001	0.00001	0.0001	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.0001	0.0001
Bismuth	0.00004	0.00002	0.000009	0.000008	0.0001	0.00004	0.00002	0.000008	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000008	0.000008	0.00001	0.0001	0.0001
Boron	0.001	0.0004	0.0002	0.0002	0.002	0.001	0.0004	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.002	0.001
Cadmium	0.002	0.0002	0.00011	0.000002	0.01	0.002	0.0002	0.00003	0.0005	0.000001	0.0002	0.0001	0.000004	0.00001	0.000001	0.000005	0.000003	0.00005	0.01	0.01
Calcium	0.03	0.07	0.22	0.42	0.2	0.03	0.07	0.5	0.08	0.3	0.04	0.06	0.4	0.1	0.1	0.06	0.07	0.1	0.01	0.08
Chromium	0.00004	0.00002	0.000009	0.000008	0.0004	0.00004	0.00002	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000008	0.000008	0.000008	0.0001	0.00004
Cobalt	0.002	0.001	0.00003	0.000003	0.006	0.002	0.001	0.000004	0.001	0.00001	0.0003	0.00003	0.00001	0.00001	0.000002	0.00006	0.000006	0.00006	0.001	0.002
Copper	0.0001	0.002	0.000010	0.0000	0.01	0.0001	0.002	0.00001	0.0002	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000008	0.00001	0.000008	0.02	0.005
Iron	0.01	0.2	0.003	0.0005	0.9	0.01	0.2	0.0005	0.0005	0.0005	0.001	0.0009	0.001	0.0007	0.001	0.0005	0.002	0.0005	0.2	0.4
Lead	0.03	0.0004	0.0000009	0.0000009	0.01	0.03	0.0004	0.000001	0.000001	0.000001	0.0007	0.00001	0.000001	0.000002	0.000001	0.000008	0.000001	0.0003	0.0002	0.004
Lithium	0.0001	0.0002	0.00004	0.00011	0.0006	0.0001	0.0002	0.0002	0.0003	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.000141	0.0002	0.00007	0.0001	0.0002
Magnesium	0.03	0.02	0.02	0.015	0.20	0.03	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.003	0.01	0.01	0.01	0.02	0.05
Manganese	0.04	0.2	0.03	0.005	1.3	0.04	0.2	0.003	0.07	0.01	0.02	0.01	0.002	0.01	0.001	0.04	0.001	0.03	0.2	0.4
Mercury	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002
Molybdenum	0.000004	0.00001	0.000008	0.00005	0.00001	0.000004	0.00001	0.00002	0.000004	0.00002	0.000002	0.00007	0.00003	0.000007	0.00001	0.000028	0.00003	0.000002	0.00001	0.0001
Nickel	0.004	0.001	0.000010	0.000009	0.009	0.004	0.001	0.00001	0.0008	0.00001	0.0004	0.00004	0.00001	0.00001	0.00001	0.00004	0.00001	0.00004	0.0003	0.0027
Phosphorus	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Potassium	0.1	0.2	0.10	0.11	0.02	0.1	0.2	0.1	0.2	0.1	0.08	0.08	0.06	0.05	0.03	0.07	0.1	0.09	0.01	0.05
Selenium	0.00001	0.000004	0.000002	0.000002	0.00002	0.00001	0.000004	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.00002	0.00001
Silicon	0.06	0.1	0.09	0.06	0.2	0.06	0.1	0.04	0.1	0.04	0.04	0.1	0.04	0.03	0.03	0.03	0.1	0.04	0.2	0.2
Silver	0.000001	0.000001	0.0000002	0.0000002	0.00001	0.000001	0.000001	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.0000002	0.000003	0.000005
Sodium	0.01	0.01	0.023	0.014	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.02	0.0124	0.09	0.02	0.01	0.02
Strontium	0.0003	0.0004	0.0009	0.0011	0.002	0.0003	0.0004	0.002	0.0009	0.0008	0.0003	0.0005	0.002	0.0004	0.0003	0.0003	0.0004	0.001	0.0001	0.0005
Sulphur	0.4	0.5	0.25	0.18	3.7	0.4	0.5	0.2	0.3	0.2	0.1	0.1	0.2	0.1	0.03	0.065	0.1	0.2	1.5	1.6
Thallium	0.000008	0.000005	0.0000005	0.000002	0.000008	0.000008	0.000005	0.0000002	0.000008	0.000001	0.0000003	0.000002	0.0000004	0.0000002	0.0000002	0.0000006	0.0000003	0.000001	0.000003	0.000004
Tin	0.000008	0.000004	0.000002	0.000002	0.00002	0.000008	0.000004	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.0000017	0.000002	0.000002	0.000024	0.000011
Titanium	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Uranium	0.000003	0.0002	0.0000013	0.00002	0.0002	0.000003	0.0002	0.000001	0.0000002	0.000003	0.0000002	0.0000002	0.00001	0.000002	0.00002	0.0000004	0.0000003	0.0000002	0.0004	0.0001
Vanadium	0.0001	0.00004	0.00002	0.00004	0.0002	0.0001	0.00004	0.00003	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.000017	0.00003	0.00002	0.0002	0.0001
Zinc	0.4	0.04	0.014	0.00006	1.0	0.4	0.04	0.0003	0.1	0.0001	0.1	0.004	0.0001	0.0005	0.00005	0.003	0.0002	0.003	1.5	0.75

6.5.3 Model Structure and Assumptions

The following assumptions were made for the base case model:

- The contribution to water quality was from a combined load generated by oxidation of PAG 1, PAG 2, and NAG 3 waste rock and low grade ore.
- The waste rock and low grade ore was assumed to be exposed for 1 year prior to instantaneous submergence.

6.5.4 Model Results

Annual interstitial quality results are presented in **Table 6-13**. The results are calculated for the annual mass of waste rock and low grade ore placed in the TSF and does not incorporate mixing of these annual masses or mixing with TSF supernatant water (which is expected to be neutral to slightly alkaline pH and have excess alkalinity with low metal concentrations). The results are only representative of the water volume filling the void space of the flooded the waste rock and low grade ore without neutralization or mixing with TSF supernatant.

Table 6-13: Predicted Annual TSF Interstitial Water Quality from the Waste Rock and Low Grade Ore

Year	Zn (mg/L)	Cd (mg/L)	Fe (mg/L)	Acidity (mg $CaCO_3$/L)	Alkalinity (mg $CaCO_3$/L)	Sulphate (mg/L)
Pre-prod	0.02	0.0004	0.01	0.8	2.7	3.9
Yr 1	0.02	0.0004	0.01	0.8	2.7	3.9
Yr 2	0.02	0.0004	0.01	0.8	2.7	3.9
Yr 3	2.6	0.014	0.8	11	1.4	13.9
Yr 4	3.6	0.019	1.0	14	1.4	18.1
Yr 5	3.0	0.016	0.9	12	2.0	16.6
Yr 6	3.7	0.020	1.0	15	1.5	18.9
Yr 7	3.6	0.020	1.0	15	1.5	18.3
Yr 8	3.6	0.020	1.0	14	1.3	17.8
Yr 9	2.6	0.014	0.7	11	1.7	14.2
Yr 10	3.1	0.017	0.8	12	1.4	15.7
Yr 11	3.7	0.021	1.0	15	0.9	17.9
Yr 12	4.0	0.022	1.0	16	0.8	19.1
Yr 13	0.02	0.0004	0.01	0.8	2.7	3.9

The predicted zinc concentrations in the interstitial waters ranged from 0.02 to 4.0 mg/L (**Figure 6-10**). The concentrations changed as the amount and ARD class of the waste rock changed over the mine life.

Cadmium concentrations varied from 0.0004 to 0.02 mg/L (**Figure 6-11**).

Iron concentrations increased from 0.01 to 1.0 mg/L.

Although pH was not modelled, the results showed an excess of acidity compared with alkalinity.

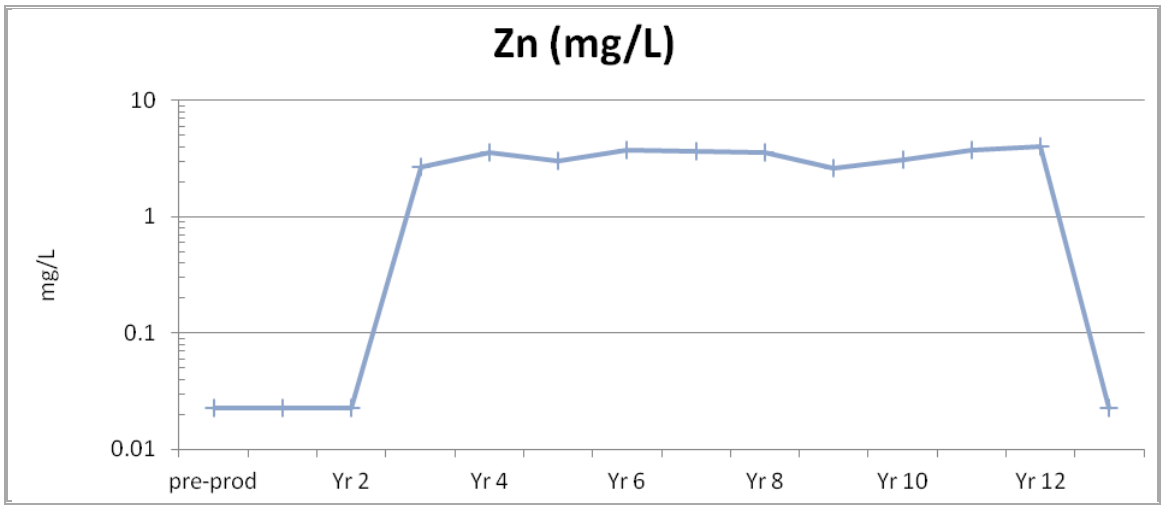


Figure 6-10: Predicted Seepage Zinc Concentrations

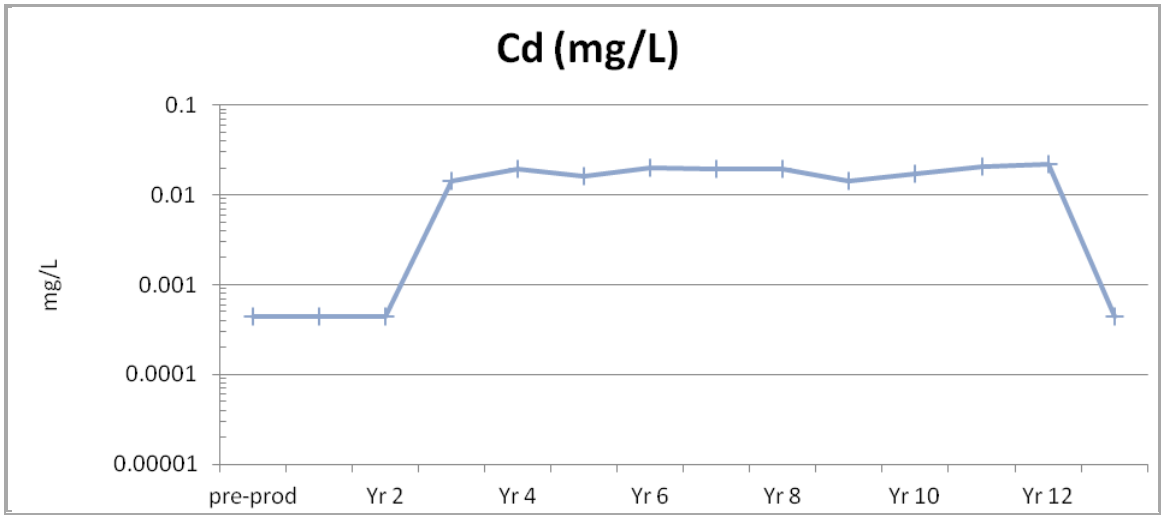


Figure 6-11: Predicted Seepage Cadmium Concentrations

6.5.5 Equilibrium Modelling

PHREEQC equilibrium modelling was conducted on one year of modelling results. The purpose of the modelling was to examine the quality of the interstitial water after flooding with tailings effluent as opposed to freshwater, which was the conservative base case.

Year 6 was chosen for modelling as it was the year with the greatest amount of PAG 1 and PAG 2 waste reporting to the TSF. Results of the 7-day ageing test for tailings supernatant was

mixed with the Year 6 model results in PHREEQC. The 7-day ageing test had slightly alkaline pH and elevated alkalinity compared to the base case. Metal concentrations were generally lower in the 7-day ageing test compared to the base case, with the exception of copper.

A comparison of the equilibrated PHREEQC results to the base case is presented in **Table 6-14**. Results of equilibrium modelling suggested that mixing with the tailings supernatant water would increase pH of the waste rock and low grade ore seepage to a neutral pH. Metal concentrations decreased due to precipitation at higher pH values.

Table 6-14: Comparison Base Case and PHREEQC Seepage Concentrations

	Base Case Year 6	Tailings Supernatant 7 Day Ageing	PHREEQC
pH	3.5	8.3	6.6
As (mg/L)	0.0012	0.022	0.011
Cd (mg/L)	0.020	0.00026	0.010
Cu (mg/L)	0.013	0.022	0.017
Fe (mg/L)	1.0	1.1	1.0
Pb (mg/L)	0.18	0.0003	0.090
Zn (mg/L)	3.7	0.002	1.9
SO_4 (mg/L)	18.9	1200	610
Alkalinity (mg/L)	-	68	38.3

6.6 Open Pit

The ultimate open pit will be approximately 2 km from east to west and 1.5 km long north to south with anticipated maximum depth of 550 m (AMEC, 2012). The open pit will be mined for about thirteen years and the processing plant will continue operations for an additional about three years to process the low grade ore stockpile. During operations, water pumped from the open pit will be sent to the TSF. At the end of mining operations (Year 13), water will no longer be pumped from the pit and the natural flow of surface water and groundwater re-established in order to flood the pit and minimize sulphide oxidation along the pit wall surface. At Year 17, fresh water from Tatelkuz Lake will be supplied into the pit. The excess water from the TSF Pond will be pumped into the pit starting in the last quarter of Year 17 to accelerate the refilling process. Approximately 20 years after the end of pit operations, the pit lake will reach its maximum extent and will discharge to the TSF (Knight Piesold, 2013d). All the pit rock will be flooded with the exception of an exposed rock and overburden high wall. Note that the model used a water balance that started pumping into the pit at Year 15, with filling and discharge into the TSF at Year 35. The changes in the timing of these events are not expected to have a significant impact on the results presented in the subsequent tables and figures.

6.6.1 Pit Model Description

The water quality model described in this report was developed to estimate the expected quality of water from the open pit during operations and through closure and post closure. A mass balance model was developed using calculated annual loadings from the pit wall rock, groundwater inflow, undisturbed catchment water and other source of geochemical loads. Source terms were developed using data derived from laboratory testing of mine wastes and site water quality measurements. Mean annual pit discharge concentrations of sulphate and metals were calculated from the annual loadings coupled with the estimated total pit water volume.

The water quality model included estimation of relevant parameters listed in the BCMOW wildlife guidelines.

6.6.2 Model Assumptions and Data Sources

This section provides additional details and describes the data sources and assumptions used in the pit model.

6.6.3 Exposed Pit Surface Area

NorWest provided the exposed pit surface areas used for the model which included annual surface area estimates for pre-production (Years -2 and -1), pit mine life (Years 1 to 13) and pit closure (Year 14) (Norwest Corporation, 2013b). The mine plan and ARD block model information was used to categorize the pit wall surface area according to rock type, e.g., PAG 1, PAG 2, NAG 3, NAG 4, NAG 5 and overburden. Undefined or unclassified rock was assumed to be PAG 1 for the purposes of the open pit model.

The cumulative exposed pit wall surface area is presented in **Table 6-15** and summarized as follows.

- At the end pit of operations (Year 13), the ultimate final pit wall will consist of 16% overburden, 41% of NAG rock (NAG 3, 4 and 5), 43% of PAG rock (PAG 1 and 2) and 1% of undefined and unclassified rock type. The NAG rock is mainly NAG 5 rock (24%). The majority of PAG rock is PAG 1 (33%).
- Once the pit has refilled, the high wall consists of 48% overburden, 56% of NAG rock, and 16% PAG rock (including 2% undefined and unclassified rock type). NAG 5 is the major NAG rock along the high wall and PAG 1 is the main PAG rock.

Table 6-15: Exposed Pit Wall Surface Area

Phase	Year	Exposed Surface Area											
			PAG 1		PAG 2		NAG 3	NAG 4	NAG 5	Undefined		Unclassified	Total
		Overburden m^2	Oxides/ TransitionFacies m^2	Sulphide Facies m^2	Oxides/ Transition Facies m^2	Sulphide Facies m^2	Oxides/Transition/ Sulphide Facies m^2	Oxides/Transition/ Sulphide Facies m^2	Oxides/Transition/ Sulphide Facies m^2	Oxides/ Transition Facies m^2	Sulphide Facies m^2	Sulphide Facies m^2	m^2
Preproduction	-2	44,000	0	0	0	0	0	0	14,000	0	0	4,000	62,000
	-1	154,000	5,000	0	4,000	0	7,000	2,000	63,000	1,000	0	5,000	241,000
Operation	1	180,000	5,000	0	6,000	0	10,000	3,000	65,000	1,000	0	5,000	275,000
	2	232,000	6,000	0	8,000	1,000	15,000	15,000	121,000	1,000	0	8,000	407,000
	3	249,000	14,000	0	12,000	4,000	19,000	29,000	164,000	2,000	0	8,000	501,000
	4	305,000	29,000	8,000	27,000	10,000	22,000	38,000	231,000	2,000	0	8,000	680,000
	5	307,000	35,000	34,000	38,000	37,000	52,000	54,000	272,000	2,000	0	8,000	839,000
	6	367,000	43,000	52,000	51,000	66,000	90,000	71,000	343,000	2,000	0	9,000	1,094,000
	7	432,000	44,000	116,000	56,000	104,000	106,000	104,000	389,000	2,000	0	16,000	1,369,000
	8	516,000	52,000	207,000	64,000	127,000	170,000	115,000	467,000	9,000	1,000	21,000	1,749,000
	9	516,000	52,000	267,000	66,000	149,000	245,000	136,000	534,000	9,000	10,000	21,000	2,005,000
	10	516,000	52,000	353,000	66,000	174,000	298,000	179,000	629,000	9,000	31,000	21,000	2,328,000
	11	516,000	52,000	435,000	66,000	184,000	316,000	186,000	699,000	9,000	31,000	21,000	2,515,000
	12	516,000	52,000	564,000	66,000	201,000	326,000	194,000	726,000	9,000	32,000	21,000	2,707,000
	13	516,000	52,000	754,000	66,000	222,000	338,000	201,000	750,000	9,000	38,000	21,000	2,967,000
Closure	14	516,000	52,000	966,000	66,000	248,000	358,000	207,000	758,000	9,000	55,000	21,000	3,256,000

6.6.4 Pit Hydrology and Water Management

Knight Piesold provided a monthly site water balance (Knight Piesold, 2013d). The decant elevation of the pit lake is expected to be 1,475 masl based on the low point of the open pit. The maximum pit lake volume is 236,285,183 m^3 (Knight Piesold, 2013d).

During operations water inflows to the pit are from:

- Direct precipitation within the mined area footprint; and,
- Non-contact water from the undisturbed upper catchment, and groundwater inflow.

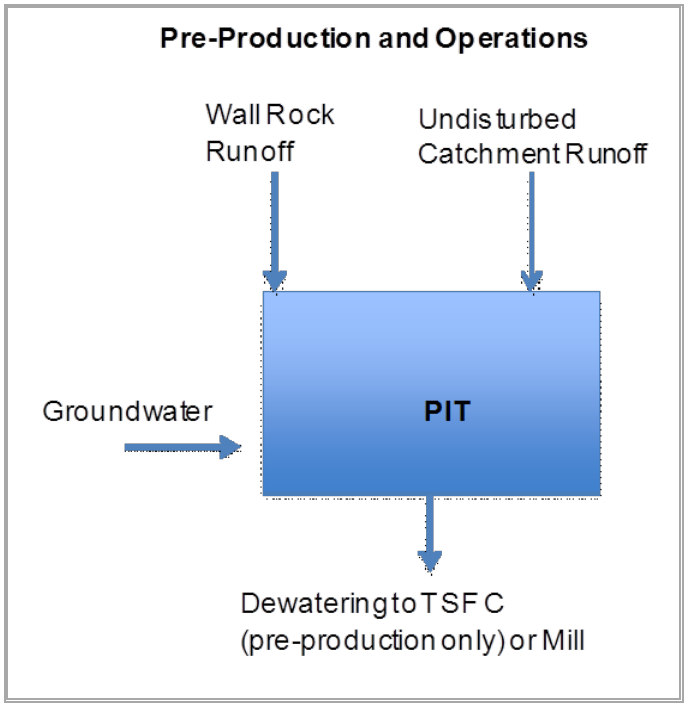
During closure and post-closure water inflows to the pit are from:

- Direct precipitation within the mined area footprint;
- Non-contact water from the undisturbed upper catchment, and groundwater inflow;
- TSF water pumped into the pit during re-filling; and,
- Freshwater from Tatelkuz Lake pumped into the pit during re-filling (closure).

Management of pit water is shown schematically in Figure 6-12 and will include the following:

- During pre-production only, non-contact water originating from the undisturbed pit catchment will be a part of the open pit dewatering system. The pit dewatering flows will be pumped to TSF C Pond.
- As mine operations begin, the inputs for the pit water balance will include undisturbed pit catchment water, contact water from pit wall run off, and ground water inflow. The water from the pit dewatering system will be pumped to the TSF for use in the process until Year 13.
- Once the open pit operation ceases in Year 13, the pit is refilled by inflow of non-contact water from the undisturbed catchment, contact water from pit wall, groundwater, and direct precipitation. The fresh water from the Tatelkuz Lake will be transferred beginning in Year 17, the excess water from the TSF D Pond will be pumped into the pit to accelerate the pit refilling process starting in Year 17. The pit is expected to fill to its maximum extent in 20 years after the cessation of mining; and,
- In about Year 35, the pit is completely refilled and overflow begins. The pit overflow will be transferred back to TSF D pond. The transfer of excess water from TSF D Pond into the pit will cease as pit overflow begins. When the pit lake reaches near the maximum level, net groundwater inflow to the pit will decrease and become zero after Year 34.

From year 35 onwards, the pit water balance component will include direct precipitation, run off from the pit high wall and undisturbed catchment as inflow, and evaporation and pit overflow as outflow.



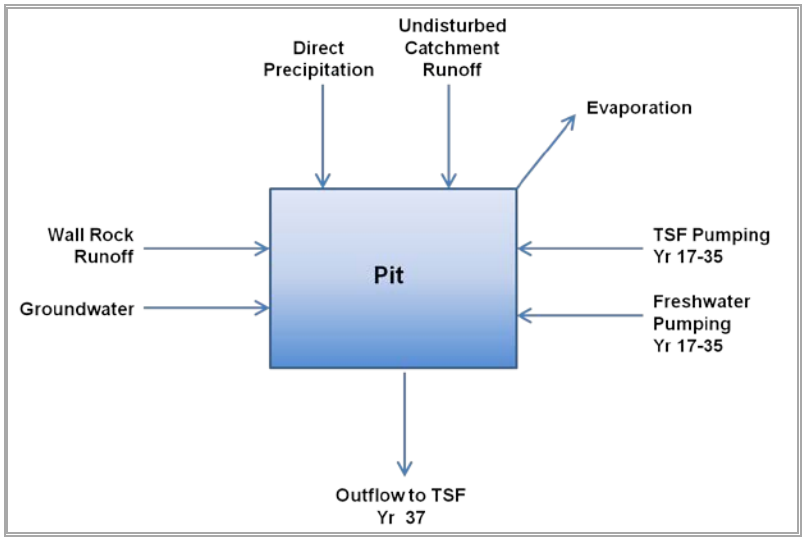


Figure 6-12: Open Pit Water Management

6.6.5 Geochemical Source Terms

The geochemical source terms used to calculate the loadings in the open pit model are presented in **Table 6-16**. Source terms were derived from humidity cell data completed for the ML/ARD characterization study.

PAG 1 and PAG 2 Waste Rock

- PAG 1 rock was conservatively assumed to become acidic immediately upon exposure. The source terms for PAG 1 rock were obtained from humidity cells results of two samples of PAG 1 oxide/transition facies rock and three samples of PAG 1 sulphate facies rock.
- The source terms for the sulphide facies and the oxide/transition facies PAG 1 waste rock were the same as the base case described in the waste rock TSF model (**Section 6.5**).
- Acidic leachates were generated in PAG 2 humidity cells ARD 566 (oxide/transition facies) and ARD 537 and ARD 288 (sulphide facies) with lag time between 20 and 30 weeks. The average rates obtained from these cells were used to represent acidic leaching conditions of PAG 2 waste rock. It was assumed that acidic rates from the humidity cells represent fully developed ARD conditions for PAG 2 waste rock.

NAG 3, NAG 4 and NAG 5 Waste Rock

The rates for each rock type of non-PAG rocks used for the pit model are the same as the rates used for the waste rock TSF model (**Section 6.5**).

- For the NAG 3 waste rock, the loading rate used the average of all seven Type 3 waste rock tests.
- Source terms for NAG 4 waste rock were obtained from the average rate of two NAG 4 HCT samples (ARD 338 and ARD 468). The same rate was applied to NAG 4 oxide, transition and sulphide facies rock.
- The loading rates for NAG 5 waste rock were calculated using humidity cell test results from the one NAG 5 waste rock sample (ARD 610).

Undefined and Unclassified Waste Rock

- All undefined and unclassified waste rock was assumed to have the same characteristics as PAG 1 rock.

Overburden

- There was no kinetic testing conducted on overburden material, therefore background water quality data from monitoring station WQ10 was assumed to represent the drainage quality from overburden.

Table 6-16: Geochemical Source Terms

	Release Rates from Humidity Cells (mg/m2/year)										Concentration (mg/L)									
	PAG 1		PAG 2		NAG 3	NAG 4	NAG 5	Undefined			Background Water	Groundwater			TSF					
Parameters	Oxides/ Transition Facies	Sulphide Facies	Oxides/ Transition Facies	Sulphide Facies	Oxides/ Transition/ Sulphide Facies	Oxides/ Transition/ Sulphide Facies	Oxides/ Transition/ Sulphide Facies	Oxides/ Transition Facies	Sulphide Facies	Unclassified	WQ 10 Station	MW-12-04	Fresh Water	Direct Precip	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21 - 35
pH (median)	4.3	3.39	3.39	5.4	6.23	8.12	8.17	4.3	3.39	3.39	7.5	7.87	7.87	5.5	8	8	8	8	8	8
Acidity (as $CaCO_3$)	44.1	90.07	4.27	11.55	3.01	2.28	2.038	44.1	90.07	90.07	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alkalinity, Total (as $CaCO_3$)	1.98	1.82	5	1.94	10.3	26.88	26.82	1.98	1.82	1.82	31.5	57.54	78.08	N/A	79.63	76.19	62.45	48.75	38.34	37.96
Sulfate (SO4)	61.71	104.98	35.683	28.36	14.39	21.83	24.88	61.71	104.98	104.98	1.6	8.9	4.01	1.6	69.57	57.61	37.64	17.89	2.87	2.32
Fluoride (F)	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	0.104	0.134	0.07	0.104	0.11	0.1	0.08	0.06	0.05	0.05
Chloride (Cl)	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	0.787	0.65	0.4	0.787	0.82	0.76	0.59	0.42	0.29	0.29
Aluminum (Al)	0.936	2.184	0.029	0.019	0.084	0.057	0.057	0.936	2.184	2.184	0.096	0.072	0.0036	0.096	0.08	0.07	0.07	0.06	0.06	0.06
Antimony (Sb)	0.0037	0.002	0.0049	0.0022	0.0209	0.0147	0.0085	0.0037	0.002	0.002	0.00005	0.00014	0.0001	0.00005	0.0967	0.0889	0.0568	0.0251	0.0009	0.0001
Arsenic (As)	0.0032	0.0045	0.0013	0.0011	0.0077	0.003	0.0215	0.0032	0.0045	0.0045	0.00042	0.0167	0.0005	0.00042	0.0126	0.0113	0.0074	0.0035	0.0005	0.0004
Barium (Ba)	0.0224	0.0181	0.0115	0.005	0.004	0.0031	0.0014	0.0224	0.0181	0.0181	0.006	0.013	0.0061	0.006	0.0794	0.0741	0.0497	0.0256	0.0073	0.0067
Beryllium (Be)	0.0021	0.0012	0.0001	0.0000	0.0001	0.0001	0.0001	0.0021	0.0012	0.0012	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001
Bismuth (Bi)	0.0016	0.0024	0.0004	0.0002	0.0004	0.0004	0.0004	0.0016	0.0024	0.0024	N/D	0.0005	N/D	N/D	N/A	N/A	N/A	N/A	N/A	N/A
Boron (B)	0.0324	0.047	0.0089	0.0035	0.0087	0.0086	0.0086	0.0324	0.047	0.047	0.001	0.0106	0.0015	0.001	0.0397	0.0366	0.0238	0.0111	0.0014	0.0011
Cadmium (Cd)	0.0476	0.1196	0.0059	0.0041	0.0015	0.0001	0.0004	0.0476	0.1196	0.1196	0.00002	0.00001	0.00002	0.00002	0.00525	0.00487	0.00312	0.00138	0.00006	0.00002
Calcium (Ca)	2.55	2.44	11.5	0.72	6.66	16.49	17.89	2.55	2.44	2.44	8.57	13.47	20.52	8.57	26.14	23.86	18.98	14.09	10.36	10.23
Chromium (Cr)	0.0016	0.0039	0.0004	0.0002	0.0004	0.0004	0.0004	0.0016	0.0039	0.0039	0.00032	0.00019	0.0003	0.00032	0.0018	0.0016	0.0012	0.0007	0.0003	0.0003
Cobalt (Co)	0.0719	0.1147	0.0015	0.0057	0.0013	0.0002	0.0001	0.0719	0.1147	0.1147	0.00003	0.00046	0.00002	0.00003	0.0971	0.0899	0.0574	0.0253	0.0009	0.000
Copper (Cu)	0.058	0.067	0.000	0.000	0.000	0.000	0.000	0.058	0.067	0.067	0.00027	0.00047	0.0003	0.00027	0.0268	0.0224	0.0143	0.0064	0.0004	0.0002
Iron (Fe)	5.533	5.99	0.14	0.022	0.039	0.026	0.026	5.533	5.99	5.99	0.066	0.088	0.0221	0.066	0.6697	0.6162	0.4119	0.2104	0.0572	0.0515
Lead (Pb)	0.705	1.171	0.0000	0.013	0.002	0.001	0.0000	0.705	1.171	1.171	0.00006	0.00006	0.0001	0.00006	0.0008	0.0007	0.0005	0.0002	0.0001	0.0001
Lithium (Li)	0.01	0.01	0.0022	0.0013	0.0063	0.0054	0.0087	0.01	0.01	0.01	0.001	0.001	0.001	0.001	0.0201	0.0185	0.0122	0.0059	0.0012	0.001
Magnesium (Mg)	1.22	2.2	0.92	0.24	0.54	0.95	0.21	1.22	2.2	2.2	1.7	2.3	4.8	1.7	5.39	5.17	4.04	2.92	2.07	2.04
Manganese (Mn)	7.35	9.77	1.44	0.35	0.63	0.25	0.01	7.35	9.77	9.77	0.0023	0.2439	0.0006	0.0023	0.5435	0.503	0.3219	0.1431	0.0071	0.0021
Mercury (Hg)	0.00001	0.00001	0.00001	0.0000	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00002	0.00002	0.00001	0.00001	0.00001	0.00001
Molybdenum (Mo)	0.0004	0.0003	0.0004	0.0000	0.0014	0.0007	0.001	0.0004	0.0003	0.0003	0.00044	0.0111	0.0005	0.00044	0.1625	0.1507	0.0964	0.0428	0.0021	0.0005
Nickel (Ni)	0.123	0.207	0.001	0.008	0.001	0.0000	0.0000	0.123	0.207	0.207	0.0002	0.0028	0.0002	0.0002	0.0056	0.0051	0.0033	0.0015	0.0002	0.0001
Phosphorous (P)	0.259	0.261	0.268	0.105	0.26	0.258	0.258	0.259	0.261	0.261	0.01	0.214	0.0129	0.01	0.0735	0.0595	0.0421	0.0242	0.0107	0.0102
Potassium (K)	7.47	5.86	4.99	1.48	3.57	2.46	3.84	7.47	5.86	5.86	0.504	1.044	0.8175	0.504	105.47	97.59	62.49	27.83	1.48	0.5
Selenium (Se)	0.00035	0.00052	0.00009	0.00004	0.00009	0.00009	0.00009	0.00035	0.00052	0.00052	0.0006	0.0001	0.0006	0.0006	0.0013	0.0012	0.001	0.0008	0.0006	0.0006
Silicon (Si)	5.11	4.4	4.6	0.75	2.82	1.49	1.87	5.11	4.4	4.4	5.47	8.01	4.05	5.47	10.8	10.42	8.74	7.08	5.82	5.77
Silver (Ag)	0.00004	0.0001	0.00001	0.0000	0.00001	0.00002	0.00001	0.00004	0.0001	0.0001	0.00005	0.00001	0.00005	0.00005	0.00003	0.0001	0.00013	0.00013	0.00007	0.00005
Sodium (Na)	0.31	0.34	1.22	0.11	1.35	1.68	2.25	0.31	0.34	0.34	2.4	9.47	3.48	2.4	21.22	16.69	11.63	6.63	2.83	2.69
Strontium (Sr)	0.0168	0.0232	0.0454	0.0056	0.0404	0.0671	0.0943	0.0168	0.0232	0.0232	0.059	0.1085	0.0971	0.059	0.81	0.76	0.51	0.26	0.08	0.07
Thallium (Tl)	0.0003	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0004	0.0004	0.00005	0.00001	0.0001	0.00005	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
Tin (Sn)	0.0003	0.0005	0.0001	0.0000	0.0001	0.0001	0.0001	0.0003	0.0005	0.0005	0.0001	0.0002	0.0001	0.0001	0.0263	0.0244	0.0156	0.0069	0.0003	0.0001
Titanium (Ti)	0.0087	0.0087	0.0089	0.0039	0.0087	0.0086	0.0086	0.0087	0.0087	0.0087	0.0011	0.0101	0.0002	0.0011	0.0025	0.002	0.0015	0.0011	0.0007	0.0007
Uranium (U)	0.0048	0.002	0.0001	0.0000	0.0002	0.0003	0.0000	0.0048	0.002	0.002	0.0002	0.0006	0.0001	0.0002	0.0033	0.0031	0.002	0.001	0.0002	0.0002
Vanadium (V)	0.0032	0.0047	0.0009	0.0004	0.001	0.0009	0.0022	0.0032	0.0047	0.0047	0.00017	0.001	0.0001	0.00017	0.0004	0.0004	0.0003	0.0002	0.0001	0.0001
Zinc (Zn)	11.8	22.323	0.716	1.23	0.076	0.003	0.003	11.8	22.323	22.323	0.0026	0.003	0.0015	0.0026	0.1152	0.1069	0.0689	0.0313	0.0028	0.0017
Nitrate-N-D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	0.0159	0.0172	0.0361	0.005	1.93	0.6	0.27	0.18	0.09	0.02
Nitrite-N-D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	0.0038	0.0018	0.0038	0.003	0.06	0.03	0.02	0.01	0.01	0.004
Cyanide, total	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	0.007	<0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cyanide, WAD	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	0.005	<0.005	N/A	N/A	0.16	0.16	0.15	0.09	0.04	0.001
Ammonia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.02	0.0169	0.0206	N/A	0.36	0.19	0.14	0.1	0.05	0.02

Note: N/D = not detected, N/A = not analyzed

Non-contact Water of Undisturbed Catchment

- The water quality from the undisturbed catchment was assumed to be the same as the average from monitoring station WQ10. Station WQ10 is located in the drainage basin hosting the Blackwater ore deposit.

Groundwater

- Groundwater quality was represented by water quality from monitoring well MW 12-04, which is located adjacent to the proposed open pit. Available data (seven samples) was averaged to estimate the groundwater quality.

Direct Precipitation

- It was assumed that the average water quality from monitoring station WQ 10 was representative of direct precipitation, with the exception of pH, alkalinity and cyanide species. The pH of direct precipitation was assumed to be 5.5. The alkalinity and cyanide species were assumed to be negligible.

TSF Pond D

- Results of the water quality model on TSF pond D were used as input (See Water Quality Section 5.3.3). Due to the cover placement the constituent concentrations in the TSF D pond water were gradually decreased and their concentrations were assumed to be same as the background water quality data in three years (See Water Quality Section 5.3.3).

Fresh Water Supply

- The water quality from the fresh water of Tatelkuz Lake was assumed to be the same as the average from monitoring station WQ8 located at Chedakuz Creek.

6.6.6 Assumptions

Additional assumptions used for the model were as follows:

- The loading rates from humidity cells were normalized to the surface area. The average surface area of the humidity cell samples was assumed to be 28.3 m^2/kg based on the average results from particle size analysis.
- All PAG rock was assumed to be immediately acidic. Constant release rates were assumed for acidic conditions. The release rates during acidic conditions may change as the oxidation of the waste rock progresses on the exposed pit wall. Sulphide exhaustion that may occur in the rock material was not considered in the model.

- The influence of temperature on the oxidation rate was applied in the model by an Arrhenius correction factor (MEND, 1996). A weighted average temperature correction factor of 66% was used in the model. This value is based on the assumption that the oxidation rate was 100% of the laboratory rates for the months with mean monthly temperatures above zero (April to October) and 20% during the remainder of the year (months with mean temperature less than 0^{o}C) due to reduced temperatures.
- The effective reactive surface area of the pit walls was assumed to be 50 times the calculated pit wall surface (calculated from pit dimensions) to allow for surface roughness and fracture influences.
- No load was retained on the pit walls. It was assumed that pit runoff will completely flush the load (oxidation products) from the pit wall surface area.
- No loads are released from the pit walls once submerged by water.
- The pH for the pit water drainage was determined by mixing the pit inflows using PHREEQC (Parkhurst and Appelo 1999). The pH of the pitwall runoff was estimated by mixing the seepage generated from the non-PAG and PAG materials of the pit wall, in proportion to the surface area of those materials present (hydrogen ion concentration basis).
- The median pH of the humidity cells was selected to represent Type 3, Type 4 and Type 5 waste rock materials (median pH values of 6.2, 8.1 and 8.1, respectively).
- Median pH values of 4.3 and 5.4 were used to represent leachate pH of Type 1 and Type 2 waste rock, respectively.

PHREEQC was also used to model geochemical equilibrium. Water quality and volume from the inputs were mixed and geochemically equilibrated to estimate concentrations in the pit water.

6.6.7 Pit Water Quality Model Mixing Scenarios

Two scenarios were modelled: a complete mixing model and a stratification model.

In the mixing case, complete and continuous vertical mixing is assumed for the whole pit lake, as shown in **Figure 6-13** and **Figure 6-14**.

Surface winds and thermal turn over drive vertical mixing in the pit lake. The open pit lake is estimated to be approximately 360 m deep, with a decant elevation of 1,475 masl. The relatively deep pit lake could lead to development of a meromictic system that consists of lower and upper layers, referred as hypolimnion and epilimnion, respectively **(Figure 6-14**). The hypolimnion is the lower, deeper layer with the unmixed water. The epilimnion is the upper, active layer which has contact with the atmosphere. The upper and lower layers are separated by the intermediate pycnocline layer. This intermediate layer is characterized by a marked change in temperature and density with depth.

In the meromictic system, the mixing potentially occurs only in the epilimnion layer since the hypolimnion layer is isolated from atmosphere. Therefore, mixing occurs at limited depth in the

pit lake. The depth of epilimnion layer may range from 7 to 30 m deep based on the field observations and predictive pit lake modelling for other sites (Sanchez-Espana et al. 2008, Gammons and Duaime 2006, Fisher and Lawrance 2006).

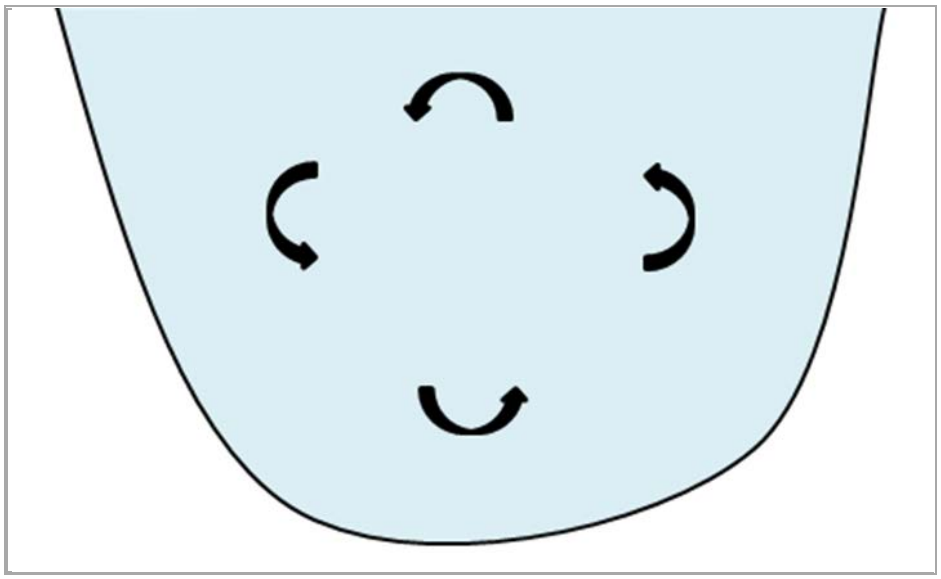


Figure 6-13: CompleteStratification Case – Meromictic Pit Lake

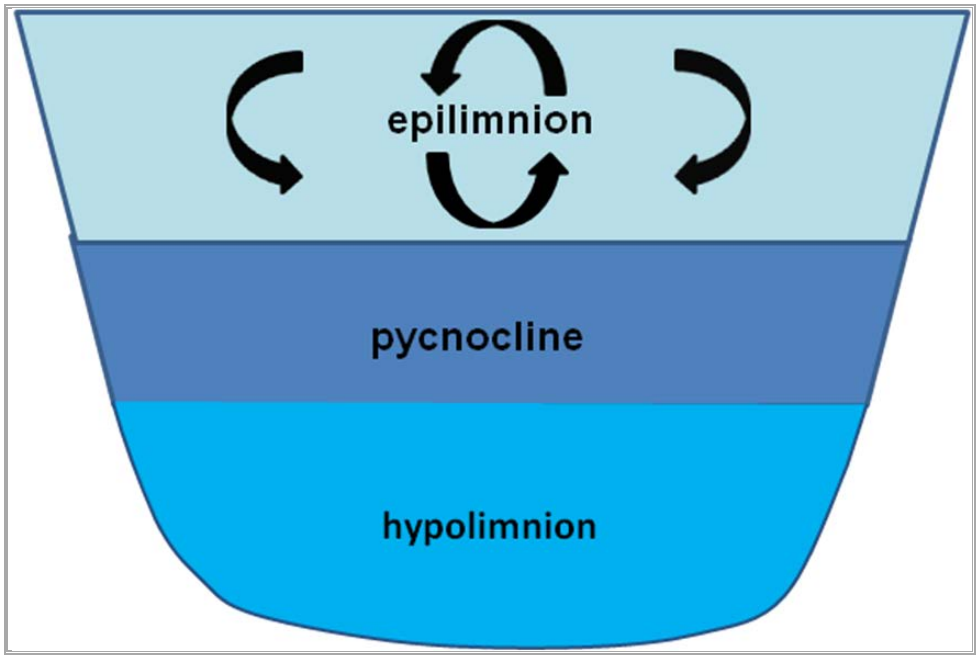


Figure 6-14 : Stratification Case – Meromictic Pit Lake

The stratification scenario was set up to evaluate the pit lake discharge quality if a meromictic system developed. The epilimnion layer was assumed to be 30 m (based on AMEC experience), and that stratification began once the pit lake depth was greater than 300 m and mixing occurred only in the epilimnion layer. The input water from the TSF was assumed to be pumped to depth below the epilimnion layer.

The pit lake depth of 300 m will be achieved in Year 30 (16 years after pit closure).

6.6.8 Estimated Pit Water Quality Model Results

The modelled water quality from the first pit discharge at post closure (Year 35) is presented in **Table 6-17**.

Table 6-17: Pit Water Quality Model Results (mg/L)

Parameter	Unit	Mixing Case	Stratification Case	BC MOE Wildlife guidelines
		Year 35		Maximum
pH		7.9	7.9	
Alkalinity	mg/L CaCO3	47.7	58.3	
Acidity	mg/L CaCO3	0.1	0.1	
Sulphate	mg/L	9.6	8.2	
Chloride	mg/L	0.389	0.442	600
Fluoride	mg/L	0.064	0.071	1.5
Aluminum	mg/L	0.017	0.017	5
Antimony	mg/L	0.0106	0.0080	
Arsenic	mg/L	0.0035	0.0035	0.025
Barium	mg/L	0.0152	0.0143	
Beryllium	mg/L	0.00011	0.00013	
Boron	mg/L	0.0064	0.0057	5
Cadmium	mg/L	0.0007	0.0006	
Calcium	mg/L	13.0	15.7	
Chromium	mg/L	0.0006	0.0008	
Cobalt	mg/L	0.0108	0.0081	
Copper	mg/L	0.0030	0.0024	0.3
Iron	mg/L	0.126	0.116	
Lead	mg/L	0.0016	0.0018	0.1
Lithium	mg/L	0.0030	0.0027	
Magnesium	mg/L	2.650	3.251	
Manganese	mg/L	0.101	0.091	
Mercury	mg/L	0.000009	0.000010	0.0000125* - 0.00002*
Molybdenum	mg/L	0.0194	0.0150	0.05
Nickel	mg/L	0.0013	0.0012	
Phosphorus	mg/L	0.039	0.043	
Potassium	mg/L	12.054	9.244	
Selenium	mg/L	0.0006	0.0007	0.004
Silicon	mg/L	6.32	6.96	
Silver	mg/L	0.00005	0.00006	
Sodium	mg/L	5.151	5.347	
Strontium	mg/L	0.156	0.151	
Thallium	mg/L	0.00006	0.00006	

Parameter	Unit	Mixing Case	Stratification Case	BC MOE Wildlife guidelines
		Year 35		Maximum
Tin	mg/L	0.0030	0.0022	
Titanium	mg/L	0.0019	0.0020	
Uranium	mg/L	0.0006	0.0005	
Vanadium	mg/L	0.0003	0.0003	
Zinc	mg/L	0.042	0.043	
Nitrate	mg/L	0.108	0.089	
Nitrite	mg/L	0.0068	0.0064	
Total Cyanide	mg/L	0.023	0.0169	
WAD Cyanide	mg/L	0.001	0.00094	
Ammonia	mg/L	0.0413	0.0406	

Note: * 30 days average concentration and depends on methyl mercury content

In general, the water quality results for the mixing cases are comparable with the results of the stratification case. Net alkalinity is produced for pit water post-closure. The alkalinity generated by the exposed non-PAG rock in the high wall and other input components (e.g., groundwater, non-contact water and fresh water) was more abundant than the acidity generated from the exposed PAG rock in the high wall. The alkalinity was approximately 48 mg/L CaCO3 for the complete mixing case, and 58 mg/L CaCO3 for the stratification case.

The pH of the pit lake was estimated using PHREEQC, the water quality, and the volume from each inflow. Based on the modelling, the average pH was estimated to be approximately 7.9 at Year 35 for the first pit lake discharge.

Concentrations of all parameters were below BCMOE wildlife guideline values. Sulphate concentrations in the first pit discharge for both cases were predicted to be relatively low (<10 mg/L). Longer-term sulphate concentrations were similar for both cases (**Figure 6-15**). Both models reported similar zinc (**Figure 6-16**) and cadmium (**Figure 6-17**) during the operations and closure periods, with concentrations diverging slightly in the long term.

As mentioned earlier, neither the base case nor the stratification model account for reductions in metal loads over time from the exposed high wall rock which would occur. The formation of secondary minerals, the occlusion of reactive minerals and the ‘burn-out’ of sulphide minerals that drive oxidation reactions are all processes that will naturally attenuate metal loads from wall rock. The predicted concentrations in the pit lake for the completed mixing and stratification cases are considered to be a conservative estimate. The model incorporated several conservative assumptions including: immediate acid generation from PAG 1 waste rock, constant loading rates through the model period (no reduction of loads due to sulphide burn out, mineral occlusion or formation of secondary minerals), assigning all unclassified or undefined rock in the block model as PAG 1 waste rock, and no reduction in temperature based loading rates for months with average temperature less than 0 degrees C.

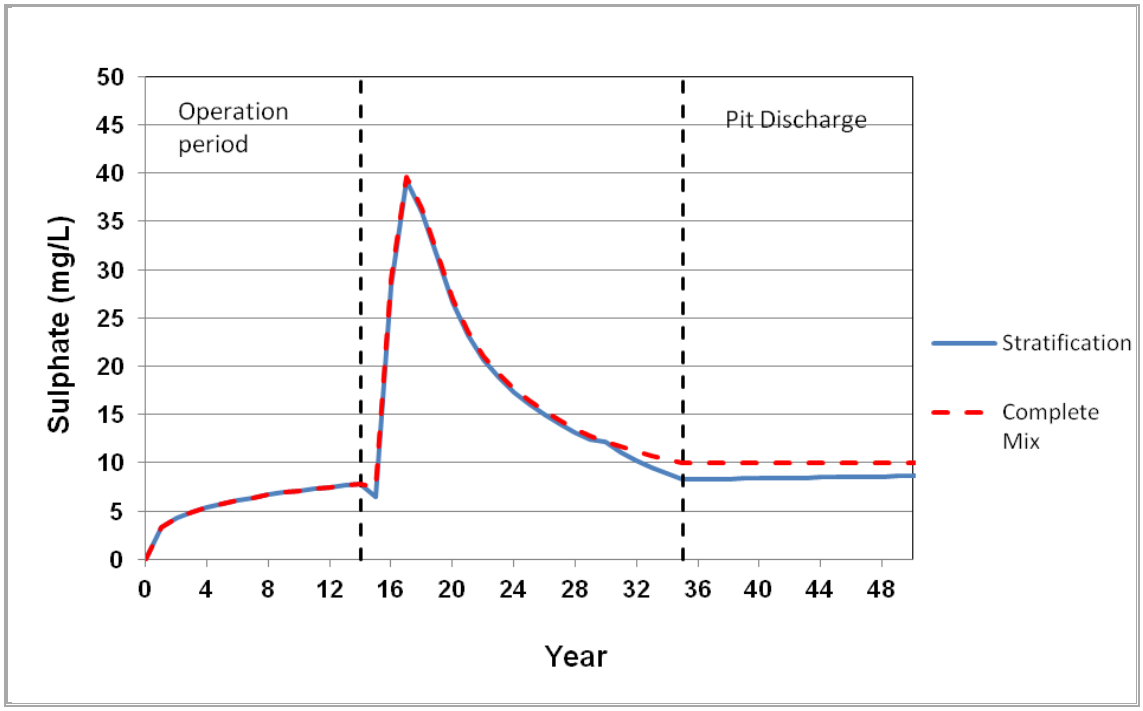


Figure 6-15: Predicted Open Pit Sulphate Concentrations

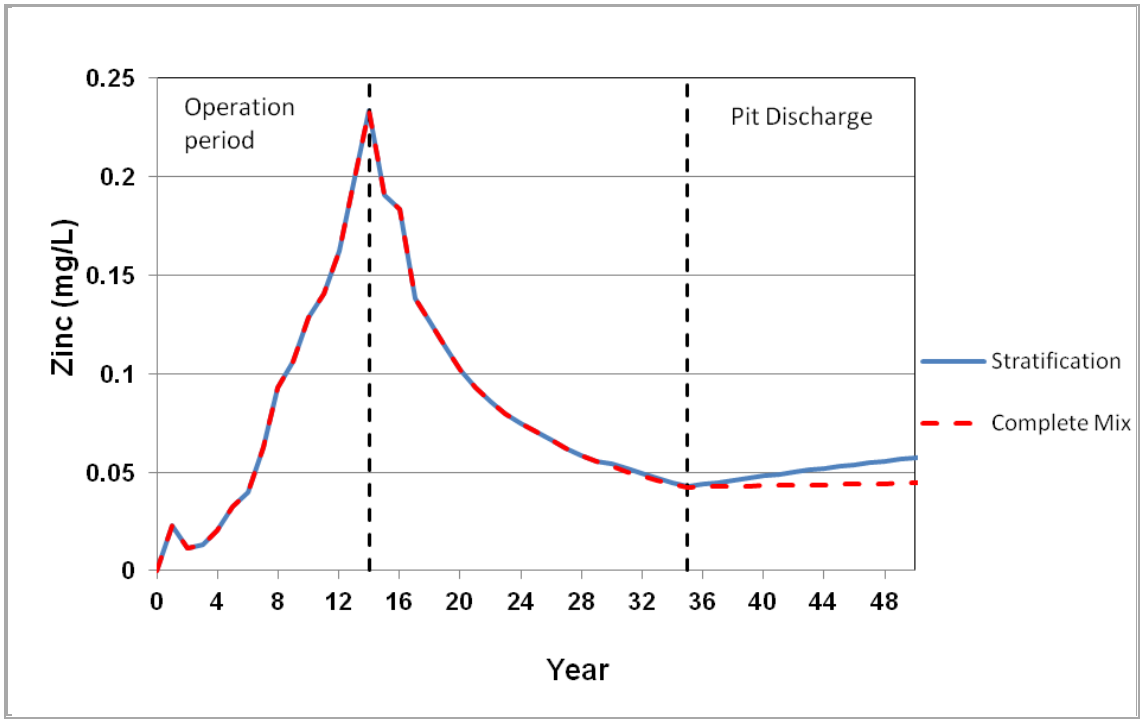


Figure 6-16: Predicted Open Pit Zinc Concentrations

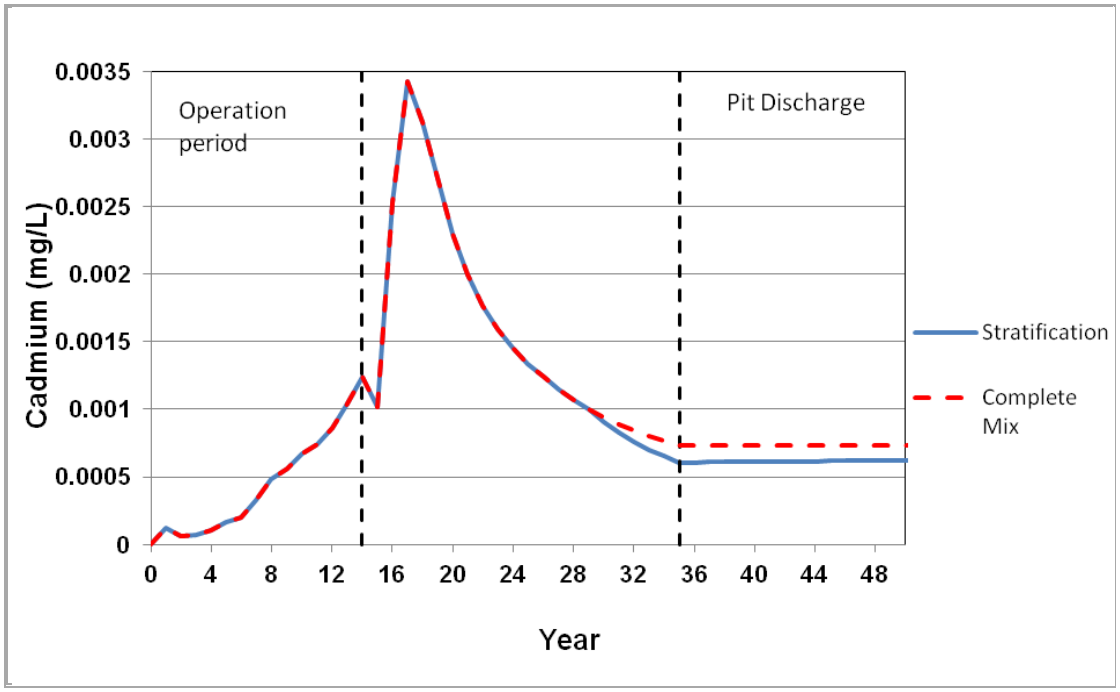


Figure 6-17: Predicted Open Pit Cadmium Concentrations

6.7 East Dump and Impact of Incomplete Segregation

The East Dump will be composed of NAG 5 waste rock and overburden. During operations, a drainage diversion will route East Dump drainage to the TSF. At closure, a compacted overburden cover will be placed on the East Dump to reduce infiltration and facilitate reclamation. Operational monitoring results of East Dump drainage quality will be used to determine if the diversion can be removed during closure, allowing drainage to flow to Creek 661.

A separate estimate of potential drainage from the East Dump and the impact of imperfect waste rock segregation on drainage quality was completed. The East Dump was chosen since drainage could flow to Creek 661 while any drainage from the West Dump would flow to the tailings storage facility.

The model examined three different scenarios to estimate drainage quality from the East Dump and assess the impact of imperfect segregation:

- Complete segregation (base case);
- 1% incomplete segregation; and,
- 3.3% incomplete segregation.

The base case assumes that only NAG 5 and overburden are placed in the East Dump. Two additional scenarios were run to assess the impact of incomplete segregation at 1% and 3.3%

(the latter is equivalent to 1 Mt or 3,459 truck loads) of the NAG 5 tonnage. It was assumed that this incompletely segregated waste rock tonnage was evenly distributed between the PAG 1, PAG 2, NAG 3 and NAG 4 ARD classes. Analysis of block model results suggests NAG 5 rock is generally next to NAG 4.

Figure 5-3 is a cross section from the ARD block model presented in Appendix 5.1.3.1A Geochemical Characterization Report. **Figure 6-18** is a sample waste segregation bench cut plan (1548 level). Both figures show that NAG 5 waste blocks are most commonly found adjacent to NAG 4 waste, suggesting that assumption made for the distribution of incompletely segregated tonnage across the ARD classes may be conservative. Additionally, there will be routine and frequent testing of blast hole chips to validate the ARD block model and minimize the potential for incomplete segregation.

Predictions of drainage quality during operations and closure (to year 35) do not account for any reduction in load from the waste rock over time resulting from sulphide burn-out, or other physical and chemical changes to the rock (such as coating of reactive mineral surfaces with secondary minerals) that tend to decrease loads. Thus, the drainage quality, as estimated at the dump toe, is constant during closure for this model.

This section also examines the potential quality of East Dump seepage that may daylight into Creek 661, Groundwater flow modeling indicates that it will take a minimum of 47 years and a maximum of 1,288 years for the seepage particles from the East Dump to reach Creek 661. Therefore, only by about 1,200 years would the full predicted seepage flow rate of 1.7 L/S from the East Dump reach Creek 661. The median time for seepage from the East Dump to reach Creek 661 is predicted to be 405 years. A travel time of 400 years was conservatively used to estimate the seepage quality when it reaches Creek 661.

A site-specific study showed that there is significant potential for sub-surface attenuation of metals in seepage from the TSF, especially in the basal till and weathered bedrock units (copper and zinc attenuation greater than 90%) (Lorax, 2013b). Although the specific characteristics of the sub-surface at the East Dump may be different, it is reasonable to expect that there will also be metal attenuation of drainage prior to entering Creek 661.

To account for the long term reduction of contaminant concentrations that would occur over centuries, it was assumed that the quality of drainage from the East Dump that daylights in Creek 661 after an approximately 400 year sub-surface transit can be calculated using a $t^{-0.5}$ degradation curve (Cathles and Apps, 1975).

The poorest quality of drainage for the main parameters of concern (sulphate, cadmium and zinc) from the East Dump are predicted to occur in Year 10 which was conservatively used as the initial quality for the seepage to Creek 661; a conservative assumption. The actual seepage quality to Creek 661 would likely be closer to the average drainage quality of the entire construction period of the dump.

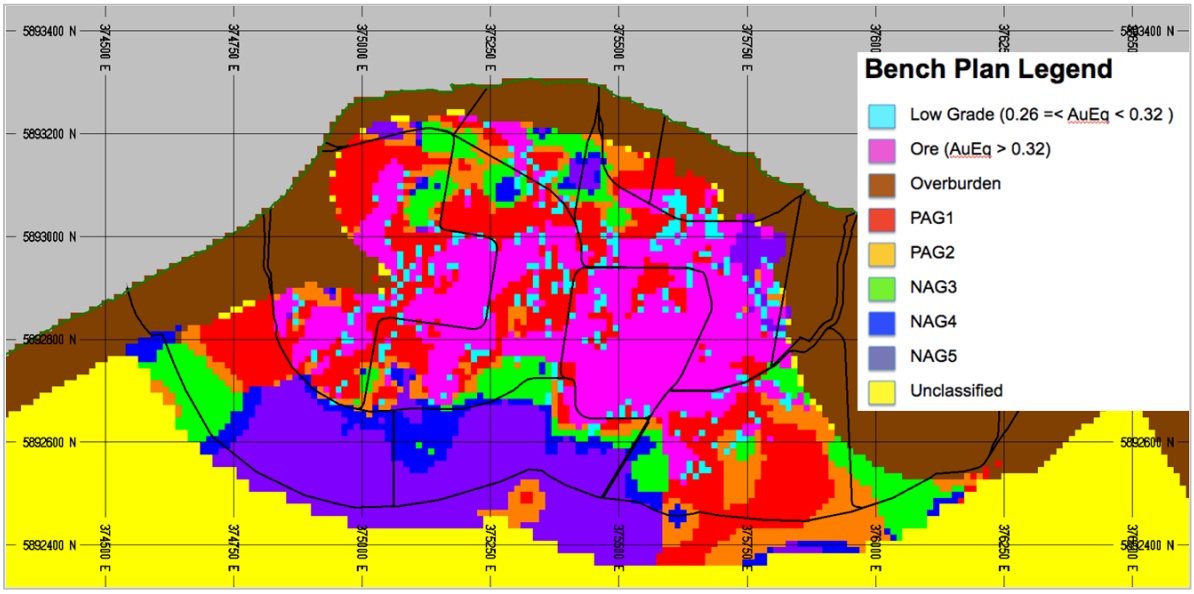


Figure 6-18: ARD Block Model – Sample Bench Shovel Cuts (1548 Bench)

6.7.1 Model Structure and Assumptions

Norwest Corporation provided the annual tonnage of NAG 5 waste rock and overburden in the East Dump. Note that these tonnages are consistent with the EA but are slightly different from the tonnages presented in the Feasibility Study. As described above, the East Dump will be comprised of both NAG 5 waste rock and overburden. A total of 30.4 Mt of NAG 5 waste rock will be placed during Operational Years 2-11 and Year 13 of the 17 year mine life. A total of 26.3 Mt of overburden will be placed Years 1 through 8.

Table 6-18: East Dump Waste Tonnages (Norwest 2013)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
NAG 5	0	650,000	2,510,000	600,000	2,040,000	4,960,000	290,000
Overburden	2,880,000	5,570,000	4,530,000	5,780,000	2,000,000	4,100,000	90,000
Total	2,880,000	6,220,000	7,040,000	6,380,000	4,040,000	9,060,000	380,000

	Year 8	Year 9	Year 10	Year 11	Year 13	Total
NAG 5	350,000	5,610,000	10,990,000	2,370,000	30,000	30,400,000
Overburden	1,330,000	0	0	0	0	26280000
Total	1,680,000	5,610,000	10,990,000	2,370,000	30,000	56,680,000

Knight Piésold provided the water balance used to estimate East Dump drainage quality (Knight Piésold, 2013e). The water balance includes runoff and infiltration from the combined East and West Dumps to the TSF. It does not provide a separate water balance for the East Dump. For

the purpose of this work, AMEC assumed that the East Dump will have half of the total water volumes of the combined East and West Dump. As the plan area of the two waste rock dumps is similar this is considered to be a reasonable assumption.

The water balance assumes that there is no runoff from the East/West Dumps during operations and drainage will be comprised only of infiltration. As closure, the dumps will be reclaimed resulting in a reduction of infiltration through the dumps and an increase in runoff volumes. Infiltration and runoff volumes are constant through post-closure.

The East Dump model was structured similar to the combined East/West Dump model and had similar assumptions:

- The surface area of waste rock was scaled up from the particle size measured during humidity cell testing. The average surface area of the waste rock was calculated at 0.065 m^2/kg (65 m^2/t);
- The oxidation rates, as measured by humidity cell test loadings, were adjusted using a weighted annual average field temperature (Arrhenius correction). Loadings were reduced to 20% of testing results when the average monthly temperature was less than zero Celsius. No reduction was applied with the average monthly temperature was greater than zero Celsius;
- There was no 'burn-out' of sulphide minerals (although a reduction of concentrations was assumed for the very long term prediction of drainage from the East Dump at Creek 661);
- 80% of the waste rock load was flushed annually;
- During closure and post-closure, runoff from the reclaimed East Dump was assumed to be equal to water quality monitoring station WQ-10; and
- All seepage and runoff is collected at the base of the dump. During operations, the drainage is routed to the TSF. During closure and post-closure, it is assumed that a small portion of the drainage (deep drainage) will flow into the subsurface, eventually daylighting at Creek 661. Surface runoff and dump toe drainage would be collected in a ditch and directed to the TSF unless its quality is acceptable for direct discharge to Creek 661.

6.7.2 Source Terms

The base case East Dump model required source terms for NAG 5 waste rock and overburden. Assessing the impact of incomplete waste rock segregation required source terms for PAG 1, PAG 2, NAG 3 and NAG 4 waste rock.

It was assumed that the leachate quality from overburden was represented by the mean water quality results at monitoring station WQ-10 (n=10, March 2011 through April 2013). Station WQ-10 is located in the drainage basin hosting the Blackwater ore deposit and which has had extensive surface disturbances including site clearing and drilling during the monitoring period.

The waste rock source terms were calculated using the average of the last 10 weeks of humidity cell testing results with data through the end of June 2014. The last 10 weeks of data generally

provided the most stable loading rates for all the tests. The source term for each ARD class was the average of all the individual tests in that class. Humidity cell results less than the method detection limits were reported as the detection limit for calculations. The waste rock source terms and number of humidity cell tests used to calculate the average source term for each ARD class are given in **Table 6-19**.

Table 6-19: Waste Rock and Overburden Source Terms

	Waste Rock					
	PAG 1 (n=3)	**PAG 2 (n=6)**	**NAG 3 (n=7)**	**NAG 4 (n=2)**	**NAG 5 (n=1)**	**Overburden (WQ-10)**
	mg/m^2/wk					(mg/L)
Cond. (mS/cm)	237	101	49	115	97	66.5
pH	4.0	6.6	7.1	8.0	8.1	7.5
Acidity	0.823	0.105	0.139	0.028	0.026	1*
Alkalinity	0.033	0.178	0.781	0.352	0.283	31.5
Sulfate	1.001	0.493	0.355	0.480	0.391	1.6
Aluminum	0.05349	0.00045	0.01511	0.00070	0.00111	0.1
Antimony	0.00001	0.00007	0.00096	0.00006	0.00004	0.00005
Arsenic	0.00001	0.00006	0.00018	0.00004	0.00012	0.0004
Barium	0.00036	0.00013	0.00007	0.00002	0.00002	0.006
Beryllium	0.000015	0.000002	0.000008	0.000002	0.000002	0.0001
Bismuth	0.00001	0.00001	0.00004	0.00001	0.00001	0.0005*
Boron	0.00025	0.00016	0.00078	0.00016	0.00016	0.001
Cadmium	0.00059	0.00018	0.00005	0.000001	0.000004	0.00002
Calcium	0.05288	0.21252	0.40568	0.32466	0.24609	8.6
Chromium	0.00002	0.00001	0.00004	0.00001	0.00001	0.0003
Cobalt	0.00031	0.00012	0.00004	0.000002	0.000002	0.00003
Copper	0.00073	0.00008	0.00004	0.00001	0.00001	0.0003
Iron	0.00318	0.00155	0.00235	0.00049	0.00048	0.07
Lead	0.01642	0.00027	0.00008	0.00001	0.000001	0.00006
Lithium	0.00015	0.00006	0.00014	0.00005	0.00007	0.001
Magnesium	0.03125	0.00708	0.01081	0.00696	0.00198	1.7
Manganese	0.02892	0.02036	0.01366	0.00117	0.00001	0.002
Mercury	0.0000002	0.0000002	0.0000008	0.0000002	0.0000002	0.000007
Molybdenum	0.000001	0.00001	0.00005	0.00002	0.00002	0.0004
Nickel	0.00053	0.00013	0.00005	0.00001	0.00001	0.0002
Phosphorus	0.00488	0.00477	0.02328	0.00487	0.00476	0.01
Potassium	0.03364	0.04774	0.08503	0.02037	0.04153	0.5
Selenium	0.000002	0.000002	0.000008	0.000002	0.000002	0.0006
Silicon	0.10954	0.04192	0.10586	0.01192	0.01424	5.5
Silver	0.000002	0.0000002	0.000001	0.0000002	0.0000002	0.00005
Sodium	0.00125	0.00256	0.02423	0.01001	0.00611	2.4
Strontium	0.00080	0.00058	0.00122	0.00082	0.00100	0.06
Sulfur	0.34959	0.17480	0.13491	0.16818	0.12921	0.5*

	Waste Rock					
	PAG 1 (n=3)	PAG 2 (n=6)	NAG 3 (n=7)	NAG 4 (n=2)	NAG 5 (n=1)	Overburden (WQ-10)
	mg/m^2/wk					(mg/L)
Thallium	0.000003	0.000001	0.000001	0.0000002	0.000001	0.00005
Tin	0.000002	0.000002	0.000008	0.000002	0.000002	0.0001
Titanium	0.00016	0.00016	0.00078	0.00016	0.00016	0.001
Uranium	0.00002	0.000001	0.000007	0.000001	0.000000	0.0002
Vanadium	0.00002	0.00002	0.00008	0.00002	0.00002	0.0002
Zinc	0.10181	0.02944	0.00218	0.00005	0.00005	0.003

Note: *assumed to be equal to humidity cell method detection limit

6.7.3 Results

Annual drainage quality results are presented in **Table 6-20** for Year 17 (last year of operations), Closure Year 35 (end of closure period) for acidity, alkalinity, sulphate, cadmium and zinc. Full results are in **Annex 12**. The reduction of concentrations in the drainage as it flows over 400 years in the sub-surface to daylight at Creek 661 is given in **Table 6-21** using the worst case drainage from operations Year 10.

Drainage pH values are expected to be alkaline given the high alkalinity to acidity ratio, which is in line with laboratory testing of NAG 5 waste rock and overburden. As expected, for each model scenario concentrations were highest during the final years of operations and decreased at closure when the dump is reclaimed. The greater tonnages of incompletely segregated waste rock also increased concentrations. Reduction of metals in the seepage as it over the centuries improves in quality by the time is reaches Creek 661.

Table 6-20: Predicted East Dump Drainage Quality (mg/L)

	Operations Yr 17			Closure Yr 35		
	Base Case	1%	3.3%	Base Case	1%	3.3%
Acidity	4.2	4.6	5.3	4.1	4.4	5.1
Alkalinity	64.4	64.5	64.7	63.2	63.3	63.4
SO_4	51.7	51.4	52	49.5	49.7	50.3
Cd	0.0005	0.0008	0.0014	0.0005	0.0008	0.00133
Zn	0.0084	0.051	0.15	0.008	0.049	0.143

Table 6-21: Estimated Worst Case Seepage Quality Reaching Creek 661 at Year 400 years (mg/L)

	Sub-surface Reduction of Worst Case Seepage Concentrations		
	Base Case	**1%**	**3.3%**
Acidity	0.21	0.22	0.26
Alkalinity	3.2	3.2	3.2
SO_4	2.5	2.5	2.1
Cd	0.00003	0.00004	0.00007
Zn	0.0004	0.0024	0.0072

Note: Includes a $t^{-0.5}$ degradation of concentrations over 400 years

6.8 Geochemical Testing and Modelling Results Used for Site Water Quality Model

A summary of the testing and modelling results provided for use in the overall site water quality modelling efforts is given in **Table 6-22**.

Table 6-22: Testing and Modelling Results Provided for Site Water Quality Model

Model or Source Term	Water Balance Component	Rationale
Tailings Supernatant 7 Day Ageing Test Results	TSF C beach tailings infiltration to pond	Test results represent best available chemistry of supernatant water in contact with tailings
	TSF C tailings beach runoff to pond	
	Water pumped from TSF D starter pond to TSF C	
	Water in tailings slurry to TSF C pond	
	Reclaim water required for Mill from TSF D pond	
	Water lost to tailings voids in TSF C	
	TSF embankment seepage (to TSF D)	
	Reclaim from TSF C pond to Mill	
	TSF D beach tailings infiltration to pond	
	TSF D beach tailings runoff to pond	
	Water in tailings slurry to TSF D pond	
	Reclaim from TSF D pond to mill	
Pre-Production period of Open Pit Model	Open Pit dewatered to TSF C	Predictive model of open pit dewatering quality
	Open Pit water overflow to TSF D in closure	
East and West Dump Model	NAG/OVB stockpile infiltration to TSF D pond	Model of mixed NAG 4, NAG 5 and overburden
	NAG/OVB stockpile runoff to TSF D pond	
pH Neutralization Experiment Results	Open pit dewatering to mill (operations)	Drainage from the low grade ore stockpile, and temporary ore stockpile, and (if needed)
	LGO stockpile infiltration to TSF D pond	
	LGO stockpile runoff to TSF D pond	

Model or Source Term	Water Balance Component	Rationale
	Water in ore contributing to Mill (operations)	the open pit will be collected and treated before pumping to the TSF. The treated water will have alkaline pH values and significantly reduced metal concentrations.
East and West Dump Model	TSF D embankment runoff to ECD pond	Conservative estimate as there will be only a small amount, if any, NAG 4 in the downstream shell of Dam D
	TSF D embankment infiltration to ECD pond	
Waste Rock in TSF model	TSF D seepage	Mixing of the waste rock contact water with the tailings interstitial water completed in site water quality model

6.9 Conceptual Model for Tailing Storage Facility Quality

Lorax Environmental Services undertook a conceptual investigation of contaminant transport and behaviour of the tailings storage facility (Lorax, 2013c). The purpose of the conceptual model was to provide insight into the origin, behaviour and fate of mine-related contaminants by linking sources, seepage pathways attenuation processes, water management and contingency planning (Lorax 2013, c). **Figure 6-19** and **Figure 6-20** show the conceptual models for operations and closure/post closure. A summary of the model is presented here and the full report is included as **Annex 13**.

All of the tailings and a majority of waste rock (PAG 1, PAG 2 and NAG 3) will be stored subaquaously in the TSF. There will be no discharge of TSF during the 17 yeasr operating and early stages (18 years) of closure. The majority of seepage from the TSF will be collected and recycled during these periods, but about 2 L/s of unrecovered seepage might discharge into the environment. Therefore, seepage management is a focus of water and waste management planning.

Potential contaminant sources associated with the TSF include those associated with tailings supernatant as well as those associated with neutral pH metal leaching that may occur post-deposition (ph and/or redox controlled dissolution of metal bearing tailings and waste rock). In contrast, metal leaching associated with ARD is less relevant given that the TSF will be engineered to ensure that the reactive transition and sulphide tailings material remain saturated below the final water table elevation where oxygen transfer will be severely limited.

During operations, the quality of the porewaters within the TSF and corresponding seepage waters will be largely governed by the composition of the tailings supernatant. However, the supernatant signature will be altered within the pond environment due to the breakdown of cyanide compounds, metal removal following degradation of metal-cyanide complexes, and re-carbonation from the atmosphere. The degradation of cyanide and cyanate will also contribute to elevated ammonia levels within the pond environment during operations. From the pond system,

water will migrate downward through the saturated tailings and waste rock mass. Within suboxic zones of saturated tailings and waste rock, the reductive dissolution of redox-sensitive phases (e.g., secondary Fe oxides that form in the mill/treatment process) will result in an increase in dissolved Fe in the porewaters. This mechanism may also promote increases in the concentration of other elements (e.g., Zn, Cu and Cd) that show associations with Fe oxides.

Mineralogical and sequential extraction data for the sulphide tailings suggest that Zn and Cd occur predominately as primary and secondary sulphide minerals, with minor to negligible amounts associated with reducible phases (e.g., Fe oxides). In contrast, the transition/oxide zone materials are characterized by a mixed mineral assemblage containing both oxidizable and reducible Cd and Zn phases. In this regard, the oxide/transition materials have a greater potential for redox and pH derived dissolution of metal bearing components. Overall, however, the generally low abundance of redox-sensitive phases (e.g, Fe oxides) identified in the tailings and waste rock samples suggest that reductive dissolution processes will not have a profound effect on the concentrations of trace elements in pore waters (e.g. Cd and Zn), Given the low abundance of soluble Cd-Zn phases associated with the tailings, the potential relevance of pH dependent dissolution processes is predicted to be low, an dless significant in comparison to redox-related mechanisms.

At the base of the impoundment where tailings and waste rock are in contact with remnant vegetation and organic soils, there is an increase potential for sulphate reduction and precipitation of secondary metal sulphides. The introduction of suboxic waters from the TSF into the underlying groundwater system may results in the development of a suboxix plume in the natural aquifer. This seepage plume may be characterized by elevated concentrations of Fe, Mn, ammonia and possibly trace metals in comparison to background conditions. The results of adsorption test work indicate that the substrates underlying the TSF afford significant potential for the attenuation of Cd and Zn. This imparts an element of conservatism into water quality predictions that do not account for trace element removal along seepage pathways.

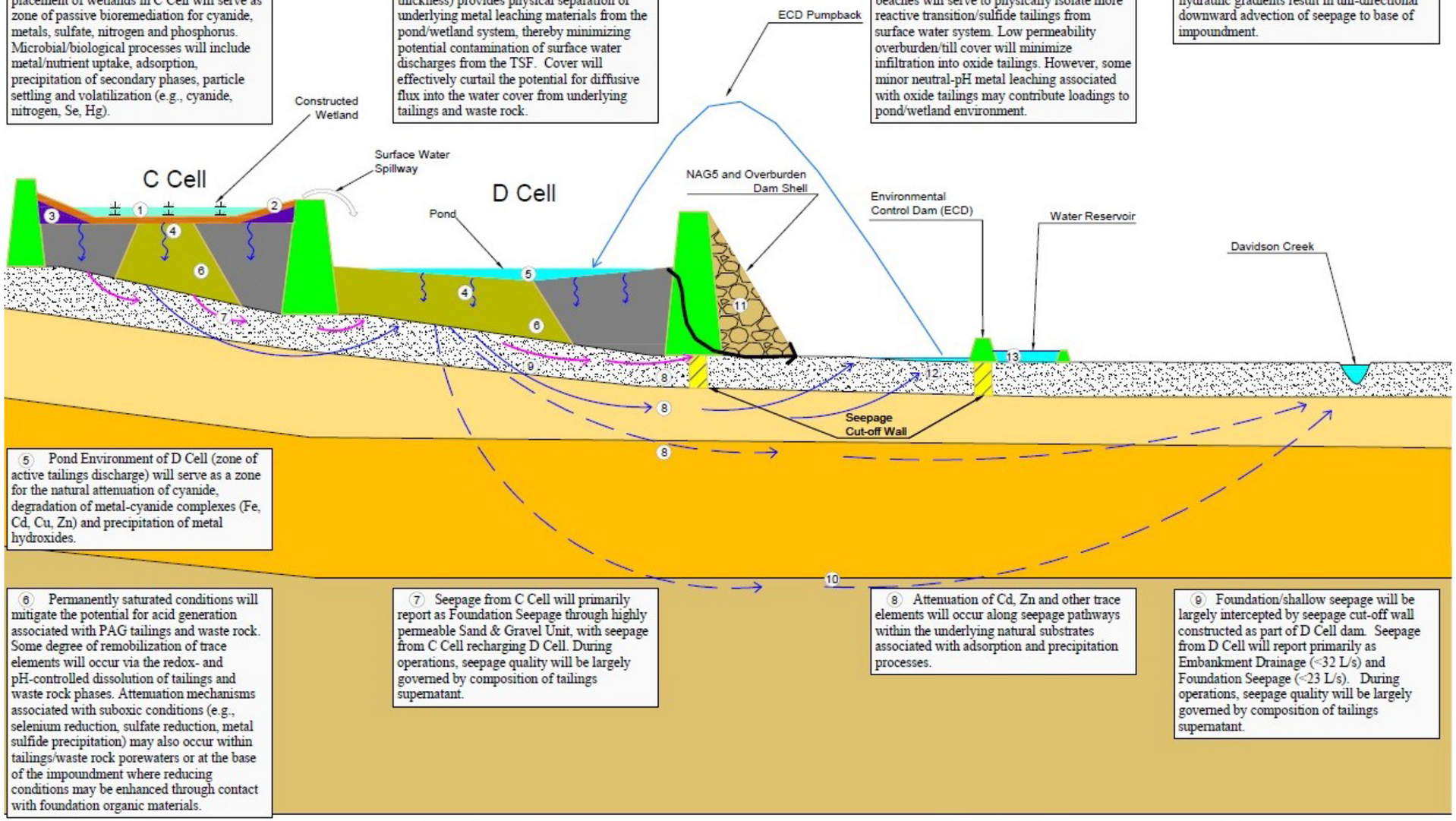
A suite of mitigation measures have been developed for the project to minimize both the volume and contamination of seepage through the impoundment design (maintenance of permanent saturation), waste management (seepage cutoff, interception, collection and pump back), active (SO_2/air treatment) and passive treatment (wetlands). Overall, the mitigation and contingency framework for TSF seepage management will provide for multiple levels of control with regards to the potential for downstream impacts.

(1) Progressive reclamation involving placement of wetlands in C Cell will serve as zone of passive bioremediation for cyanide, metals, sulfate, nitrogen and phosphorus. Microbial/biological processes will include metal/nutrient uptake, adsorption, precipitation of secondary phases, particle settling and volatilization (e.g., cyanide, nitrogen, Se, Hg).

(2) Till/overburden cover (30 cm in thickness) provides physical separation of underlying metal leaching materials from the pond/wetland system, thereby minimizing potential contamination of surface water discharges from the TSF. Cover will effectively curtail the potential for diffusive flux into the water cover from underlying tailings and waste rock.

(3) Oxide tailings cover on tailings beaches will serve to physically isolate more reactive transition/sulfide tailings from surface water system. Low permeability overburden/till cover will minimize infiltration into oxide tailings. However, some minor neutral-pH metal leaching associated with oxide tailings may contribute loadings to pond/wetland environment.

(4) Predominantly vertically-downward hydraulic gradients result in uni-directional downward advection of seepage to base of impoundment.



LEGEND

- Infiltration
- Foundation Seepage
- Shallow Seepage
- Unrecovered Seepage
- Embankment Drain
- Constructed Wetlands
- Tailings
- PAG Waste Rock
- Sand and Gravel
- Overburden/Till
- Weathered Bedrock
- Bedrock
- Overburden/Till Cover
- Dam
- Seepage Cut-off Wall
- Oxide Tails Cover

(5) Pond Environment of D Cell (zone of active tailings discharge) will serve as a zone for the natural attenuation of cyanide, degradation of metal-cyanide complexes (Fe, Cd, Cu, Zn) and precipitation of metal hydroxides.

(6) Permanently saturated conditions will mitigate the potential for acid generation associated with PAG tailings and waste rock. Some degree of remobilization of trace elements will occur via the redox- and pH-controlled dissolution of tailings and waste rock phases. Attenuation mechanisms associated with suboxic conditions (e.g., selenium reduction, sulfate reduction, metal sulfide precipitation) may also occur within tailings/waste rock porewaters or at the base of the impoundment where reducing conditions may be enhanced through contact with foundation organic materials.

(7) Seepage from C Cell will primarily report as Foundation Seepage through highly permeable Sand & Gravel Unit, with seepage from C Cell recharging D Cell. During operations, seepage quality will be largely governed by composition of tailings supernatant.

(8) Attenuation of Cd, Zn and other trace elements will occur along seepage pathways within the underlying natural substrates associated with adsorption and precipitation processes.

(9) Foundation/shallow seepage will be largely intercepted by seepage cut-off wall constructed as part of D Cell dam. Seepage from D Cell will report primarily as Embankment Drainage (<32 L/s) and Foundation Seepage (<23 L/s). During operations, seepage quality will be largely governed by composition of tailings supernatant.

(10) A small fraction of seepage from D Cell (about 2 L/s) may remain unrecovered and report directly to Davidson Creek along flow paths through Weathered Bedrock and Shallow Bedrock (fractured) Units.

(11) Neutral pH metal leaching from NAG5/overburden (minor NAG4) used for construction of D Cell dam will contribute only minor loadings to runoff and shallow seepage system that ultimately reports to ECD.

(12) Virtually all of the shallow seepage that bypasses the seepage cut off wall in the D Cell dam will recharge the surface drainage up-gradient of the Environmental Control Dam (ECD), with upward flows controlled by depressurization of surficial sand and gravels. ECD will serve to impound seepage water for pump back to TSF. Seepage collection and pump back system will capture about 96% of TSF seepage flows.

(13) Water reservoir will store and discharge water pumped from Tatelkuz Lake to mitigate flow reduction for fish resources in Davidson creek.

REFERENCE:

Lorax 2013c, Conceptual Model for Contaminant Transport and Behaviour in Tailings Storage Facility. Prepared for New Gold Inc. November 25, 2013.

CLIENT: newgold

AMEC Environment & Infrastructure
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

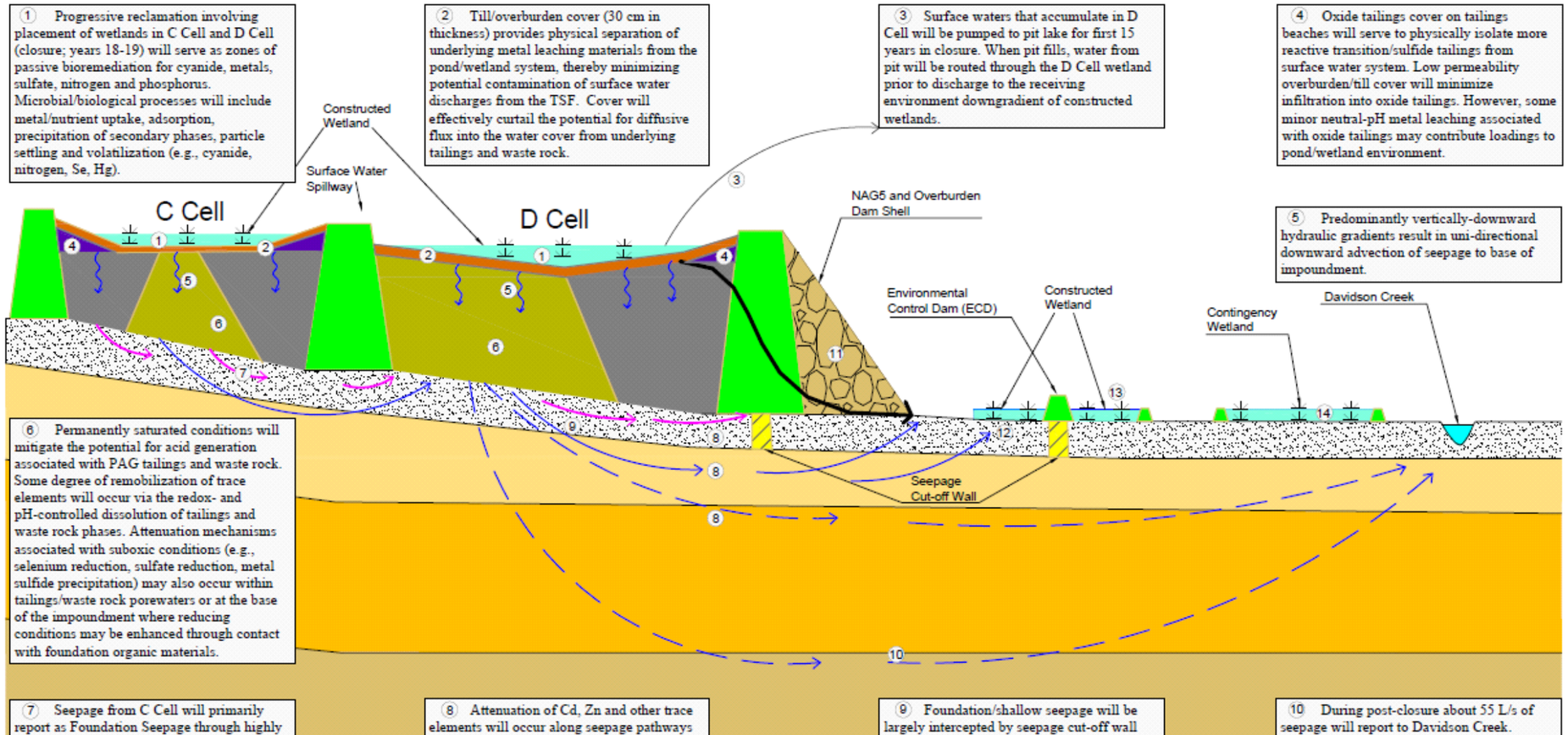
DWN BY:	MY
CHK'D BY:	MY
DATUM:	N/A
PROJECTION:	N/A
SCALE:	N/A

PROJECT: Blackwater Gold Project

TITLE: **Conceptual model for contaminant transport and behaviour in TSF (Operations)**

DATE:	January 2014
PROJECT NO:	VE52277
REV. NO.:	A
FIGURE No.	6-19

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\07_hydrogeology\EIA\07-200-045_Tailings_SeepageAnalysisArrangement.ai



① Progressive reclamation involving placement of wetlands in C Cell and D Cell (closure; years 18-19) will serve as zones of passive bioremediation for cyanide, metals, sulfate, nitrogen and phosphorus. Microbial/biological processes will include metal/nutrient uptake, adsorption, precipitation of secondary phases, particle settling and volatilization (e.g., cyanide, nitrogen, Se, Hg).

② Till/overburden cover (30 cm in thickness) provides physical separation of underlying metal leaching materials from the pond/wetland system, thereby minimizing potential contamination of surface water discharges from the TSF. Cover will effectively curtail the potential for diffusive flux into the water cover from underlying tailings and waste rock.

③ Surface waters that accumulate in D Cell will be pumped to pit lake for first 15 years in closure. When pit fills, water from pit will be routed through the D Cell wetland prior to discharge to the receiving environment downgradient of constructed wetlands.

④ Oxide tailings cover on tailings beaches will serve to physically isolate more reactive transition/sulfide tailings from surface water system. Low permeability overburden/till cover will minimize infiltration into oxide tailings. However, some minor neutral-pH metal leaching associated with oxide tailings may contribute loadings to pond/wetland environment.

⑤ Predominantly vertically-downward hydraulic gradients result in uni-directional downward advection of seepage to base of impoundment.

⑥ Permanently saturated conditions will mitigate the potential for acid generation associated with PAG tailings and waste rock. Some degree of remobilization of trace elements will occur via the redox- and pH-controlled dissolution of tailings and waste rock phases. Attenuation mechanisms associated with suboxic conditions (e.g., selenium reduction, sulfate reduction, metal sulfide precipitation) may also occur within tailings/waste rock porewaters or at the base of the impoundment where reducing conditions may be enhanced through contact with foundation organic materials.

⑦ Seepage from C Cell will primarily report as Foundation Seepage through highly permeable Sand & Gravel Unit, with seepage from C Cell recharging D Cell. During post-closure period, seepage water quality from TSF may be worse than operations due to post-depositional remobilization of tailings and waste rock components (e.g., redox- and pH-controlled processes).

⑧ Attenuation of Cd, Zn and other trace elements will occur along seepage pathways within the underlying natural substrates associated with adsorption and precipitation processes.

⑨ Foundation/shallow seepage will be largely intercepted by seepage cut-off wall constructed as part of D Cell dam. Seepage from D Cell will report primarily as Embankment Drain (<32 L/s) and Foundation Seepage (<23 L/s). During post-closure period, post-depositional processes will exert a progressively greater influence on seepage quality.

⑩ During post-closure about 55 L/s of seepage will report to Davidson Creek.

⑪ Neutral pH metal leaching from NAG5/overburden (minor NAG4) used for construction of D Cell dam will contribute only minor loadings to runoff and shallow seepage system that ultimately reports to a wetland constructed in the ECD.

⑫ Virtually all of the shallow seepage that bypasses the seepage cut off wall at the D Cell dam will recharge the surface drainage up-gradient of the former Environmental Control Dam (ECD), with upward flows controlled by depressurization of surficial sand and gravels. Wetlands will afford passive treatment for the combined seepage flow (~55 L/s) prior to discharge to Davidson Creek. Attenuation of metals can also be expected for seepage waters recharging the wetland system through organic-rich sediments.

⑬ Engineered wetland system of former ECD and water reservoirs will provide secondary polishing for mine-related discharges from TSF prior to entry to Davidson Creek.

⑭ Contingency treatment using Permeable Reactive Barriers and/or wetlands represent enhanced mitigation measures that may be implemented if further passive treatment is required to ensure compliance with water quality objectives in Davidson Creek.

LEGEND

- Infiltration
- Foundation Seepage
- Shallow Seepage
- Unrecovered Seepage
- Embankment Drain
- Constructed Wetlands
- Tailings
- PAG Waste Rock
- Sand and Gravel
- Overburden/Till
- Weathered Bedrock
- Bedrock
- Overburden/Till Cover
- Dam
- Seepage Cut-off Wall
- Oxide Tails Cover

REFERENCE:

Lorax 2013c, Conceptual Model for Contaminant Transport and Behaviour in Tailings Storage Facility. Prepared for New Gold Inc. November 25, 2013.

CLIENT: newgold

AMEC Environment & Infrastructure
4445 Lougheed, Suite 600, Burnaby, B.C., V5C 0E4
Tel. 604-294-3811 Fax 604-294-4664

DWN BY:	MY
CHK'D BY:	MY
DATUM:	N/A
PROJECTION:	N/A
SCALE:	N/A

PROJECT: Blackwater Gold Project

TITLE: **Conceptual model for contaminant transport and behaviour in TSF (Closure and Post Closure)**

DATE:	January 2014
PROJECT NO:	VE52277
REV. NO.:	A
FIGURE No.	6-20

Y:\GIS\Projects\VE\VE52095_Richfield_Blackwater\Mapping\07_hydrogeology\EIA\07-200-045_Tailings_SeepageAnalysisArrangement.ai

7.0 ML/ARD RULES FOR MINE WASTE MANAGEMENT

This section describes recommended guidelines for management of mine rock and tailings based on the results of the geochemical characterization studies conducted to date on the Blackwater project. The rules are a collaborative document designed to reduce ML/ARD risks and impacts to the Project through applying the characterization results to manage mine waste during operations and closure. Input into the development of these rules was obtained from many technical specialists involved in the Blackwater project, including geochemists, geotechnical engineers, mining engineers, and environmental scientists.

7.1 Overburden

Overburden is NAG with low ML characteristics except potentially some blocks near the bedrock interface that might be ML. Overburden blocks near the bedrock interface would be tested for metal content to confirm that they are not ML using the 1000 ppm Zn criterion for NAG 3 waste rock. Otherwise, overburden blocks may be used for construction on or off the mine site, or stored in on-land dumps.

7.2 Waste Rock

Waste rock categories for segregation are as follows:

- PAG 1 (PAG) – NPR ≤1.0: store underwater in TSF;
- PAG 2 (PAG) – 1.0 < NPR ≤ 2.0 (PAG) store underwater in TSF;
- NAG 3 (non-PAG, ML potential) – NPR >2.0 and Zn ≥1,000 ppm: store underwater in TSF;
- NAG 4 (non-PAG) – NPR >2.0 and Zn 600-1000 mg/kg store in on-land dump with limited amounts in dam D downstream shell;
- NAG 5 (non-PAG) – NPR >2.0 and Zn < 600 mg/kg: dam D downstream shell & on-land dump.
- PAG 1 waste rock is PAG, with little to no lag time until acid generation. PAG 1 waste rock should be stored underwater within 1 year to minimize ARD and metal release.
- PAG 2 waste rock is PAG with a short lag time until acid generation (ranging from approximately half a year to seven years). PAG 2 waste rock should be stored underwater within one year of placement in TSF to reduce ARD and significant metal release.
- Overburden should be placed on top of exposed PAG 1 and PAG 2 waste rock in the TSF to isolate supernatant prior to flooding at closure.
- PAG 1 or PAG 2 waste rock should not be used for construction except in the upstream section of the TSF dams, where it will be flooded.

- NAG 3, 4, and 5 waste rock types are suitable for construction of the upstream section of the TSF dams where they will be flooded. NAG 3 waste rock could be used preferentially in TSF upstream shells to reduce TSF storage requirements..
- NAG 3 waste rock is not predicted to generate acidic leachate, but it should be stored underwater in the TSF within 3 to 5 years to inhibit metal leaching.
- NAG 4 waste rock may be used for construction on the mine site (including the Dam C downstream shell and limited amounts in the Dam D downstream shell). Geochemical testing found no significant difference in leaching potential of NAG 4 and NAG 5 waste rock. Preferential use of NAG 5 over NAG 4 waste rock in the Dam D downstream shell is simply an additional risk reduction measure.
- NAG 5 waste rock or overburden should be preferentially used for construction of the Dam D downstream shell, and any construction on or off the mine site.
- NAG 5 waste rock not used for construction should be placed in the East Dump..
- NAG 4 waste rock not used for construction should be placed in the West Dump that drains by gravity to the TSF..
- The East and West waste rock dumps should be covered with a till cover at closure to facilitate reclamation and potentially reduce infiltration. Detailed cover thickness specifications will depend on material characteristics, but it is likely to be 30 cm.
- Drainage from the West and East waste rock dumps should be collected, monitored, and directed to the TSF during operations.
- Drainage from the on land East Dump should be monitored during operations, and, if found to have acceptable quality, may be released to the Creek 661.

7.3 Ore and Tailings

- Where possible, run-of-mine ore should be processed through the mill within six months of mining.
- WOL tailings are expected to be PAG during operations and should be stored underwater or covered with fresh saturated tailings within 1 year of production.
- Towards the end of the mine life, tailings should be discharged into the centre of the pond to flatten and reduce the exposed beach.
- After the cessation of tailings discharge to the TSF, overburden should be placed (potentially slurried) onto the beach and the water level raised to cover and/or saturate the tailings to the maximum extent possible. Additional data are required, but an oxide tailings cover could be placed instead of overburden on Cell C beach, or a cover of oxide / transition LGS tailings with depleted sulphide content on Cell D beach with additional overburden cover as required.
- At closure, excess TSF supernatant should be pumped to the open pit to facilitate flooding while maintaining the water cover on PAG waste rock and saturated tailings.

7.4 Low-Grade Stockpile

- Low-grade stockpile (LGS) ore should be placed on a compacted till pad where it would drain towards the TSF. A seepage and runoff collection and freshwater diversion system should be established.
- Any acidic drainage from the LGS should be neutralized to increase pH concentration and reduce metals before discharge to the TSF.
- The LGS ore should be processed through the mill during the mine life to remove its long-term liability. Oxide and transition facies LGS tailings might be used for cover over the Cell D beach near the end of mine life, but requires additional supporting data that could be collected during operations.
- The LGS should be placed where it can be moved to the pit or TSF and flooded at closure if unprocessed. It may be necessary to add lime to the low-grade ore before submergence to ensure neutral to alkaline interstitial water, and reduce metal loadings to the pit or TSF.

7.5 Open Pit

- Although not predicted in the pit lake model, the pit water may become acidic with elevated metals during operations. If required, open pit water would be neutralized to increase pH and reduce metals concentrations before placing in the TSF.
- The open pit should be filled rapidly at closure by pumping TSF supernatant and available surface water, including from Tatelkuz Lake, to minimize ARD and metal release from exposed PAG walls. After filling, drainage from the pit lake would be directed to the TSF. Treatment of pit water during filling may be beneficial as a contingency by adding nutrients (e.g., fertilizer) to the pumped TSF supernatant to facilitate algal growth and metal removal.

8.0 CONCLUSIONS

All overburden samples from the open pit, plant, TSF and access road area were classified as NAG based on ABA results and the NAG test. One sample from the overburden-bedrock interface had elevated sulphur and was classified as PAG and three samples had an uncertain ARD classification (NPR between 1-2). No sulphide minerals were identified in overburden from the open pit. Generally, the overburden had low solid phase and static leach testing metal concentrations. Except for material near the bedrock interface, overburden can be used for construction and reclamation purposes. Overburden near the interface will be tested and if found to be metal leaching, managed like NAG 3 waste rock.

Waste rock at Blackwater has low sulphur concentrations (median of 0.3% total sulphur) and low NP (median of 10 kg CaCO3/t). Waste rock will be segregated and managed on the basis of NPR and zinc concentrations.

Table 8-1: Waste Rock Classification Based on NPR and Zn Concentrations

Classification	NPR	Metal Content
PAG 1	NPR ≤ 1	
PAG 2	NPR 1- ≤2	
NAG 3	NPR > 2	zinc ≥ 1,000 mg/kg
NAG 4	NPR > 2	zinc 600 to 1,000 mg/kg
NAG 5	NPR > 2	zinc < 600 mg/kg

Pyrite and sphalerite were the most common sulphide minerals identified in waste rock samples. Calcite was the most common carbonate mineral for NAG 4 and NAG 5 samples and was also observed in NAG 3 material. Siderite was only identified in PAG 1, PAG 2 and NAG 3 samples. This suggests that the carbonate NP in the NAG 4 and NAG 5 waste rock will be available for neutralization. Andesite is the most common rock type for NAG 4 and NAG 5 waste rock.

Some of the waste rock had high concentrations of solid phase metals, most notable zinc and cadmium.

The ABA results showed that the waste rock had low sulphur concentrations; 88% of all samples had a total sulphur concentration less than 1.0%. The waste rock also had low NP and carbonate NP values. The median NP value for all samples was 10 kg CaCO3/t and the median CNP was 4.2kg CaCO3/t.

Sulphur content measured by aqua regia digestion ICP analysis was shown to be a good surrogate for total sulphur as determined by Leco furnace. Using the ABA database, which was more conservative than the block model, Ca NP can be used as a surrogate for NP, although it did result in reclassification of a small amount of PAG 1, PAG 2, and NAG 3 samples being classified as NAG 4 or NAG 5 waste rock. As was shown in the block model, many of these were isolated, singleton blocks, which would be handled as PAG/NAG 3 waste rock, and submerged

in the TSF. Additionally, operations testing will target material near the boundary of PAG/NAG 3 and NAG 4/5 rock.

The humidity cell tests showed that all the PAG 1 and some of the PAG 2 samples were acid-generating with little to no lag time. None of the NAG humidity cell tests had depressed leachate pH values. In general, cadmium, zinc, iron and lead loads are higher in the tests with acidic pH values compared to those with neutral or alkaline values.

The results of the field bin tests were similar to those for the humidity cell tests, but typically had a longer lag time until acid generation. Metal loads from the sub-aqueous waste rock columns were significantly lower (often by an order of magnitude) than comparable humidity cell tests, due to oxygen-deficient conditions inhibiting sulphide mineral oxidation. Taken together, the results of kinetic testing indicate time until acid generation will be longer under field conditions than in laboratory testing, metal loads under neutral pH conditions are lower than under acidic conditions, and underwater storage of waste rock significantly reduced metal leaching. Selenium and mercury were generally less than detection limit in all leaching tests and not expected to be of concern.

The pH neutralization experiments showed that metal loads in acidic humidity cell leachate can be significantly reduced by increasing to alkaline pH values through lime addition and co-precipitation or adsorption onto iron hydroxides. This suggests that adding acidic, metal-rich drainage from the low grade stockpile of temporary ore stockpile, or from adding interstitial PAG waste rock water in the TSF to alkaline water generated during the milling process, would reduce metal concentrations. Nevertheless drainage from the LGS and temporary ore stockpile will be neturalized by lime prior to addition to the TSF.

Ore samples are primarily PAG with high metal concentrations and low NP values.

A range of metallurgical test samples were tested including whole ore leach samples. The whole ore leach tailings were PAG and had elevated solid phase concentrations of arsenic, cadmium and zinc. Humidity cell testing results indicate that the whole ore leach tailings have lower metal loads than the heap leach tailings and similar loads to sulphide ore flotation tailings and the rougher flotation tailings. The whole ore leach tailings sample typically also had a lag time between the start of testing, development of slightly acidic leachate (pH less than 6.0) and the increase in metal loads. Given the similar loads between the rougher tailings and the whole ore leach tailings, there would have to be very high removal of metal sulphides to produce ‘clean’ rougher tailings with low metal loads. Metallurgical tests showed high sulphide removal from rougher tailings is not feasible.

The WOL tailings are expected to be PAG with elevated metal concentrations in leachates if left exposed on a tailings beach. Results from the humidity cell test suggest a lag time of up to 1 year (based on lab conditions) until acidic drainage and metal leaching may occur in exposed, non-saturated conditions as might be found in an exposed tailings beach.

The ABA block model showed the overall zonation from PAG material towards the center of the ore body with an increase in NAG material towards the periphery. Most of the waste generated

by mining will be PAG 1 and PAG 2 (53%). Overburden will comprise 13% of the total amount of waste and 33% of the waste rock is NAG 3, NAG 4 or NAG 5. The block model showed that blocks of the same waste rock types tend occur together and will be amenable to segregation during operations.

The block model was also used to examine the waste rock types exposed in the open pit at the end of mining and after the pit lake is flooded. The flooding of the open pit reduced the exposed area of PAG 1 and PAG 2 waste rock from 32% of the ultimate pit walls to 16%, and reduced the area of the NAG 3 waste rock from 11% to 5%. Most of the exposed high wall will be overburden and NAG 4 and NAG 5 waste rock. Therefore the exposed ultimate high wall above the pit lake has limited potential for ARD and ML drainage.

The geochemical characterization results were used to develop source terms and predictive water quality models for several mine features. The results of testing and modelling were provided as input to the overall site water quality modelling efforts.

All the testing and modelling results were used to support a series of ARD ‘rules’ to guide waste management during all phases of mining. In general, PAG and metal leaching NAG waste rock will be permanently submerged in the TSF. NAG waste rock with low metal content will be stored in on-land waste rock dumps or used for construction. The best available material, typically NAG 5, and overburden will be used for the Dam D downstream shell and the East Dump. Limited NAG 4 will be used in the Dam D downstream shell. PAG whole ore leach tailings will be kept saturated or covered as quickly as possible by fresh alkaline tailings during operations. All sulphide and transition tailings will be permanently submerged for closure. Tailings and waste rock interstitial water in the TSF will be separated from the supernatant by a layer of overburden.

From Year -1 of construction until the overflow of the pit lake and TSF some 18 years after the cessation of milling (i.e., about 36 years total or Year 35) all surface water drainage from the mine site including from the TSF beaches and dams, pit, waste rock dumps, low grade ore and temporary ore stockpiles will be collected and contained within the TSF. Only a very minor amount (about 2 L/s) of seepage from the TSF might be discharged to Davidson Creek during this period. The long surface water containment period allows for thorough monitoring of the system and the implementation of contingency plans, if required. As such, this robust water management strategy combined with the waste management plan results in a low risk to the environment.

REFERENCES AND BIBLIOGRAPHY

AMEC, 2012. Preliminary Economic Assessment Report, Blackwater Project. Prepared for New Gold Inc., September 20, 2012.

AMEC, 2013. DRAFT – Potentially Acid Generating Waste Rock Seepage Quality Model. Prepared for New Gold Inc., April 4, 2013.

AMEC, 2013. Feasibility Study Blackwater Project, BC. Prepared for New Gold Inc., December 6, 2013.

AMIRA, 2002. ARD Test Handbook. AMIRA P387A Project. Ian Wark Research Institute and Environmental Geochemistry International Pty Ltd.

British Columbia Ministry of Energy and Mines, 1998. Policy for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia.

British Columbia Ministry of Environment and Mine, 2012. Water and Air Monitoring Guidance Document for Mine Proponents and Operators.

Cathles, L. M.; Apps, J. A., (1975). A model of the dump leaching process that incorporates oxygen balance, heat balance and air convection. Metall. Mater. Trans. B., 6 (4), 617-624.

EGi, 2013. Specialized ARD Testing of Samples from the Blackwater Gold Project, BC, Canada.

Ferguson, K. 2013. Email dated February 4, 2013. Screen capture of recent blasting study for Blackwater ore and waste.

Fisher, T.S.R. and G.A. Lawrence. 2006. Treatment of acid rock drainage in a meromictic mine pit lake. Journal of Environmental Engineering, Vol. 132(4), pp. 515-526.

Fontaine, D. 2013. Email dated March 26, 2013. Initial water balance estimates pertaining to precipitation reporting to dumps and stockpiles.

Gammons, C.H. and T.E. Duaime. 2006. Long Term Changes in the Limnology and Geochemistry of the Berkeley Pit Lake, Butte, Montana. Mine Water and the Environment, Vol. 25, pp. 76-85.

GARD Guide, 2009. www.gardguide.com.

Horton, J., 2013. Email dated June 20, 2013. Approximate foot print area of temporary ore stockpile.

Knight Piesold, 2013a. Preliminary Engineering Hydrometerology Report. Prepared for New Gold Inc., February 22, 2013.

Knight Piesold, 2013b. DRAFT Preliminary Feasibility Study Water Balance Model. Prepared for New Gold Inc., June 25, 2013.

Knight Piesold, 2013c. Infiltration and Runoff_Jul18.xlsx. Prepared for New Gold Inc., July 18, 2013.

Knight Piesold, 2013d. Blackwater_FS_WBM_008_result_WQM_20130712.xlsx. Prepared for New Gold Inc., July 12, 2013.

Knight Piésold, 2013e. Blackwater – Site Water Balance Model update in GoldSim (WBM_013). Prepared for New Gold Inc., December 13, 2013.Lorax 2013c, Conceptual Model for Contaminant Transport and Behaviour in Tailings Storage Facility. Prepared for New Gold Inc. November 25, 2013.

Lorax, 2013a. Blackwater Gold Project: Mineralogical Characterization of Waste Rock and Tailings. Prepared for New Gold Inc. September 9, 2013.

Lorax, 2013b. Metal Sorption Potential of Natural Substrates Underlying the Blackwater Tailings Storage Facility: Implications for Attenuation Along Seepage Flowpaths. Prepared for New Gold Inc. July 29, 2013.

MEND, 1996. MEND Project 1.61.2 Acid Mine Drainage in Permafrost Regions: Issues, Control Strategies and Research Requirements.

Miller, S.; Robertson, A.; Donohue, T., 1997. Advances in Acid Drainage Prediction using the Net Acid Generation (NAG) Test. Fourth International Conference on Acid Rock Drainage. Proceedings (Volume 2). Vancouver, B.C.

Morin, K. and Hutt, N., 2004. The Minewall Approach for estimating the geochemical effects of mine walls on pit lakes. Pit Lakes 2004. United States Environmental Protection Agency. 16 – 18 November 2004.

Morin, K.A., Hutt, N.M. 1999. MDAG Grain 3.0. Minesite Drainage Assessment Group (MDAG)TM.

New Gold, 2013. Feasibility Study Block Model (bwfs15.dat). Provided by New Gold April 11, 2013.

Norwest Corporation, 2013b. MaterialsExposedInpitwall-clean.xlsx. Prepared for New Gold Inc., July 12, 2013.

Norwest Corporation. 2013a. Preliminary Environmental Assessment Data Package. Prepared for New Gold Inc., May 15, 2013.

Parkhurst, D.L. and C.A.J. Appelo. 1999. Users Guide to PHREEQC. Water Resources Investigations Report 99-4259. Denver, CO

Payne, J.G., 2010. Report 100099. Prepared for Christopher Leslie, Richfield Ventures Corp.

Price, W.A.,1997. Draft guidelines and recommended methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia.

Price, W.A. 2009. Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. CANMET - Mining and Mineral Sciences Laboratories. Natural Resources Canada. Prepared for MEND Program. MEND Report 1.20.1. December 2009.

Raudsepp, M and E. Pani, 2001. Quantitative Phase Analysis of Tailings and Waste Rock using the Rietveld Method and X-ray Powder Diffraction Data. In: Proceedings of 8th Annual British Columbia Ministry of Energy and Mines – MEND Metal Leaching and ARD Workshop. Vancouver, British Columbia, Nov. 28-29.

Raudsepp, M and E. Pani, 2003. Application of Rietveld Analysis to Environmental Mineralogy – Chapter 8. In: J.L. Jamob, D.W. Blowes and A.I.M. Ritchie (eds.) Envrionmental Aspects of Mine Wastes. Mineralogical Assocation of Canada Short Course Series, Volume 31.

Sanchez Espana, J., E. Lopez Pamo, E. Santofimia Pastor and M. Diez Ercilla. 2008. The acidic mine pit lakes of the Iberian Pyrite Belt: An approach to their physical limnology and hydrogeochemistry. Applied Geochemistry, Vol. 23, pp. 1260-1287.

SGS, 2013. An Investigation of the Recovery of Gold From the Blackwater Project Samples. Excerpt of Cyanide Destruction Test work. Prepared for New Gold Inc. Project 13989-001 Final Report. October 18, 2013.

Tessier, A, P. G. C. Campbell, and M. Bisson. Sequential Extraction Procedure for the Speciation of Particulate Trace Metals. Analytical Chemistry, Vol. 51, No. 7, June 1979, pp 844-850.

Vancouver Petrographics Ltd., 2011. Report 101176. Prepared for Scott McBride, Richfield Ventures Corp.

ANNEXES

ANNEX 1
Mineralogy Results

QUANTITATIVE PHASE ANALYSIS OF TWENTY-TWO POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA

Project: Blackwater

Andrea St. Pierre - Emily Sportsman (AMEC)
Richfield Ventures Corp.
242 Reid Street
Quesnel, B.C. V2J 2M2

Mati Raudsepp, Ph.D.
Elisabetta Pani, Ph.D.
Jenny Lai, B.Sc.
Edith Czech, M.Sc.

Dept. of Earth & Ocean Sciences
The University of British Columbia
6339 Stores Road
Vancouver, BC V6T 1Z4

June 17, 2011

EXPERIMENTAL METHOD

The twenty-two samples of Project Blackwater were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1 (separate file, ***Richfield Ventures Corp Results June 17 2011- Project Blackwater.xls***). These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 22. The ideal formulae of phases present are given in Table 2.

Note that the sample **"BW-ARD-170"** (Figure 10) contains a significant amount of unidentified clay, likely a member of the smectite-group. As these disordered clays do not have predictable crystal structure, we have used an empirical structural model for montmorillonite. Therefore the determined amount is semi-quantitative.

Table 1. Results of quantitative phase analysis (wt. %) XRD-Rietveld – Richfield Ventures Corp. Project Blackwater – 22 samples

WASTE ROCK															
	#1 BW-ARD2-9		**#2 BW-ARD-037**		**#3 BW-ARD-029**		**#4 BW-ARD-105**		**#5 BW-ARD-058**		**#6 BW-ARD-073**		**#7 BW-ARD-253**		**#8 BW-ARD-288**
Quartz	27.8	Quartz	37.4	Quartz	60.8	Quartz	30.1	Quartz	45.9	Quartz	53.3	Quartz	33.3	Quartz	36.1
Muscovite	20.5	Clinochlore	6.4	Muscovite	32.3	Muscovite	4.2	Muscovite	28.1	Muscovite	25.5	K-feldspar	26	Sphalerite	0.5
Clinochlore	6.6	K-feldspar	26	K-feldspar	2.4	K-feldspar	21.9	K-feldspar	13	K-feldspar	20	Sphalerite	0.8	Clinochlore	6.8
K-feldspar	39.5	Sphalerite	0.7	Biotite	4.2	Biotite	23.4	Siderite	6.3	Kaolinite	0.5	Biotite	18.1	Muscovite	10.4
Pyrite	4	Muscovite	18.4	Sphalerite ?	0.1	Clinochlore	4	Pyrite	2.1	Sphalerite	0.1	Clinochlore	4.8	Siderite	0.7
Siderite	1.4	Biotite	10.7	Ankerite ?	0.3	Plagioclase	15.1	Kaolinite	4.3	Pyrite	0.6	Plagioclase	0.9	Biotite	18.8
Sphalerite	0.3	Pyrite	0.4			Siderite	0.7	Hematite ?	0.3			Muscovite	15.6	K-feldspar	16.8
						Pyrite	0.3					Siderite	0.5	Plagioclase	10
						Sphalerite	0.4								
	#9 BW-ARD-159		**#10 BW-ARD-170**		**#11 BW-ARD-176**		**#12 BW-ARD-178**		**#13 BW-ARD-184**		**#14 BW-ARD-093**		**#15 BW-ARD-206**		
Quartz	54.7	Quartz	9.2	Quartz	30.9	Quartz	30.7	Quartz	47.8	Quartz	35.1	Quartz	49.5		
Muscovite	25.4	Cristobalite	11.5	Plagioclase	15.6	Muscovite	17.9	Muscovite	35.5	Muscovite	21.9	Muscovite	24.8		
K-feldspar	13.1	Biotite	3.1	Muscovite	13.7	Clinochlore	7.1	K-feldspar	11	K-feldspar	20.2	K-feldspar	10.6		
Kaolinite	6.6	Plagioclase	33.5	Biotite	23.5	K-feldspar	25.2	Pyrite	1	Sphalerite	0.8	Biotite	13.7		
Dawsonite ?	0.2	Rhomboclase	0.1	K-feldspar	13.1	Biotite	14.6	Kaolinite	1.6	Biotite	19.9	Kaolinite ?	1.1		
		K-feldspar	27.8	Sphalerite	0.3	Plagioclase	3	Sphalerite	0.3	Kaolinite	1	Sphalerite ?	0.2		
		Montmorillonite Model	14.7	Hydroxylapatite	1	Hydroxylapatite	1	Biotite	2.8	Andradite ?	0.5				
				Kaolinite	0.7	Siderite	0.5			Siderite	0.5				
				Siderite	0.5										
				Calcite ?	0.8										

Overburden					
	#16 BW-ARD-310		#17 BW-ARD-315		#20 BW-ARD-007
Quartz	35.7	Quartz	37.3	Quartz	63.1
K-feldspar	16.7	K-feldspar	17.1	Muscovite	33.5
Hematite	0.6	Muscovite	11	K-feldspar	3.4
Muscovite	9.5	Plagioclase	29.1		
Actinolite	6.3	Clinochlore	2.5		
Plagioclase	26.5	Biotite	2.5		
Dolomite	0.8	Hematite	0.5		
Clinochlore	4.1				

Ore							
	#18 BW-ARD-001		#19 BW-ARD-258		#21 BW-ARD-009		#22 BW-ARD-200
Quartz	54.6	Quartz	52.1	Quartz	34.9	Quartz	48.5
K-feldspar	7.7	K-feldspar	24.1	Muscovite	27.9	Muscovite	31.8
Muscovite	31.4	Muscovite	20.7	K-feldspar	13.1	Pyrite	15.1
Biotite	2.3	Pyrite	1.2	Biotite	15.5	Siderite	0.5
Kaolinite	3.5	Sphalerite	0.6	Sphalerite	1.6	K-feldspar	2.5
Dolomite	0.4	Diopside	1.3	Kaolinite	2	Sphalerite	0.5
				Pyrite	2.5	Calcite ?	1
				Pyrrhotite	1.9		
				Siderite	0.6		

Table 2

Mineral	**Ideal Formula**
Actinolite	$Ca_2(Mg,Fe^{2+})_5Si_8O_{22}(OH)_2$
Andradite	$Ca_3Fe_2^{3+}(SiO_4)_3$
Ankerite – Dolomite	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2 – CaMg(CO_3)_2$
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$
Calcite	$CaCO_3$
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$
Cristobalite	SiO_2
Dawsonite	$NaAl(CO_3)(OH)_2$
Diopside	$CaMgSi_2O_6$
Hematite	α-Fe_2O_3
Hydroxylapatite	$Ca_5(PO_4)_3(OH)$
Kaolinite	$Al_2Si_2O_5(OH)_4$
K-Feldspar	$KAlSi_3O_8$
Montmorillonite Model	$(Na,Ca)_{0.3}(Al,Mg)_2Si_4O_{10}(OH)_2 \cdot nH_2O$
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$
Pyrite	FeS_2
Pyrrhotite	$Fe_{1-x}S$
Quartz	SiO_2
Rhomboclase	$(H_5O_2)^{1+}Fe^{3+}(SO_4)_2 \cdot 2H_2O$
Siderite	$Fe^{2+}CO_3$
Sphalerite	$(Zn,Fe)S$

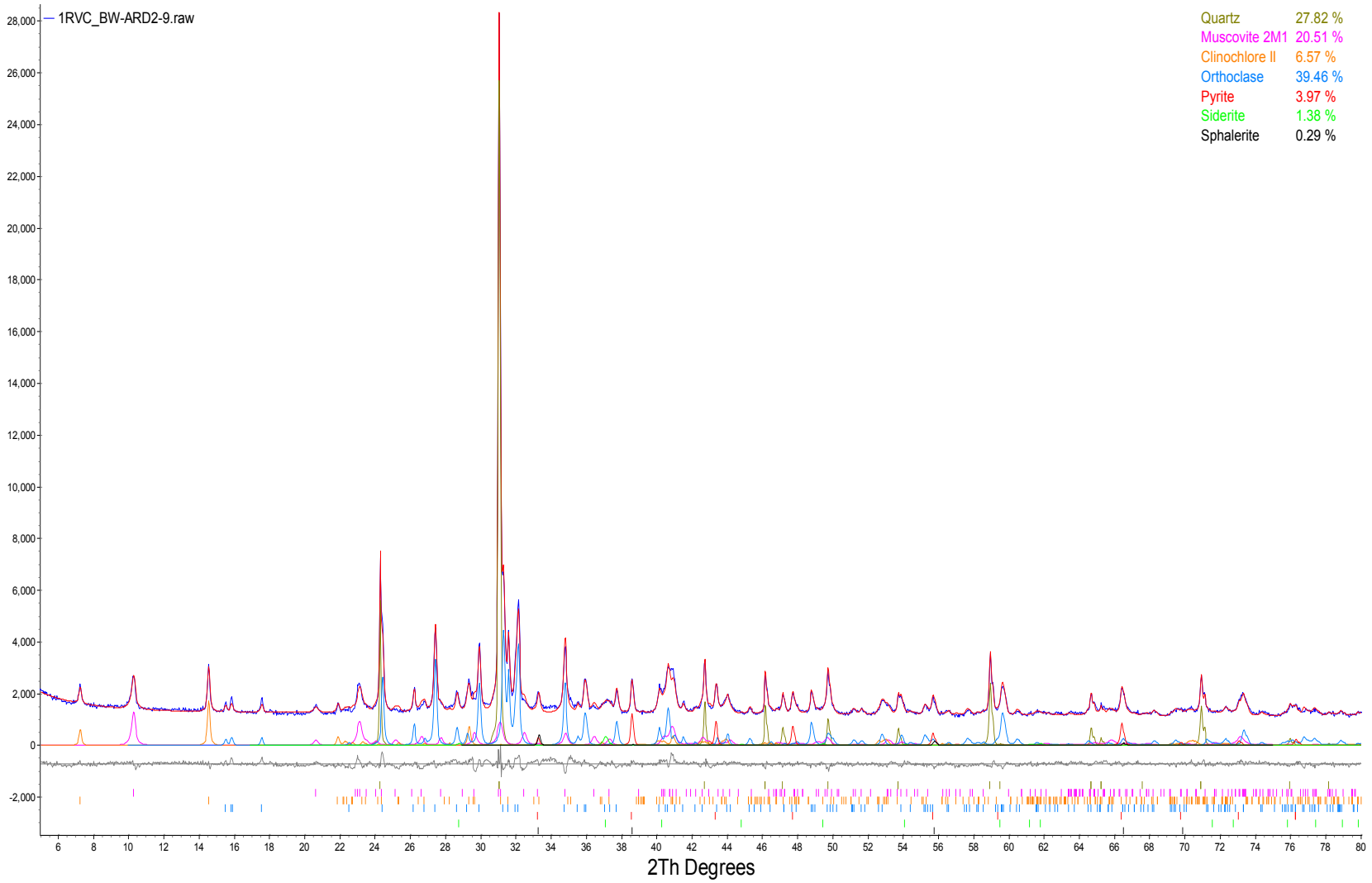


Figure 1: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD2-9"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

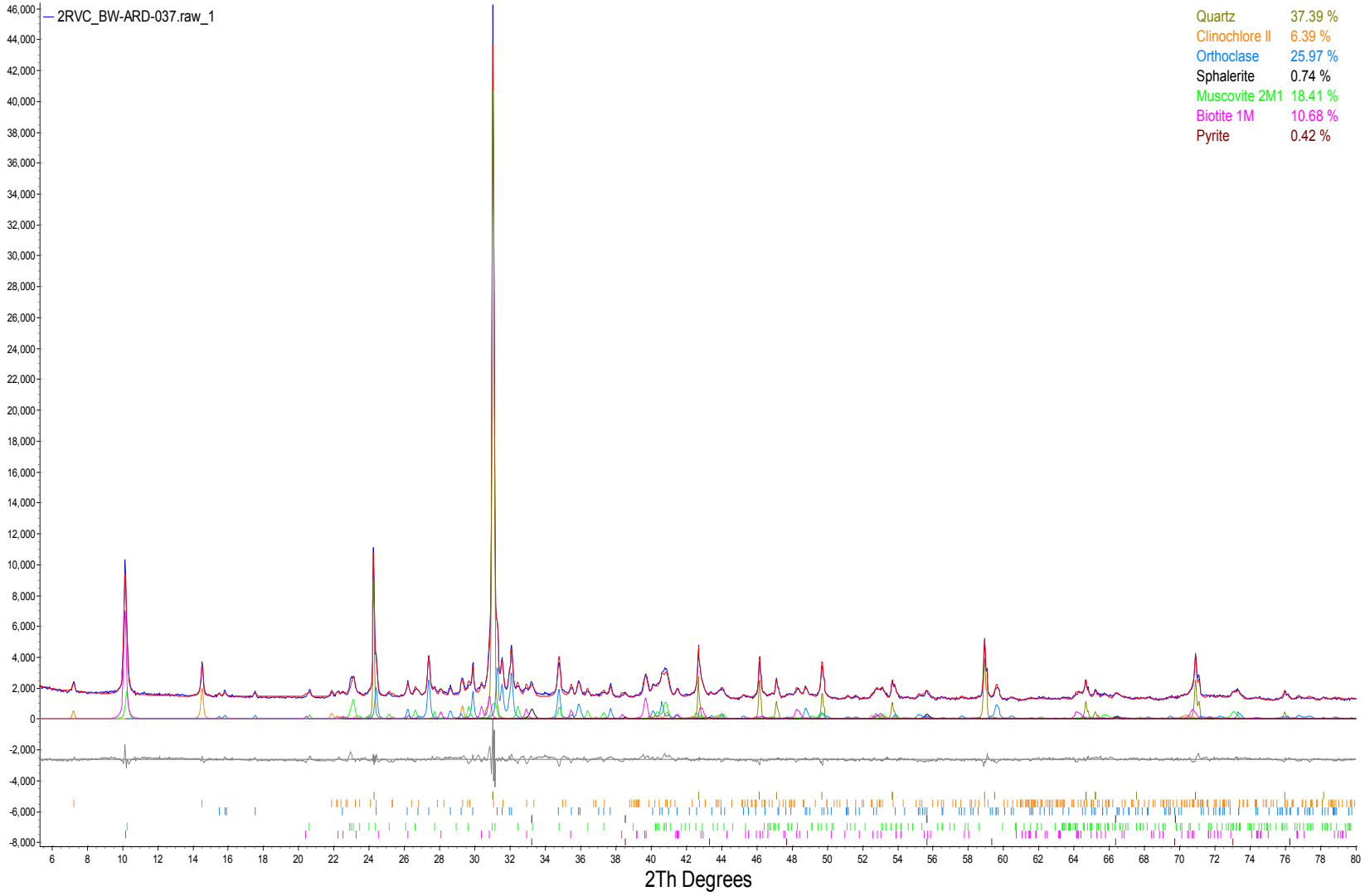


Figure 2: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-037"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

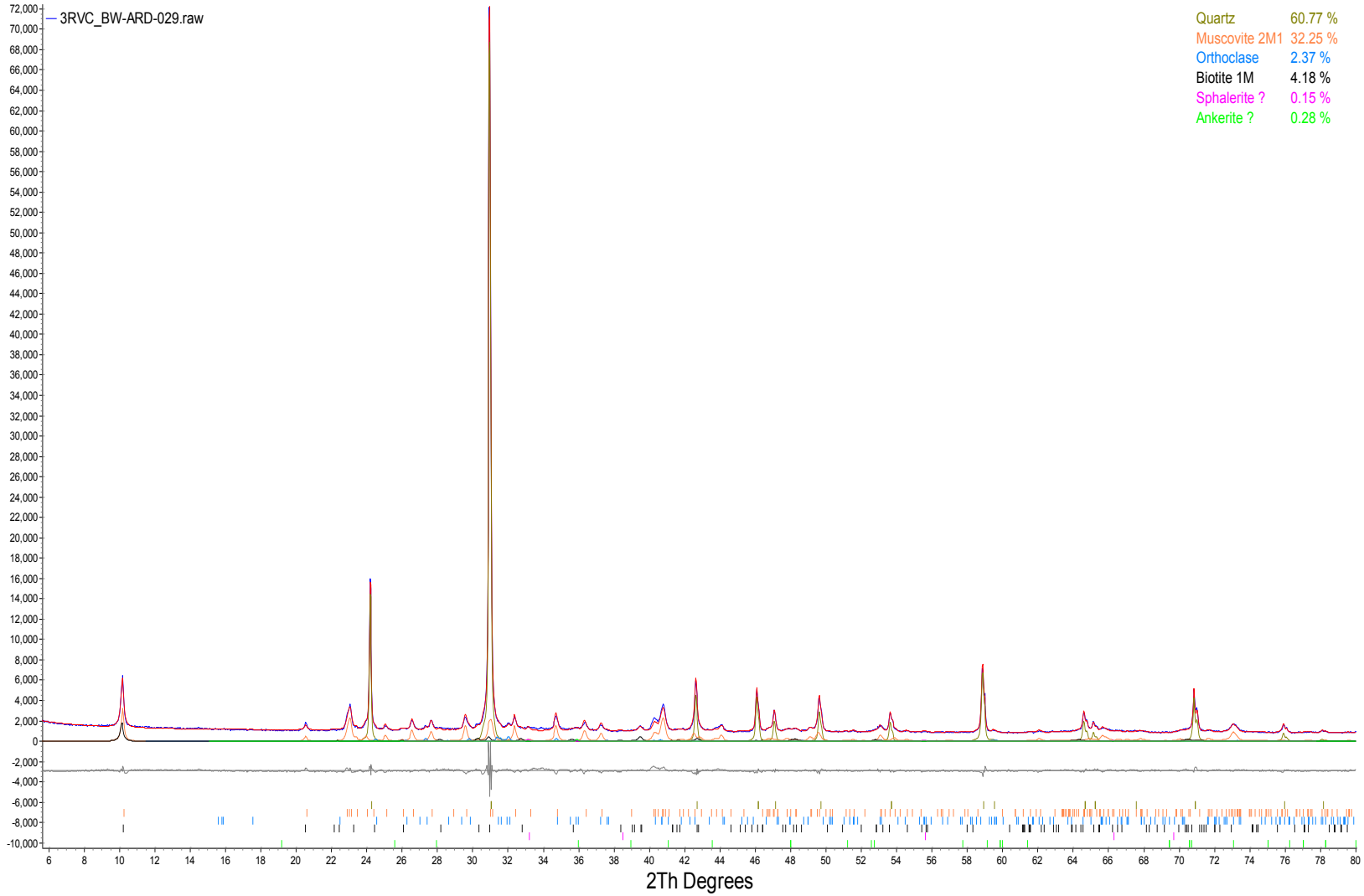


Figure 3: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-029"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

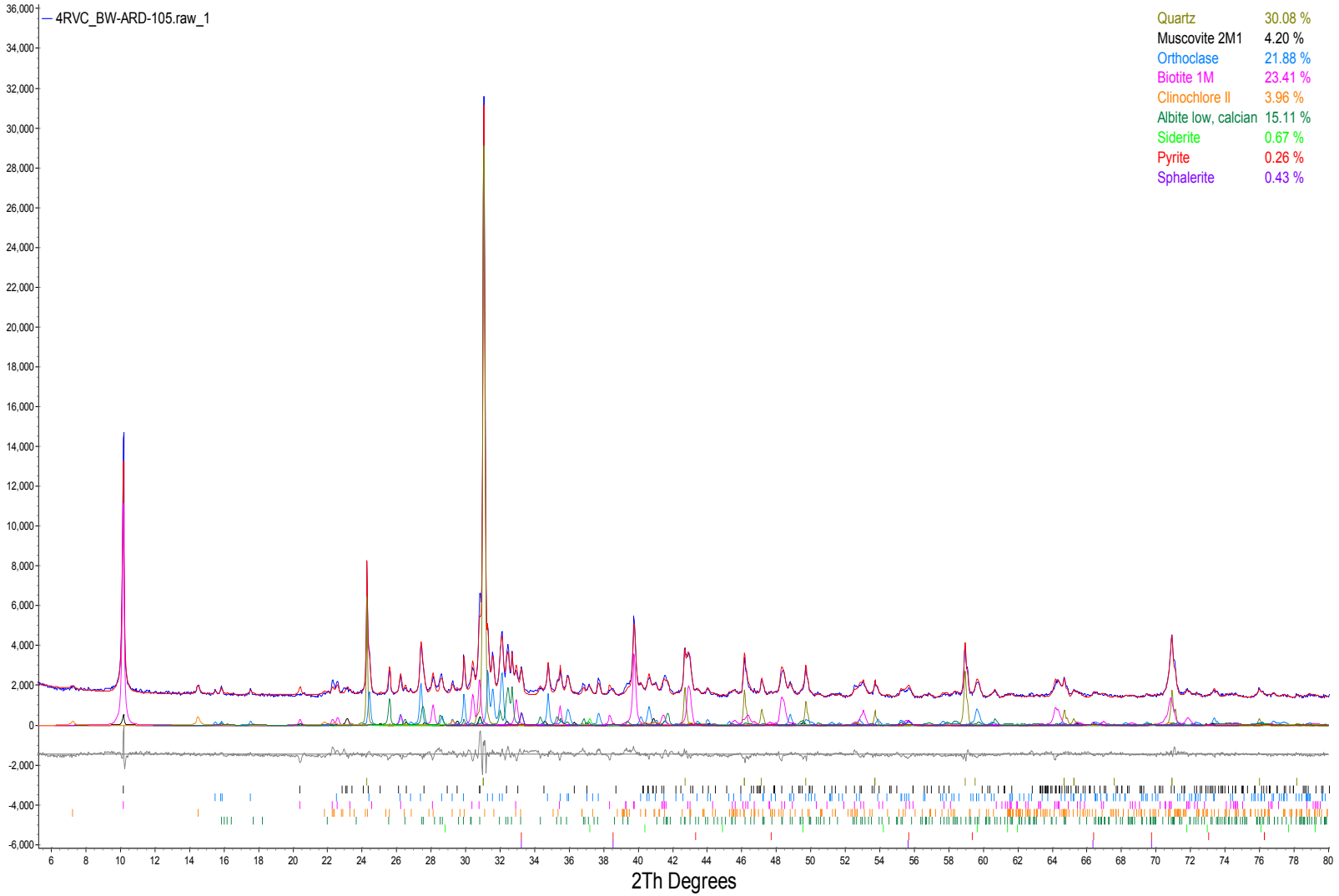


Figure 4: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-105"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

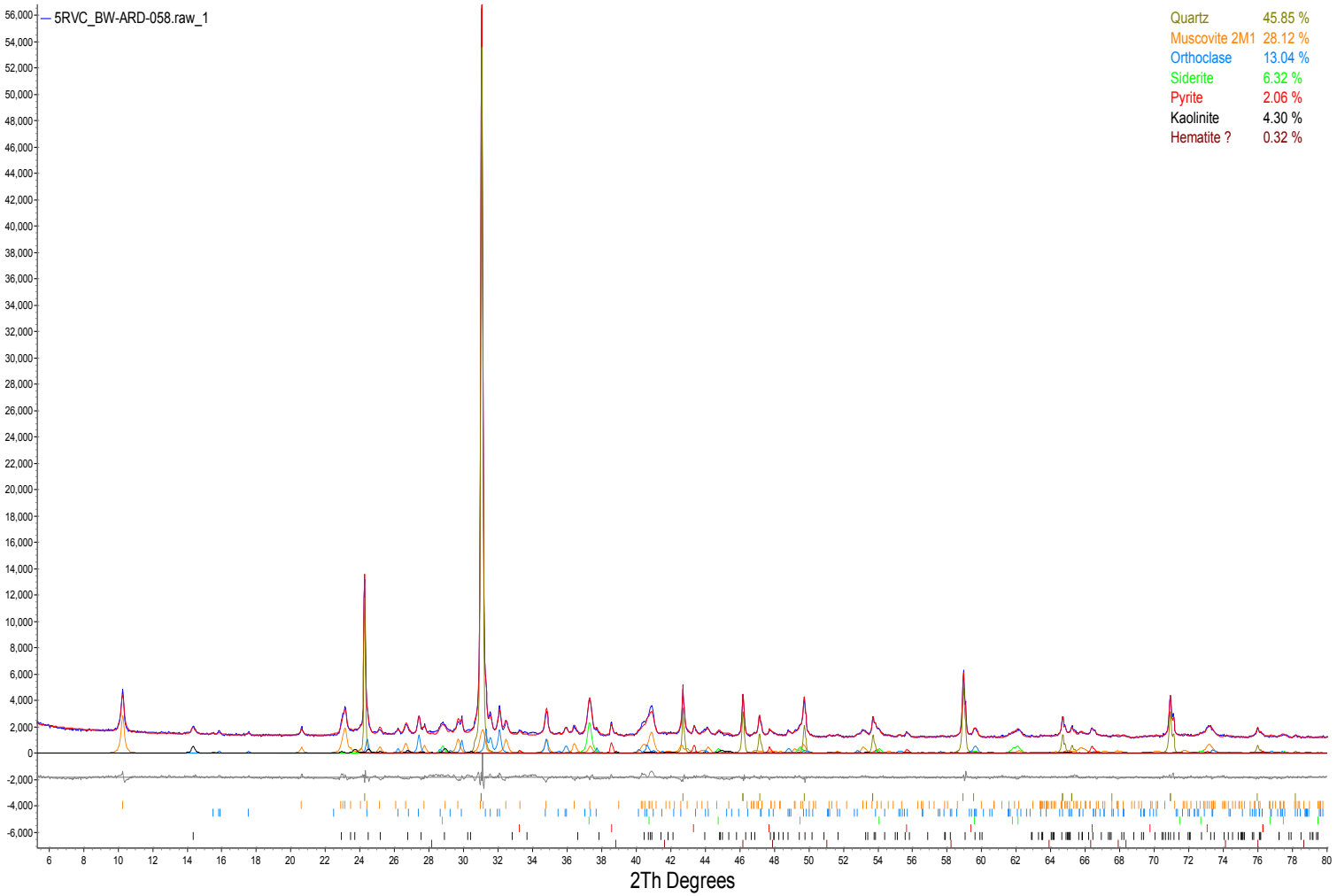


Figure 5: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-058"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

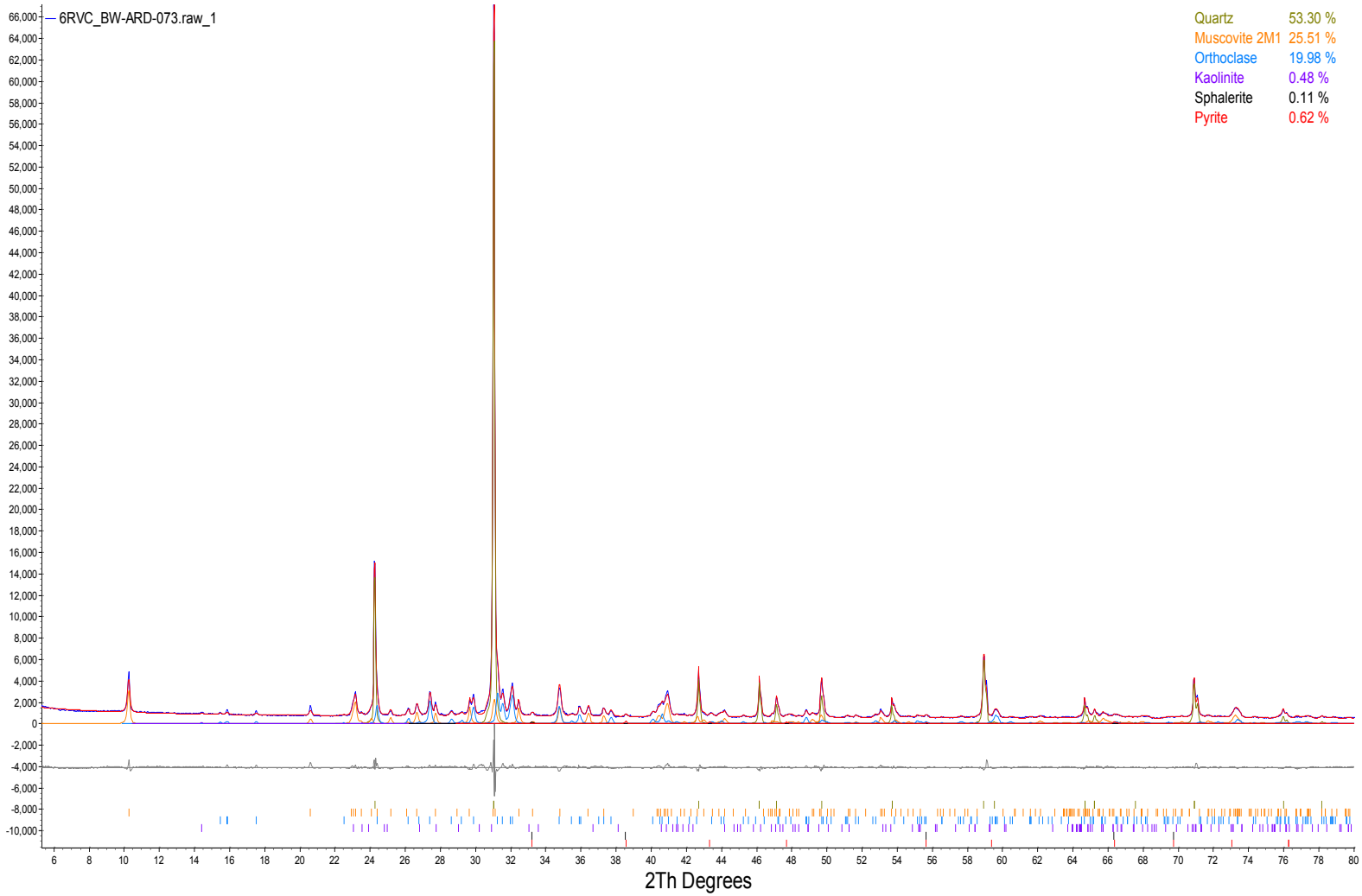


Figure 6: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-073"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

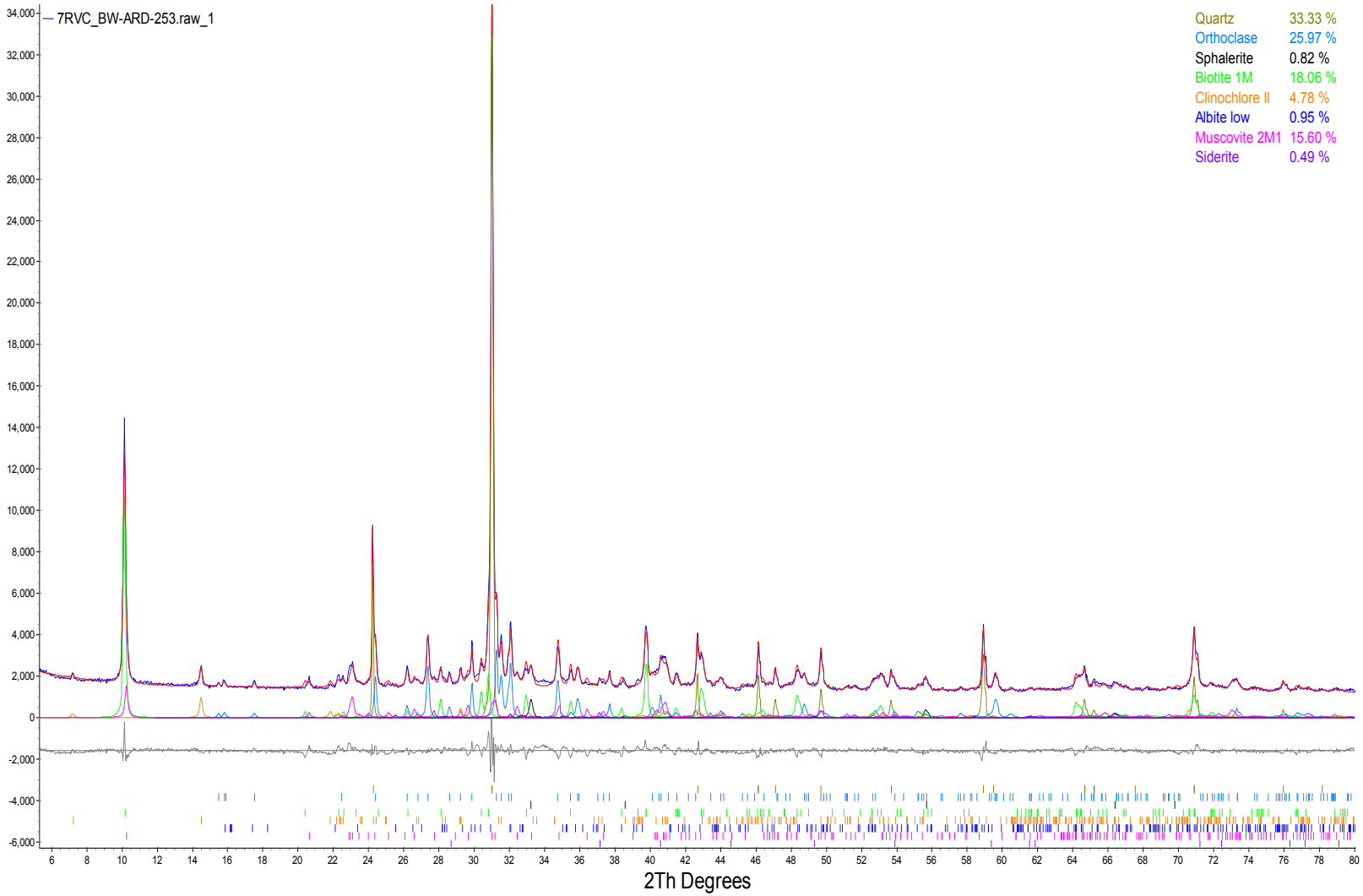


Figure 7: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-253"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

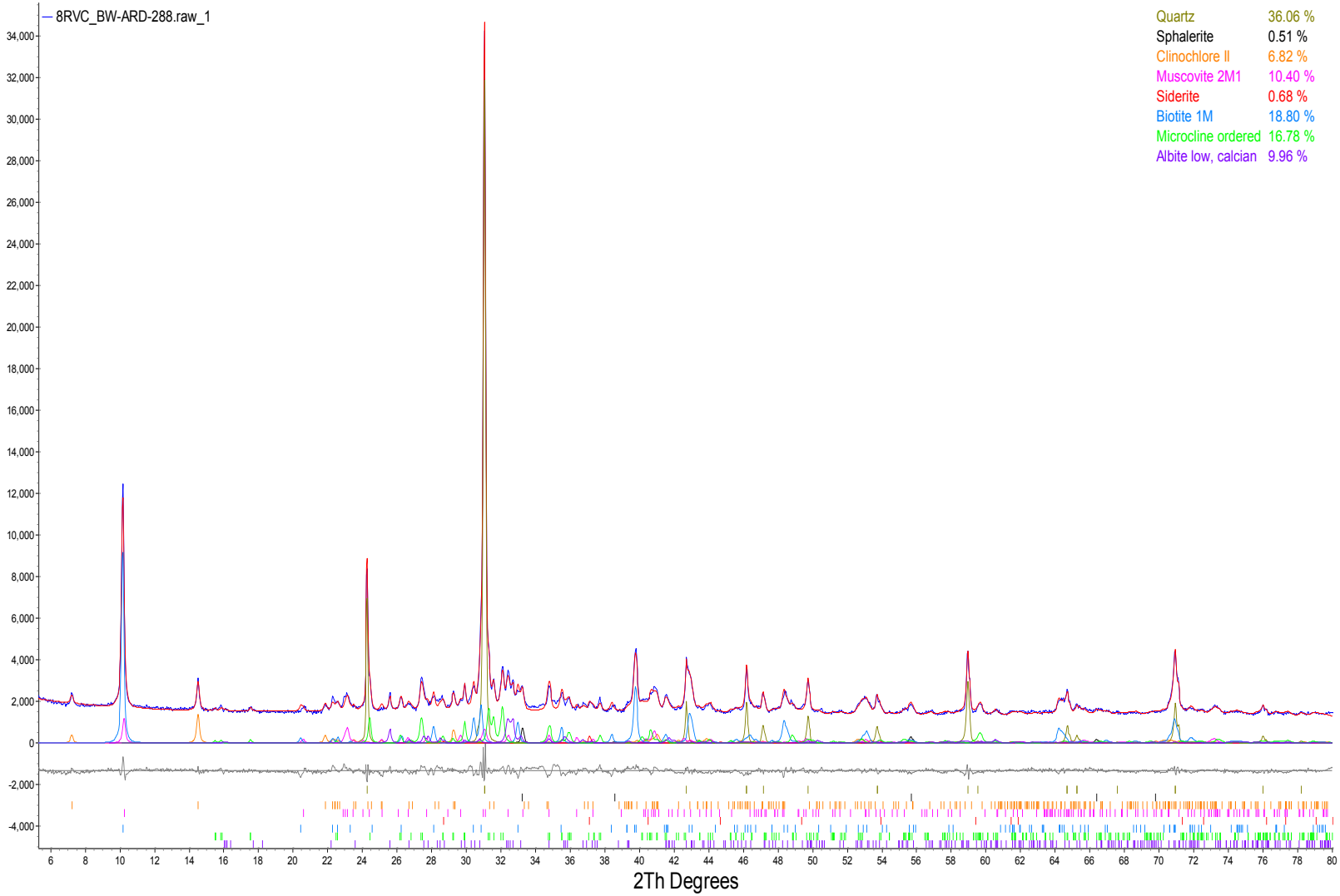


Figure 8: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-288"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

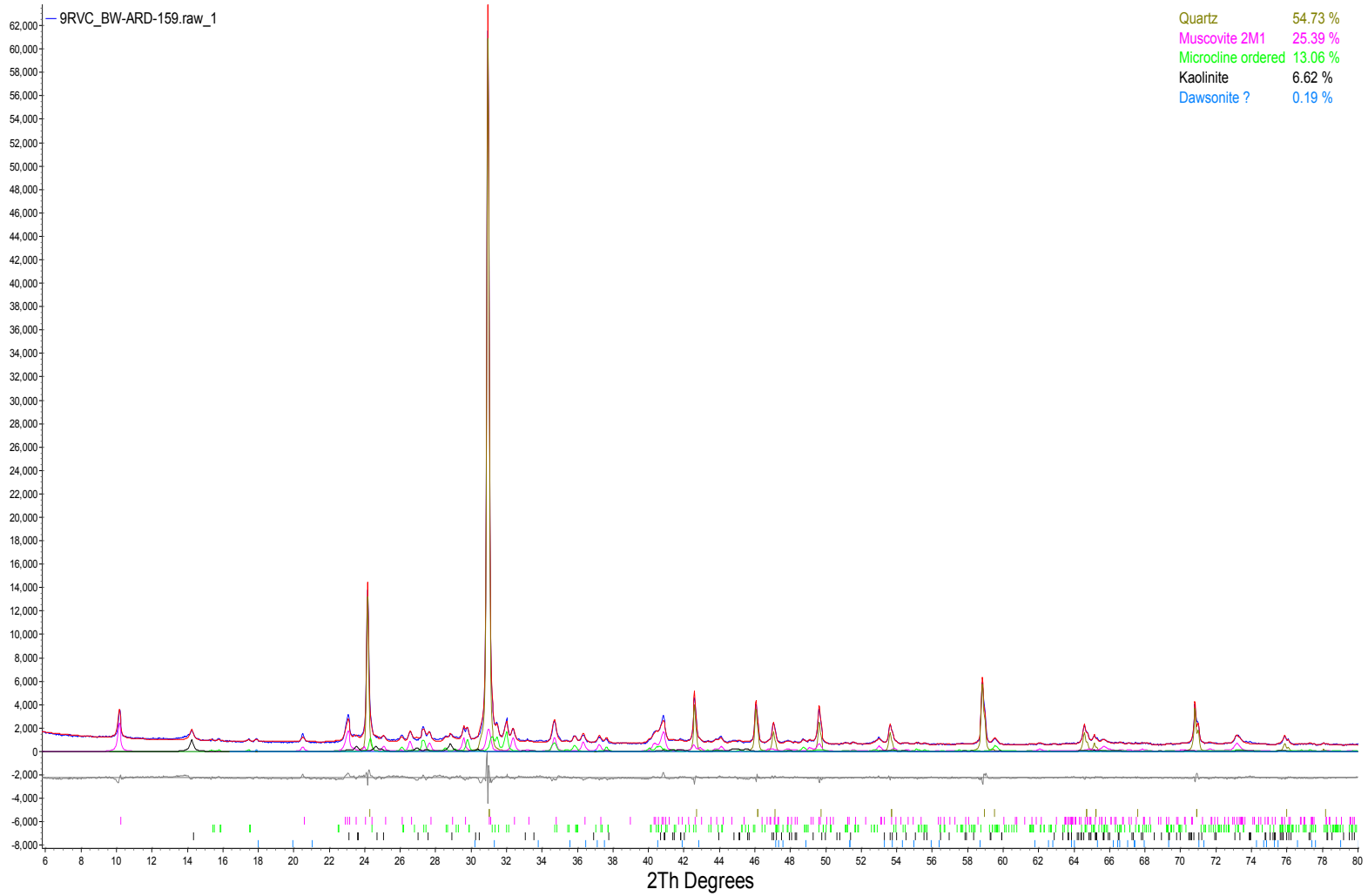


Figure 9: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-159"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

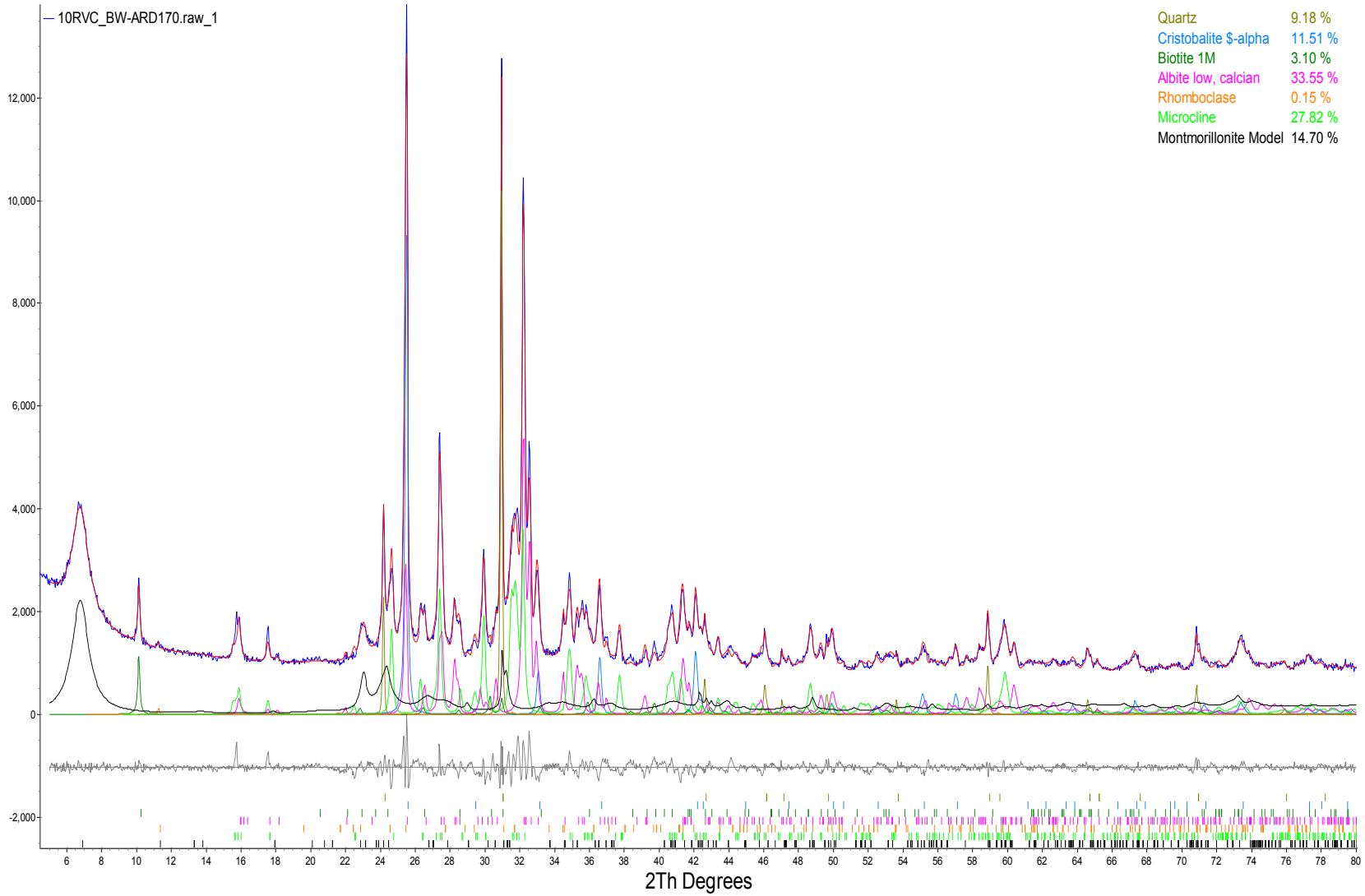


Figure 10: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-170"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

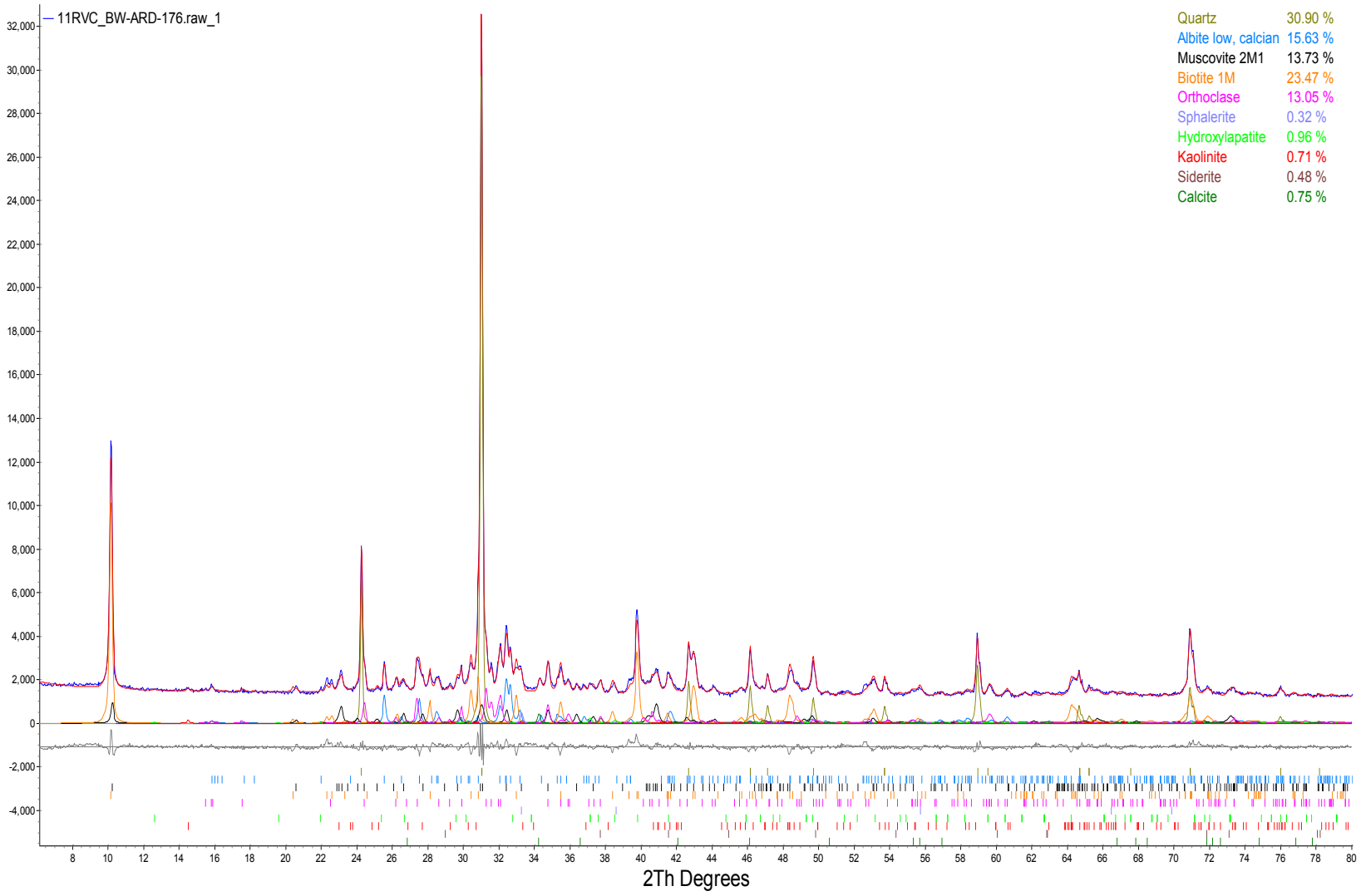


Figure 11: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-176"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

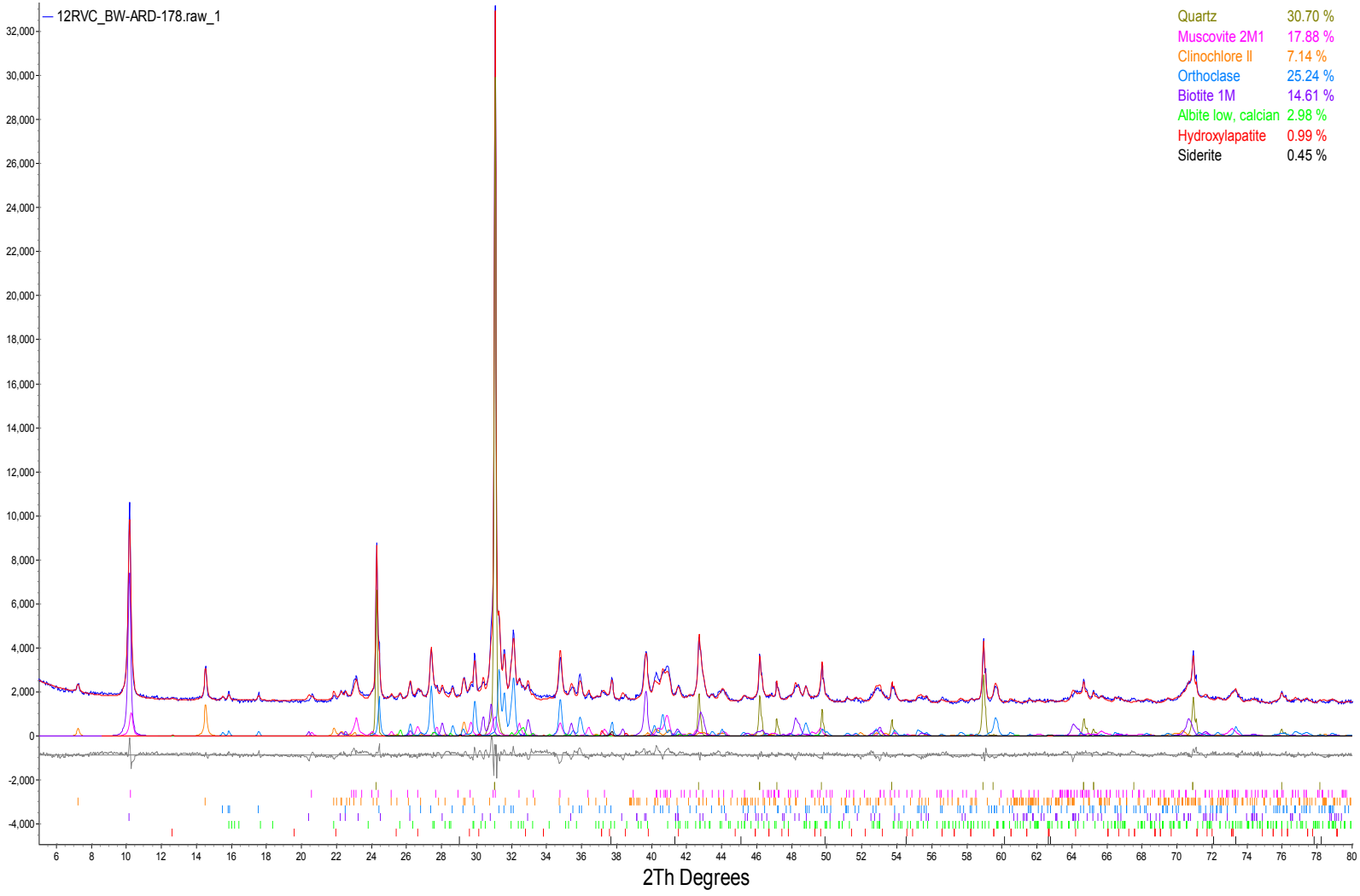


Figure 12: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-178"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

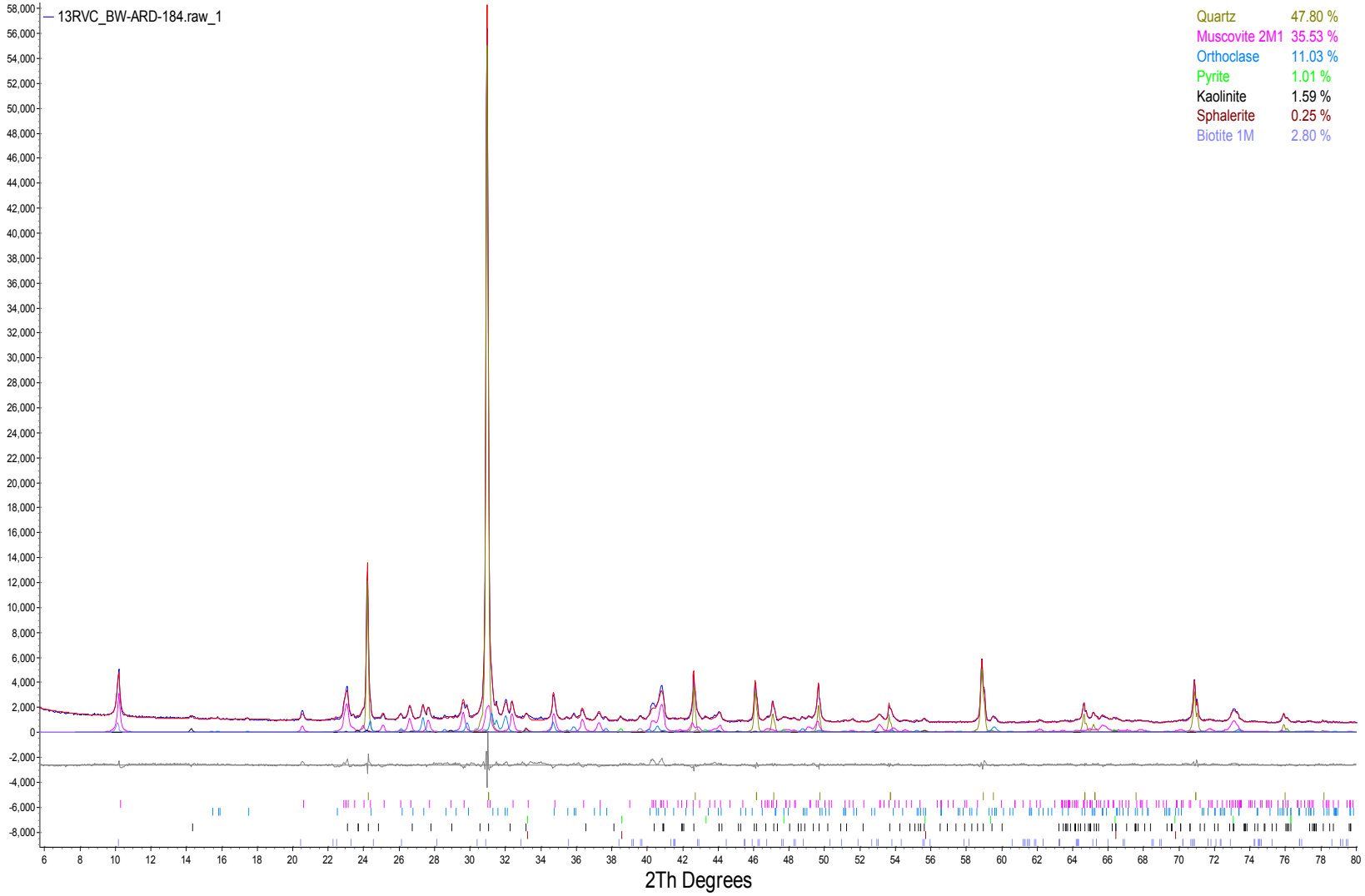


Figure 13: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-184"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

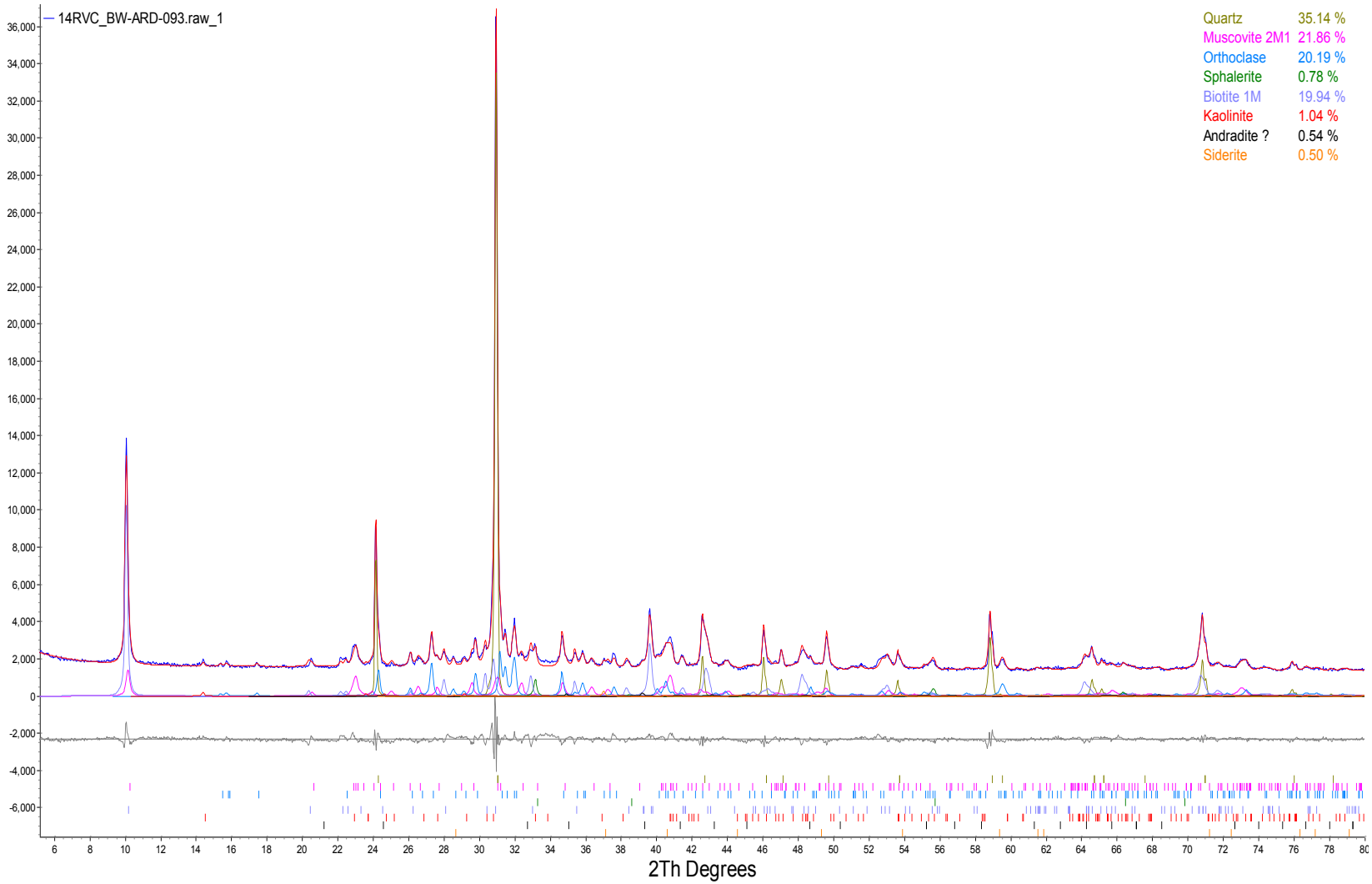


Figure 14: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-093"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

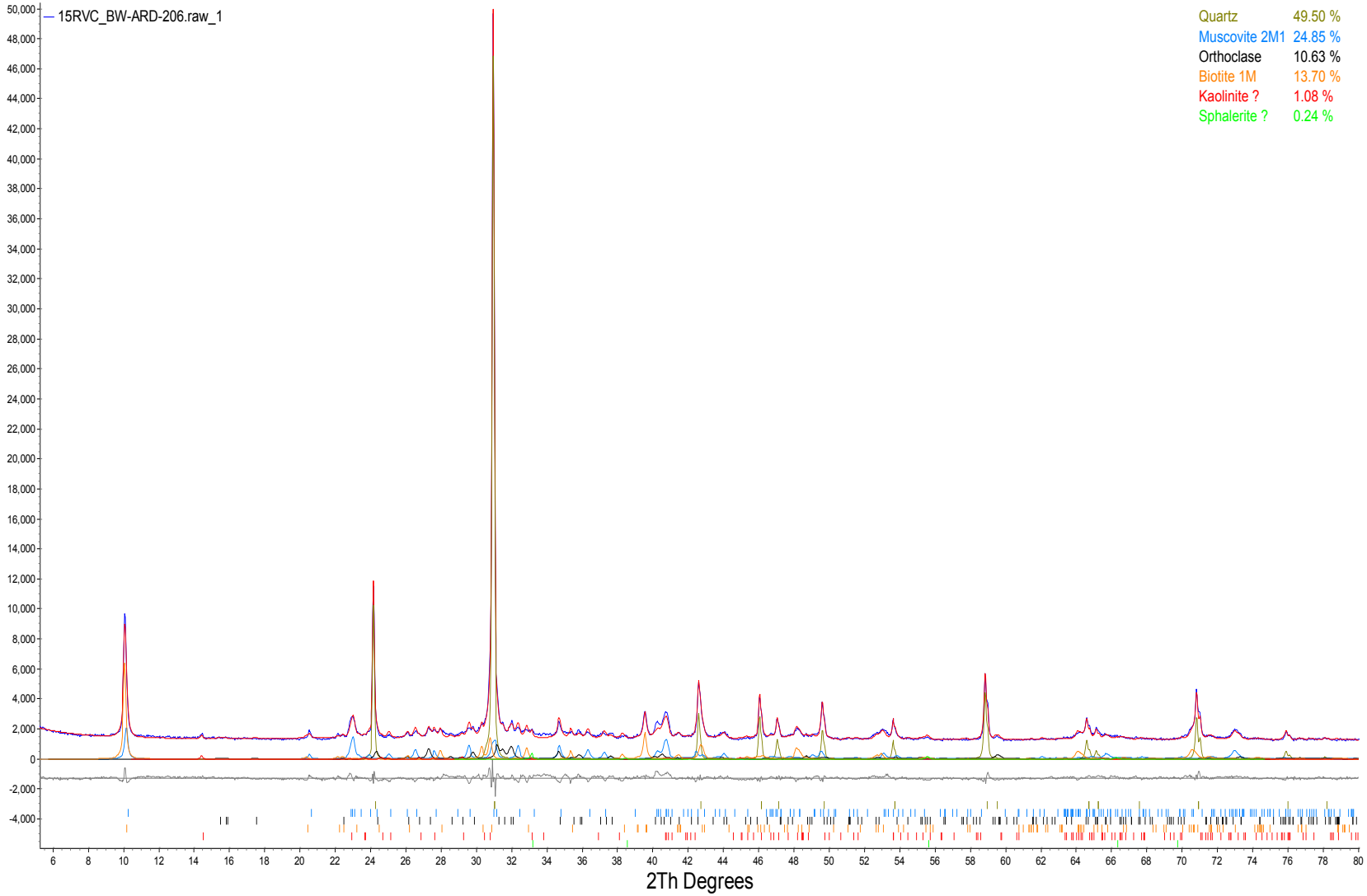


Figure 15: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-206"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

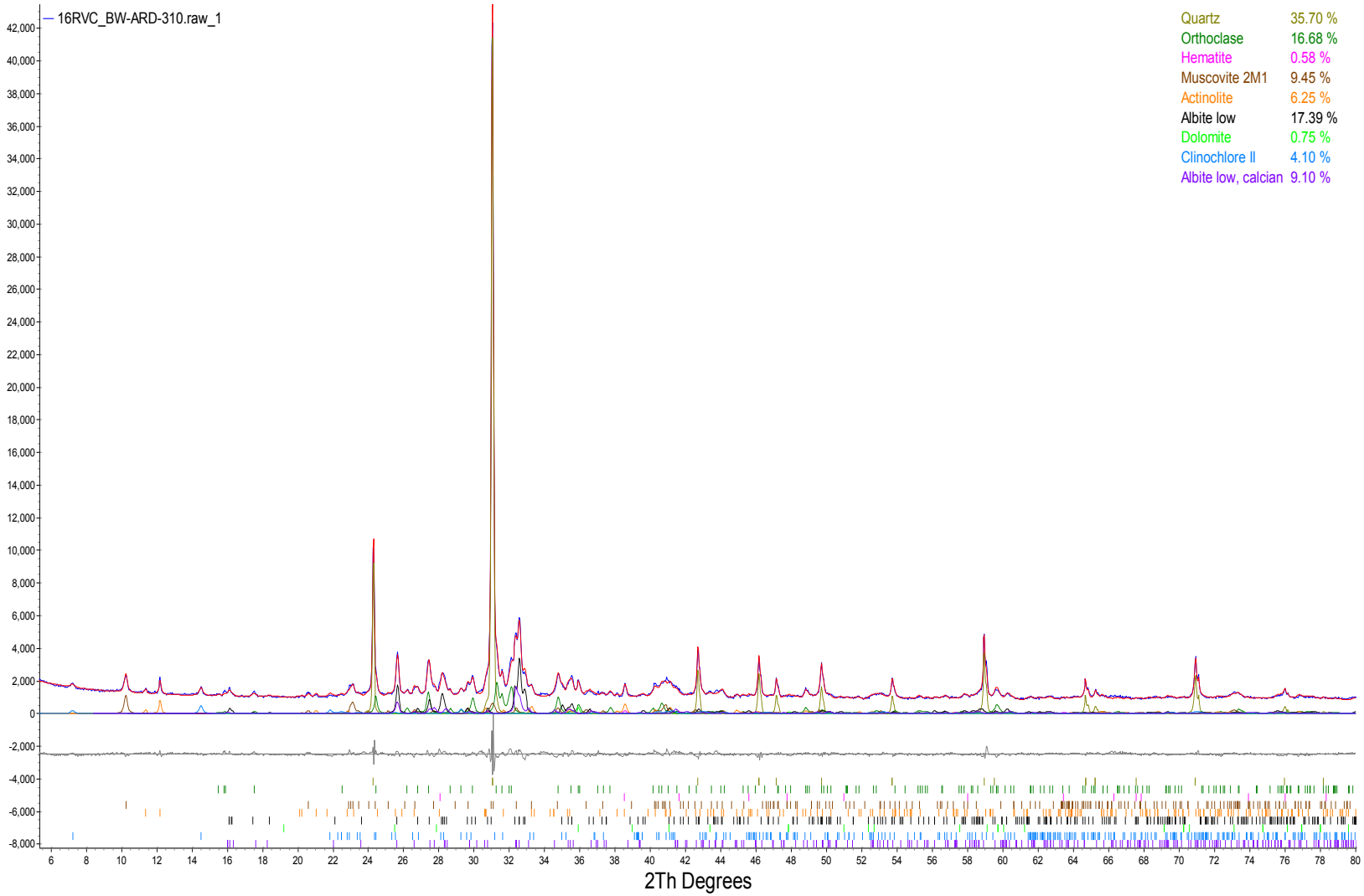


Figure 16: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-310"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

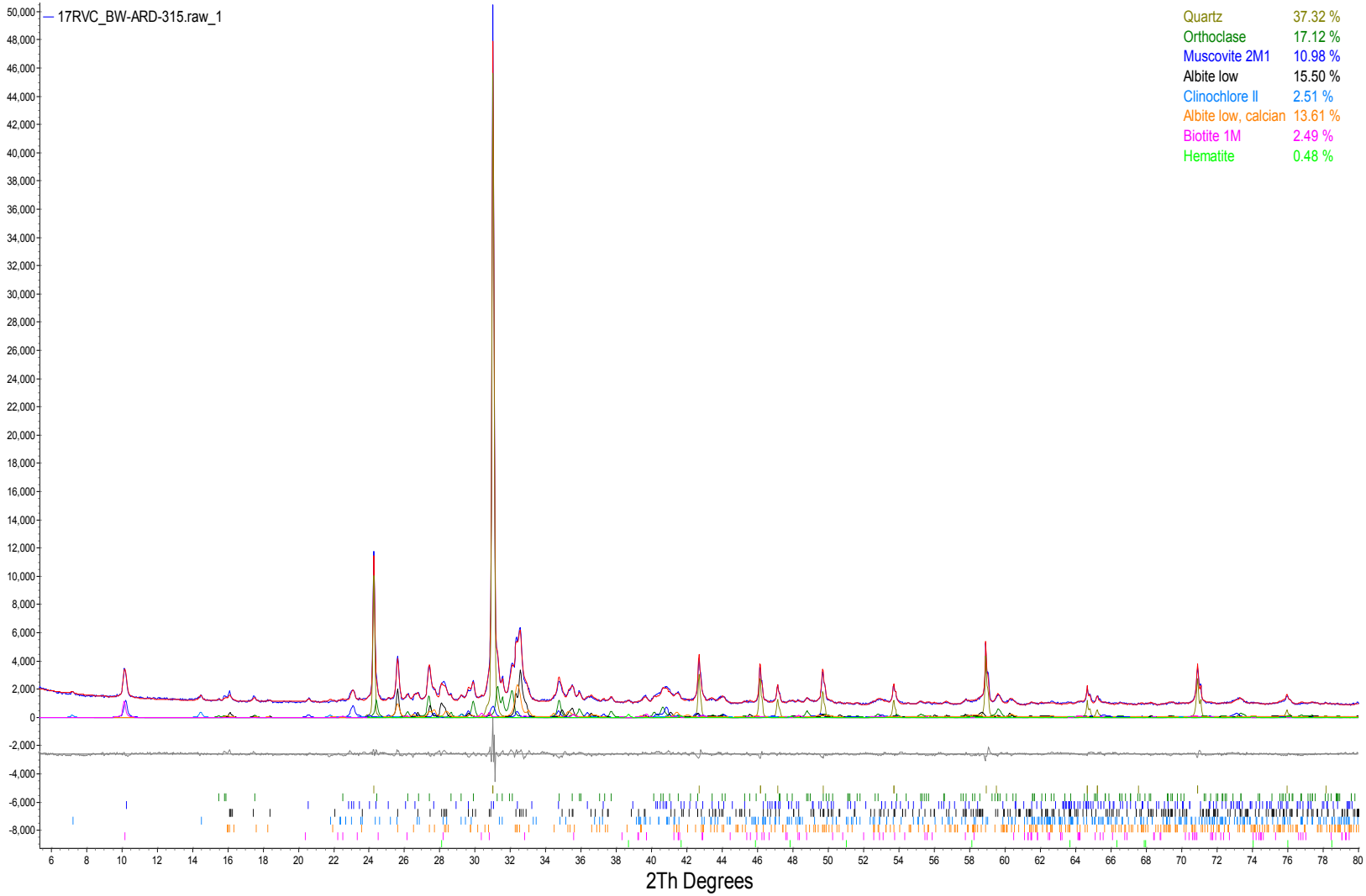


Figure 17: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-315"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

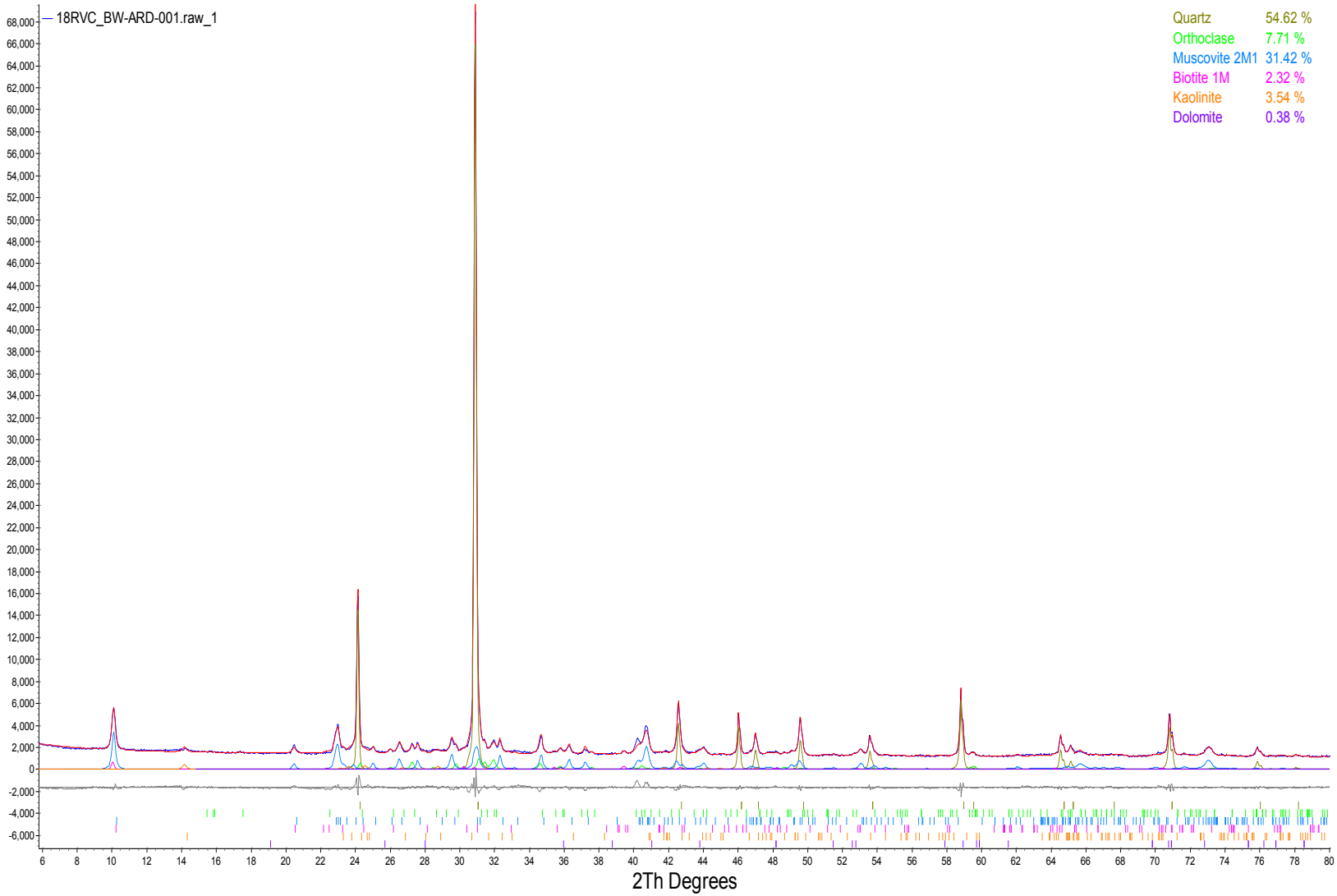


Figure 18: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-001"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

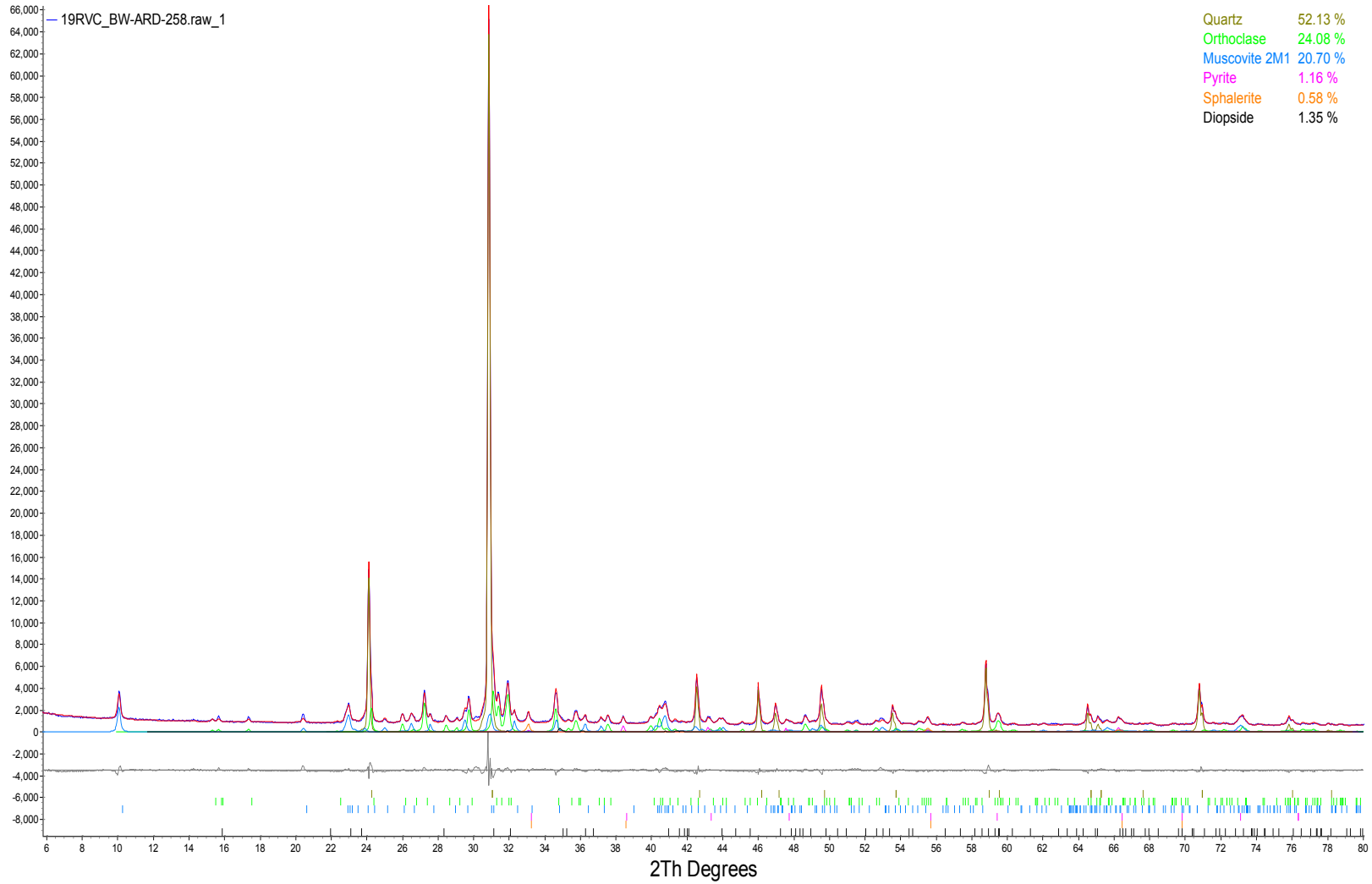


Figure 19: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-258"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

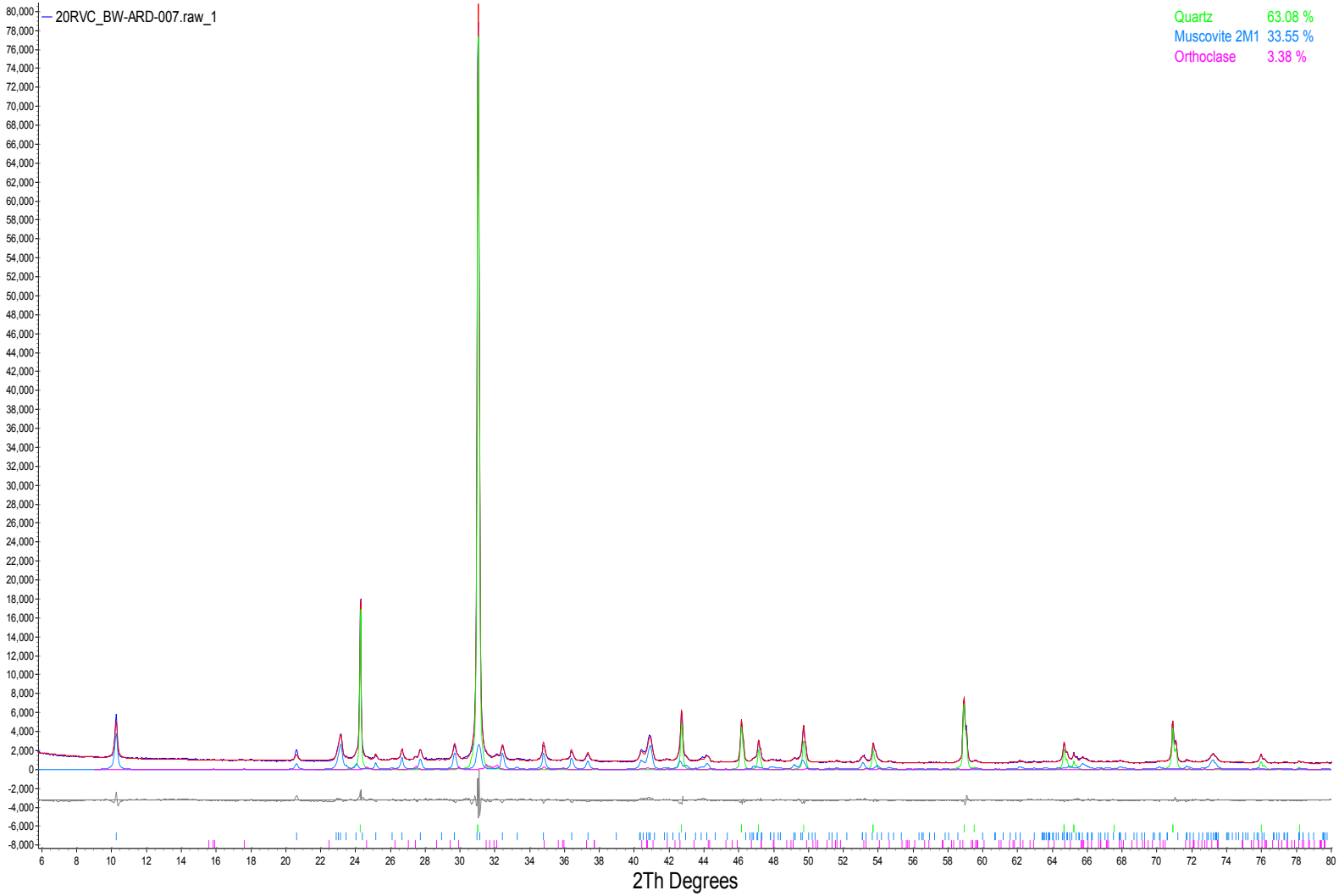


Figure 20: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-007"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below –difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

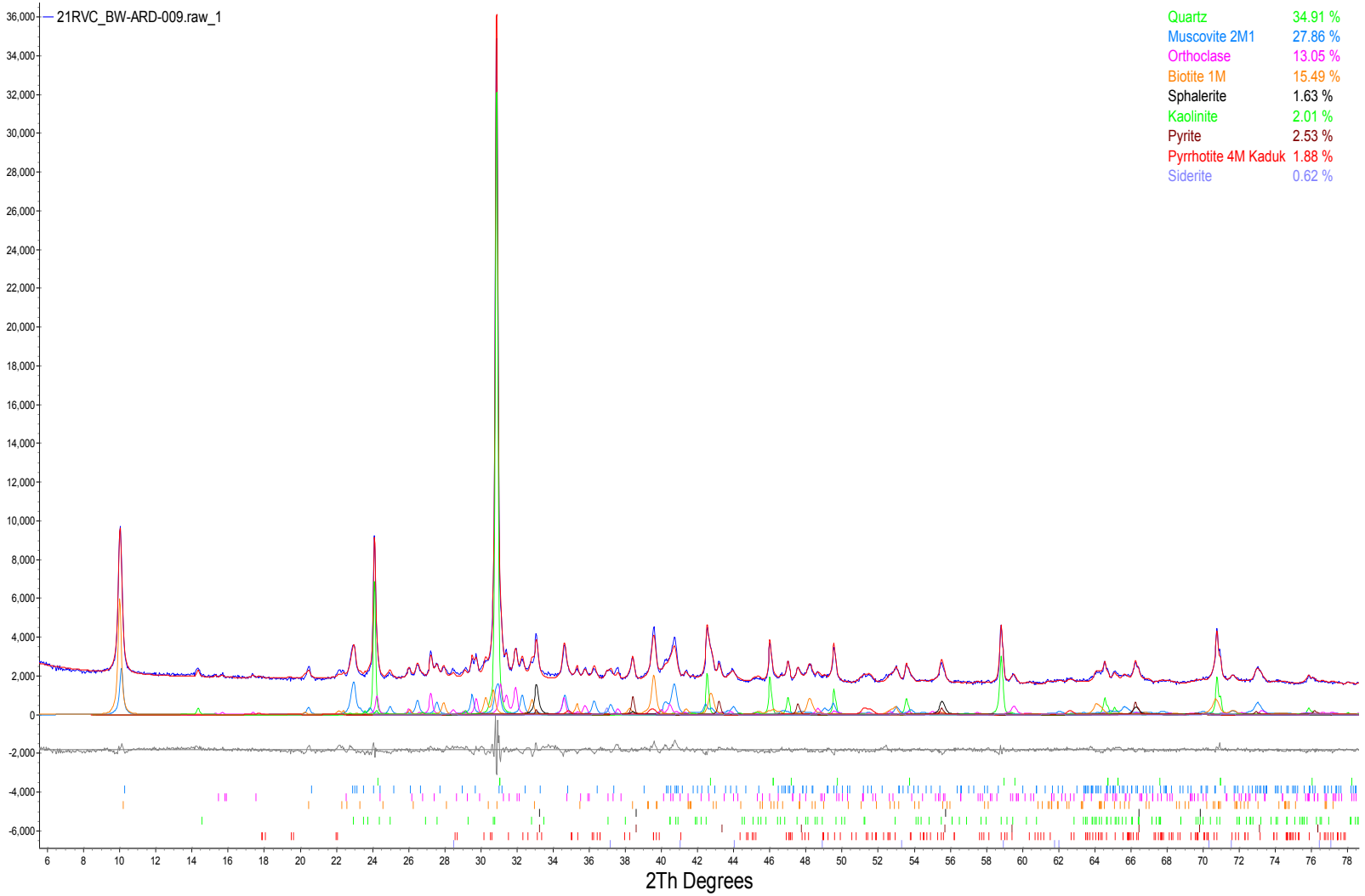


Figure 21: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-009"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below –difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

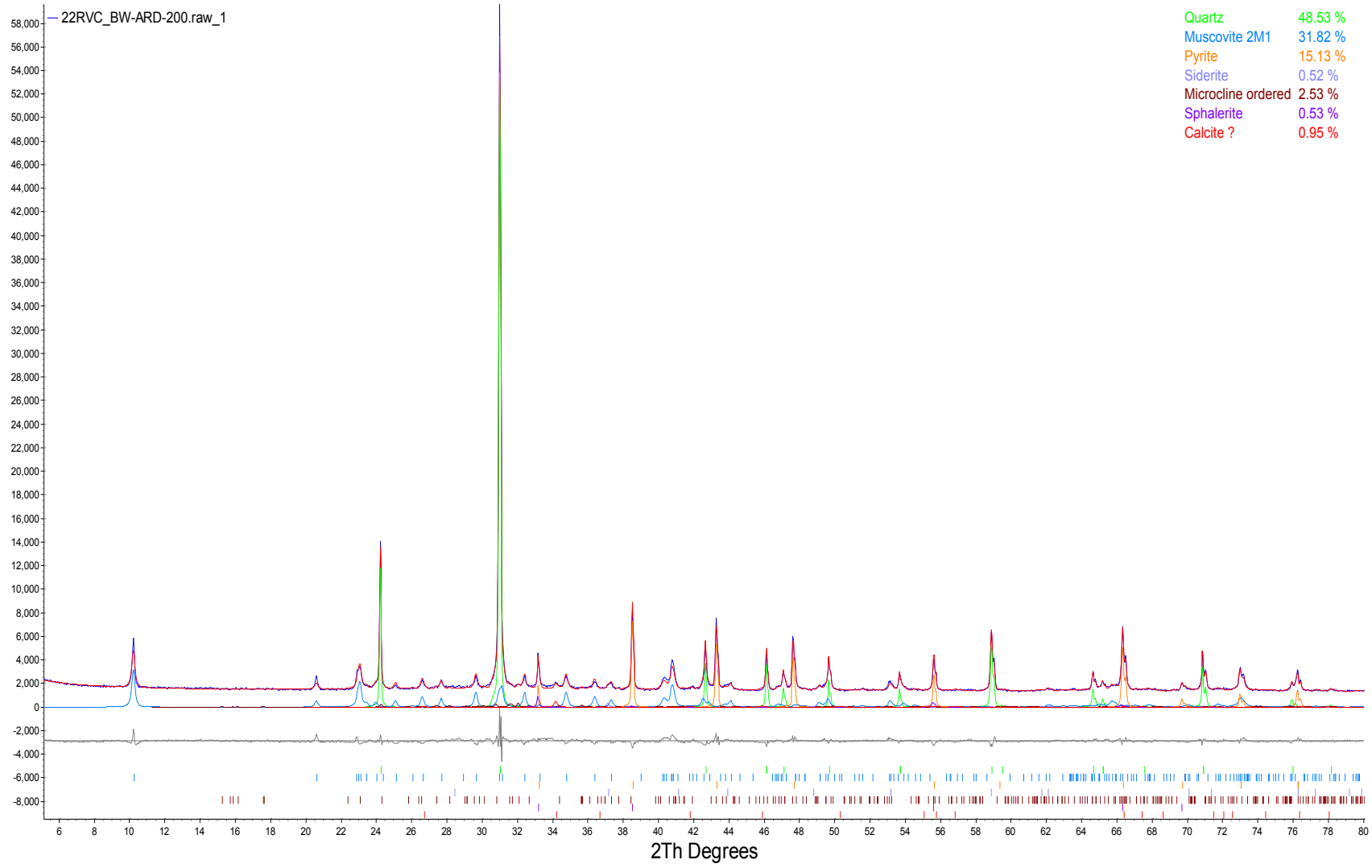


Figure 22: Rietveld refinement plot of sample **Richfield Ventures "BW-ARD-200"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF THREE POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA

Project: Blackwater

Jennifer Kavalench, M.Sc. (AMEC)
New Gold Inc.
3110 – 666 Burrard Street
Vancouver, BC V6C 2X8

Mati Raudsepp, Ph.D.
Elisabetta Pani, Ph.D.
Edith Czech, M.Sc.
Jenny Lai, B.Sc.

Dept. of Earth & Ocean Sciences
The University of British Columbia
6339 Stores Road
Vancouver, BC V6T 1Z4

April 12, 2012

EXPERIMENTAL METHOD

The three samples of **Project Blackwater** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKα radiation on a standard Siemens (Bruker) D5000 Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a Vantec-1 strip detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 3.

Table 1: Results of quantitative phase analysis (wt %)

Mineral	**Ideal Formula**	**BW-ARD-499_Dup**	**BW-ARD-509_Dup**	**BW-ARD-537_Dup**
Quartz	SiO_2	49.0	45.3	41.0
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$			5.3
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	16.8	17.4	8.3
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	10.2	4.6	8.3
K-Feldspar	$KAlSi_3O_8$	23.9	32.6	27.3
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$			9.0
Calcite ?	$CaCO_3$			0.3
Pyrite	FeS_2			0.5
Total		100.0	100.0	100.0

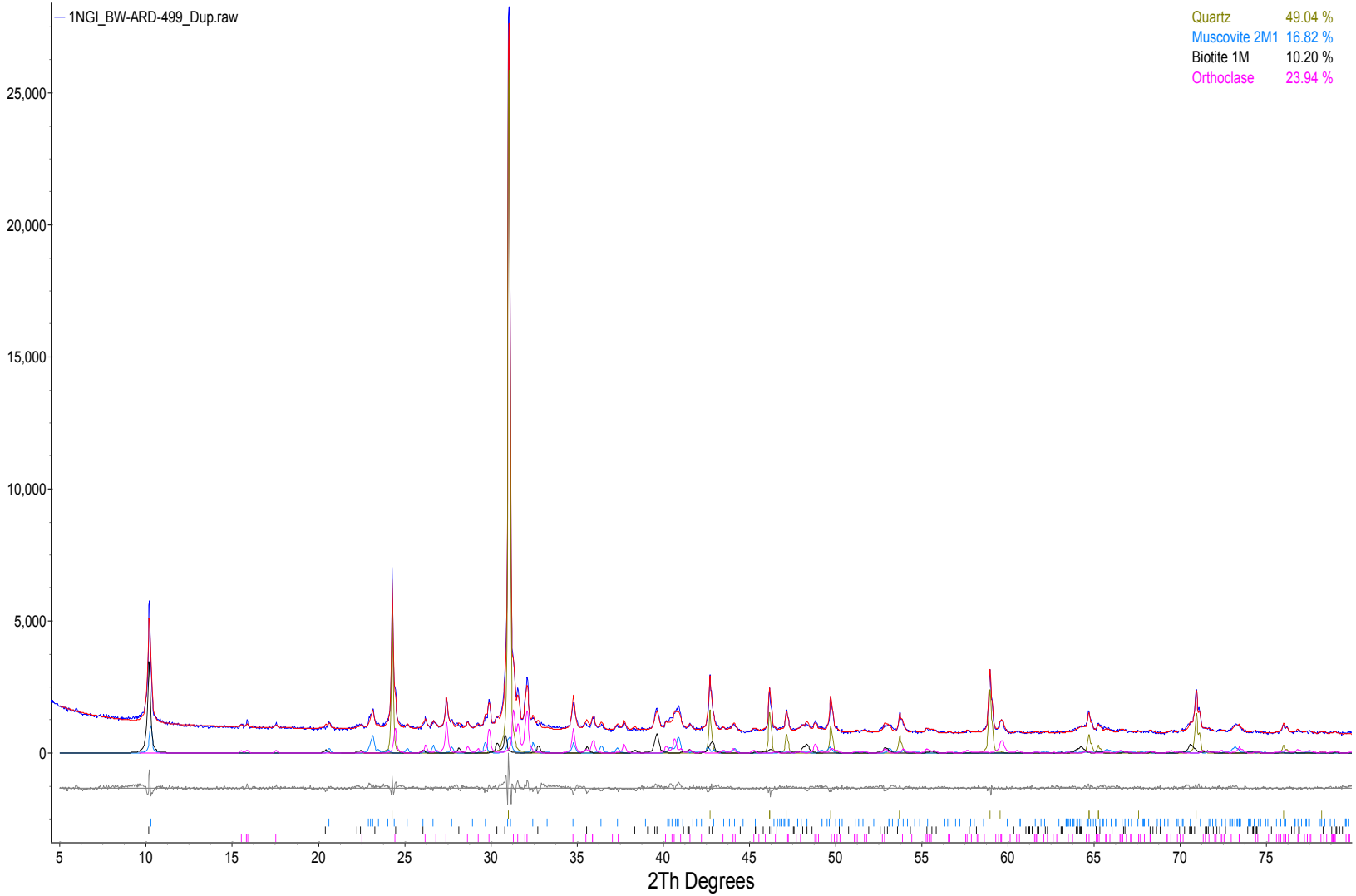


Figure 1: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-499_Dup"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

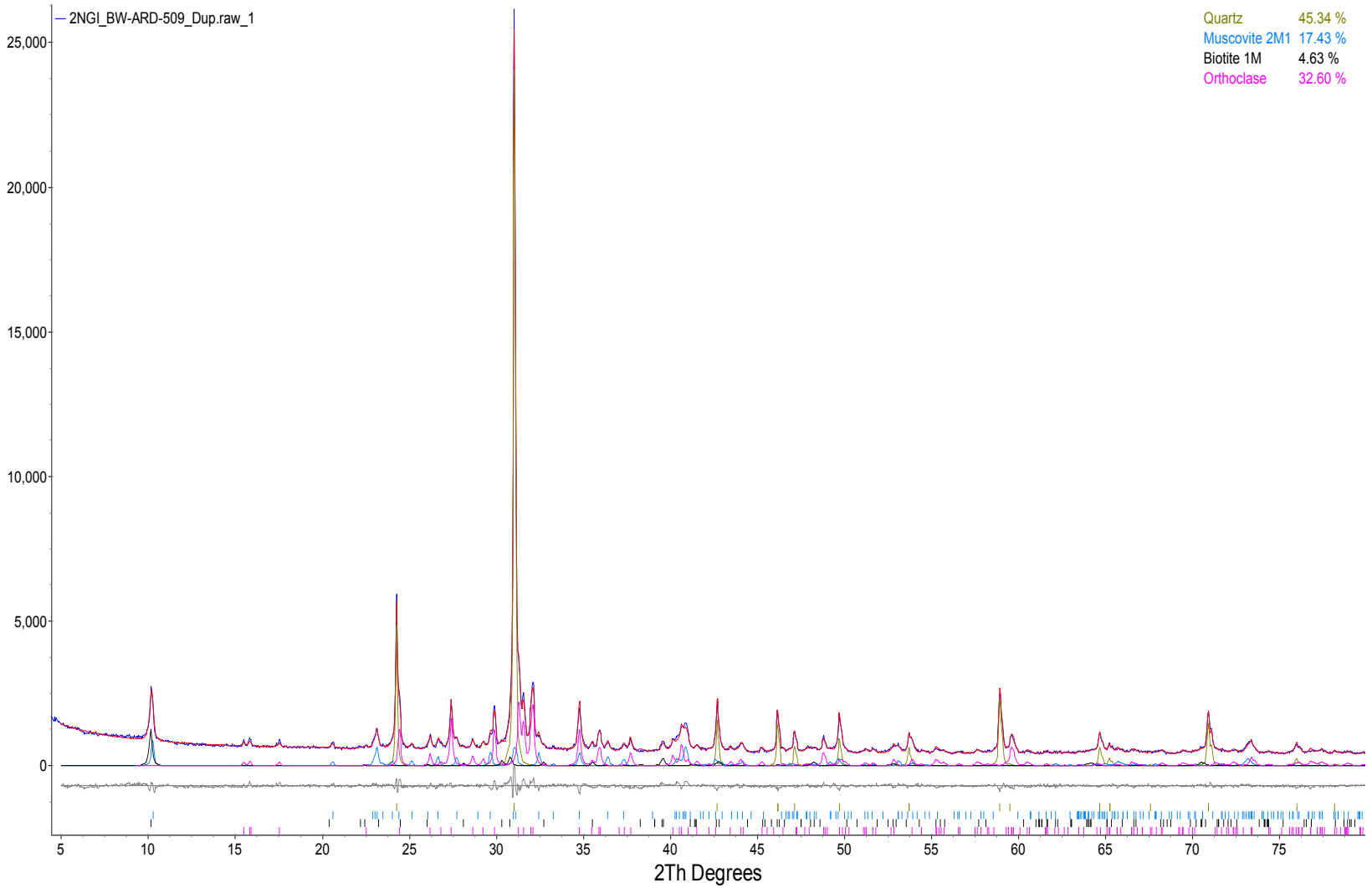


Figure 2: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-509_Dup"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

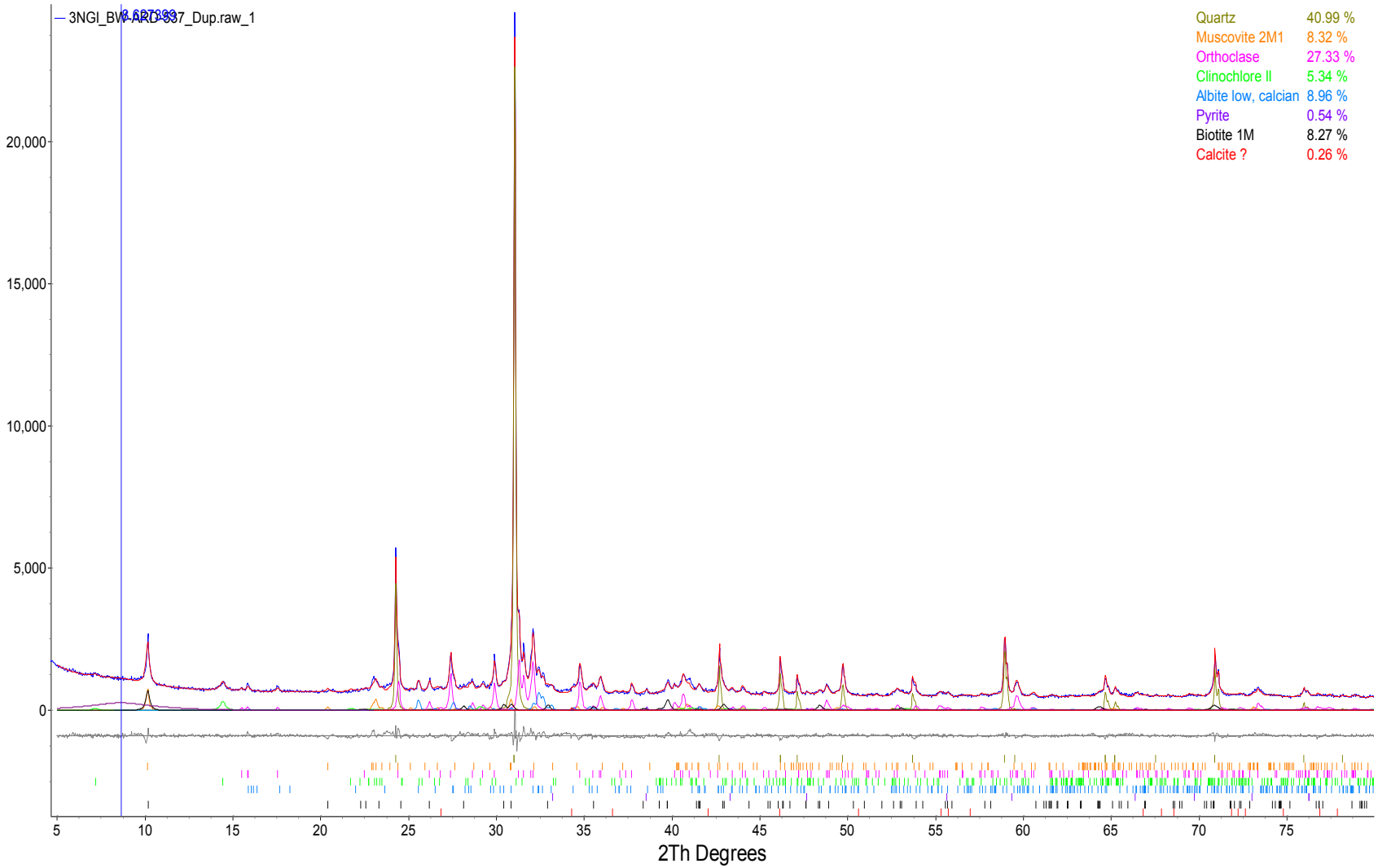


Figure 3: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-537_Dup"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF THREE POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA

Project: Blackwater

Jennifer Kavalench, M.Sc. (AMEC)
New Gold Inc.
3110 – 666 Burrard Street
Vancouver, BC V6C 2X8

Mati Raudsepp, Ph.D.
Elisabetta Pani, Ph.D.
Edith Czech, M.Sc.
Jenny Lai, B.Sc.

Dept. of Earth & Ocean Sciences
The University of British Columbia
6339 Stores Road
Vancouver, BC V6T 1Z4

April 17, 2012

EXPERIMENTAL METHOD

The three samples of **Project Blackwater** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKα radiation on a standard Siemens (Bruker) D5000 Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a Vantec-1 strip detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 3.

Table 1: Results of quantitative phase analysis (wt %)

Mineral	**Ideal Formula**	**BW-ARD-566_Dup**	**BW-ARD-510_Dup**	**BW-ARD-526_Dup**
Quartz	SiO_2	52.9	33.4	38.6
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	1.5	3.4	1.2
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	15.3	18.4	17.4
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$		10.3	4.6
K-Feldspar	$KAlSi_3O_8$	20.9	20.4	38.2
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	9.3	14.1	
Sphalerite	(Zn,Fe)S	0.2		
Total		100.0	100.0	100.0

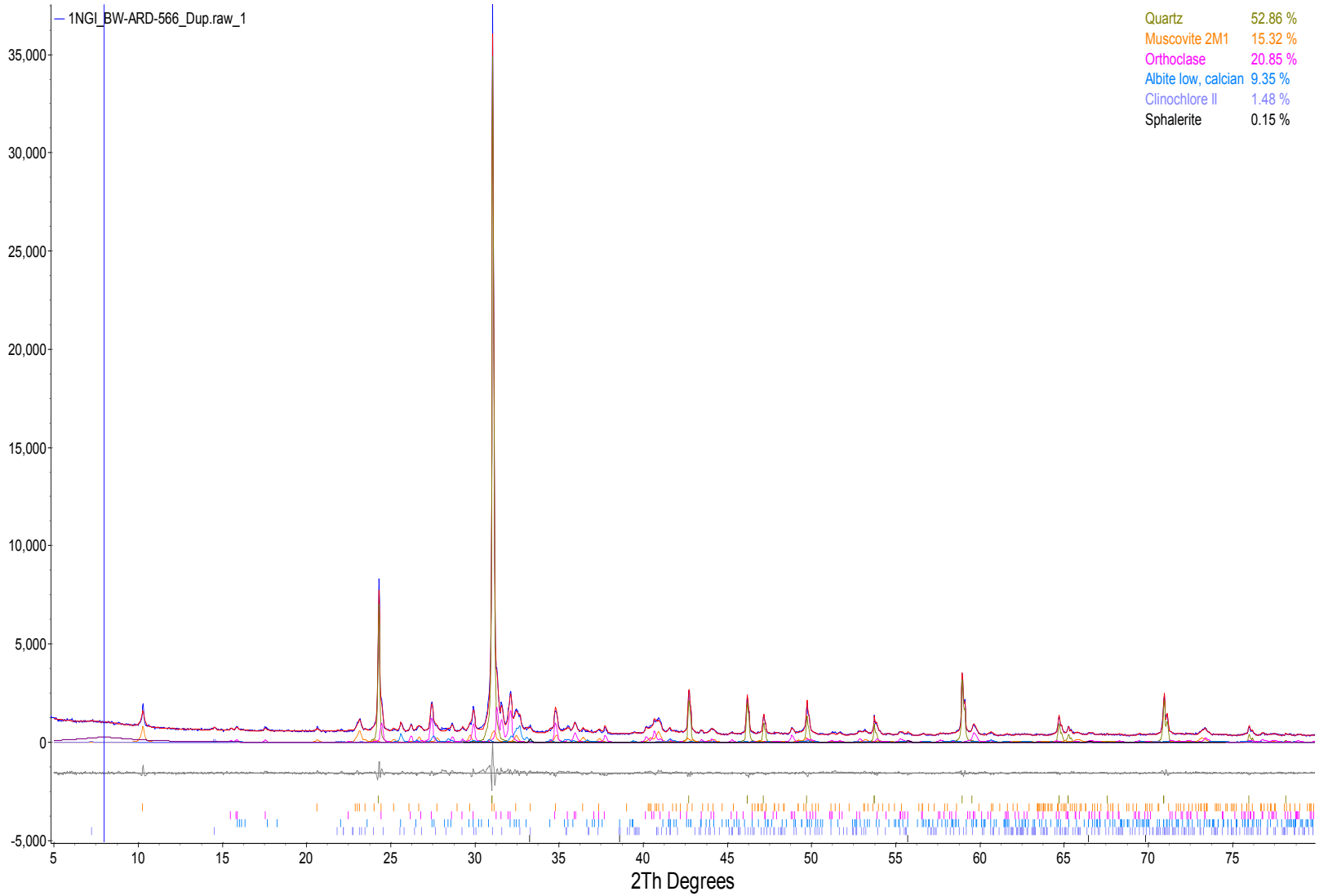


Figure 1: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-566_Dup"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

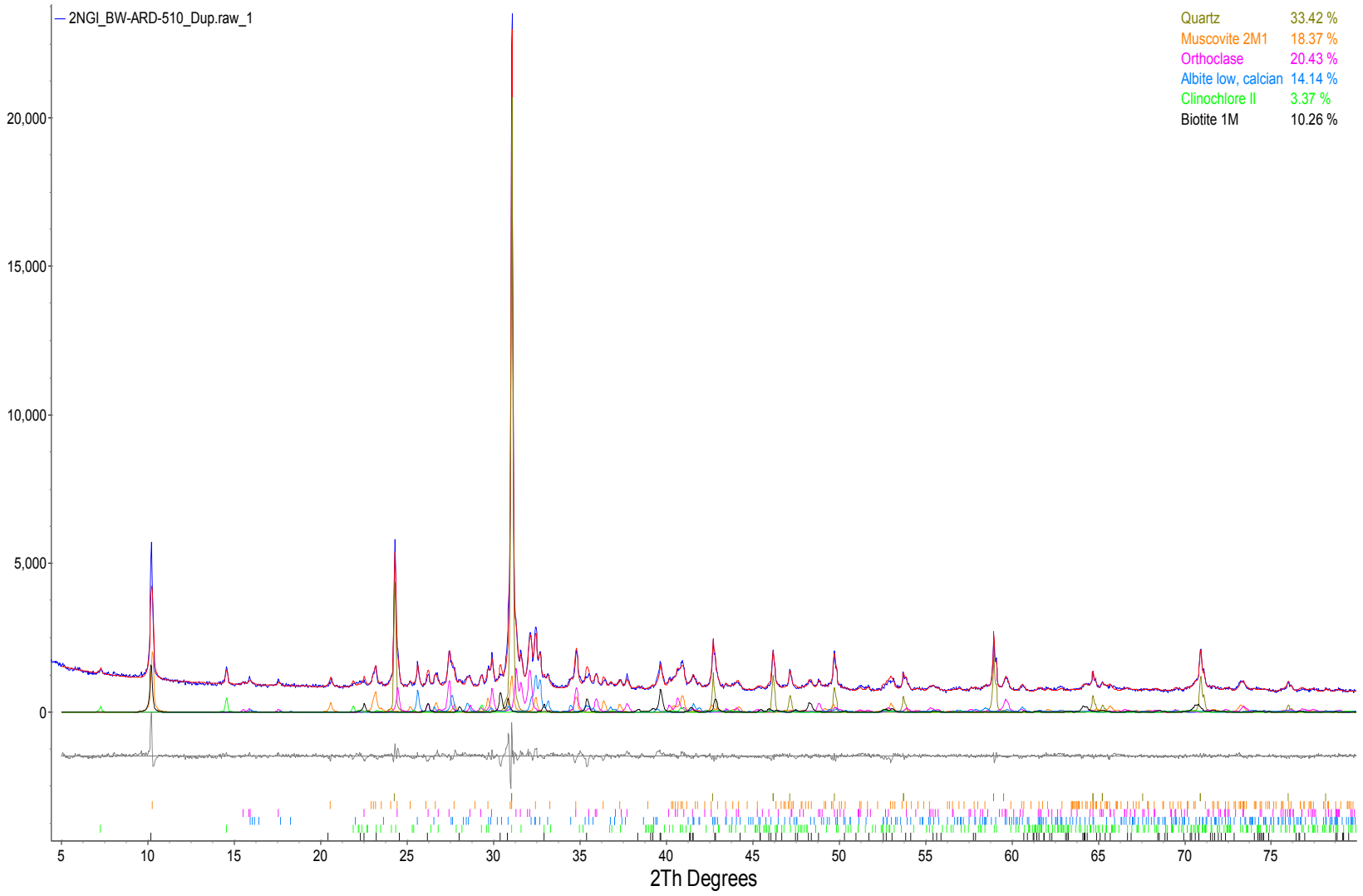


Figure 2: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-510_Dup"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

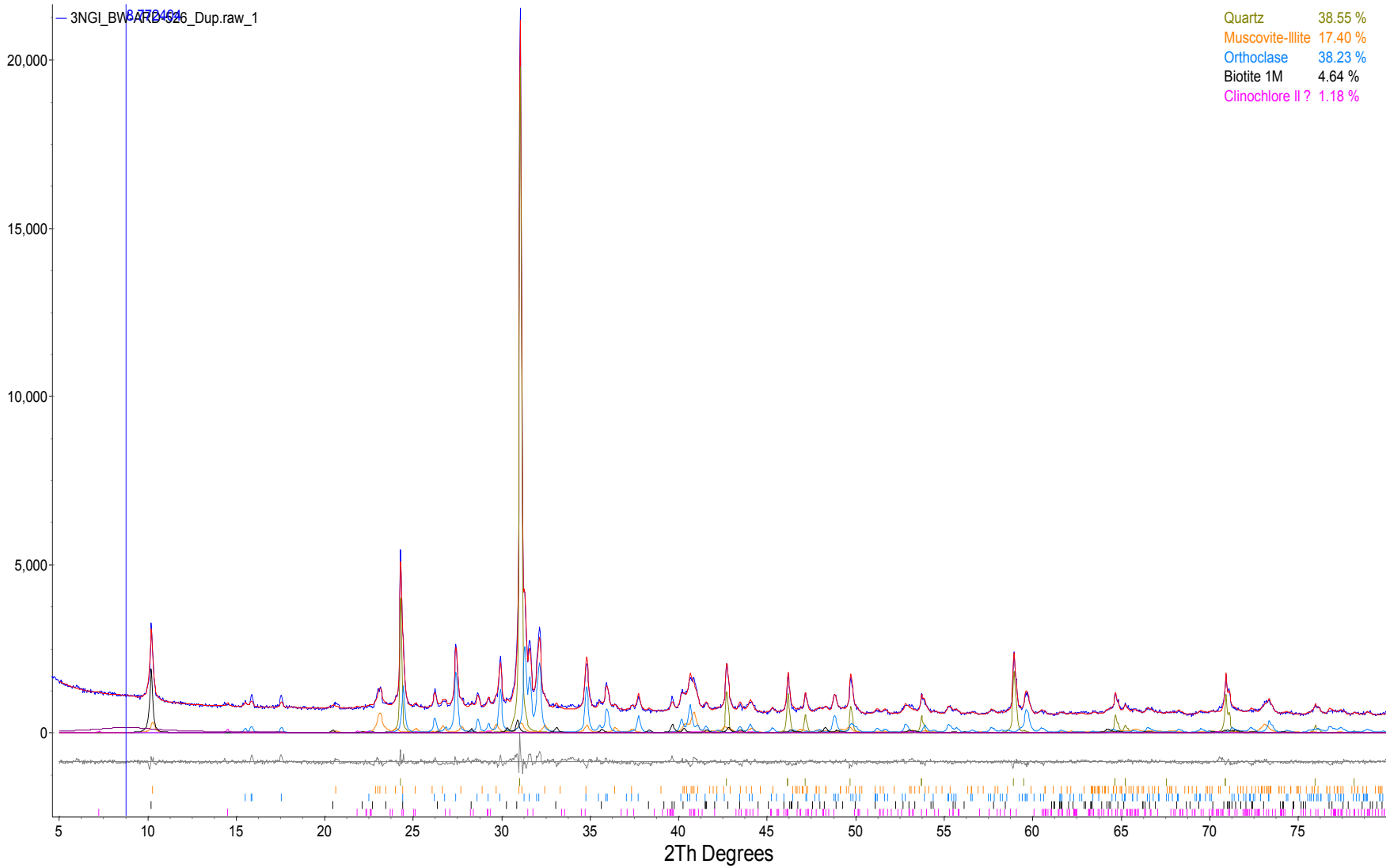


Figure 3: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-526_Dup"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF TWO POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA

Jennifer Kavalench, M.Sc. - AMEC
New Gold Inc.
Park Place 3110 – 666 Burrard Street
Vancouver, BC V6C 2X8

Mati Raudsepp, Ph.D.
Elisabetta Pani, Ph.D.
Edith Czech, M.Sc.
Jenny Lai, B.Sc.

Dept. of Earth & Ocean Sciences
The University of British Columbia
6339 Stores Road
Vancouver, BC V6T 1Z4

June 18, 2012

EXPERIMENTAL METHOD

The two samples were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKα radiation on a standard Siemens (Bruker) D5000 Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a Vantec-1 strip detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 2.

Table 1: Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**#1 BW-ARD2-10_Dup**	**#2 BW-ARD-283_Dup**
Quartz	SiO_2	47.9	41.9
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	18.3	29.9
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$		3.7
Kaolinite ?	$Al_2Si_2O_5(OH)_4$		1.7
K-Feldspar	$KAlSi_3O_8$	31.9	19.3
Pyrite	FeS_2	0.9	0.5
Marcasite	FeS_2		0.4
Sphalerite	(Zn,Fe)S	1.0	0.6
Pyrrhotite	$Fe_{1-x}S$		2.0
Total		100.0	100.0

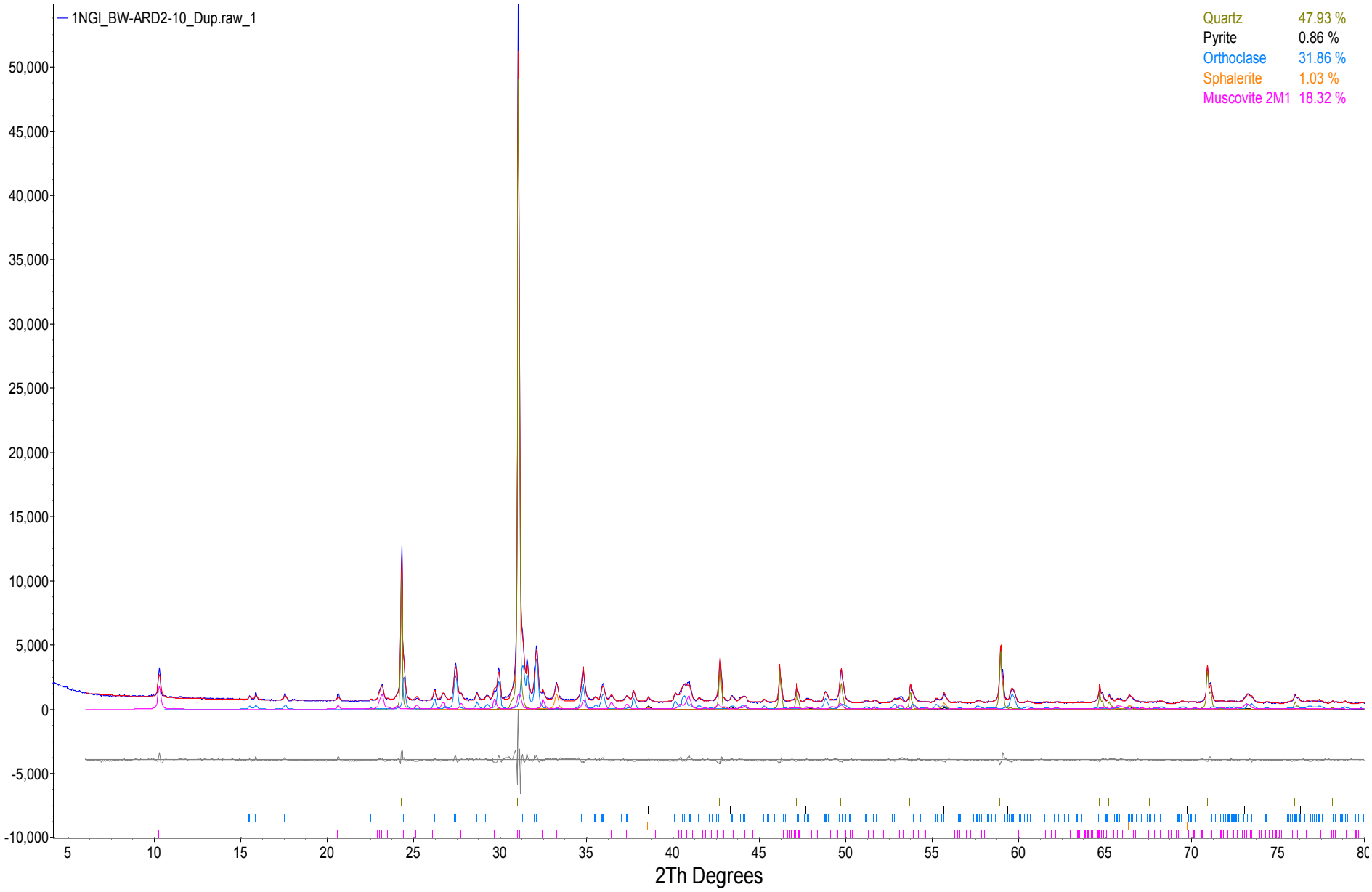


Figure 1: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD2-10_Dup"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

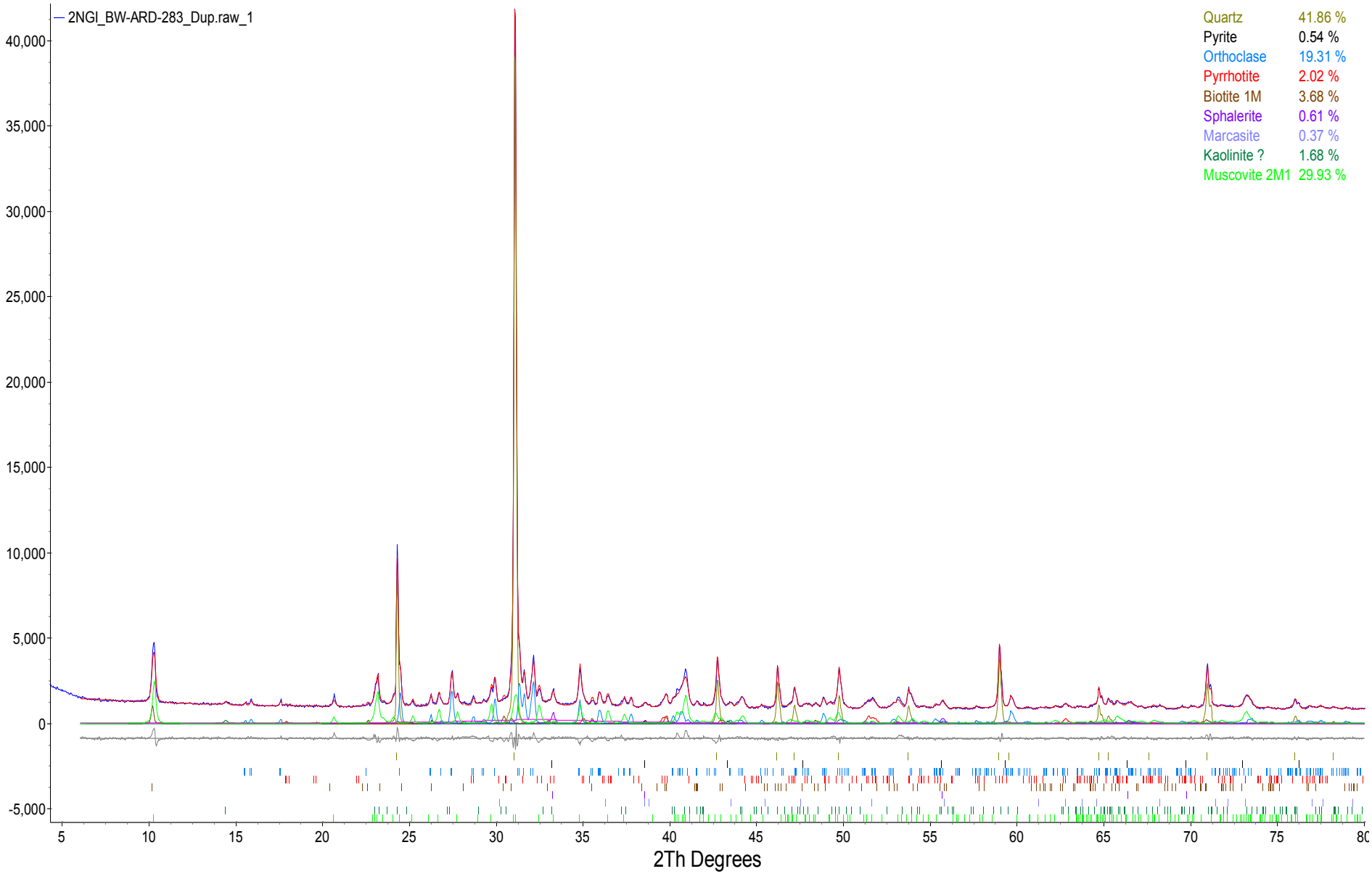


Figure 2: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-283_Dup"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below –difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF 10 POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA

Ezra Kulczycki (AMEC)
New Gold Inc.
Suite 1800 – Two Bentall Centre 555 Burrard Street
Box 212
Vancouver, BC V7X 1M9

Mati Raudsepp, Ph.D.
Elisabetta Pani, Ph.D.
Edith Czech, M.Sc.
Jenny Lai, B.Sc.

Dept. of Earth, Ocean & Atmospheric Sciences
The University of British Columbia
6339 Stores Road
Vancouver, BC V6T 1Z4

January 14, 2013

EXPERIMENTAL METHOD

The ten samples were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 using Search-Match software by Bruker. X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1 (separate file, ***New Gold Inc Results Jan 14 2013 – 10 samples.xls***). These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 10. Ideal formulae of the minerals are given in Table 2.

Table 1. Results of quantitative phase analysis (wt.%) XRD-Rietveld – New Gold Inc. Project

	#1 BW-ARD-568		**#2 BW-ARD-556**		**#3 BW-ARD-569**		**#4 BW-ARD-527**		**#5 BW-ARD-538**
Quartz	29.0	Quartz	27.6	Quartz	34.6	Quartz	47.5	Quartz	36.9
K-feldspar	15.7	K-feldspar	28.4	K-feldspar	21.1	K-feldspar	27.0	K-feldspar	27.3
Clinochlore	4.5	Clinochlore	3.1	Calcite	1.4	Plagioclase	12.6	Plagioclase	14.1
Calcite	2.6	Calcite	0.7	Plagioclase	18.6	Illite-Muscovite 2M1	8.6	Illite-Muscovite 2M1	4.5
Plagioclase	23.6	Plagioclase	15.7	Illite-Muscovite 2M1	7.1	Clinochlore	1.3	Clinochlore	4.6
Hydroxylapatite	1.0	Hydroxylapatite	1.1	Phlogopite 1M	13.3	Epistilbite	2.2	Calcite	3.3
Illite-Muscovite 2M1	4.9	Illite-Muscovite 2M1	6.0	Actinolite	1.1	Almandine ?	0.7	Phlogopite 1M	9.3
Phlogopite 1M	18.6	Phlogopite 1M	17.4	Kaolinite	1.1				
Total	100.0		100.0		100.0		100.0		100.0
	#6 BW-ARD-547		**#7 BW-ARD-132**		**#8 BW-ARD2-7**		**#9 BW-ARD-042**		**#10 BW-ARD-048**
Quartz	33.8	Quartz	27.0	Quartz	31.1	Quartz	30.7	Quartz	30.8
K-feldspar	18.4	K-feldspar	15.8	K-feldspar	17.0	K-feldspar	14.5	K-feldspar	15.0
Plagioclase	25.1	Plagioclase	28.7	Plagioclase	16.1	Plagioclase	24.6	Phlogopite 1M	7.4
Phlogopite 1M	13.6	Phlogopite 1M	18.9	Phlogopite 1M	20.4	Phlogopite 1M	20.0	Illite-Muscovite 2M1	12.9
Clinochlore	2.8	Clinochlore	3.1	Clinochlore	4.7	Illite-Muscovite 2M1	4.3	Hydroxylapatite ?	1.2
Actinolite	4.3	Actinolite	4.7	Illite-Muscovite 2M1	9.2	Hydroxylapatite ?	0.7	Clinochlore	11.7
Hydroxylapatite ?	0.6	Hydroxylapatite ?	1.0	Hydroxylapatite	1.5	Calcite	1.9	Plagioclase	19.7
Grossular ?	0.6	Grossular ?	0.8			Clinochlore	3.3	Ilmenite	1.3
Pyrrhotite	0.7								
Total	100.0		100.0		100.0		100.0		100.0

Table 2:

Mineral	**Ideal Formula**
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$
Almandine	$Fe_3^{2+}Al_2(SiO_4)_3$
Andradite - Grossular	$Ca_3Fe_2^{3+}(SiO_4)_3$ - $Ca_3Al_2(SiO_4)_3$
Calcite	$CaCO_3$
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$
Epistilbite	$CaAl_2Si_6O_{16}$ $5H_2O$
Hydroxylapatite	$Ca_5(PO_4)_3(OH)$
Illite-Muscovite	$K_{0.65}Al_{2.0}Al_{0.65}Si_{3.35}O_{10}(OH)_2$-$KAl_2(AlSi_3O_{10})(OH)_2$
Ilmenite	$Fe^{2+}TiO_3$
Kaolinite	$Al_2Si_2O_5(OH)_4$
K-Feldspar	$KAlSi_3O_8$
Phlogopite	$KMg_3AlSi_3O_{10}(OH)_2$
Plagioclase	$NaAlSi_3O_8$ – $CaAl_2Si_2O_8$
Pyrrhotite	$Fe_{1-x}S$
Quartz	SiO_2
Stilbite	$(Ca_{0.5},Na,K)_9[Al_9Si_{27}O_{72}]$ $28H_2O$

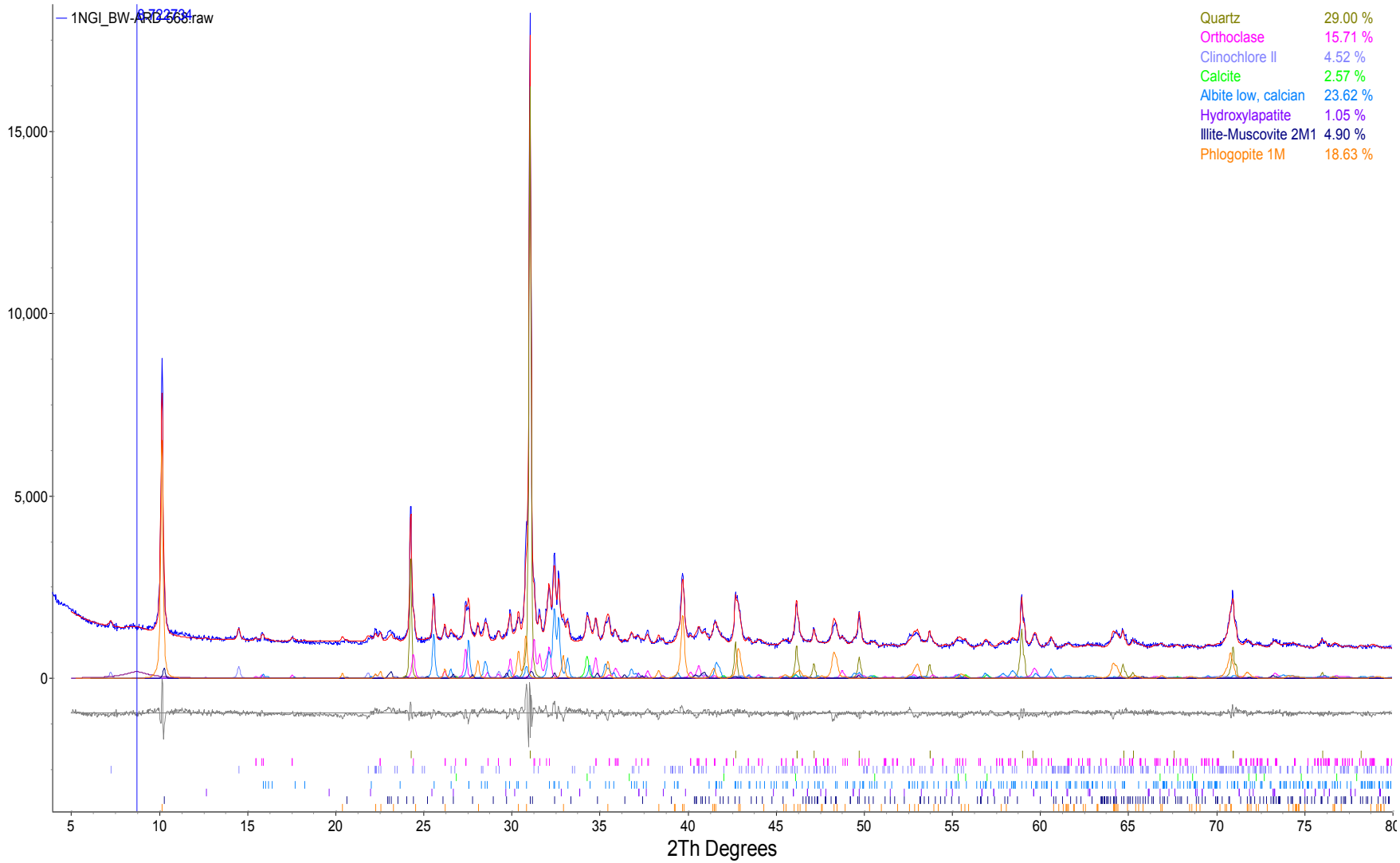


Figure 1: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-568"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

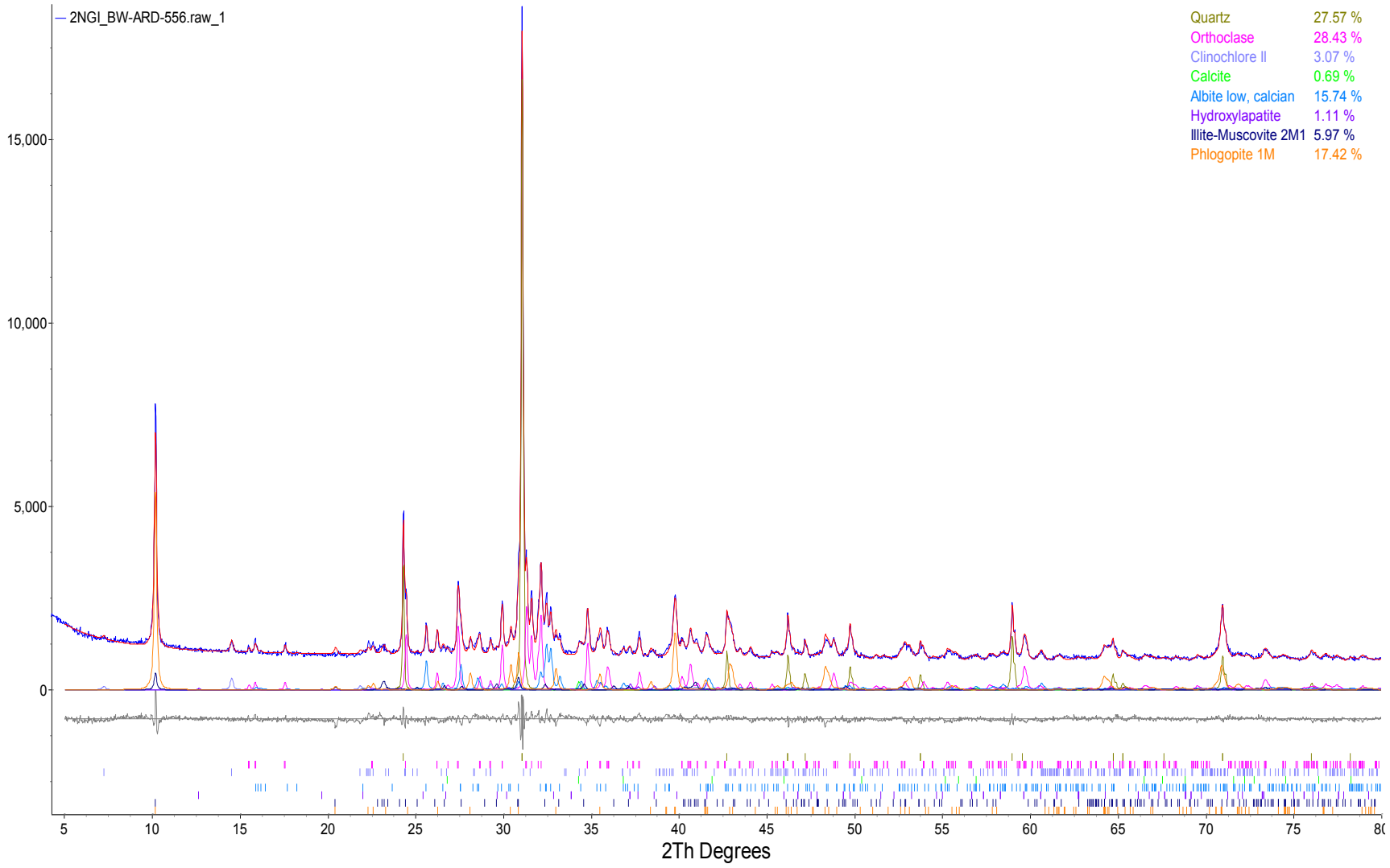


Figure 2: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-556"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

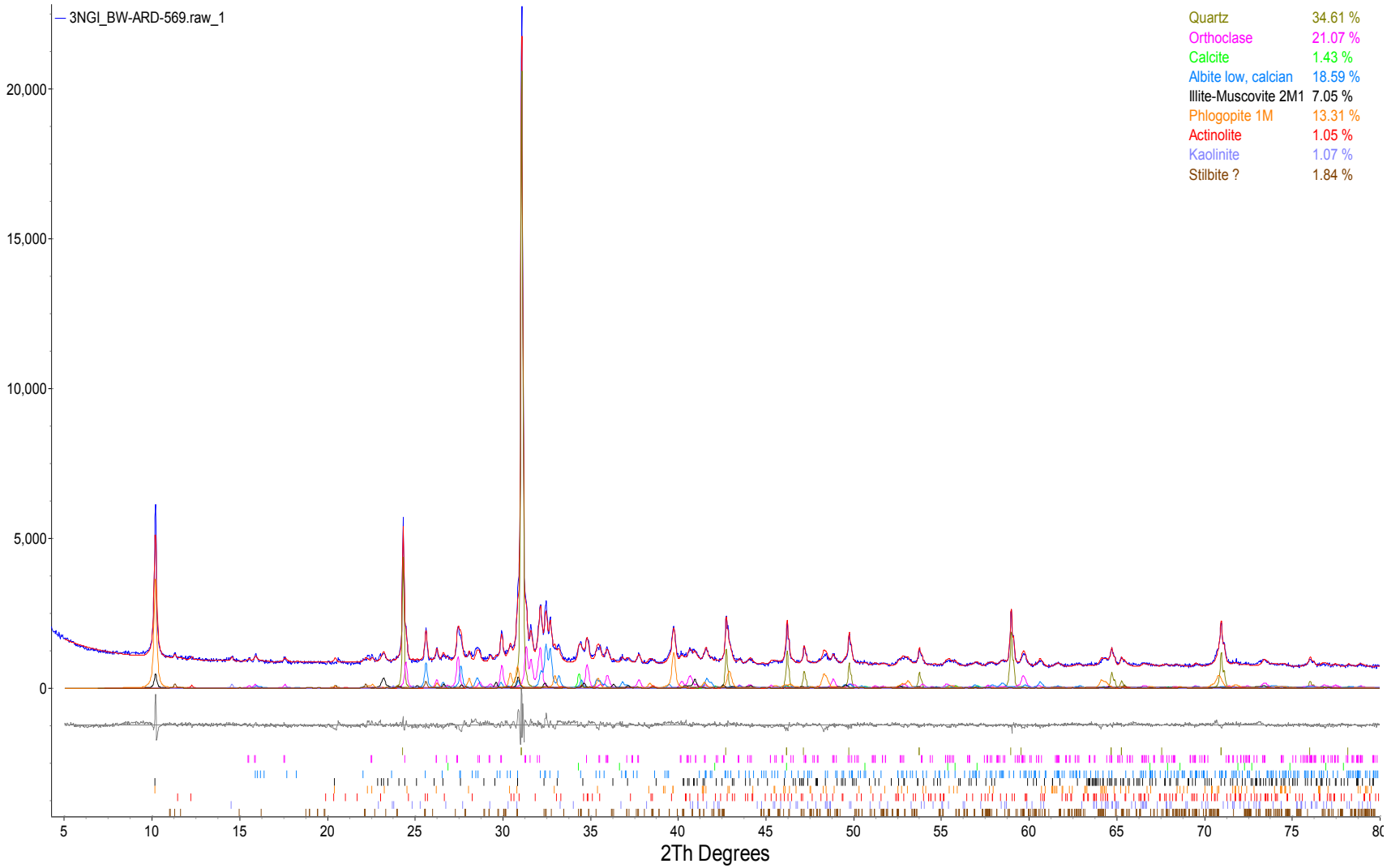


Figure 3: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-569"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

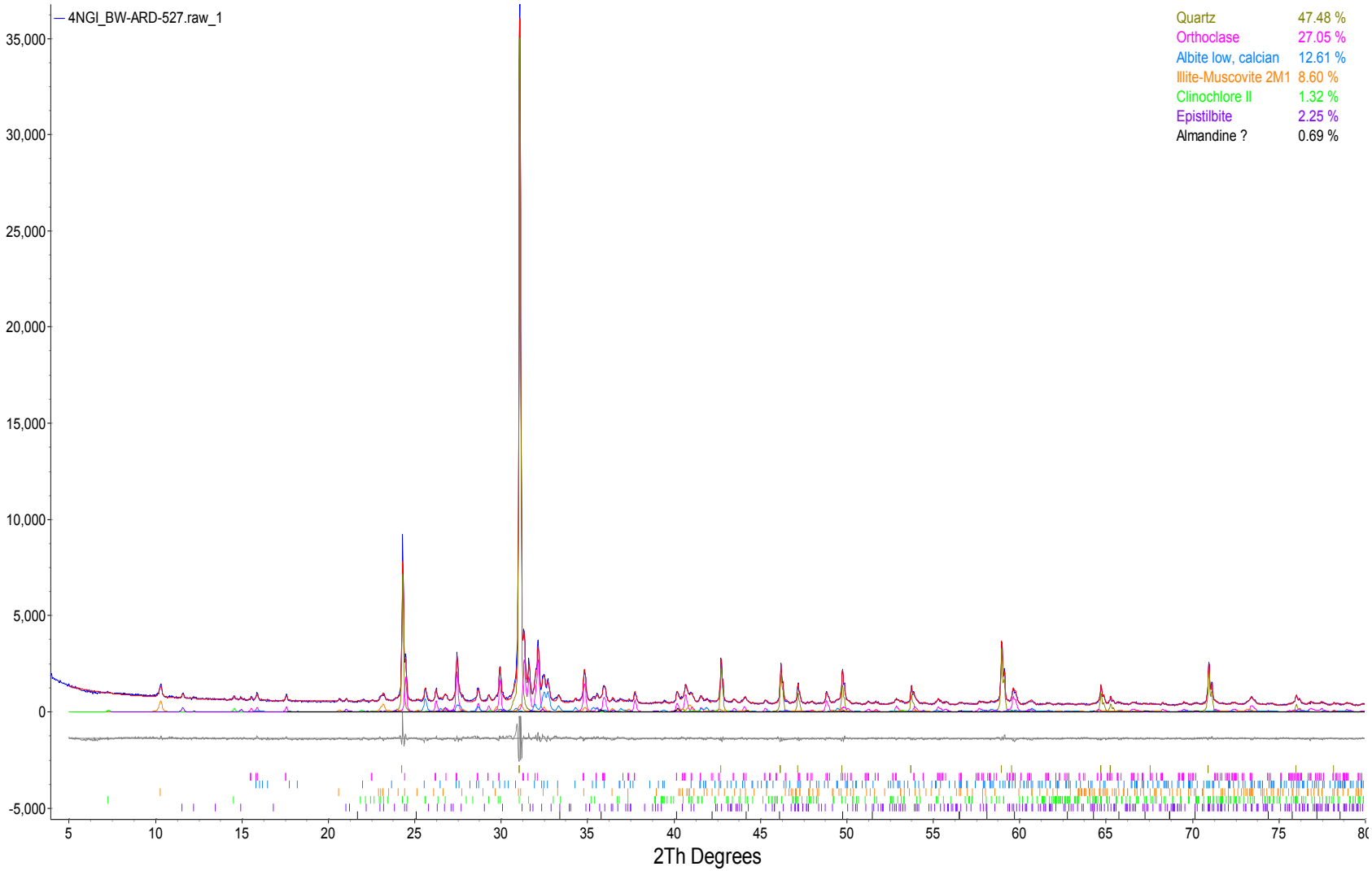


Figure 4: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-527"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

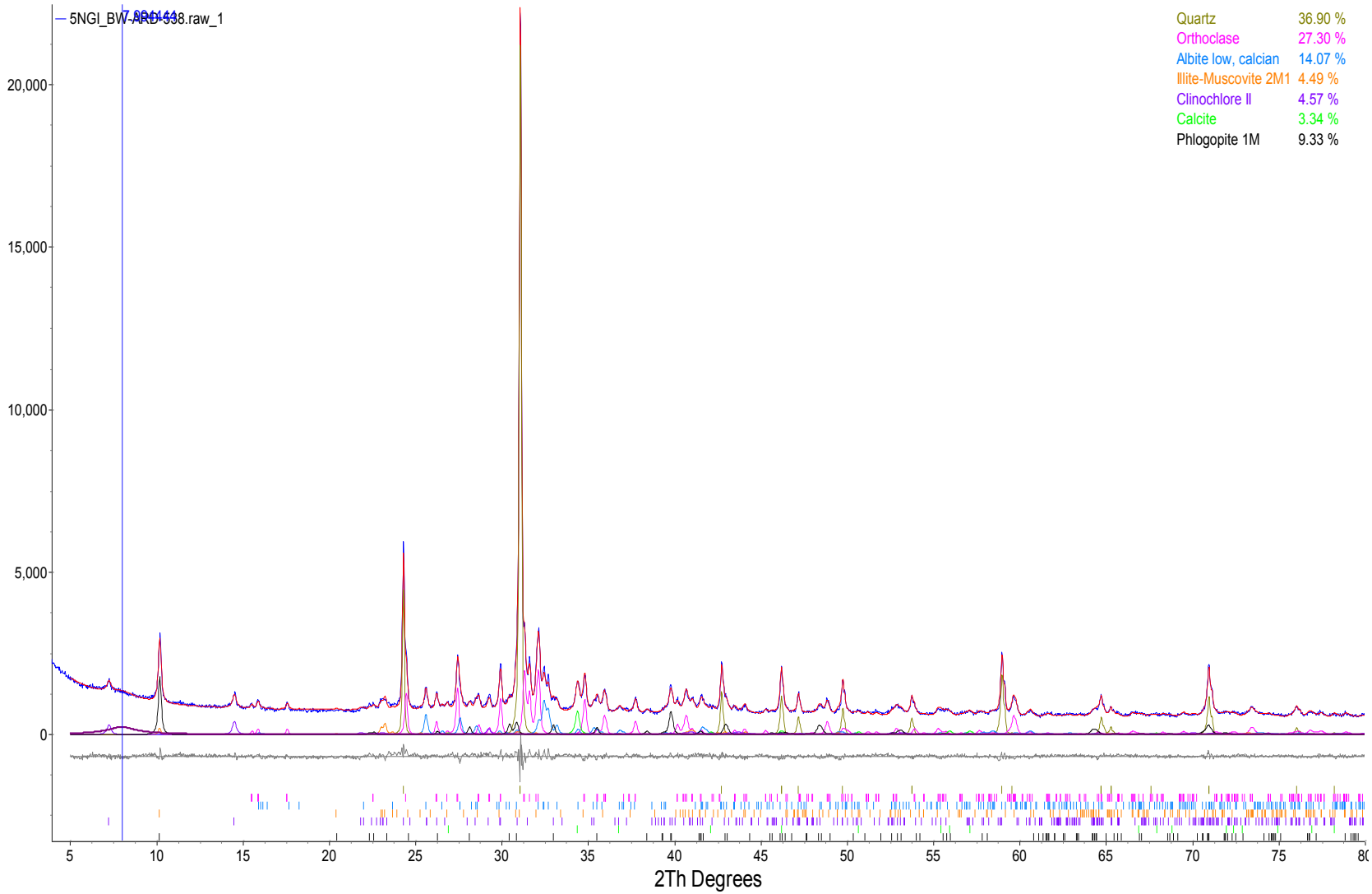


Figure 5: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-538"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

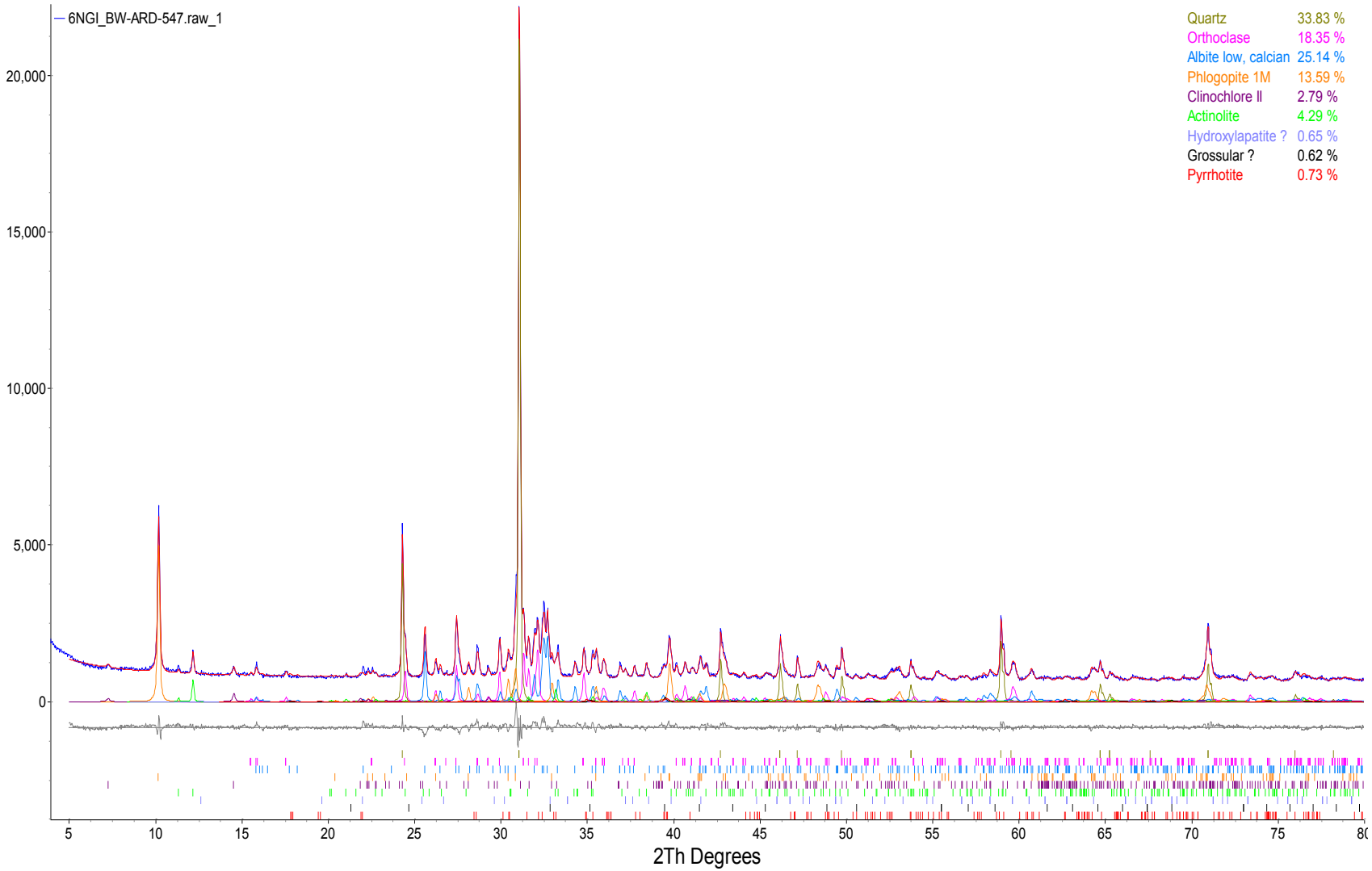


Figure 6: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-547"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

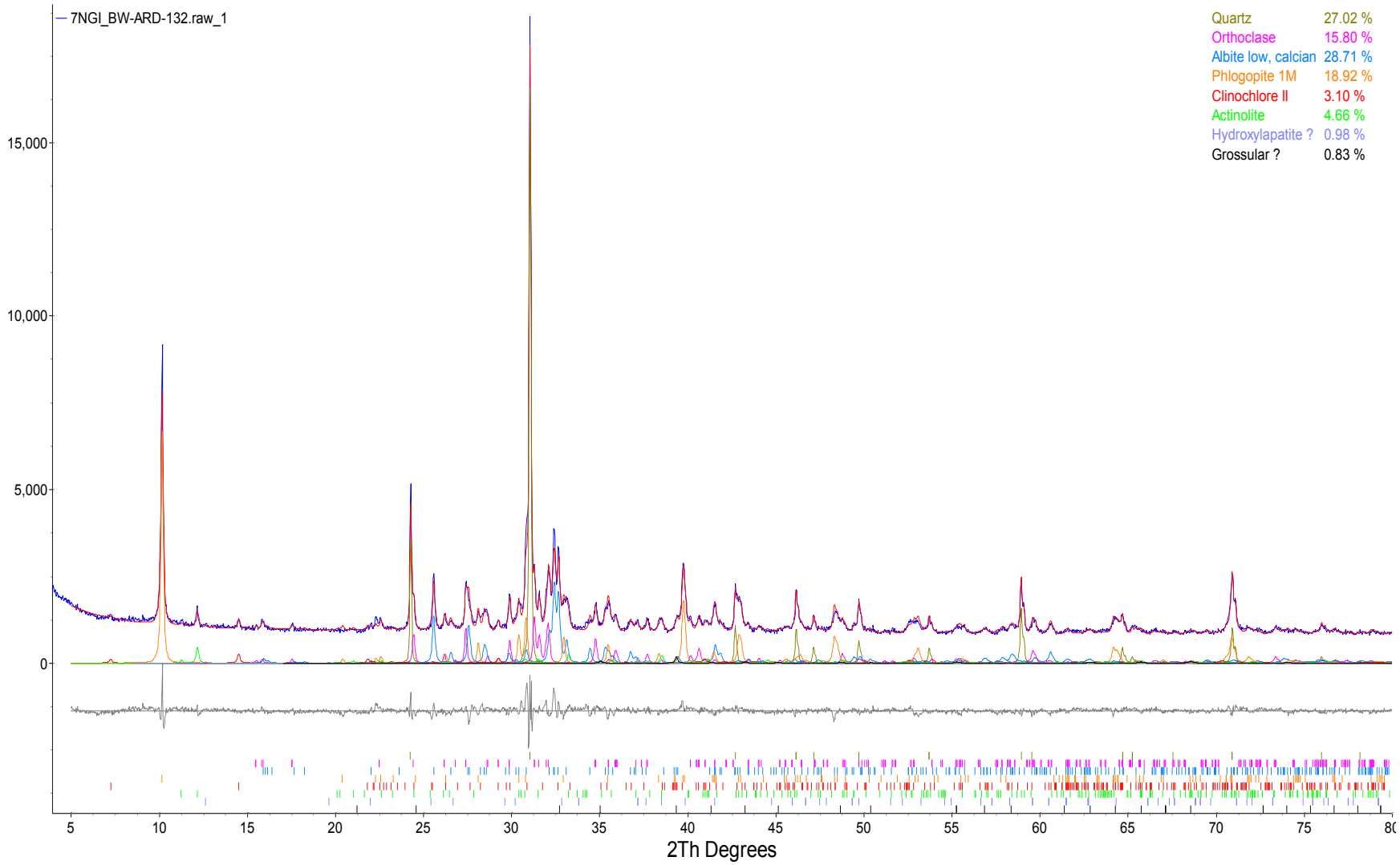


Figure 7: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-132"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

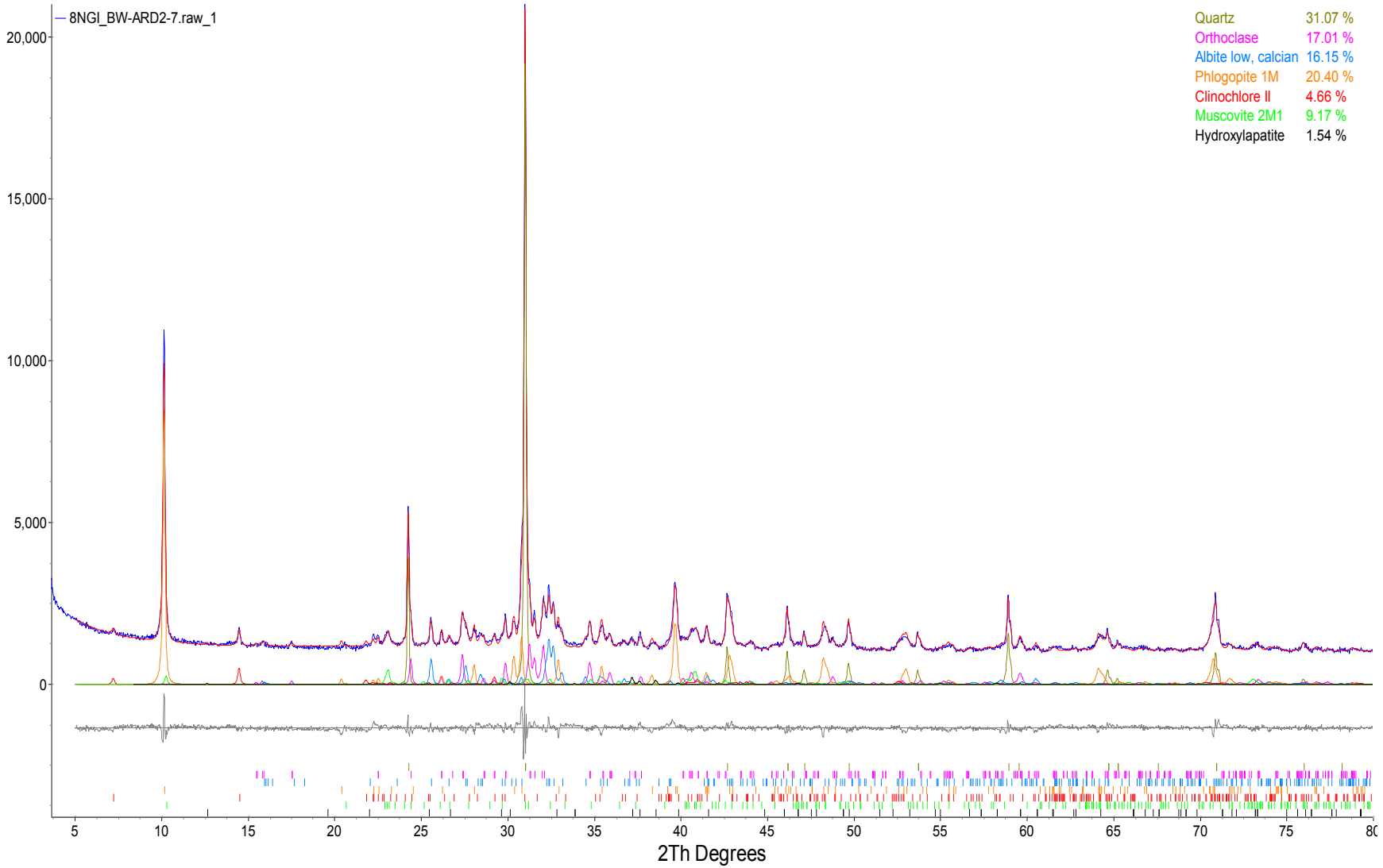


Figure 8: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD2-7"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

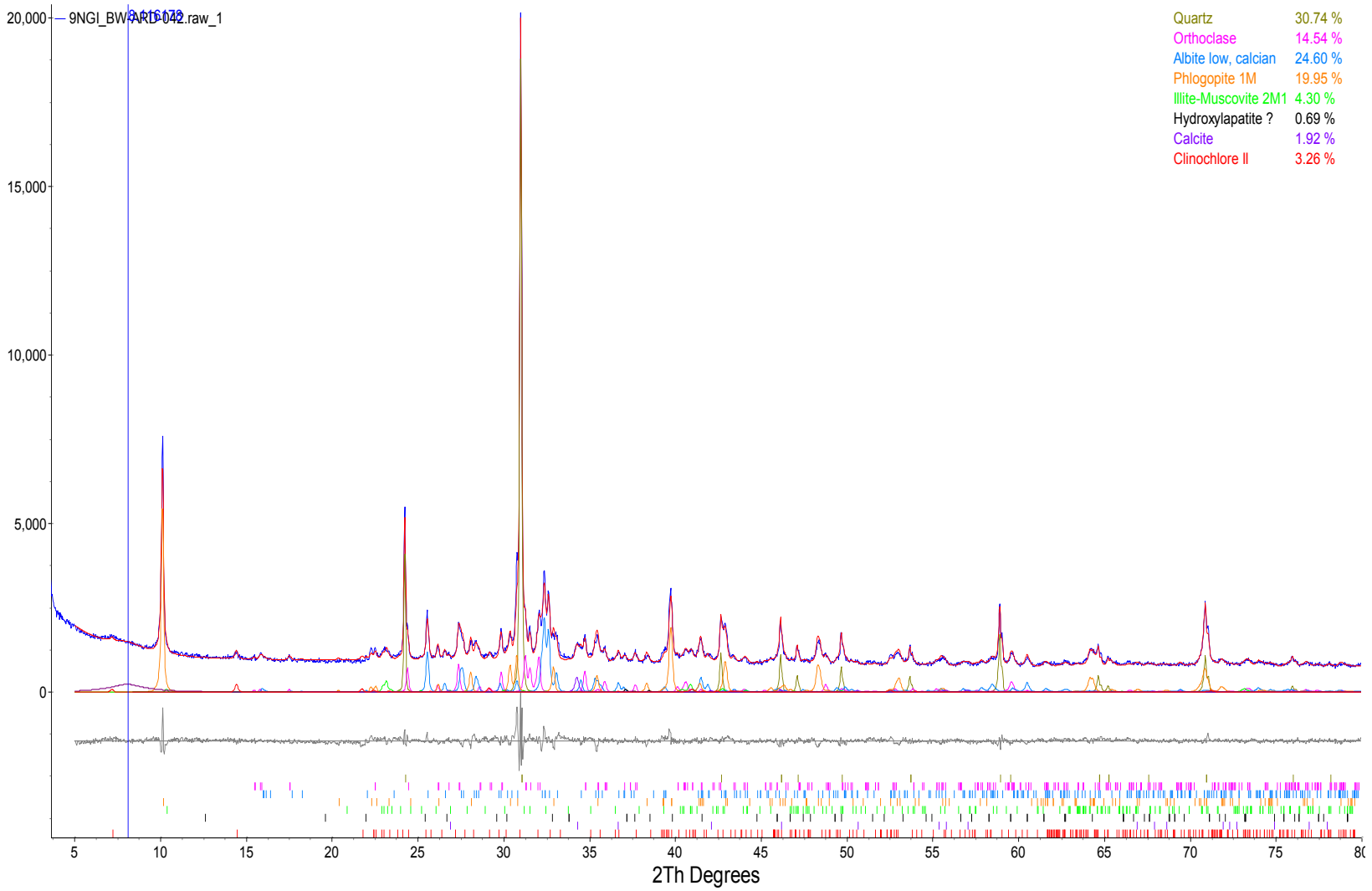


Figure 9: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-042"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

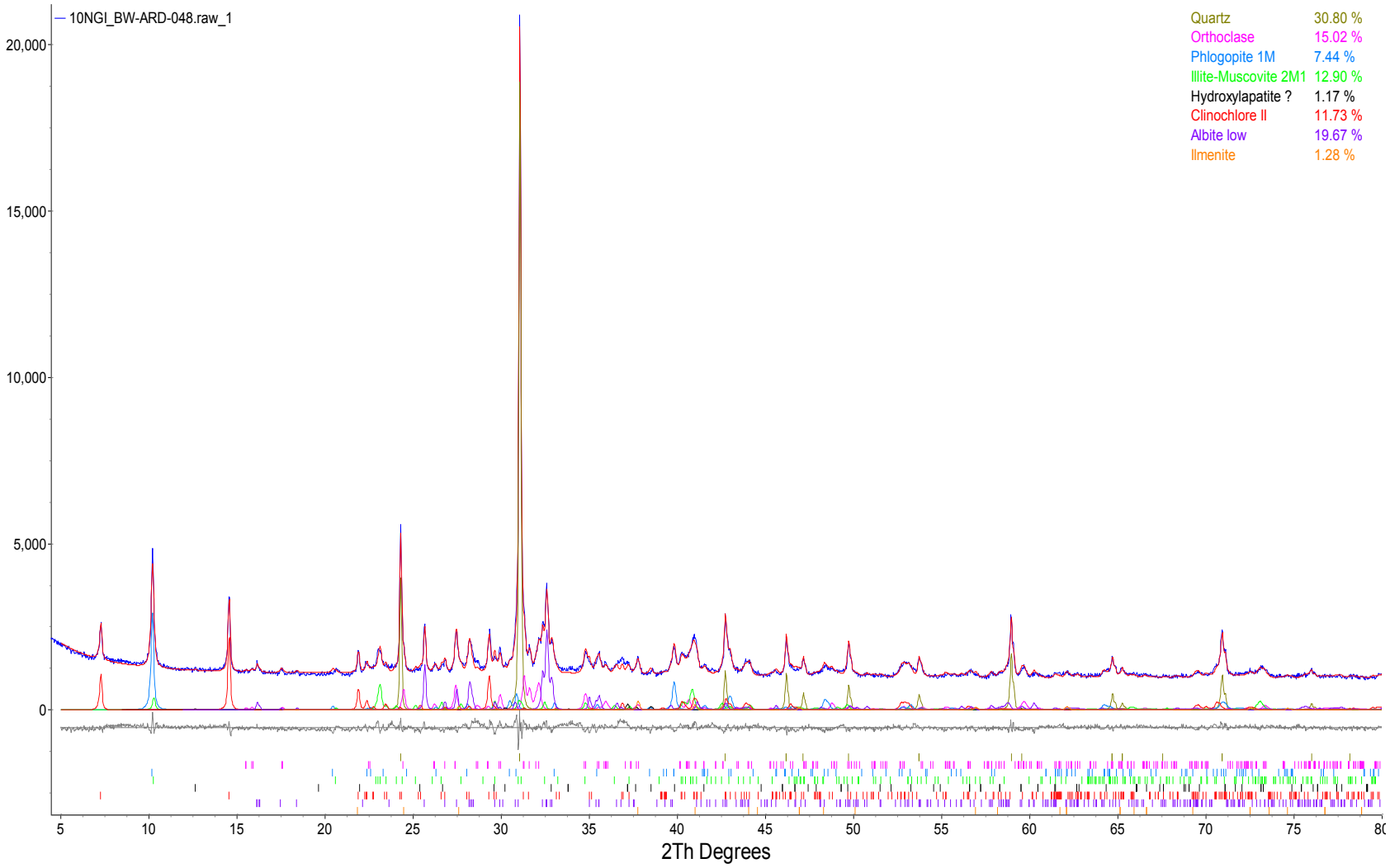


Figure 10: Rietveld refinement plot of sample **New Gold Inc. "BW-ARD-048"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below –difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF THREE POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA

Ezra Kulczycki (AMEC)
New Gold Inc.
Suite 1800 – Two Bentall Centre 555 Burrard Street
Box 212
Vancouver, BC V7X 1M9

Mati Raudsepp, Ph.D.
Elisabetta Pani, Ph.D.
Edith Czech, M.Sc.
Jenny Lai, B.Sc.

Dept. of Earth, Ocean & Atmospheric Sciences
The University of British Columbia
6339 Stores Road
Vancouver, BC V6T 1Z4

April 12, 2013

EXPERIMENTAL METHOD

The three samples were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 using Search-Match software by Bruker. X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 3.

Note that the sample "**COMPG012651-G012660"** (Figure 3) contains a significant amount of unidentified clay, likely a member of the smectite-group (Figure 1, hump between 5-8º2θ). As these disordered clays do not have predictable crystal structure, we have used an empirical structural model for montmorillonite. Therefore the determined amount is semi-quantitative.

Table 1: Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**COMPQ011311-Q011320**	**COMPP012900-P1290909**	**COMPG012651-G012660**
Quartz	SiO_2	32.4	47.3	25.2
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	16.1	22.1	
Illite/Muscovite	$K_{0.65}Al_{2.0}(Al_{0.65}Si_{3.35}O_{10})(OH)_2$/ $KAl_2(AlSi_3O_{10})(OH)_2$	8.9		
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	10.7		10.9
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	5.6	2.7	
Stilbite(-Na)	$(Na,Ca,K)_{6\text{-}7}[Al_8Si_{28}O_{72}]\cdot nH_2O$			3.4
Montmorillonite	$(Na,Ca)_{0.3}(Al,Mg)_2Si_4O_{10}(OH)_2\cdot nH_2O$			22.2
K-Feldspar	$KAlSi_3O_8$	13.4	24.8	15.1
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	12.9	3.1	23.2
Total		100.0	100.0	100.0

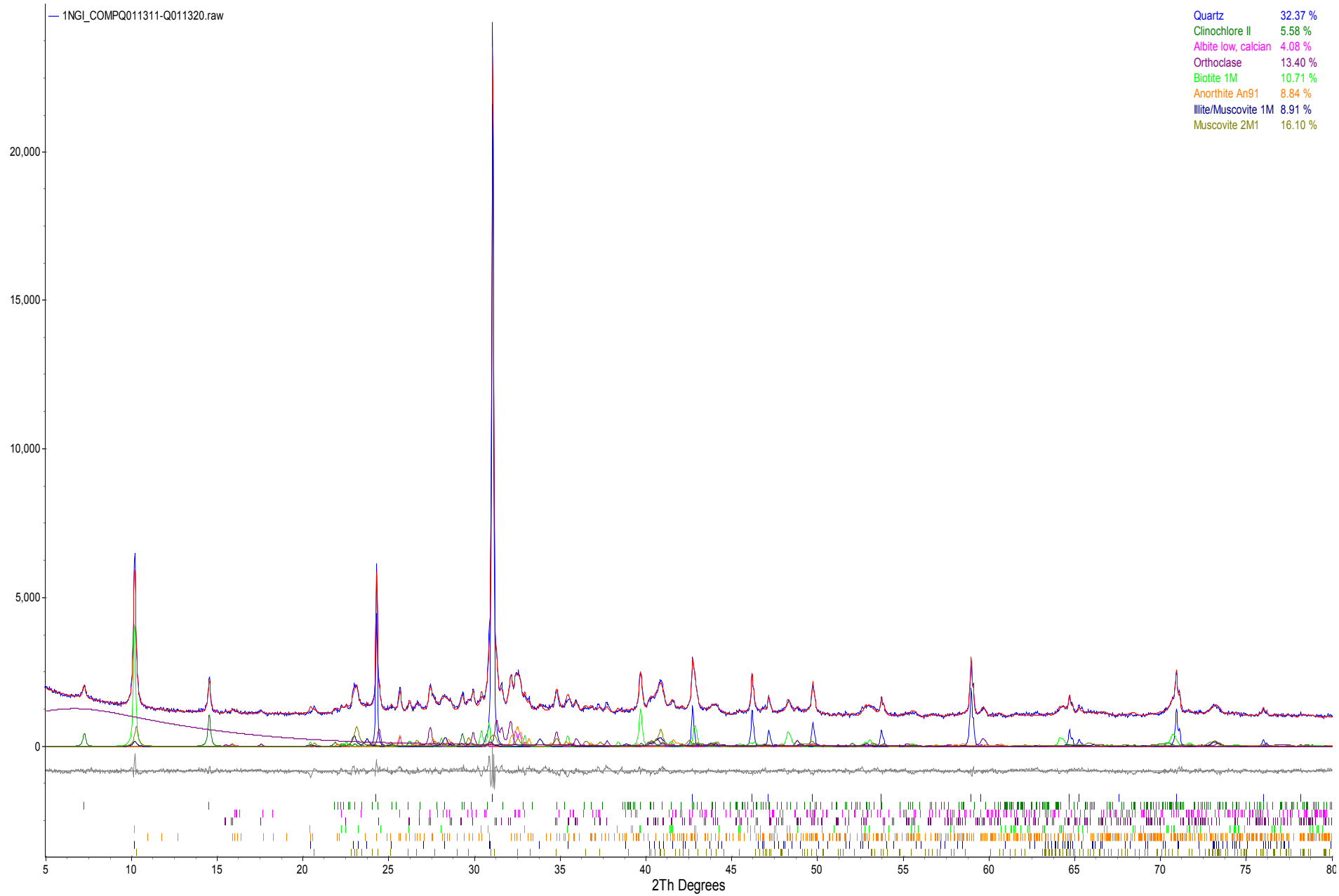


Figure 1: Rietveld refinement plot of sample **New Gold Inc. "COMPQ011311-Q011320"** (blue line – observed intensity at each step; red line – calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars – positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

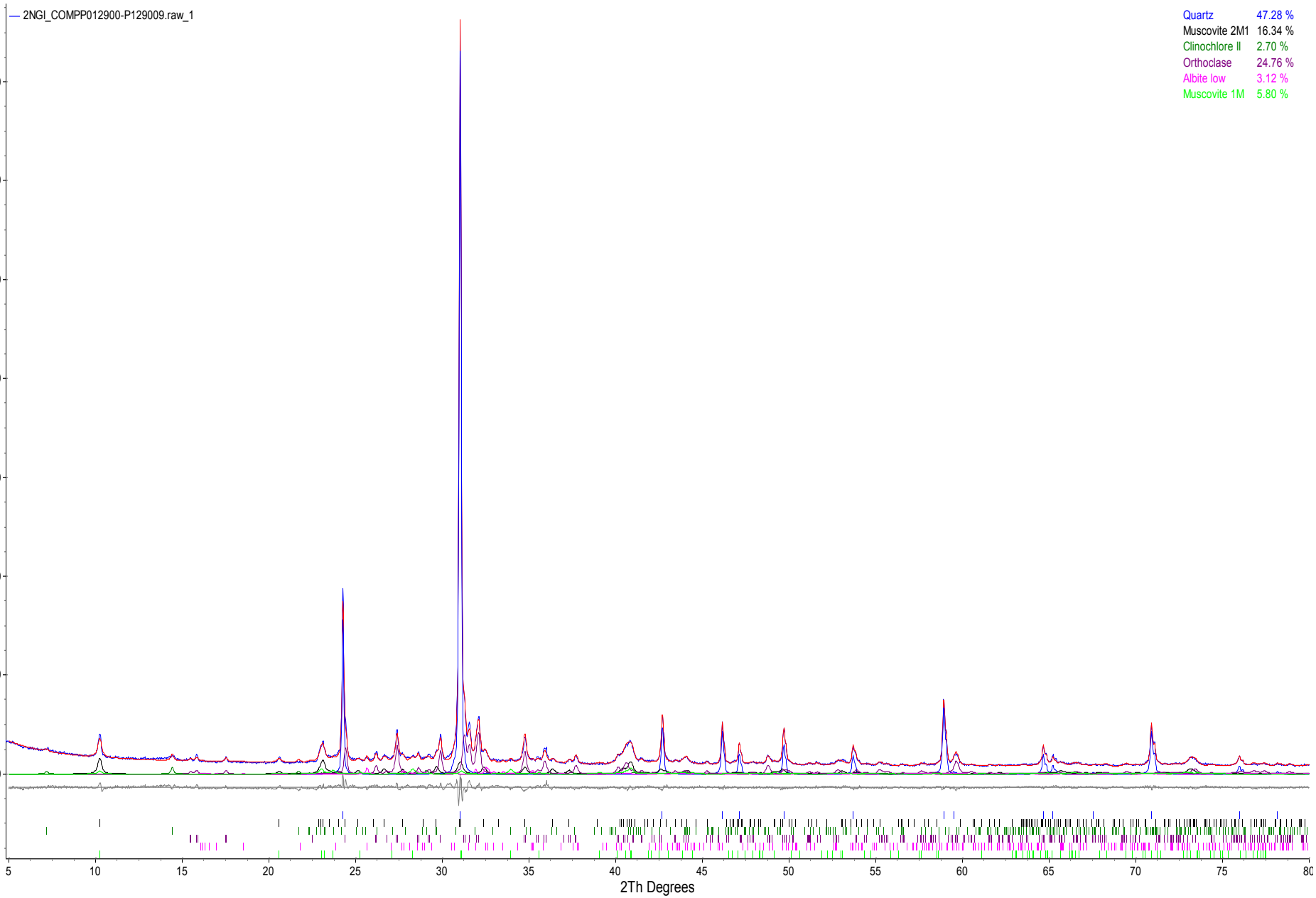


Figure 2: Rietveld refinement plot of sample **New Gold Inc. "COMPP012900-P1290909"** (blue line – observed intensity at each step; red line – calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars – positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

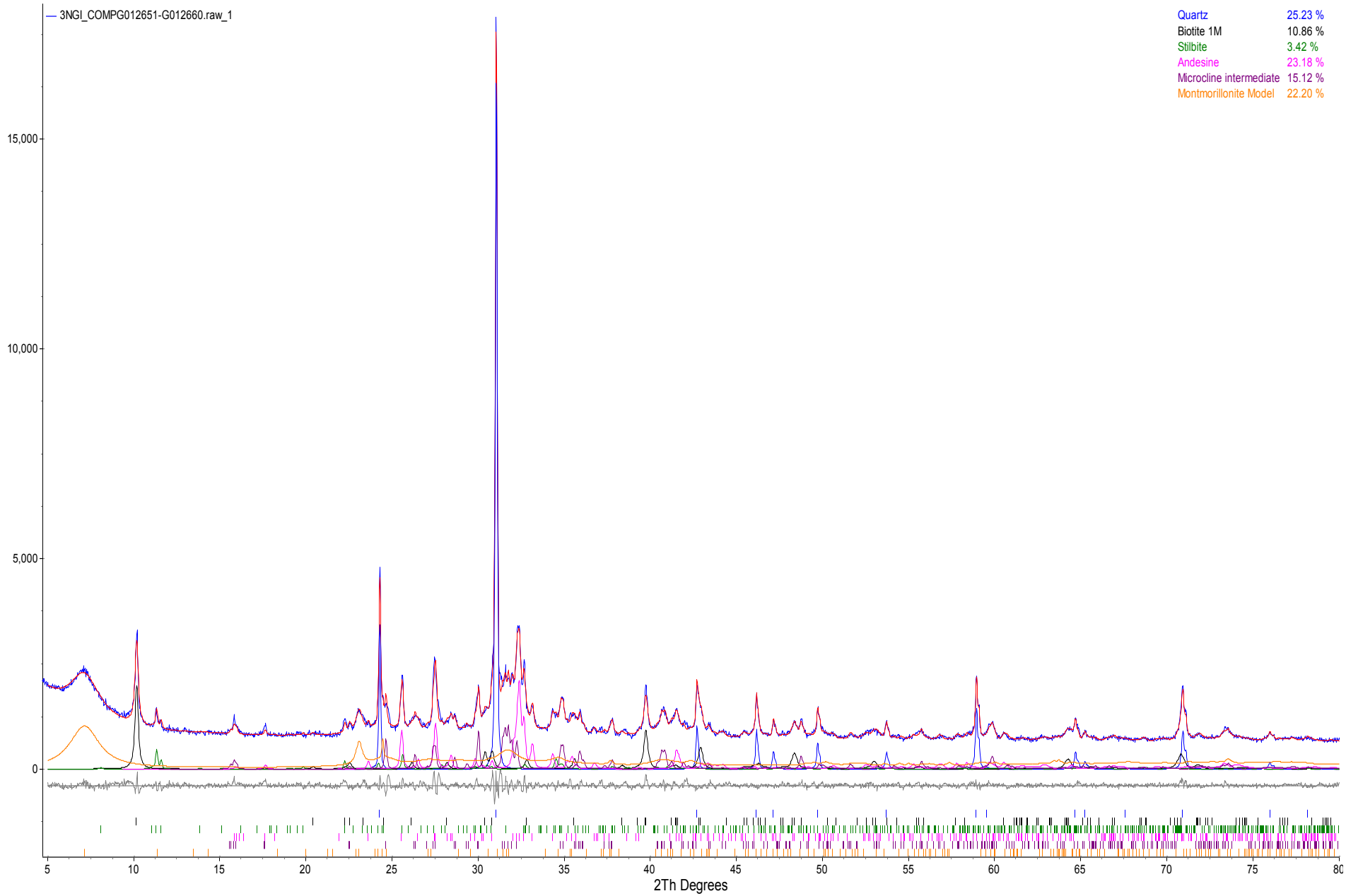


Figure 3: Rietveld refinement plot of sample **New Gold Inc. "COMPG012651-G012660"** (blue line – observed intensity at each step; red line – calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars – positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF 12 POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA

Project: Blackwater - Ref #: VA13079771

Ezra Kulczycki, (AMEC)
New Gold Inc.
Suite 1800, Two Bentall Centre
555 Burrard Street, Box 212
Vancouver, BC V7X 1M9

Mati Raudsepp, Ph.D.
Elisabetta Pani, Ph.D.
Edith Czech, M.Sc.
Jenny Lai, B.Sc.

Dept. of Earth, Ocean & Atmospheric Sciences
The University of British Columbia
6339 Stores Road
Vancouver, BC V6T 1Z4

May 24, 2013

EXPERIMENTAL METHOD

The 12 samples of **Project Blackwater – Ref # VA13079771** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Bruker. X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1 (separate file, ***New Gold Inc Results May 24 2013 – Project Blackwater – Ref VA13079771.xls***). These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figure 1-12. The ideal formulae of phases present are given in Table 2.

Table 1. Results of quantitative phase analysis (wt.%) XRD-Rietveld – New Gold Inc. Project Blackwater – Reference # VA13079771

	#1 W007677		**#2 O016797**		**#3 O016800**		**#4 K018205**		**#5 K017994**		**#6 W009806**
Muscovite	21.9	Quartz	61.2	Quartz	58.6	Quartz	47.7	Quartz	61.8	Quartz	50.2
Quartz	56.8	Muscovite	30.8	Muscovite	29.1	Muscovite	15.4	Pyrite	0.8	Pyrite	1.8
Almandine	5.7	K-feldspar	4.3	K-feldspar	8.8	K-feldspar	36.9	Muscovite	34.7	Muscovite	22.6
Annite	15.6	Galena	0.2	Galena	0.2			Sphalerite	0.4	Sphalerite	0.5
		Pyrite	1.1	Pyrite	0.6			K-feldspar	2.3	K-feldspar	23.5
		Sphalerite	0.2	Sphalerite	0.4					Galena	0.4
		Kaolinite	1.1	Kaolinite	1.3					Kaolinite	1.0
		Calcite ?	0.7	Calcite ?	0.40						
		Arsenopyrite	0.4	Arsenopyrite	0.7						
Total	100.0		100.0		100.0		100.0		100.0		100.0
	#7 P014960		**#8 J020228**		**#9 W008165**		**#10 CP000258**		**#11 K018764**		**#12 K018765**
Quartz	59.5	Quartz	50.1	Quartz	39.6	Quartz	50.5	Quartz	42.8	Quartz	41.8
Pyrite	1.9	Pyrite	1.9	K-feldspar	20.7	K-feldspar	22.8	K-feldspar	11.4	K-feldspar	10.6
Muscovite	33.9	Muscovite	26.4	Clinochlore	4.7	Muscovite	21.5	Pyrite	1.6	Sphalerite	0.3
Sphalerite	0.9	Sphalerite	0.3	Plagioclase	15.3	Siderite	4.4	Sphalerite	0.4	Clinochlore	4.7
Kaolinite ?	0.4	K-feldspar	20.9	Pyrrhotite	3.0	Pyrite	0.3	Clinochlore	6.9	Muscovite	22.5
K-feldspar	3.4	Clinochlore ?	0.5	Pyrite ?	0.3	Galena	0.2	Biotite	14.7	Biotite	20.1
				Siderite	0.4	Sphalerite	0.4	Muscovite	22.2		
				Sphalerite ?	0.17						
				Biotite	15.9						
Total	100.0		100.0		100.0		100.0		100.0		100.0

Table 2:

Mineral	**Ideal Formula**
Almandine	$Fe_3^{2+}Al_2(SiO_4)_3$
Annite	$KFe_3^{2+}AlSi_3O_{10}(OH)_2$
Arsenopyrite	FeAsS
Biotite	$K(Mg,Fe^{2+})_3AlSi_3O_{10}(OH)_2$
Calcite	$CaCO_3$
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$
Galena	PbS
Kaolinite	$Al_2Si_2O_5(OH)_4$
K-feldspar	$KAlSi_3O_8$
Muscovite	$Kal_2AlSi_3O_{10}(OH)_2$
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$
Pyrite	FeS_2
Pyrrhotite	$Fe_{1-x}S$
Quartz	SiO_2
Siderite	$Fe^{2+}CO_3$
Sphalerite	(Zn,Fe)S

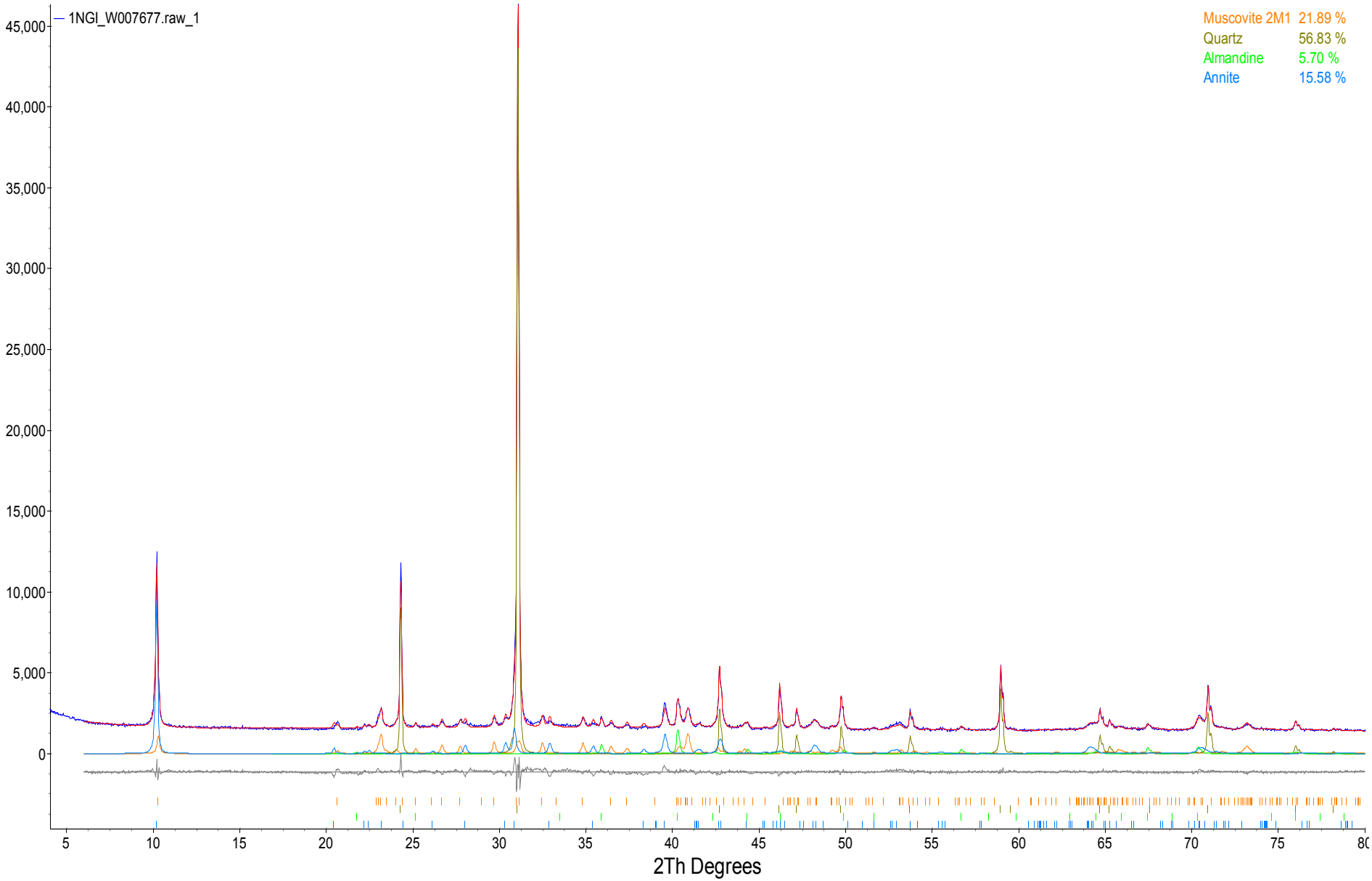


Figure 1: Rietveld refinement plot of sample **New Gold Inc "W007677"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

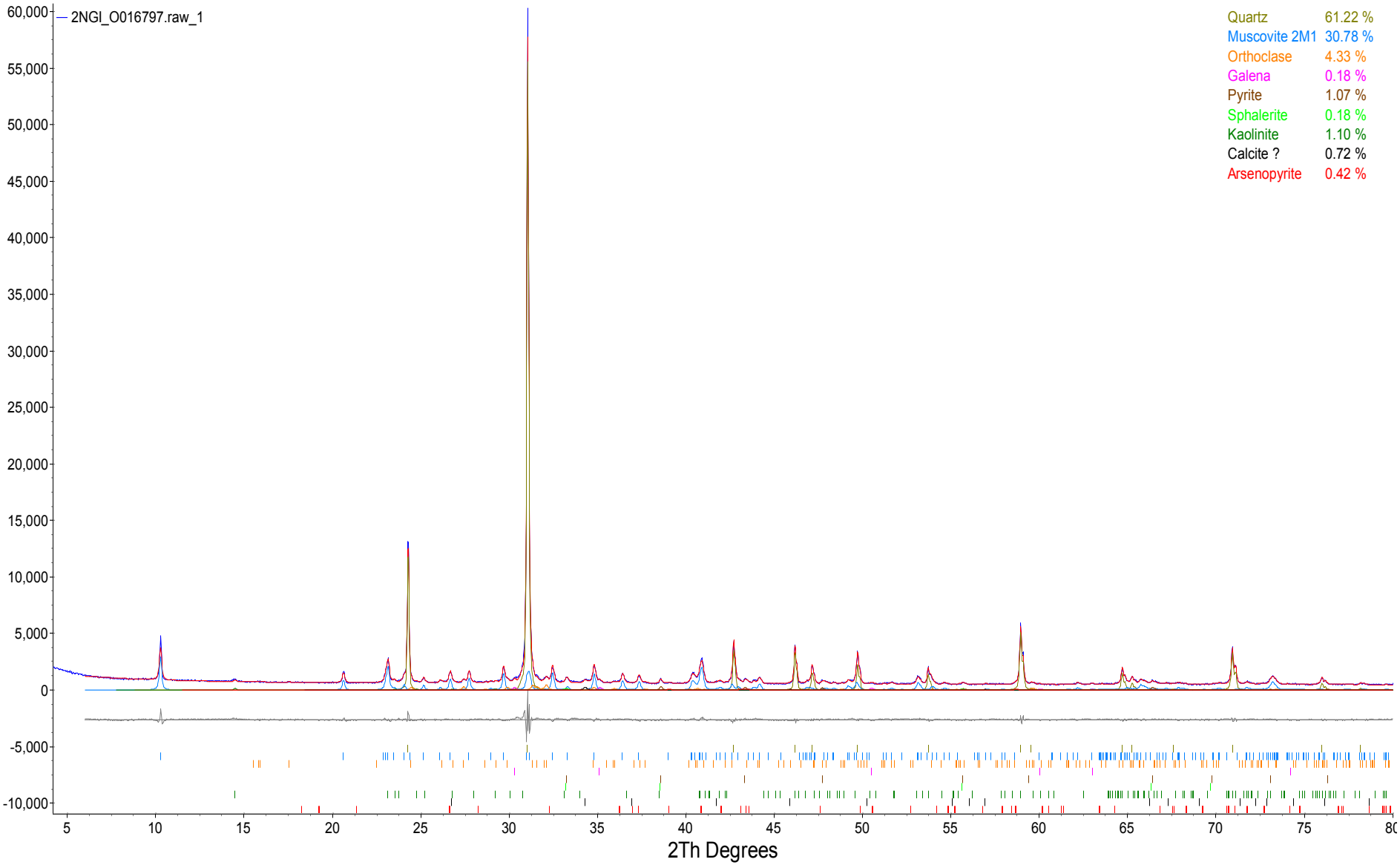


Figure 2: Rietveld refinement plot of sample **New Gold Inc "O016797"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

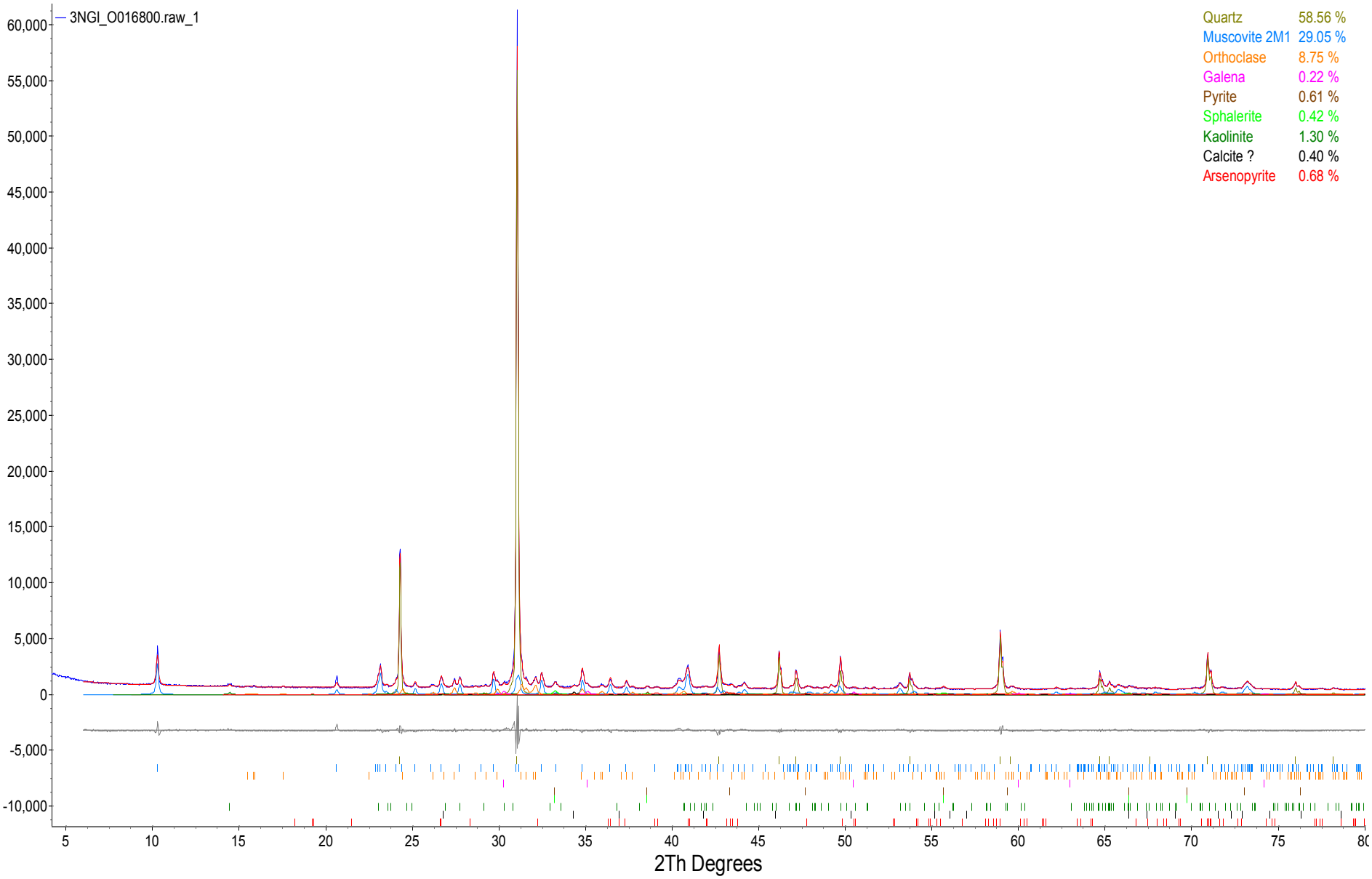


Figure 3: Rietveld refinement plot of sample **New Gold Inc "O016800"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

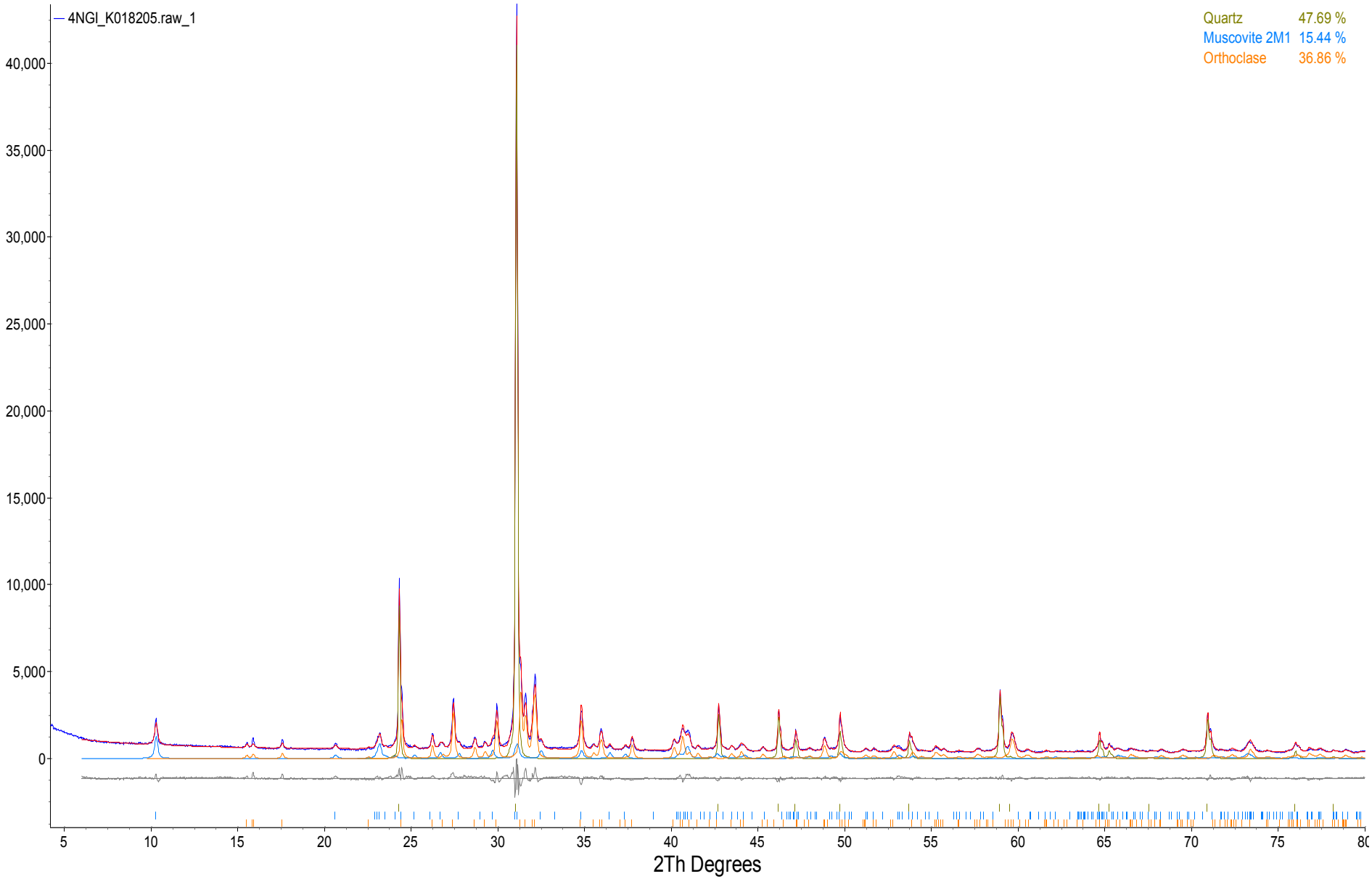


Figure 4: Rietveld refinement plot of sample **New Gold Inc "K018205"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

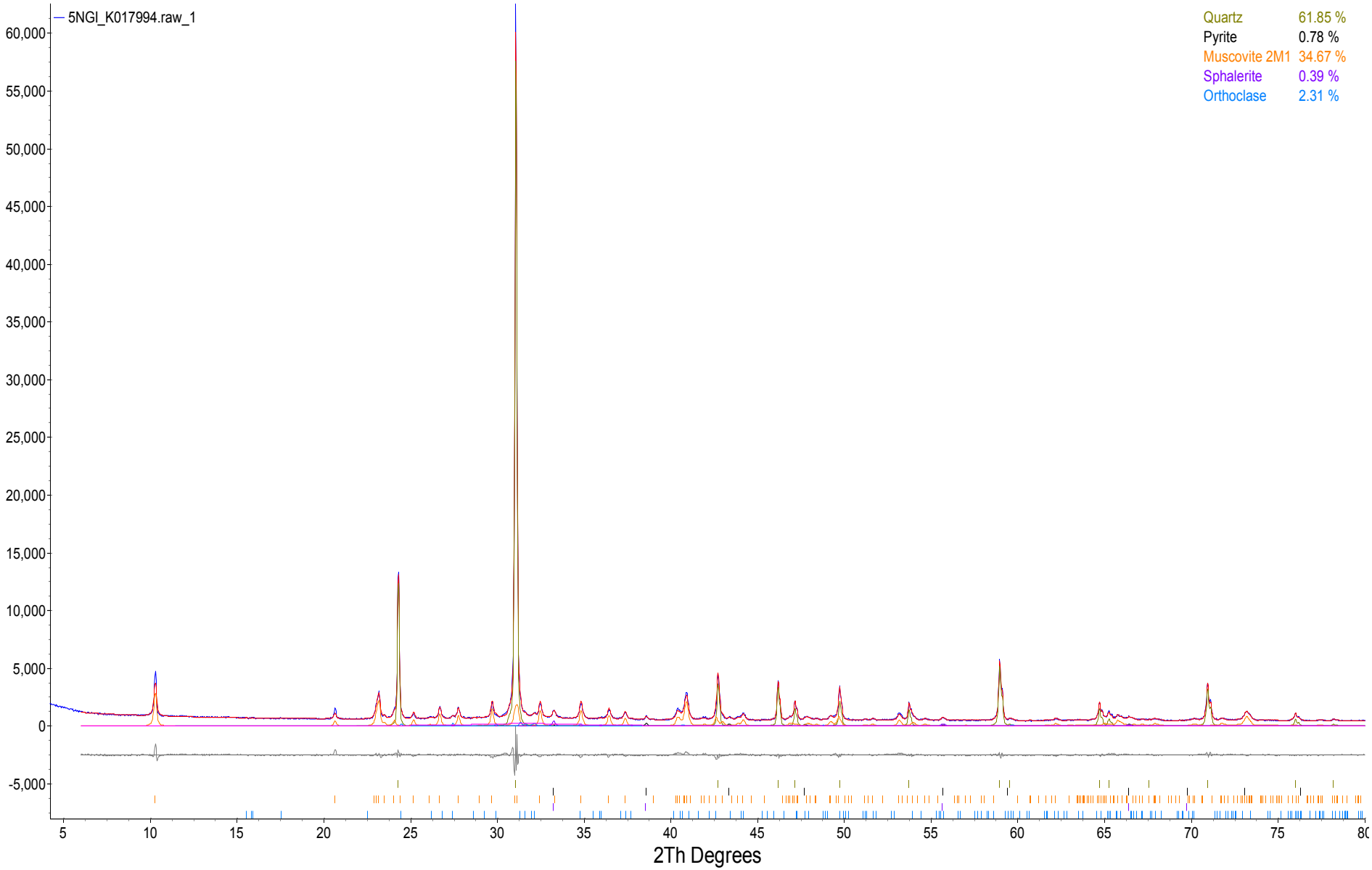


Figure 5: Rietveld refinement plot of sample **New Gold Inc "K017994"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

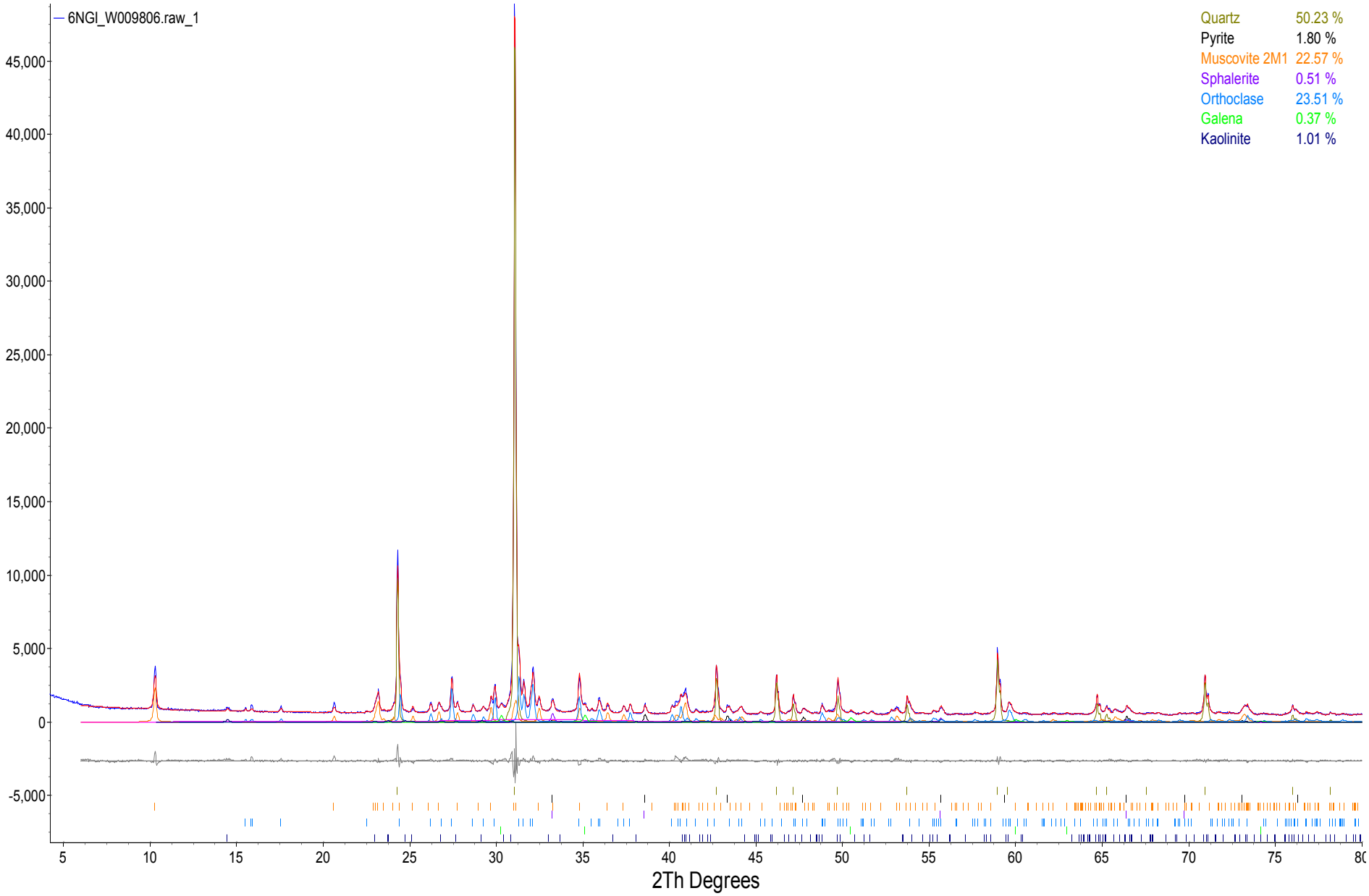


Figure 6: Rietveld refinement plot of sample **New Gold Inc "W009806"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

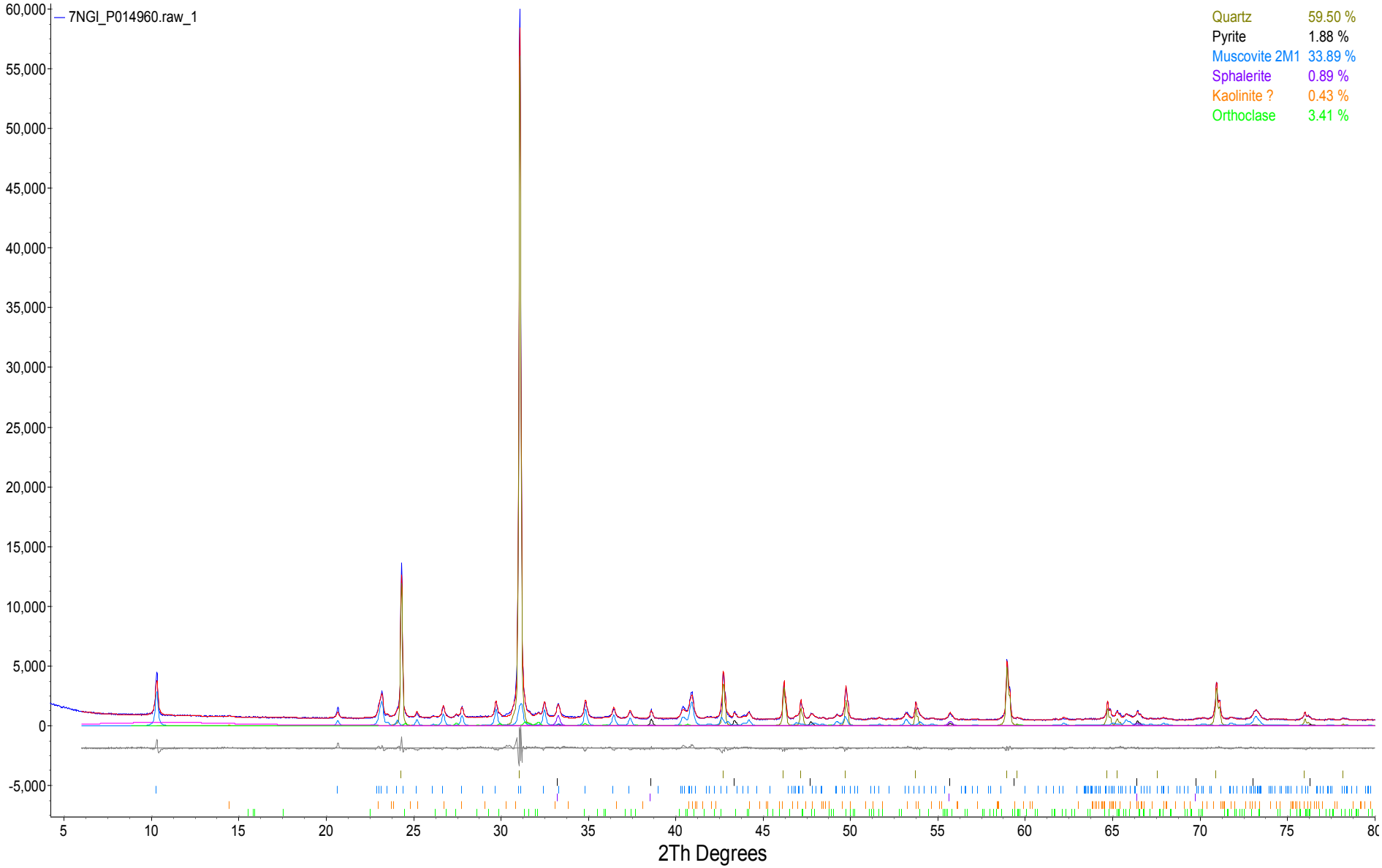


Figure 7: Rietveld refinement plot of sample **New Gold Inc "P014960"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

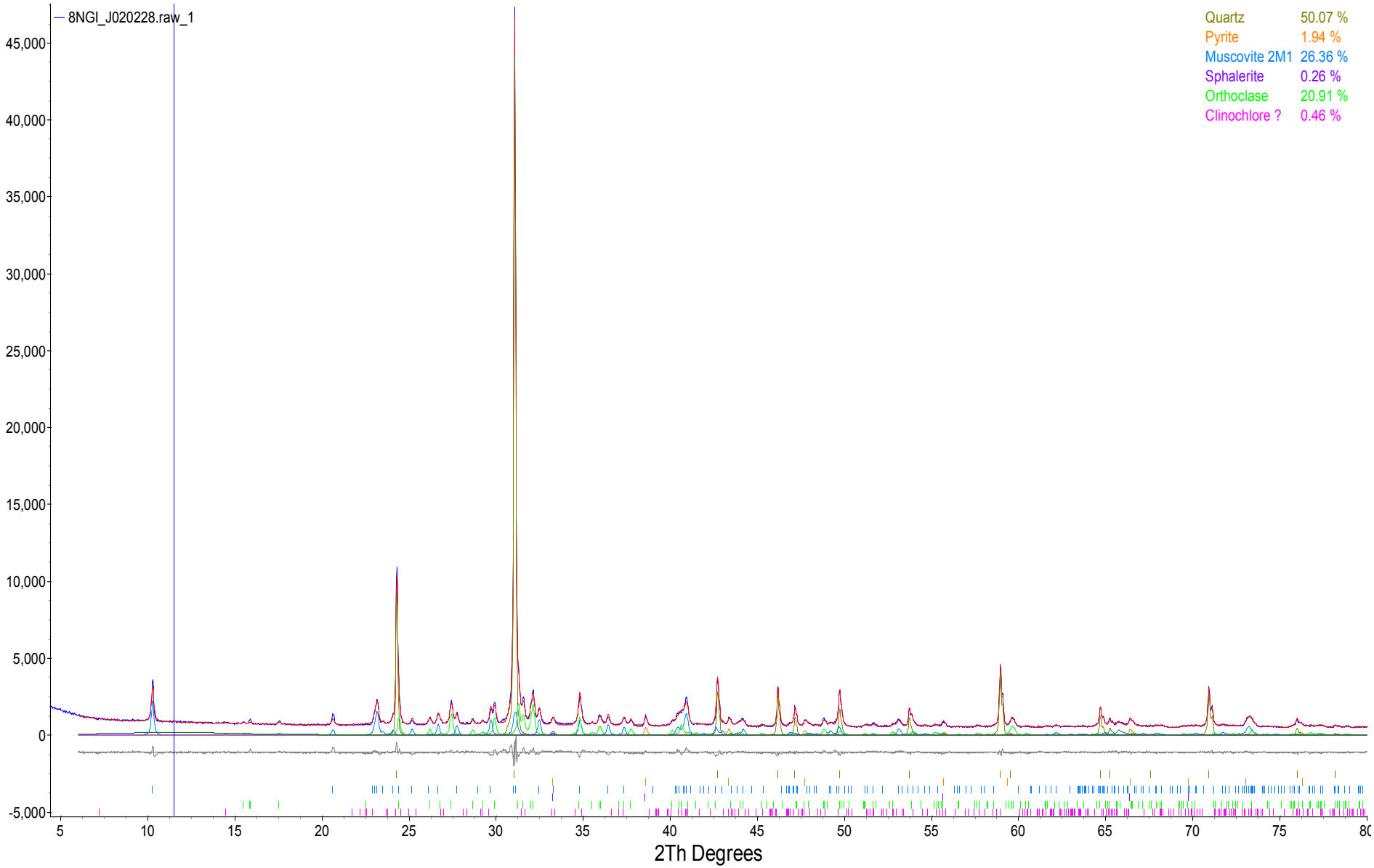


Figure 8: Rietveld refinement plot of sample **New Gold Inc "J020228"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

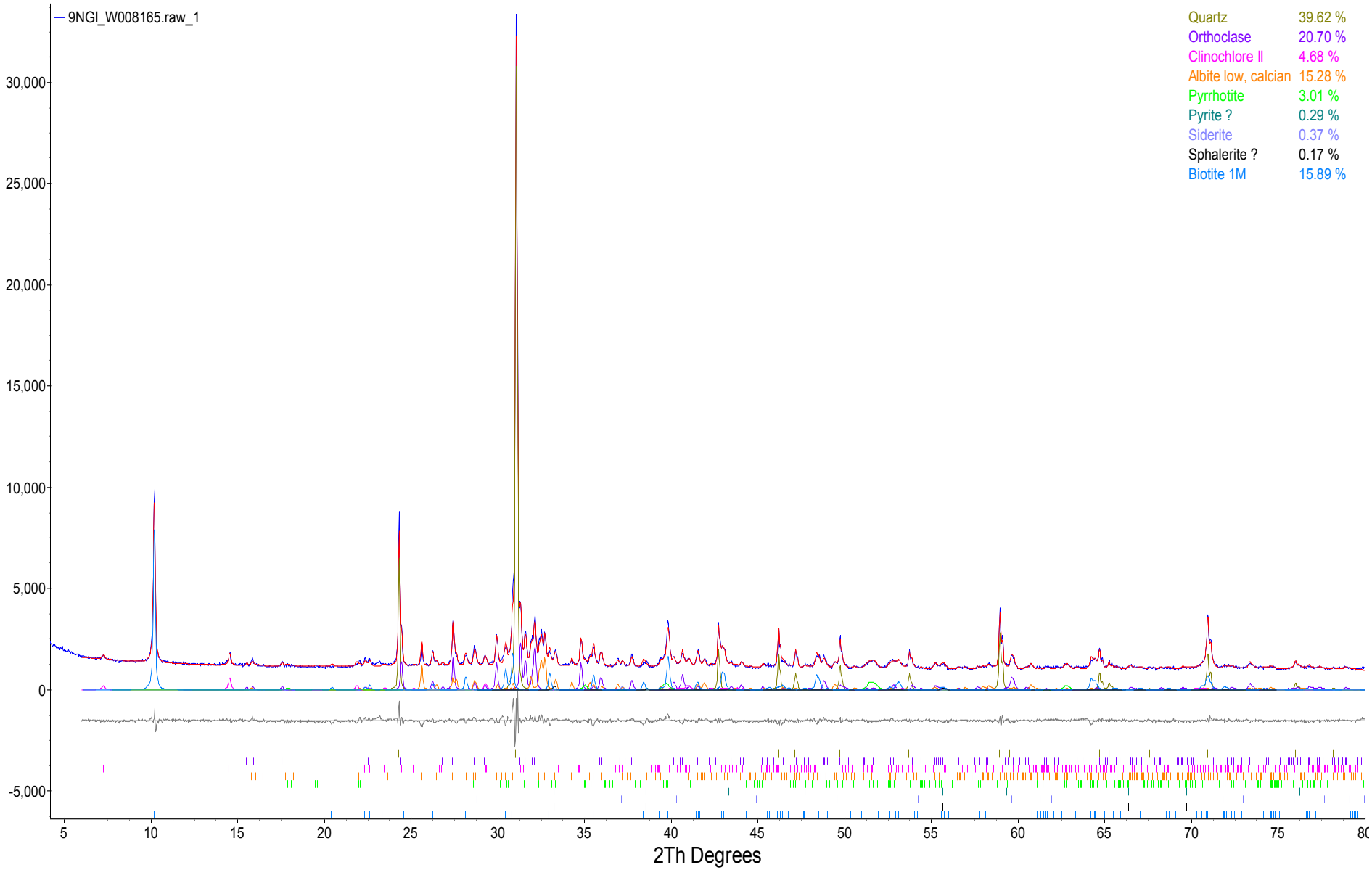


Figure 9: Rietveld refinement plot of sample **New Gold Inc "W008165"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

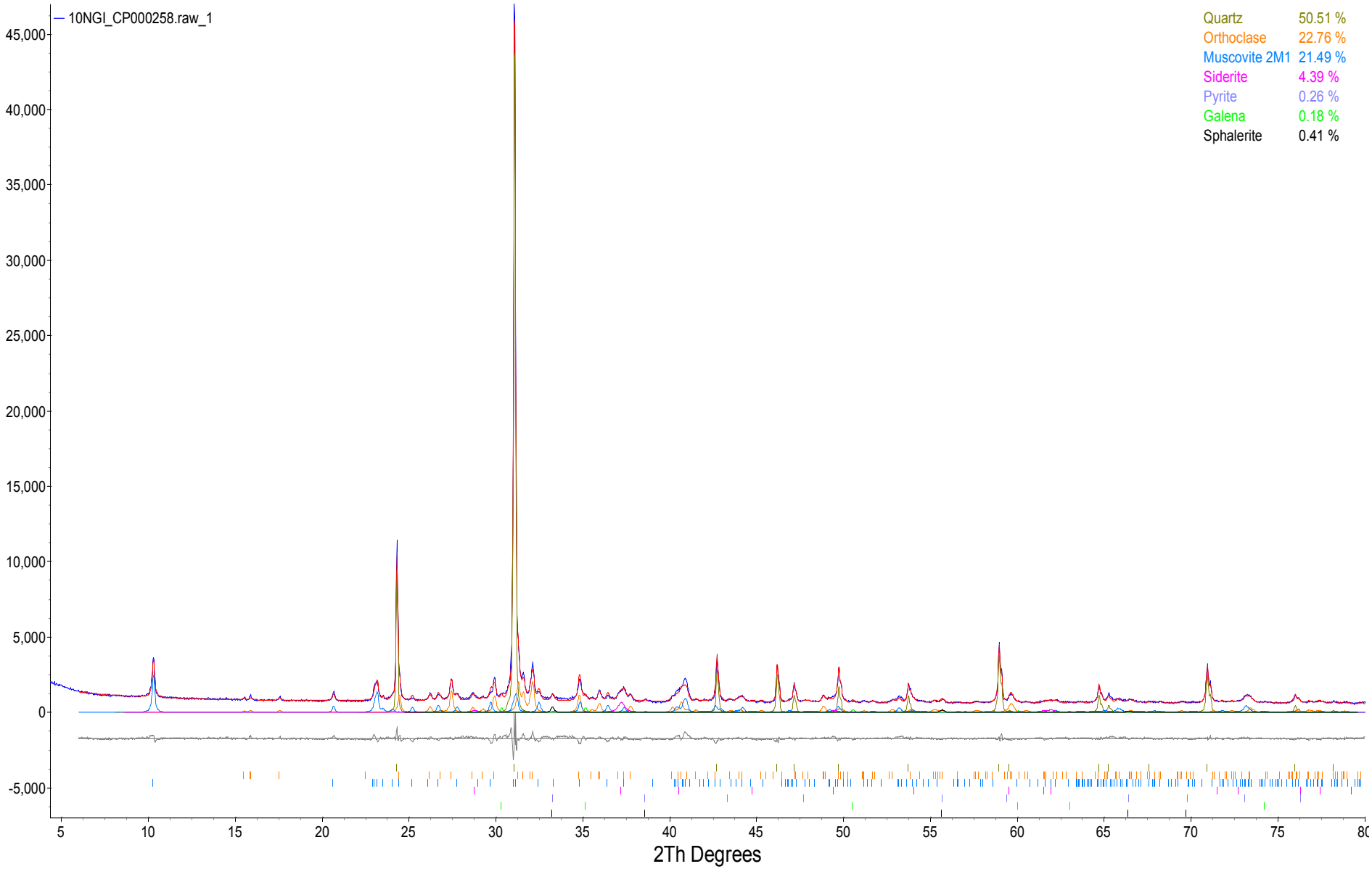


Figure 10: Rietveld refinement plot of sample **New Gold Inc "CP000258"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

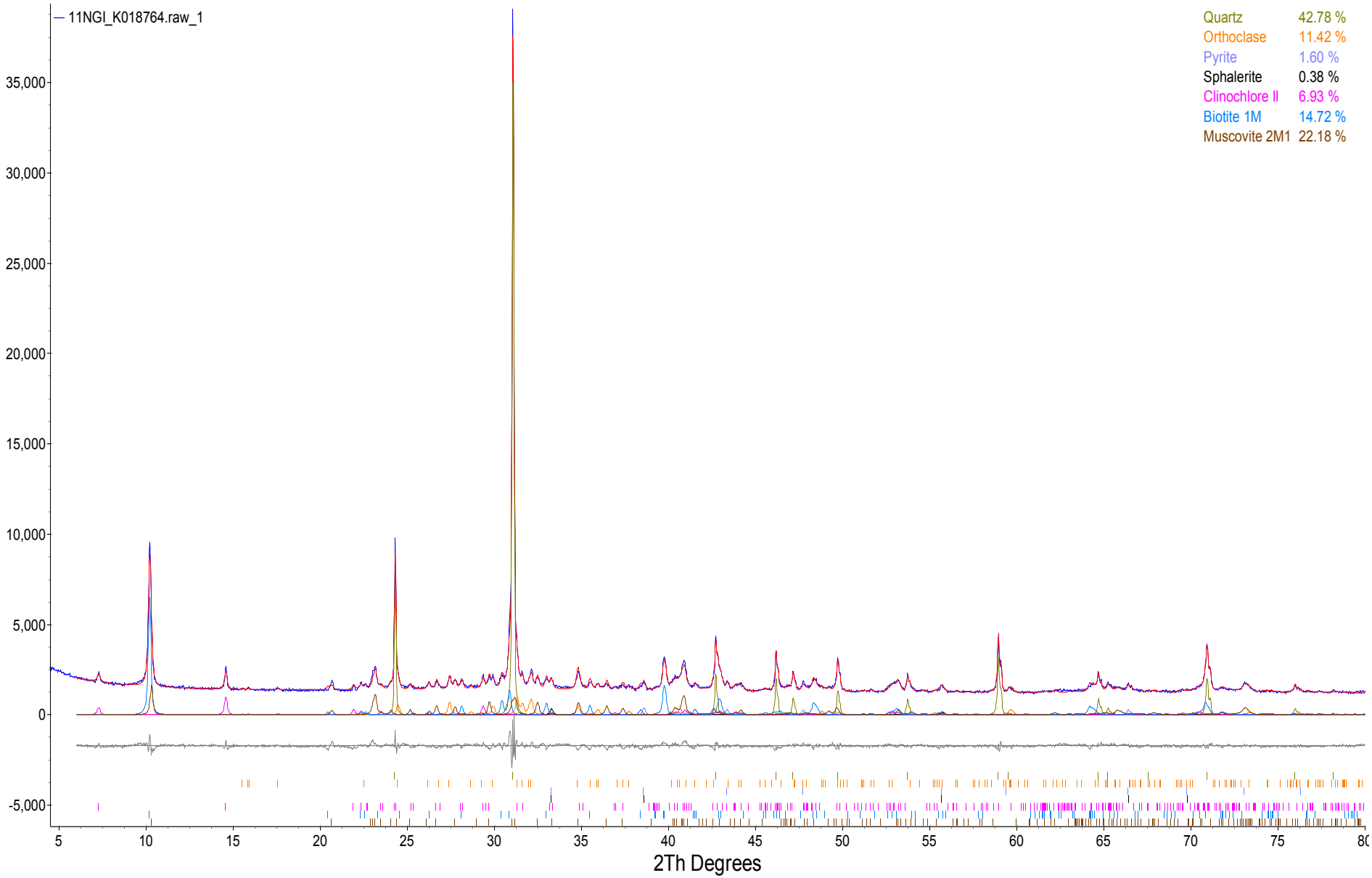


Figure 11: Rietveld refinement plot of sample **New Gold Inc "K018764"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

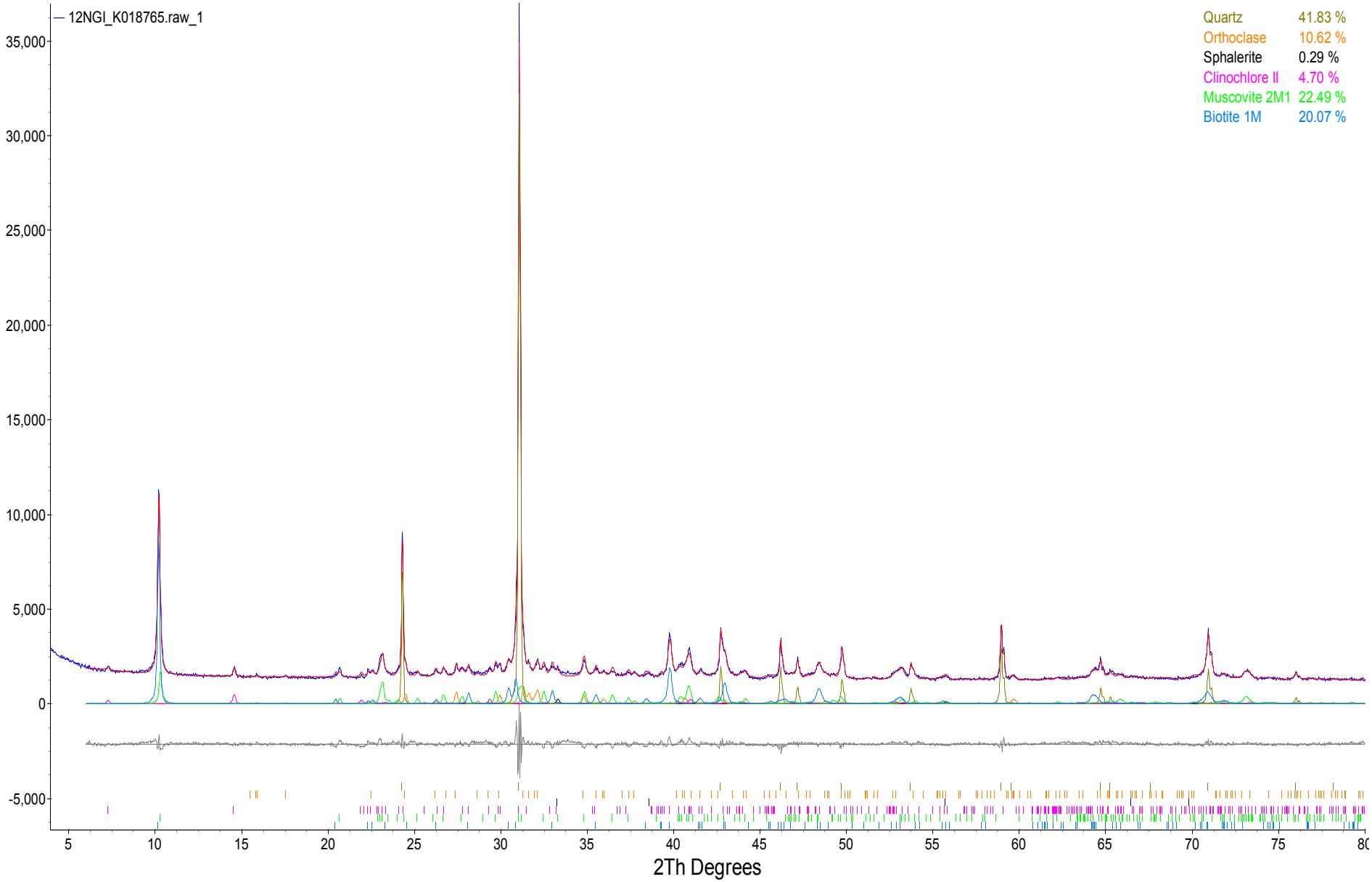


Figure 12: Rietveld refinement plot of sample **New Gold Inc "K018765"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

Vancouver Petrographics Ltd.
8080 GLOVER ROAD, LANGLEY, B.C. V1M 3S3
PHONE: 604-888-1323 • FAX: 604-888-3642
email: vanpetro@vanpetro.com
Website: www.vanpetro.com

Report for: Scott McBride
Richfield Ventures Corp.
1013-1030 West Georgia St.
Vancouver, BC, V6E 2Y3

Report 101176

February 9, 2011

Samples:
Twenty-one rock samples, as detailed below, were submitted, with a request for petrographic study.

Sample	ID1	ID2	ID3	Lithology
1	BW	59	560.3	Kaolinite-quartz-albite-white mica, matrix supported, volcanic sandstone
2	BW	64	220.5	White mica-quartz altered rock and pyrite-quartz-sphalerite-chalcopyrite-dolomite-tourmaline-galena vein
3	BW	66	262.6	Quartz-clay-white mica altered rock and quartz-pyrite-tourmaline vein
4	BW	68	202.5	Clay altered rock and quartz-chalcopyrite-pyrite-pyrrhotite-white mica-hematite vein
5	BW	68	407.0	Chlorite-quartz-white mica-garnet-pyrite-pyrrhotite-chalcopyrite and tourmaline altered rock
6	BW	72	161.3	Quartz-sericite, laminated, volcanic mudstone and hydraulic breccia
7	BW	77	125.8	Pyrite-chalcopyrite, volcanic breccia
8	BW	77	281.0	Quartz-oxides, volcanic mudstone and arsenopyrite-pyrrhotite-quartz-chlorite vein
9	BW	77	435.5	Flow banded lava, quartz-garnet-tourmaline-chalcopyrite vein and quartz-pyrite-clino-zoisite veinlet
10	BW	82	213.2	Albite-quartz-white mica altered lava and quartz pyrite-chalcopyrite-sphalerite-pyrrhotite-tourmaline vein
11	BW	86	37.3	Quartz-white mica-pyrite, poorly sorted, polymict, volcanic lithic-breccia
12	BW	86	50.3	Quartz-pyrrhotite-sphalerite-chlorite-white mica, poorly sorted, polymict, volcanic lithic-breccia
13	BW	86	189.8	Biotite-chlorite-white mica-quartz-pyrrhotite-chalcopyrite-sphalerite, andesite(?).
14	BW	96	198.5	Albite-quartz-white mica-pyrite-galena, flow banded lava
15	BW	98	69.8	Quartz-white mica-pyrrhotite, poorly sorted, polymict, volcanic lithic-breccia
16	BW	98	79.7	Quartz-white mica-pyrrhotite, poorly sorted, polymict, volcanic lithic-breccia
17	BW	98	138.1	Quartz-white mica-garnet schist and quartz-pyrrhotite-biotite-chalcopyrite vein/breccia
18	BW	98	149.5	Quartz-white mica-pyrrhotite-dolomite-chalcopyrite altered rock
19	BW	100	222.8	Quartz (and clay?), volcanic(?) mudstone
20	BW	100	270.2	Pyrrhotite, clast supported, poorly sorted, volcanic lithic breccia
21	BW	104	91.0	Porphyritic andesite

Summary:
The samples submitted can be subdivided into five different suites. The first suite of samples (Sample 1, 6, 7, 8, 11, 12, 15, 16, 19, 20) are volcaniclastic lithologies and the nomenclature used in this report follows the suggestions reported in McPhie et. al. (1993). The components of the deposits are generally poorly sorted, polymict lithic fragments with a grain-size ranging from mudstone to breccia. Only sample 20 show evidence of volcanic derived lithic fragments, such as microstructural evidence of the compaction of the lithic fragments under high temperature conditions and possibly devitrified spherulites. In the same sample, the coexistence of rounded and angular fragments indicates syn-eruptive resedimentation of primary deposits.

The second group of samples show a more intense alteration and they are possibly the altered equivalent of the volcaniclastic lithologies described above. Alteration products include clay (samples 3 and 4), quartz and white mica (samples 2, 3, 5, 10 and 18), albite (sample 10), chlorite (sample 5) and tourmaline (sample 5).

The third group of samples (9 and 14) show flow microstructures and a possibly rhyo-dacitic composition.

Samples 13 and 21 are porphyritic andesites with differing alteration products. Sample 13 is altered by a biotite-white mica-quartz-pyrrhotite-chalcopyrite-sphalerite assemblage and sample 21 is altered by a weak to subtle clay alteration.

Sample 17 shows a garnet porphyroblast that is rotated within a microgranular matrix made up of white mica-rich layers and is consequently named a quartz-white mica-garnet schist.

Garnet is present both in sample 5 where it is immersed in a very fine-grained groundmass of white mica, possible chlorite, pyrite, tourmaline and oxides, and within sample 9 as a constituent of a vein in association with quartz, tourmaline and chalcopyrite. The crystallization of the garnet in samples 5 and 9 is interpreted as being coeval with a contact metamorphic event and therefore post-dating the crystallization of the garnet observed within sample 21.

In a few occurrences pyrite is associated with pyrrhotite (samples 4, 5, 6 and 12) and, in a few samples, pyrrhotite is the predominant ore mineral (samples 13, 15, 17, 18, 19, 20) indicating a possible progression of the mineralizing fluids towards lower oxygen fugacities.

Tourmaline occurs as part of the alteration assemblage in samples 2, 3, 5 and 9. The presence of tourmaline in the vein containing the highest gold value (4.33 ppm) among the analyzed polished thin sections points towards a possible intrusion-related source of the mineralization.

The gold mineralization, occurring in the submitted sample population, seems to be positively correlated with most of the second group of samples (Samples 2, 3, 4, 10, 17, 18) and within this group it seems possible to tentatively draw a correlation between the relative amount of chalcopyrite and the gold values. Scanning Electron Microscopy is recommended for the samples characterized by high values of gold and the presence of chalcopyrite in order to test this tentative correlation. No free gold particles were observed microscopically.

A glossary of microstructural terms, individual descriptions, and a set of photomicrographs are attached.

Glossary of microstructural and petrologic terms

Alteromorph: Mineral or group of minerals developed by partial to complete alteration or weathering of a primary mineral. The alteromorph does not always preserve the shape, size and volume of the mineral that it has replaced.

Antitaxial veins: Veins with minerals that are different from those of the wall-rock (e.g. calcite fibres in quartzite) and that grow from the contacts of fibres and wall-rock towards the walls and away from the centre of the vein, in contrast to syntaxial veins (q.v.). in which the youngest growth is in the centre.

Ataxial vein: Vein containing fibres that lack a localised growth surface.

Centroporo-alteromorph: Alteromorph made up of secondary products and pores.

Composite vein: Vein showing evidence of both syntaxial (q.v.) and antitaxial (q.v.) growth histories.

Epitaxy: Preferential nucleation of a mineral on the lattice of another, with a fixed orientation relationship between the two crystal lattices.

Interlobate: Microstructure composed of crystals with irregular, lobate grain boundaries.

Microlithon: Layer or lens with a relatively small degree of preferred orientation as compared to cleavage domains.

Poikiloblastic: Describes the structure of a porphyroblast with many inclusions (poikiloblast), and of a rock with pokiloblasts.

Strain shadow: Approximately cone-shaped domain adjacent to a porphyroclast or -blast in the direction of the foliation and usually composed of another mineral than the porphyroclast or -blast. It forms by rearrangement of material in response to inhomogeneous deformation of the matrix adjacent to the porphyroclast or -blast. Strain shadows are usually massive or contain equidimensional crystals.

Subgrain: Volume of crystalline material surrounded by subgrain boundaries.

Syntaxial veins: Veins with elongate crystals (columnar or fibrous) crystals projecting from the walls of the vein and growing towards the centre. Typically these crystals nucleate heterogeneously on minerals of the wall-rocks, so that generally the fibres are closely related to minerals in the wall-rocks.

References:

Delvigne, J.E., 1998, *Atlas of Micromorphology of Mineral Alteration and Weathering*, The Canadian Mineralogist Special Publication No. 3. Mineralogical Association of Canada 494 pp.

McPhie, J., Doyle, M. and Allen, R.,1993, *Volcanic Textures – A guide to the interpretation of textures in volcanic rocks*, Centre for Ore Deposit and Exploration Studies University of Tasmania., 198 pp.

Passchier, C.W. and Trouw, R.A.J., 1998, *Microtectonics*, Springer, 289 pp.

Ramdohr, P., 1980, *The ore minerals and their intergrowths -2nd Edition*, V 1 and 2, Pergamon Press, 1207 pp.

Vernon R.H., 2004, *A practical guide to rock microstructure*. Cambridge University Press, 594 pp.

Respectfully submitted,

F. Colombo, Ph.D., P.Geo.

Sample: BW 59 560.3

Kaolinite(?)-quartz-albite-white mica, matrix supported, volcanic sandstone

The microstructure of the rock is dominated by sub-angular fragments completely substituted by very fine-grained clay (kaolinite?) and immersed in a fine-grained matrix made up of inequigranular-interlobate quartz and very fine-grained clay.

mineral	*modal %*	*main size range (mm)*
clay (and kaolinite?)	55 - 60	<0.01
quartz	20 - 25	up to 0.2
albite	10 - 15	up to 0.2
whte mica	1 - 2	<0.01
sphalerite	tr	up to 0.3
galena?	tr	up to 0.2
sphene	tr	
chlorite	tr	<0.01
carbonate	tr	<0.01
pyrite	tr	<0.005

Very fine-grained aggregates of **clay**, possibly **kaolinite,** completely replace sub-angular fragments of up to 2 mm and amoeboid domains of up to 10 mm in size. Very fine-grained white mica is dispersed within the clay-rich alteromorphoses. Most of the fragments are fractured and the fractures are infilled by quartz and white mica.

Quartz is inequigranular-interlobate and occupies interstitial positions with respect to the subangular clay-rich fragments. In a few instances quartz is fragmented and the fragments are infilled by very fine-grained white mica (and clay?). In a few fragments the very fine-grained aggregate of clay is associated with interlobate crystals of quartz up to 0.1 mm in size.

Albite is inequigranular-interlobate and, in association with quartz, occupies the interstices between the clay-rich fragments.

Amoeboid crystals of **galena**(?) and **sphalerite** are generally associated with quartz and amoeboid crystals of carbonate. In one instance the supposed galena is intergrown with fine-grained lamellae of chlorite. **Pyrite** is anhedral and is subordinate toand spatially associated with galena and sphalerite.

Sample: BW 64 220.5

White mica-quartz altered rock and pyrite-quartz-sphalerite-chalcopyrite-dolomite-tourmaline-galena vein

The polished thin section is made up of angular lithic fragments, composed of quartz, very fine-grained white mica and clay, that are infilled by iron-oxides, subhedral pyrite and interstial sphalerite and chalcopyrite. Pyrite and sphalerite are locally fragmented and infilled by quartz, dolomite, and tourmaline.

mineral	*modal %*	*main size range (mm)*
pyrite	40 - 44	up to 4 and massive
quartz	25 - 27	up to 0.2
sphalerite	12 - 15	massive infill dmains
white mica	10 - 12	<0.002
clay	4 - 5	<0.001
chalcopyrite	3 - 4	up to 0.6
dolomite	3 - 4	up to 0.2
tourmaline	tr	up to 0.4

Pyrite is massive to subhedral and occurs as infill material of the quartz, white mica, clay and lithic fragments. Pyrite is fractured and is infilled by quartz, dolomite, sphalerite and chalcopyrite.

Quartz occurs as a constituent of the lithic fragments as interlobate to amoeboid crystals, preferentially forming quartz aggregates, which are amoeboid and associated with very fine-grained white mica and lesser clay. Quartz also occurs as infill material between the lithic fragments, pyrite and sphalerite crystals. At the fringes of the pyrite crystals quartz may form equigranular to inequigranular-polygonal grain aggregates with crystals of up to 0.2 mm in size.

White mica constitutes most of the lithic fragments as very fine-grained aggregates associated with subordinate quartz and lesser amounts of **clay**.

Sphalerite occurs as irregular and massive infill domains up to 20 mm. In association with chalcopyrite it infills the fractures and the triangular microstructures of pyrite. Sphalerite is fractured and the fractures are infilled by quartz and carbonate. It contains inclusions of anhedral chalcopyrite.

Dolomite is associated with quartz, both as infill material of the ore minerals and at their rims.

Tourmaline forms equant to slender prisms of up to 0.4 mm, is generally associated with dolomite and occurs between the crystals of pyrite.

Chalcopyrite occurs as anhedral inclusions or exsolutions within sphalerite. In many instances chalcopyrite nucleates at the contact between sphalerite and pyrite and preferentially mantles the latter.

Sample: BW 66 262.6

Quartz-clay-white mica altered rock and quartz-pyrite-tourmaline vein

The polished thin section is made up of fragmented rock with a well-defined layering. The layering is given by alternating domains composed of clay and thin (0.05-0.2 mm) layers of quartz. The rock fragments are infilled, overprinted and partially substituted by quartz-rich, vein-like, irregular domains, mostly following the relict layering of the rock.

mineral	*modal %*	*main size range (mm)*
quartz	50 - 52	up to 0.1
clay	40 - 45	<0.002
whte mica	3 - 5	up to 0.005
pyrite	1 - 2	up to 0.2
oxides	1 - 2	up to 0.5 and interstitial
tourmaline	tr	up to 0.4

Quartz occurs as a component of the thin layers within the layered and fragmented rock and was possibly recrystallized during the quartz-rich overprinting. It defines thin, discontinuous and subparallel layers and lensoidal domains which are possibly of sedimentary origin. The grain size of quartz within the layered rock is generally less than 0.1 mm and the shape is interlobate to amoeboid. Quartz occurs as the major component of vein-like infilling of the rock fragments and of irregularly shaped overprinting domains. The grain-size varies from less than 0.01 mm, within the overprinting domains, up to 0.1 mm, within the vein-like domains. In a few instances the quartz grains are aligned perpendicularly to the vein-walls.

Clay is very fine-grained and is generally associated with very fine-grained white mica. It is the major component of the layered rock, in which it defines an earthy “felt-like” mass unresolvable by the microscope

Very fine-grained (up to 0.005) **white mica** forms anastomosing cleavage domains within the clay-rich domains and is associated with the fine-grained quartz.

Pyrite is mostly anhedral to skeletal, rarely euhedral and is, in many instances, overgrown by a second generation of pyrite (pyrite II). Pyrite II, which is possibly altered by marcasite, forms corona-like structures (centroporo-alteromorphosis), with a porous aspect and slender prismatic shapes. Pyrite II grows around a completely destroyed phase now reduced to an empty space (“centroporo”) with rare earthy and very fine-grained relicts . Pyrite is spatially associated with quartz overprint and vein-like domains.

One skeletal crystal of **tourrmaline** contains epitaxial inclusions of pyrite II and is associated with the late overprint of quartz.

Sample: BW 68 202.5

Clay altered rock and quartz-chalcopyrite-pyrite-pyrrhotite-white mica-hematite vein

The sample is characterized by a strong to intense cryptocrystalline clay alteration. Relicts of feldspar and/or quartz are still visible within the dispersed clays. Their grain-size is generally less than 0.05 mm. The rock is brecciated (crackle or mosaic breccia structures) and the slightly rotated angular rock fragments are infilled by quartz and lesser white mica and hematite.

mineral	*modal %*	*main size range (mm)*
clay	42 - 45	cryptocrystalline
quartz+feldspar?	35 - 37	up to 0.05
quartz	15 - 17	up to 1
white mica	3 - 5	up to 0.005
chalcopyrite	tr	up to 2 as massive interstitial domain
pyrite	tr	up to 0.1
hematite	tr	up to 0.2
pyrrhotite	tr	up to 0.04 as pseudo-inclusion within pyrite

Clay occurs as cryptocrystalline aggregates replacing a possibly quartzofeldspathic aggregate. In part the clay may consist of kaolinite, as indicated by its white colour on the offcut.

Quartz is possibly associated with feldspar as a constituent of the rock fragments. The grain-size of the phantom crystals are generally less than 0.05 mm and are amoeboid to interlobate. Quartz infills the fractures of the rock, the triangular structures generated by the slight rotation of the fragments and the veins (up to 2 mm thick). Quartz within the vein reaches 1 mm in size and grows elongated perpendicularly to the vein walls. In one instance the euhedral crystals are mantled by interstitial **chalcopyrite,** which forms a 2 mm long interstitial domain and includes pyrite. The microstructure of the vein demonstrates dilation in absence of simple shear.

Pyrite forms anhedral crystals, in many cases porous, that are skeletal and mantled by chalcopyrite. In one occasion a pyrite crystal displays a pseudo(?)-inclusion of **pyrrhotite**. Pyrite is fragmented, preferentially grows in contact with the euhedral quartz crystals and is interpreted as forming after the quartz and before the deposition of chalcopyrite. In the rest of the rock pyrite is fine-grained and is preferentially concentrated at the selvages of the quartz veins.

Lamellar **hematite** up to 0.2 mm is rare and occurs preferentially within some of the quartz veins/veinlets.

Sample: BW 68 407.0

Chlorite-quartz-white mica-garnet-pyrite-pyrrhotite-chalcopyrite and tourmaline altered rock

The polished thin section is made up of two main domains: the first domain (upper right corner in Fig. 0) is made up of subidioblastic garnet immersed in a very fine-grained groundmass of white mica, possibly chlorite, pyrite, tourmaline and oxides. The second is made up of irregular domains (lithic fragments?) completely replaced by very fine-grained white mica, which are immersed in a fine-grained matrix of white mica, chlorite, quartz, pyrite, oxides, limonitic material and subordinate garnet and tourmaline.

The two domains mainly differ in their magnetic susceptibility due to the occurrence of inclusions of pyrrhotite within pyrite in the second domain.

mineral	*modal %*	*main size range (mm)*
quartz	35 - 37	up to 0.2
chlorite	35 - 15	up to 0.02
white mica	20 - 25	up to 0.1
pyrite	2 - 3	up to 0.5
tourmaline	2 - 3	up to 0.1
garnet	2 - 3	up to 1
oxides-limonite	1 - 2	
chalcopyrite	1	up to 0.1
pyrrhotite	tr	up to 0.1

Quartz is preferentially dispersed within the groundmass as amoeboid to interlobate grains associated with white mica and chlorite and forms amygdaloidal domains of up to 1 mm in size and associated with pyrite and white mica.

Fine-grained **quartz**, in association with fine-grained and randomly oriented **chlorite** flakes, constitutes the groundmass of the rock.

White mica occurs as very fine-grained flakes consisting of complete alteromorphoses after lithic fragments, and associated with very fine-grained flakes of **chlorite** and quartz within the groundmass. Flakes up to 0.1 mm in size are associated with oxides, “felt-like” domains of tourmaline, limonitic material and pyrite.

Pyrite is skeletal to amoeboid, forms crystals of up to 0.5 mm in size and is heterogeneously dispersed within the two domains. Within the second domain pyrite includes anhedral **pyrrhotite**.

Garnet is preferentially subidioblastic and more abundant at the boundary between the pyrrhotite-bearing and the pyrrhotite-free or poor domain. Garnet includes pyrite and rare

chalcopyrite

Pyrrhotite forms anhedral crystals of up to 0.1 mm and contains inclusions of chalcopyrite.

Chalcopyrite is anhedral to amoeboidal, generally mantles pyrite and is enclosed within pyrrhotite.

Tourmaline is dispersed as equant to prismatic crystals and locally forms “felt-like” domains spatially associated with pyrite.

Sample: BW 72 161.3

Quartz-sericite, laminated, volcanic mudstone and hydraulic breccia

The sample is characterized by the presence of three domains: the first (top of the offcut in Fig. 0) shows a layering given by the alternation of clay-rich cryptocrystalline domains and quartzofeldspathic-clay domains. The layering is sub-planar and contains a spinel-rich sub-rounded lithic clast (8 x 4 mm) aligned parallel to the anisotropy of the domain. A second domain is made up of lithic fragments with a composition similar to the first domain described and a moderate to strong alteration by a very fine-grained white mica. The interstices of the lithic fragments are infilled by quartz-rich material and are ductilely deformed. This domain gradually grades into a fine-grained quartz-rich domain (bottom part of the offcut in Fig. 0) containing a minor amount of white mica.

mineral	*modal %*	*main size range (mm)*
quartz	45 - 47	up to 0.1
clay	40 - 45	cryptocrystalline
white mica	10 - 12	<0.002
spinel	1	up to 0.5
pyrite	1	up to 0.15
pyrrhotite	tr	up to 0.1

Quartz occurs as amoeboid to interlobate grains associated with the cryptocrystalline clay-rich aggregate, defines irregular domains aligned parallel to the layering in the first domain and is the main constituent of the infill material between the lithic fragments of the intermediate domain. Quartz reaches a maximum grain-size of about 0.1 mm, is interlobated and some of the grains show a fair degree of undulose extinction. In the absence of the lithic fragments quartz forms a fine-grained aggregate in association with very fine-grained white mica. Rare, interlobate polygonal quartz aggregates surround white mica altered fragments.

Clay is the main constituent of the layered domains and occurs as a cryptocrystalline aggregate irresolvable by the microscope. It is locally associated with white mica. Clay is interpreted to belong to an alteration paragenesis overprinted by quartz-sericite alteration.

Spinel is skeletal to xenoblastic and is the main constituent of the lithic fragment occurring within the layered domain. It is associated with an interstitial aggregate of clay, quartz and white mica.

Rare skeletal and euhedral crystals of **pyrite** of up to 0.15 mm in size are dispersed within the sample, preferentially occurring within the clay-rich domains.

Anhedral **pyrrhotite** and **pyrite** are spatially associated with the quartz-rich infill material.

Sample: BW 77 125.8

Pyrite-chalcopyrite, volcanic breccia

The polished thin section is made up of sub-angular lithic fragments of intensely clay altered sandstone including white mica altered fragments, lesser quartz and sub-angular to sub-rounded fragments (up to 8 mm) of xenoblastic garnet (up to 5 mm). A few fragments are composed of a sandstone in which the clay-rich and white mica groundmass hosts sub-angular fragments completely altered by possible tourmaline and lesser garnet. The interstices between the clasts are occupied by material derived by the comminution of the above lithologies, limonitic material and anhedral pyrite.

mineral	*modal %*	*main size range (mm)*
clay	30 - 33	cryptocrystaalline
white mica	25 - 27	0.01
pyrite	15 - 17	infill domains up to 10, anhedral crystals up to 3
quartz	7 - 10	up to 0.2
chlorite	5 - 7	0.01
garnet	4 - 5	up to 5
biotite	4 - 5	up to 0.05
tourmaline?	3 - 4	up to 0.02
Fe-oxides-hematite	3 - 4	domains up to 2, anhedral crystals up to 0.4
chalcopyrite	tr	up to 0.04

Clay constitutes most of the groundmass of the lithic fragments in this sample. It is cryptocrystalline and is, in most cases, associated with fine-grained flakes of white mica.

White mica constitutes alteromorphoses after sub-angular lithic fragments contained within the sandstone. A few fragments consist of patchy aggregates of very fine-grained white mica and **chlorite**.

Pyrite infills the fractures of the lithic fragments and occurs as interstitial infill of the fragments within breccia groundmass. Pyrite also forms anhedral to skeletal crystals growing within the lithic fragments.

Quartz is interlobated to amoeboid and occurs as clasts dispersed within the groundmass of the breccia and as a constituent of the lithic fragments of the sandstones, it also occurs as inclusions within garnet.

Garnet is xenoblastic and poikilitic, it reaches 5 mm in size and includes quartz and possibly albite. Garnet is overgrown on a clay-chlorite altered sandstone which occurs within a clay-rich groundmass hosting sub-angular fragments up to 1.2mm altered by randomly oriented biotite and white mica. Garnet includes quartz and possibly albite.

Biotite occurs as randomly oriented flakes, constitutes sub-angular fragments ofthe sandstone and, in association with quartz, occurs as sub-angular lithic fragments up to 3 mm dispersed within the groundmass of the breccia.

Amoeboid **Fe-oxides** and, locally, **hematite** partially substitute fragments of very fine-grained “felt-like” aggregates, possibly made up of altered biotite and/or tourmaline, The Fe-oxides contain relict droplets of chalcopyrite.

Chalcopyrite occurs as anhedral crystals dispersed within the clay, chlorite and white mica alteration of the fragmented clasts and the groundmass of the breccia and is spatially associated with pyrite.

Sample: BW 77 281.0

Quartz-oxides, volcanic mudstone and arsenopyrite-pyrrhotite-quartz-chlorite vein

The microstructure of this sample is characterized by disrupted bedding defined by cryptocrystalline “felt-like” domains and lens shaped, elongated, irregular domains mostly composed of quartz. The amount of limonite and Fe-oxides gradually increases across the sample and therefore assumes a brown colour at the selvage (ca 15 mm) of a 10 mm thick vein (see the bottom of the polished thin section in Fig. 0) made up of euhedral arsenopyrite, quartz, limonitic material and, possibly, chlorite.

mineral	*modal %*	*main size range (mm)*
cryptocrystalline material, possibly clay and limonite	72 - 80	
quartz	15 - 20	up to 1
oxides	4 - 5	up to 0.05
arsenopyrite	3 - 4	up to 4
white mica	tr	up to 0.1
chlorite	tr	up to 0.1

Clay and limonite possibly constitute the majority of the cryptocrystalline domains that define a disrupted bedding and are associated with quartz. The cryptocrystalline aggregate locally forms layered domains with bedding disrupted by brecciation. The brecciated rock is infilled by quartz, lithic fragments wrapped by the bedding, and angular fragments immersed in a microgranular matrix mostly composed of quartz and, possibly, chlorite, white mica and clay.

Quartz occurs as lens shaped, elongated and irregular domains up to 1 mm in length. Within these domains quartz forms inequigranular-interlobate grain aggregates. Quartz is interpreted to be re-crystallized after its deposition as suggested by the very rare polygonal grain shapes observed within the coarse lensoidal domains. The lensoidal and elongated domains of quartz are progressively occupied by increasing **Fe-oxides** and **limonite** in proximity to the vein and are rimmed by fine-grained equant crystals of quartz. Minor oxides and white mica flakes locally occur within the quartz domains.

Arsenopyrite occurs primarily within the vein as euhedral crystals. In many instances it is mantled and enclosed by interstitial quartz. Within the vein, quartz also occurs as subhedral to euhedral crystals associated with a fine-grained and anhedral aggregate of limonite, chlorite and white mica. Arsenopyrite is rare and fine-grained (0.02 mm) within the selvage of the vein.

Chlorite forms fan shaped and radiate aggregates occupying interstitial positions between arsenopyrite and quartz within the vein.

Sample: BW 77 435.5

Flow banded lava, quartz-garnet-tourmaline-chalcopyrite vein and quartz-pyrite-clino-zoisite veinlet

The microstructure of this sample is characterized by a very thinly folded (flow?) foliation defined by very fine-grained quartzofeldspathic aggregates and lesser white mica. Foliation continuity is disrupted by microfaults infilled by quartz veinlets and microbrecciation, again infilled by quartz. Quartz overprinting further complicates the microstructure and blurs the foliation. A 3 mm thick vein and 1 mm veinlet crosscut the above structure. The vein is made up of quartz, garnet, tourmaline and very minor chalcopyrite and pyrite. The veinlet is made up of quartz, pyrite and clinozoisite.

mineral	*modal %*	*main size range (mm)*
quartz	50 - 55	up to 1
K-feldspar (+albite?)	43 - 45	microcrystalline
garnet	2 - 3	up to 3
tourmaline (schorlite)	1 - 2	up to 2
pyrite	tr	up to 1.5
white mica	tr	<0.05
chlorite	tr	up to 0.1
clinozoisite	tr	up to 0.5
chalcopyrite	tr	up to 0.03

Quartzofeldspathic aggregates constitute most of the rock and are very fine-grained. The presence of K-feldspar is indicated by the staining colour (see Fig. 0), quartz is determined by the presence of coarser grains with a refractive index higher than the K-feldspar and possibly albite grains. The aggregates define thin foliated domains, which are folded and locally disrupted by microfaults, veinlets and locally underlined by very fine-grained white mica. The quartzofeldspathic aggregates are generally inequigranular-interlobate. The overprinting quartz tends to assume a grain size of up to 0.1 mm and the grain aggregates are interlobate to polygonal. Within the vein and veinlet quartz occurs as polygonal to interlobate aggregates. Irregular amygdules of polygonal quartz and lesser chlorite occur within the foliated and folded microstructure.

Garnet occurs within a quartz-rich vein as xenoblastic grains up to 3 mm, it includes quartz and is intergrown with tourmaline prisms which were possibly nucleated within the embayment of the garnet, suggesting that the tourmaline might have started to grow during the late stage of growth of the garnet.

Tourmaline occurs as slender prisms and acicular crystals up to 2 mm in size. Due to the olive-brown colour of pleochroism parallel to the Z crystallographic axis it is interpreted as

being a schorlite.

Pyrite occurs within the veinlet with an anhedral crystal elongated parallel to the vein wall and with one subhedral crystal. One small crystal (0.02 mm) of pyrite is spatially associated with chalcopyrite and is intergrown with tourmaline.

Within the veinlet one anhedral crystal of **clinozoisite** is elongated parallel to the vein wall.

Chalcopyrite occurs in proximity to the vein wall as three anhedral crystals up to 0.03 mm and is intergrown with quartz and acicular tourmaline.

Sample: BW 72 213.2

Albite-quartz-white mica altered lava and quartz pyrite-chalcopyrite-sphalerite-pyrrhotite-tourmaline vein

The polished thin section is characterized by subhedral to euhedral structural relicts of feldspar phenocrysts, replaced by quartz, white mica and albite, and immersed in a groundmass mostly composed of fine-grained white mica. Amoeboid quartz domains show undulose extinction, are locally mantled by chalcopyrite and pyrite and are possibly coeval with the quartz-rich crosscutting vein with which they share the same assemblage.

mineral	*modal %*	*main size range (mm)*
white mica	30 - 35	<0.01
quartz	23 - 25	up o 3
(feldspar): albite+white mica and quartz and rare K-feldspaar	20 - 23	up to 4
pyrite	22 - 24	massive within 8 mm vein
chalcopyrite	2	up to 1
sphalerite	tr	up to 1.5
tourmaline (schorlite)	tr	<0.05
pyrrhotite	tr	up to 0.1
limonite	tr	up to 0.3
carbonate	tr	up to 0.1
wurzite?	tr	up to 0.2

Feldspar(s) is completely altered by a polyphase alteromorphosis of albite, white mica and quartz. In a few instances the relicts display euhedral to subhedral shapes immersed in a very finegrained groundmass now completely altered by white mica.

Anhedral to amoeboid intergrowths of **chalcopyrite** and **pyrite** may have been nucleated on the ferromagnesian minerals which are now completely replaced and thus invisible. Chalcopyrite infills pyrite and quartz interstices. A few fractures within pyrite are infilled by **carbonate**.

Quartz is subhedral to polygonal within the vein. A few prismatic crystals are oriented perpendicularly to the vein walls and are projected towards the median part of the vein where the subhedral terminations are mostly mantled by pyrite. Quartz forms amoeboid domains within the rock and shows undulose extinction and elongate subgrains. These domains are rimmed by chalcopyrite and pyrite and are interpreted as being formed during the emplacement of the vein. The undulose extinction of the quartz is attributed to the dilational strain also responsible for the formation and emplacement of the vein.

Sphalerite is mostly confined to the vein-wall where it is intergrown with chalcopyrite. It is rarely observed as inclusions within pyrite.

Rare, fine-grained crystals of **tourmaline** are observed within the quartz of the vein and within the white mica-rich groundmass.

Pyrrhotite is observed enclosed within pyrite.

Sample: BW 86 37.3

Quartz-white mica-pyrite, poorly sorted, polymict, volcanic lithic-breccia

The sample is made up of angular and inequigranular polymictic lithic fragments of up to 5 mm in size immersed in a fine-grained aggregate of white mica, quartz, possible chlorite, clay, pyrite and oxides. Among the fragments the following lithologies are recognized: **a)** relict subhedral phenocrysts of possible feldspar (up to 1.2 mm) completely replaced by fine-grained white mica and quartz immersed in a fine-grained groundmass made up of white mica, possible clay, possible chlorite, hematite and oxides; **b)** fine-grained aggregates of quartz (up to 0.1 mm), white mica and clay; **c)** pyrite and oxides immersed in a fine-grained white mica and chlorite aggregate; these fragments are, in a few instances, ovoid shaped, up to 2 mm in size and are surrounded by a very fine-grained clay-rich material;**d)** fragments composed of irregular aggregates of possible clay and fine-grained white mica with dispersed pyrite and oxides; and **e)** very fine-grained aggregates of white mica, quartz (up to 0.04 mm) and clay.

mineral	*modal %*	*main size range (mm)*
white mica	40 - 45	<0.02
clay	28 - 30	cryptocrystalline
quartz	15 - 17	up to 0.2
chlorite	10 - 12	<0.02
pyrite	3 - 4	<0.2
oxides	2 - 3	<0.02
sphalerite	tr	up to 2
chalcopyrite	tr	<0.02

White mica is very fine-grained and is the dominant mineral phase of the fine aggregates comprising the lithic fragments described above, the groundmass of the porphyritic lithic fragments and the alteromorphoses after feldspar.

Quartz is inequigranular and occurs as a fine-grained constituent associated with white mica and possible clay within the fine-grained aggregates. Quartz also occurs as anhedral and amoeboid grains of up to 0.2 mm in size and, in this case, is interpreted as being a late phase, possibly contemporaneous with the alteration, which post-dates the deposition of the fragments as indicated by its continuity across their boundaries. Quartz occurs in a vein-like domain associated with sphalerite and is up to 2 mm in size and anhedral.

Sphalerite includes chalcopyrite, possibly as exsolution droplets, and is rimmed by pyrite.

Pyrite is mostly anhedral and amoeboid. In a few instances it is altered by marcasite. In many of its occurrences it is intergrown with quartz which preferentially includes pyrite crystals. Pyrite infills some of the thin fractures and interstices surrounding the lithic fragments. It is

possible that some pyrite could have been present within some of the lithic fragments, however most of the pyrite is interpreted as being coeval with the quartz+white mica+sphalerite alteration event.

Sample: BW 86 50.3

Quartz-pyrrhotite-sphalerite-chlorite-white mica, poorly sorted, polymict, volcanic lithic-breccia

The polished thin section is made up of heterogranular and polymict, subrounded lithic fragments immersed in a fine-grained matrix of quartz, chlorite and white mica. Recognized among the components of the sample are sub-angular fragments completely replaced by randomly oriented fine-grained chlorite (up to 5 mm); sub-angular fragments made up of inequigranular-interlobate quartz aggregates and minor white mica; and angular fragments consisting of an equigranular aggregate of albite and overprinted by amoeboid aggregates of fine-grained chlorite (up to 8 mm).

mineral	*modal %*	*main size range (mm)*
chlorite	35 - 40	0.01
quartz (and albite?)	35 - 40	up to 0.2
clay	10 - 12	cryptocrystalline
white mica	10 - 12	0.01
oxides-limonite	4 - 5	<0.05
pyrite	2 - 3	up to 0.5
sphalerite	tr	up to 0.5
chalcopyrite	tr	up o 0.01

Chlorite is very fine-grained to fine-grained, occurs as replacement of some of the lithic fragments and forms fine-grained aggregates with different relative amounts of quartz, white mica and albite.

Quartz occurs as an infill phase of irregular shaped aggregates heterogeneously distributed within the polished thin section. In a few cases the quartz aggregates are associated with pyrite and sphalerite. Quartz is one of the constituents of some of the lithic fragments, in a few cases it is possibly related to a silicification event prior to the fragmentation of the lithology.

Pyrite is anhedral and preferentially associated with coarse (0.1-0.2 mm) quartz, oxides and sphalerite.

Sphalerite is anhedral and subordinate with respect to the pyrite. It is, in many instances, intergrown with pyrite, chlorite and white mica, and contains fine-grained exsolution droplets of chalcopyrite.

The variety of the relative amount of the above mentioned mineral phases, the angular shape of the fragments and the absence of microstructural features pointing to a definite genetic process leaves the possibility of interpreting this lithology as being derived from volcanoclastic, pyroclastic (as suggested by the nomenclature used in the database) or sedimentary processes.

Sample: BW 86 189.8

Biotite-chlorite-white mica-quartz-pyrrhotite-chalcopyrite-sphalerite, andesite(?).

The microstructure of this sample is characterized by subhedral to euhedral phenocrysts (up to 3 mm) of feldspar (possibly plagioclase) immersed in a fine-grained groundmass. The feldspar is substituted by alteromorphoses of white mica, chlorite and patches of very fine-grained biotite. The groundmass is made up of fine-grained white mica, mostly replacing euhedral feldspars laths of up to 0.1 mm in length and cryptocrystalline aggregates of clay, possible chlorite and Fe-oxides. Pyrrhotite locally infills amygdalar, amoeboid and irregular structures rimmed by quartz.

mineral	*modal %*	*main size range (mm)*
clay	30 - 33	cryptocrystalline
white mica	25 - 27	up to 0.05
chlorite	15 - 18	up to 0.02
biotite	13 - 15	up to 0.05
quartz	8 - 10	up to 1
pyrrhotite	2 - 3	up to 0.2, rare up to 4
oxides	1 - 2	<0.2
sphalerite	tr	<0.1
chalcopyrite	tr	<0.1

White mica is fine-grained and constitutes polyphase alteromorphoses, in association with **chlorite** and **biotite**, after euhedral phenocrysts of feldspar. White mica also replaces fine-grained laths of possible euhedral to subhedral feldspar immersed in the groundmass.

Clay occurs as a “felt-like” cryptocrystalline mass comprising part of the groundmass and its composition should be ascertained by other means as it is not resolved by the microscope.

Chlorite is associated with the white mica within the alteromorphoses after feldspar and is generally finer-grained than the white mica.

Biotite is fine-grained and forms “felt-like” patches that preferentially occur within the alteromorphoses after feldspar. In a few domains it is substituted by pyrrhotite.

Quartz occurs as a minor constituent of the alteromorphoses after feldspar. In a few instances quartz and patches of very fine-grained biotite replace tabular crystals, possibly of feldspar. Quartz forms rims around amygdalar, amoeboid and irregular domains of very fine-grained biotite and, in a few instances, pyrrhotite. In a very few instances quartz crystals are up to 1 mm in size, may show undulose extinction and infill subangular fragments of fine-grained biotite and white mica-clay fragments from the host rock. These domains are interpreted as being the product of a local hydraulic fracturing induced by quartz-rich fluids.

Pyrrhotite, sphalerite and chalcopyrite intergrowths are spatially associated with the quartz-rich brecciated domains.

Pyrrhotite is anhedral and mostly it occurs as a phyllophoro-alteromorphosis after biotite, it includes white mica and is intergrown with **chalcopyrite.** It is dispersed within the sample and is spatially associated with the biotite-rich patches, quartz replacement and occasionally with sphalerite.

Undetermined fine-grained **oxides**(?) form polycrystalline aggregates associated with fine-grained biotite, generally smaller than 0.2 mm and possibly alteromorphic on a previous mineral phase.

Sample: BW 96 198.5

Albite-quartz-white mica-pyrite-galena, flow banded lava

The microstructure is characterized by an equigranular-interlobate albite aggregate and interlobate aggregates of very fine-grained white mica and possibly clay intensely altering a possibly feldspathic mineral. The sample displays a rhythmic layering underlined by thin (0.05 mm) discontinuous and rough, cleavage-like domains composed of mostly iso-oriented very fine-grained white mica. Subhedral phenocrysts of albite are rotated within the magmatic flow.

mineral	*modal %*	*main size range (mm)*
albite	50 - 52	0.05-2
white mica	20 - 22	<0.02
clay	18 - 20	crypocrrystalline
quartz	8 - 10	up to 1
pyrite	1	up to 0.7
galena	tr	up to 0.6

Albite occurs as fine-grained (0.05-0.2 mm) intelobated aggregates and is weakly altered by a dusty dispersion of white mica and possible clay. Albite grains are associated with a very fine-grained “felt-like” aggregate of white mica and possibly clay which may be substituting an undetermined mineral or aggregate. Albite also occurs as subhedral to euhedral phenocrysts up to 1.5 mm, rimmed by a thin coat of white mica, which are rotated within the magmatic flow as indicated by the white mica layers.

White mica comprises the very fine-grained, “felt-like” aggregates possibly in association with clay and is aligned to define the thin cleavage-like domain that may indicate the flow direction. This interpretation is derived from the deflection of the layers around the phenocrysts of albite in absence of any preferential orientation of the crystals in the groundmass (i.e. albite). Euhedral tabular alteromorphoses of white mica and subordinate oxides are up to 0.6 mm, and are possibly after biotite.

Quartz is subordinate to albite and forms interlobate crystals, which, in many instances, show evident undulose extinction and subgrain development.

A vein with a variable thickness up to 0.5 mm crosscuts the magmatic flow and is made up of white mica (up to 0.2 mm), pyrite and lesser chlorite.

Pyrite is subhedral and forms crustiform aggregates of up to 2 mm within the veinlet.

Galena forms amoeboid pseudo-inclusions within the albite phenocrysts and the rare quartz domains. It may have been re-crystallized and is surrounded by white mica rims.

In the upper right corner of the polished thin section (see Fig. 0) the layering and the interstices between the albite are infilled by oxides. There is also a microlithon with no relict foliation made up of amoeboid aggregates of quartz, interlobate albite, amoeboid and

interstitial pyrite, which is preferentially hosted within quartz, and elongated prisms (up to 2 mm) that have been replaced by pyrite and galena.

Sample: BW 98 69.8

Quartz-white mica-pyrrhotite-biotite, poorly sorted, polymict, volcanic lithic-breccia

The polished thin section is made up of inequigranular, polymict fragments, up to 15 mm in size. The components form a poorly-sorted, clast-supported breccia fabric. The majority of the lithologies represented in this sample consist of inequigranular to equigranular-interlobate aggregates of albite, interstitial white mica, interstitial clay and rare quartz. The relative amount of quartz and the grain-size of the albite-rich aggregates may vary in the different clasts, thus justifying the term polymict. Other kind of clasts are made up of a very fine-grained aggregates of dispersed white mica and fine-grained clusters of hematite, and including irregular fragments of fine-grained brownish and possibly oxidized biotite(?). Pyrrhotite preferentially occupies the core of the oxidized fragments as anhedral replacements. The matrix occupying the interstices of the clasts primarily consists of fine-grained albite and very fine-grained white mica and clay.

mineral	*modal %*	*main size range (mm)*
albite	35 - 37	<0.1
white mica	25 - 27	<0.01
clay	22 - 25	cryptocrystalline
quartz	7 - 10	up to 0.2
biotite?	3 - 4	<0.01
hematite	2 - 3	<0.05
pyrrhotite	1.5 - 2	up to 1
sphalerite	tr	up to 0.6
chalcopyrite	tr	<0.002

Albite, and possibly **quartz,** form interlobate aggregates, their presence is not positively determined due to their fine grain-size (generally less than 0.1 mm, and the dusty dispersion of clay that obscures their relief. By comparison with rare, clay-free quartz it is possible to postulate that albite is more prevalent than quartz within the interlobate aggregates.

White mica is the primary constituent of a different type of lithic fragment made up of very fine-grained white mica, oxides and oxidized fragments of fine-grained **biotite**. White mica also occurs as a very fine-grained dispersion and occurs preferentially along the interstices and fractures of the albite-rich lithic fragments. All of the lithic fragments are moderately to intensely altered by white mica and possibly clay.

Quartz infills fractures where it occurs as polygonal to blocky crystals and appears to be coeval with the deposition of pyrite. Quartz also forms isolated domains, aggregates (up to 0.5 mm) and amoeboid to interlobate crystals immersed within the lithologies described above.

Pyrrhotite is anhedral, preferentially occupies the fragments made up of oxidized biotite, and is spatially associated with quartz and very fine-grained withe mica. It is otherwise dispersed as rare, fine-grained grains. In one occurrence pyrrhotite is intergrown with sphalerite.

Sphalerite includes exsolutions of chalcopyrite (<0.002 mm) in the form of rounded droplets. Where it is in contact with pyrrhotite it shows a curved boundary.

Sample: BW 98 79.7

Quartz-white mica-pyrrhotite, poorly sorted, polymict, volcanic lithic-breccia

The microstructure of this sample is dominated by the presence of poorly-sorted lithic fragments, from submillimetric up to 15 mm in size, immersed in a fine-grained (~0.1 mm) quartzofeldspathic aggregate with an inequigranular-intelobate shape of the grains. Lithic fragments are polymict and consist of variable amounts of quartzofeldspathic aggregates, cryptocrystalline clay, rejuvenated(?) quartz fragments and crystals and pyrite. A very fine-grained dispersion of clay hampers the positive identification of albite and quartz. Pyrite preferentially nucleates as anhedral crystals and clusters, spatially associated with biotite aggregates.

mineral	*modal %*	*main size range (mm)*
quartz (and albite?)	60 - 64	<0.1
clay	20 - 22	xcryptocrystalline
white mica	10 - 12	<0.01
biotite	5 - 7	<0.01
pyrite	2 - 3	up to 0.5
oxides	tr	<0.05
sphalerite	tr	<0.2
chalcopyrite	tr	<0.002

Quartz, and possibly **albite,** constitute inequigranular to equigranular-interlobate to polygonal aggregates with grain-sizes generally smaller than 0.1 mm. The “quartzofeldspathic” aggregates host a very fine-grained dispersion of white mica, and possibly clay, which hampers the positive identification of albite which is therefore only assumed. The quartzofeldspathic aggregate both forms most of the lithic fragments within this sample as well as the majority of the interstitial matrix. Hosted within this aggregate are differing amounts of clay, generally occupying interstitial positions with respect to the quartzofeldspathic grains. Lithic fragments made up of fine-grained (0.01-0.02 mm) quartz possibly represent fragments of a silicified lithology and they host lesser amounts of clay and pyrite. Some quartz crystals are inclusion-free and are interpreted as being recrystallized after the deposition of the breccia.

White mica is very fine-grained, it rims the quartz, and possibly albite grains, and is dispersed within most of the lithic fragments and matrix. Some lithic fragments are very fine-grained and mainly consist of very fine-grained white mica, possibly associated with some clay and biotite.

Biotite is very fine-grained, forms lithic fragments and occupies interstitial positions within the quartzofeldspathic aggregates of the lithic fragments. Biotite fragments and clusters are the preferential site of nucleation for fine-grained clusters and anhedral pyrite.

Pyrite is abundant in some of the lithic fragments but absent from others and very rare within the matrix. This indicates that at least some of the precipitation of pyrite happened before the deposition of the breccia.

Rare and anhedral crystals of **sphalerite** and **chalcopyrite** are dispersed within the matrix of the breccia.

Sample: BW 98 138.1

Quartz-white mica-garnet schist and quartz-pyrrhotite-biotite-chalcopyrite vein/breccia

The polished thin section shows a finely layered rock that is fractured, fragmented and infilled by fine-grained quartz-rich material which locally permeates along the layered planes.

A xenoblast of garnet is showing strain shadows of quartz, thus indicating the occurrence of ductile deformation after the deposition of the quartzofeldspathic aggregate.

mineral	*modal %*	*main size range (mm)*
quartz (+albite+Kfeldspar?)	67 - 70	up to 0.05, rare up to 0.1
white mica	20 - 25	<0.02
clay	10 - 12	cryptocrystalline
pyrrhotite	1 - 2	up to 0.3 and up to 1 as massive infill of quartz-rich veins
biotite	tr	<0.05
garnet	tr	~1.8
chalcopyrite	tr	up to 0.1
hematite	tr	up to 0.05

Quartz, and possibly albite and K-feldspar, as suggested by the yellow stain colour, constitute an inequigranular interlobate aggregate that forms most of the layered rock. Layering is formed mainly by the variation of the grain-size of the quartzofeldspathic aggregate along with differences in the relative amount of white mica and clay along the different layers. As reported earlier for other samples, the presence of feldspar(s) is assumed due to the very fine-grained dispersion of white mica, and possibly clay, that hampers the positive identification of the feldspar(s). The layered rock is fragmented and intruded by an anastomosing network of vein-like domains made up of fine to very fine-grained grained **quartz** and a subordinate amount of clay and white mica. The rock fragments are angular to sub-angular. Veinlets of quartz are microboudinaged and enclosed within the fragmental portion of the vein-like domain. Quartz forms rare irregular domains in which the grain shapes are interlobate to polygonal, with grain-sizes of up to 0.2 mm. These domains are possibly coeval with the quartz-biotite-pyrrhotite-chalcopyrite veining.

White mica is very fine-grained and defines foliated domains of white mica-rich microlithons elongated parallel to the main foliation/layering and associated with clay-rich microlithons. These domains are interpreted as being formed as a consequence of dynamic recrystallization.

Veins at different angles with the layering of the rock are infilled by **quartz**, **pyrrhotite**, **biotite,** which locally rims the pyrrhotite, and **chalcopyrite, which** mostly occurs as

inclusions within pyrrhotite. Sets of fractures within the layered rock are infilled by quartz and are also oriented at high angles to the layering.

Pyrrhotite is anhedral and is distributed preferentially within the matrix of the breccia and in proximity to the edges of the fragments.

Garnet occurs as xenoblastic crystal and shows a strain shadow infilled with inequigranular-interlobate quartz and subordinate white mica.

Sample: BW 98 149.5

Quartz-white mica-pyrrhotite-dolomite-chalcopyrite altered rock

The microstructure is dominated by an homogeneous, fine-grained and inequigranular-interlobate aggregate of quartz and very fine-grained white mica. White mica forms very fine-grained alteromorphoses, possibly after feldspar. The quartz-white mica aggregate hosts irregular quartz aggregates (up to 1 mm in size), quartz crystals and clusters of anhedral pyrrhotite and white mica along with subordinate pyrite-carbonate and chalcopyrite that are up to 2mm in size. A 1 mm thick dolomite-quartz vein crosscuts the sample.

mineral	*modal %*	*main size range (mm)*
quartz	50 - 55	up to 1
white mica	43 - 45	up to 0.1
pyrrhotite	2 - 3	up to 2
pyrite	0.2 - 0.5	up to 0.1
dolomite	1	up to 0.3
chalcopyrite	tr	up to 0.2

Quartz forms an inequigranular-interlobate aggregate with a grain-size generally smaller than 0.3 mm. Quartz grains are rimmed by a thin coat of white mica. Possible re-crystallized quartz domains, characterized by inclusion-free, clear aspect, are hosted within the quartz-white mica aggregate and, in many instances, are spatially associated with the pyrrhotite-pyrite-white mica-dolomite-chalcopyrite clusters. Quartz occurs in a 1 mm thick straight vein which crosscuts the sample. Euhedral quartz crystals are projecting towards the centre of the vein with a constant angle with respect to the vein wall, the remaining portion of the vein is occupied by dolomite. Oriented samples of this type of vein would enable the determination of the attitude of the extension occurring at the time of emplacement of dolomite and quartz.

White mica is associated with the quartz and completely replaces possible feldspar mineral(s) as a very fine-grained, “felt-like” aggregate. White mica also forms an irregular network, preferentially following the interstices of the quartz grains and possibly generated by infilling of brittle fracturing. Well-formed white mica flakes are intergrown with pyrrhotite and are interpreted as being coeval with the deposition of the pyrrhotite-pyrite-chalcopyrite-carbonate clusters.

Pyrrhotite forms clusters of anhedral crystals. It encloses and is mantled by **pyrite** and rare **chalcopyrite** and is intergrown with **carbonate** and **white mica**. In a few instances pyrrhotite occurs as blades with an high aspect ratio (10:1 or higher). Dissemination of pyrrhotite in the rest of the rock is rare and it is possible to interpret the deposition of the pyrrhotite-pyrite-white mica-dolomite-chalcopyrite assemblage as being associated with the quartz re-crystallization and infill of the irregular domain described above.

Chalcopyrite is subordinate to and is preferentially nucleated at the rim of the pyrrhotite.

Sample: BW 100 222.8

Quartz (and clay?), volcanic(?) mudstone

The microstructure of the sample is inequigranular and fine-grained with angular to sub-angular quartz crystals up to 0.1 mm immersed in a very fine-grained aggregate irresolvable by the microscope. A very irregular and fine-grained anastomosing foliation is defined by cleavage domains (<0.01 mm in thick) of a dark irresolvable aggregate and microlithons made up of quartz fragments and fragments mostly altered by very fine-grained white mica. The foliated domains are disrupted by irregular and patchy zones mostly consisting of quartz and very fine-grained white mica. The foliation-free domains are interpreted as either being produced by an overprinting alteration of quartz and white mica or lithic fragments composed of quartz and white mica. Quartz veinlets (up to 0.2 mm thick) are crosscutting the sample.

mineral	*modal %*	*main size range (mm)*
clay(?) and dark cryptocrystalline material	45 - 50	cryptocrystalline
feldspar?+white mica	30 - 35	cryptocrystalline
quartz	20 - 25	up to 0.1
oxides	3 - 4	up to 0.1
pyrrhotite	1	up to 0.1
hematite	tr	up to 0.01

-

Quartz forms angular to sub-angular fragments (<0.1 mm) immersed in a fine-grained aggregate, possibly composed of various intensely altered fragments now visible as a cryptocrystalline aggregate of clay and dark material. Veinlets of quartz show locally undulose extinction of the monomineralic infill. In a few instances quartz infill appears to form fibrous aggregates consistently oriented parallel to the direction of dilation of the veinlet (ataxial veinlets).

White mica, and possibly **clay,** form a cryptocrystalline aggregate mostly irresolvable by the microscope. White mica is suspected to partially replace a feldspar mineral, however the grain-size and the dusty appearance of the minerals hampers further determinations and interpretations.

Pyrrhotite is dispersed as anhedral crystals of up to 0.1 mm and does not show any spatial correlation with the quartz veinlets.

Sample: BW 100 270.2

Pyrrhotite, clast supported, poorly sorted, volcanic lithic breccia

The microstructure is characterized by polymictic, poorly sorted lithic fragments in a clast supported breccia. Locally the contacts between the lithic fragments show jig-saw and interlobated shape, possibly indicating compaction at high temperature. The lithic fragments are made up of many different lithologies. Many lithic fragments are made up of fine-grained inequigranular-interlobate aggregates of quartz. The grain-size of the aggregates vary from less than 0.01 up to 0.1 mm. Fine-grained white mica and clay may occur in some fragments. Fragment made up of a “felt-like” aggregate of possibly clay and white mica are observed, as well as fragments composed of rounded polycrystalline aggregates of quartz, immersed in a very fine-grained quartz-rich matrix. Foliation and layering are observed in some of the fragments and an elliptical fragment of 10 x 5 mm in size is mostly made up of a dark irresolvable material and displays a layering with alternated, irregular domains of very fine-grained quartz, clay and domains of mostly dark cryptocrystalline material. In a different portion of the same fragment, irregular subrounded aggregates of very fine-grained polygonal quartz are immersed in a dark cryptocrystalline material. This fragment shows a regularly rounded outer edge and a half of its outer shape is interlobated with the adjacent fragments. The matrix between the lithic fragments is almost non existent and in few cases a dark, irresolvable aggregate with stylolitic-like edges are observed as fragment boundaries.

mineral	*modal %*	*main size range (mm)*
quartz	70 - 75	0.01-0.1
clay	20 - 25	cryptocrystalline
white mica	5 - 6	<0.01
pyrrhotite	1 - 2	up to 0.1
oxides	1	

Quartz is the most abundant mineral within the lithic fragments and it generally occurs as a fine-grained, mostly equigranular-intelobate to polygonal aggregate. The average grain size of the aggregate varies between 0.01 up to 0.1 mm. In a few instances quartz forms rounded polycrystalline aggregates where the fine-grained quartz crystals show a polygonal grain shape, possibly derived by the recrystallization of a quartz-rich phase. Some of the fragments are crosscut by quartz veinlets that do not continue across the margin of the fragments indicating that a veining event occurred before the fragmentation and the deposition of the fragment.

Pyrrhotite occurs as anhedral to rare subhedral crystals of up to 0.1 mm in size unequally distributed among the lithic fragments and preferentially occurring along the interstices between them.

Sample: BW 104 90.1

Porphyritic andesite

The polished thin section is characterized by a porphyritic microstructure with euhedral phenocrysts of plagioclase and biotite immersed in a fine-grained groundmass made up of plagioclase. Quartz forms rare polygonal crystal agglomerates and the groundmass mostly consists of subhedral plagioclase. Plagioclase is subtly to weakly altered by clay and the biotite is fresh.

mineral	*modal %*	*main size range (mm)*
plagioclase	70 - 75	up to 3
clay	12 - 15	cryptocrystalline
biotite	10 - 12	up to 1
quartz	5 - 7	up to 0.5
hematite?	0.5 - 1	up to 0.5
chalcopyrite	tr	

Plagioclase forms euhedral phenocrysts of up to 3 mm in size. It is zoned, however the lack of properly oriented albite type twinning does not allow the optical determination of the anorthite content. Plagioclase phenocrysts are generally fractured and, in some cases, there is clay alteration along the fractures. Plagioclase forms most of the groundmass where fine-grained (0.05-0.1 mm) subhedral laths are randomly oriented and the interstices are locally occupied by a earthy cryptocrystalline material, possibly clay.

Clay appears to be locally abundant and occupies irregular patches with an earthy dispersion.

Biotite occurs as euhedral phenocrysts with a relatively fresh aspect and rare kink bands, possibly generated during the cooling stages of the magma.

Quartz forms rare aggregates up to 3 mm in size made up of polygonal crystals up to 0.5 mm with well developed 120° triple junctions between the grains.

Suspected **hematite** forms aggregates of up to 1 mm composed of anhedral crystals.

Chalcopyrite is rare and occur as anhedral crystals. One crystal of 0.08 mm is observed within the clay altered fractures of the plagioclase.

Report 100099 for:
Christopher Leslie,
Richfield Ventures Corp,
101 – 242 Reid Street,
Quesnel, BC V2J 2M2 **January 2010**

Samples:	**BW-42:**	**71.5, 95.1, 101.8, 148.2, 210.9, 222.2, 248.35**
	BW-44	**85.1, 95.2, 146.1**
	BW-46	**51**
	BW-50	**10.9, 26.5, 28.7, 90.4, 95.2**
	BW-51	**90.5, 92.6**
	BW-53	**145.3**
	BW-57	**133.5**
	BW-59	**247.3, 247.4**

Summary:

Sample BW-42 71.5 is of dacite tuff to lapilli tuff that contains equant fragments averaging a few to several mm in size of a variety of fresh to silicified latite and dacite and phenocrysts of plagioclase (altered completely to sericite). These are set in a groundmass of extremely fine grained plagioclase/quartz and lesser sericite. Irregular replacement patches are of one or more of pyrite, sphalerite, high-relief carbonate, and quartz. Numerous wispy veinlets are of carbonate and/or pyrite, a few larger discontinuous veinlets are of pyrite and one larger veinlet is of carbonate and minor pyrite.

Sample BW-42 95.1 is of porphyritic latite tuff to lapilli tuff that contains fragments of secondary biotite and/or sericite, a few large ones of porphyritic andesite/latite containing phenocrysts of plagioclase (altered completely to biotite-sericite-(quartz), a few small ones of hypabyssal latite, several of phenocrysts of plagioclase (altered completely to biotite-sericite), and a few of K-feldspar. These are set in a groundmass of extremely fine grained plagioclase-(quartz-sericite-biotite). Replacement patches are of quartz and of pyrrhotite (altered moderately to hematite) with lesser sphalerite and minor chalcopyrite; some of the latter also contain biotite.

Sample BW-42 101.5 is of brecciated latite flow. Fragments up to a few cm across are of slightly porphyritic latite that contains scattered plagioclase phenocrysts (altered strongly to sericite) and a few of hornblende (altered completely to tremolite/actinolite) and of quartz in a groundmass of mainly equant plagioclase with patches of biotite and sericite. K-feldspar is concentrated moderately to strongly along margins of some fragments. The latite also contains a few fragments of coarser grained hypabyssal latite. Abundant replacement patches in the host rock fragments are of sphalerite with much less abundant pyrite, locally abundant pyrrhotite, and minor chalcopyrite. The breccia matrix contains minor phenocrysts of K-feldspar and hornblende(?) in a groundmass of secondary biotite-plagioclase-sericite-quartz with scattered patches of pyrite and of sphalerite. A wispy veinlet is of sphalerite with much less abundant pyrite.

Sample BW-42 148.2 is of hypabyssal latite flow breccia that contains abundant ragged patches (fragments?) mainly from 1-2.5 mm in size. Many of them are dominated by sericite with lesser disseminated plagioclase and locally quartz, and lesser ones are of intergrowths of sericite and plagioclase. These are intergrown with and partly enclosed in patches of finer grained hypabyssal latite consisting of plagioclase (altered slightly to sericite-opaque) with minor quartz. The origin of the sericite-rich patches and sericite-plagioclase patches is uncertain. Abundant disseminated replacement patches are dominated by sphalerite, with locally abundant pyrite and very locally quartz and high-relief carbonate.

Sample BW-42 222.2 is of porphyritic andesite that contains phenocrysts of plagioclase (altered moderately to sericite/phlogopite) and of hornblende (altered completely to quartz-chlorite-calcite-[ilmenite-clinozoisite]) in a groundmass dominated by plagioclase (altered slightly to sericite-biotite) with much less abundant quartz and minor ilmenite, chlorite, clinozoisite, and high-relief carbonate. Replacement patches are of quartz-calcite-pyrrhotite-marcasite-(chlorite). Veinlets of calcite-K-feldspar-(chlorite) have alteration envelopes containing abundant K-feldspar.

Sample BW-42 248.35 is of hypabyssal porphyritic andesite that contains abundant phenocrysts of plagioclase (altered slightly to moderately to sericite) and scattered ones of hornblende (altered completely to chlorite-Mineral X in a groundmass of plagioclase and much less abundant quartz and biotite, with minor ilmenite, calcite, and Mineral X. Replacement patches are of pyrrhotite/pyrite, K-feldspar, and calcite, with minor sphalerite and trace chalcopyrite and arsenopyrite.

Sample BW-44 85.1 is of latite lapilli tuff that contains angular fragments up to several mm across of latite tuff (dominated by plagioclase, K-feldspar, and sericite in widely varying amounts). These are set in a groundmass of extremely fine grained latite dominated by plagioclase with much less abundant K-feldspar and sericite. Diffuse replacement patches are of quartz and lesser sphalerite. A few discontinuous veinlets up to 0.5 mm wide are of quartz.

Sample BW-44 95.2 is of latite lapilli tuff that contains fragments of latite and trachyte tuff (in part probably pumice) up to several mm across in a groundmass of extremely fine grained latite dominated by plagioclase with much less abundant K-feldspar and sericite. Replacement patches consist of sphalerite and quartz with lesser marcasite and trace chalcopyrite and arsenopyrite.

Sample BW-44 146.1 is of slightly porphyritic latite that contains scattered phenocrysts of plagioclase (altered completely to sericite/muscovite), a few of biotite (altered completely to pseudomorphic muscovite), and one of quartz in a variable groundmass dominated in part by coarser grained, equant plagioclase with interstitial sericite and in part by much finer grained plagioclase with interstitial sericite. Replacement patches are of pyrite and of sphalerite. Veinlets are of jarosite-pyrite and pyrite-sericite.

Sample BW-46 51 is of latite flow/dyke that contains minor small phenocrysts of quartz in a uniform groundmass that is dominated by very fine grained equant plagioclase with much less abundant interstitial sericite and minor grains of quartz and flakes of muscovite. Disseminated replacement patches are of sphalerite and of pyrite. Numerous of these patches have halos that contain moderately abundant limonite along selvages between plagioclase grains. Late veinlets of limonite have similar alteration envelopes in which limonite extends along fractures between plagioclase grains.

Sample BW-50 10.9 is of slightly porphyritic hypabyssal diorite that contains scattered elongate prismatic phenocrysts of plagioclase and slightly elongated anhedral ones of hornblende (altered completely to biotite) in a groundmass of finer grained plagioclase (altered slightly to biotite) with much less abundant hornblende (altered completely to biotite) and interstitial patches of quartz, plagioclase, and biotite. Minor patches are of chlorite and chalcopyrite. Calcite forms replacement patches and a lensy veinlet.

Sample BW-50 26.5 is of felsic breccia that contains angular fragments up to a few cm in size of aphanitic, commonly flow-banded rhyolite/ trachyte composed of K-feldspar and lesser sericite, quartz, and clinozoisite(?). Textures suggest that many of the fragments are pumaceous in origin. They are set in an igneous groundmass of extremely fine grained equant plagioclase-(K-feldspar-quartz), with scattered patches of slightly coarser grained quartz.

Sample BW-50 28.7 is of felsic breccia that contains fragments mainly less than 1.5 mm in size and a few up to a few cm across of moderately banded rhyolite/trachyte that is dominated by K-feldspar with lesser lenses and bands of sericite-clinozoisite(?) and moderately abundant to minor disseminated coarser grains of quartz. A few fragments are of hypabyssal latite and one is of sericite/muscovite-quartz. Fragments are set in a latite matrix composed of extremely fine grained equant plagioclase with much less abundant quartz and K-feldspar. Quartz forms abundant slightly coarser grained replacement patches in both matrix and fragments.

Sample BW-50 90.4 is of felsic breccia. Half of the section consists of felsic breccia that contains a few fragments of porphyritic latite/andesite, two large fragments of rhyolite, numerous fragments of sericite and biotite, and a few of quartz-biotite replacement. Some biotite-rich fragments contain abundant sphalerite and one also contains pyrrhotite. Fragments are set in a matrix of aphanitic latite dominated by plagioclase with minor quartz and biotite that contains minor phenocrysts of K-feldspar. The other half of the section is a replacement zone dominated by sericite with patches of quartz and of biotite, with minor apatite and patches of sphalerite and ilmenite.

Sample BW-50 95.2 is of felsic breccia that contains numerous irregular banded (probably pumaceous) fragments from 1 mm to a few cm in size. These consist of layers trachyte consisting of aphanitic K-feldspar-(sericite) enclosing lenses and patches of latite dominated by very fine grained equant plagioclase with minor to locally moderately abundant interstitial K-feldspar and minor disseminated sericite. Banding is warped moderately in trachyte layers in many fragments. A few fragments are of biotite (after hornblende phenocrysts?) and a few are of sericite (after plagioclase phenocrysts?). Fragments are set in a matrix of aphanitic latite/dacite dominated by plagioclase with less abundant quartz. Within the matrix are irregular patches of coarser gained quartz with diffuse boundaries; at least some of these probably are of replacement origin.

Sample BW-51 90.5 contains one large patch up to a few mm across and several small ones of extremely fine grained latite dominated by equant plagioclase with much less abundant quartz and minor coarser K-feldspar. Much of the sample is of replacement origin and is of two textural varieties. The more abundant type consists of anhedral, fine grained quartz with scattered patches dominated by sericite and lesser biotite and with disseminated patches of pyrrhotite and sphalerite, with much less abundant chalcopyrite. Garnet forms scattered grains, in part bordering sulphide patches. The other is of intergrowths of very fine grained quartz and interstitial extremely fine grained sericite and lesser patches of biotite.

Sample BW-51 92.6 contains minor relic patches of latite that is dominated by plagioclase with disseminated patches of biotite. Much of the sample is dominated by replacement quartz with lesser sericite and biotite and minor sphalerite and garnet. Arsenopyrite forms moderately abundant disseminated grains in both host rock and replacement patches. A discontinuous veinlet is of quartz and sphalerite with minor chalcopyrite and arsenopyrite.

Sample BW-53 145.3 is of heterolithic breccia. Many fragments are of a wide variety of volcanic rock types ranging from andesite to trachyte. Several fragments are dominated by biotite and some are dominated by sericite with minor to moderately abundant biotite. A few fragments are of alteration assemblages dominated by quartz, sericite, and biotite, with locally abundant phlogopite and pyrrhotite. These are set in a groundmass of extremely fine grained latite. A large replacement patch of biotite-quartz contains a patch of biotite 1.7 mm across containing abundant ilmenite.

Sample BW-51 133.5 is of latite breccia that contains fragments of hypabyssal latite, sericite and sericite-(quartz), and a few alteration assemblages, dominated by quartz and sericite with lesser pyrrhotite and sphalerite. These are enclosed in a groundmass of extremely fine grained latite with scattered patches of slightly coarser grained quartz. Pyrite forms disseminated grains. Sphalerite forms disseminated patches. A set of subparallel irregular braided veinlets contain lenses of pyrrhotite (altered completely to pyrite and altered further to limonite) intergrown with sericite, with wispy seams of limonite-sericite.

Sample BW-59 247.3 is of latite flow that contains minor small phenocrysts of plagioclase (altered completely to sericite) in a groundmass of plagioclase with much less abundant sericite and scattered grains and patches of quartz. A few fragments are of hypabyssal latite and of sericite-plagioclase-quartz. Abundant commonly elongated disseminated patches are of pyrrhotite (altered completely to marcasite) with much less abundant arsenopyrite, carbonate, and chalcopyrite. A few veinlets are of carbonate (probably ankerite). A few late veinlets are of limonite.

Sample BW-59 247.4 is of latite tuff that contains numerous fragments of sericite (probably after plagioclase) and lesser ones of aphanitic latite in a slightly foliated groundmass of plagioclase with lesser sericite and minor quartz. Pyrrhotite (altered completely to marcasite forms moderately abundant, commonly elongated patches, with associated patches of high-relief carbonate and minor chalcopyrite and arsenopyrite. Veinlets are of carbonate. A few late veinlets are of limonite.

Photographic Notes:

The scanned section shows the gross textural features of the sections; these features are seen much better on the digital image than on the printed image. Photo numbers are shown in the lower left corner of the photographs. The letter in the lower right-hand corner indicates the lighting conditions: P = plane light, X = plane light in crossed nicols; R = reflected light, ~RP = reflected light and plane incident light; ~RX = reflected light in nearly crossed nicols and plane light in crossed nicols. Locations of photographs are shown on the scanned section. Descriptions of the photographs are at the end of the report.

Sample BW-42 71.5 **Dacite Tuff/Lapilli Tuff**
Replacement : Pyrite-Sphalerite-Carbonate-Quartz
Veinlets : Carbonate-Pyrite

The sample contains equant fragments averaging a few to several mm in size of a variety of fresh to silicified latite and dacite and phenocrysts of plagioclase (altered completely to sericite) in a groundmass of extremely fine grained plagioclase/quartz and lesser sericite. Irregular replacement patches are of one or more of pyrite, sphalerite, high-relief carbonate, and quartz. Numerous wispy veinlets are of carbonate and/or pyrite, a few larger discontinuous veinlets are of pyrite and one larger veinlet is of carbonate and minor pyrite.

mineral	percentage	main grain size range (mm)	
fragments			
hypabyssal latite	3- 4%	0.03-0.05	
silicified latite	17-20	0.03-0.15	
phenocrysts			
plagioclase	4- 5	0.3-0.5	(a few up to 0.7 mm)
groundmass			
plagioclase	35-40	0.005-0.01	
quartz	12-15	0.01-0.015	
sericite	5- 7	0.005-0.01	
apatite	trace	0.02-0.03	
replacement			
pyrite	2- 3	0.05-0.5	
sphalerite	1	0.05-0.5	
carbonate	1	0.02-0.1	
quartz	1	0.05-0.1	
chlorite	trace	0.03-0.05	
electrum	*	0.01	
veinlets			
1) pyrite-carbonate	1	0.01-0.15	

Hypabyssal latite forms equant fragments that are dominated by anhedral interlocking plagioclase grains (0.05-0.2 mm). Some also contains scattered subhedral prismatic plagioclase phenocrysts (0.3-0.7 mm long; altered completely to light brown sericite) and minor interstitial patches of quartz (0.05-0.1 mm). Some contain 1-2% disseminated extremely fine grained ilmenite and up to a few subhedral to euhedral grains of apatite (0.03-0.07 mm).

Silicified hypabyssal latite fragments contain grains of anhedral plagioclase (0.03-0.1 mm) intergrown with patches of replacement quartz (0.03-0.1 mm) and patches of sericite (0.005-0.01 mm).

One fragment of andesite 2.5 mm across contains 4-5% elongated lathy plagioclase grains (0.3-0.5 mm; with dusty opaque inclusions) in a groundmass of equant plagioclase/quartz (0.02-0.05 mm) and sericite, with minor equant grains of apatite (0.05-0.07 mm).

A few fragments up to 1.5 mm long are of metamorphosed mudstone(?) that consist of sericite with 2-3% disseminated irregular lenses and patches of ilmenite (0.01-0.03 mm).

A few fragments up to 0.7 mm long are of cherty plagioclase/quartz (0.003-0.005 mm).

(continued on page 2)

Plagioclase forms anhedral to locally subhedral phenocrysts that were altered completely to pale brown sericite. One patch several mm across may represent a large plagioclase phenocryst or cluster of phenocrysts; it consist of sericite with disseminated patches of carbonate and locally of chlorite 0.25-0.3 mm across that have square outlines, suggesting replacement of pyrite grains. A few of the patches with a square outline consists of quartz with abundant moderately aligned inclusions of chalcopyrite and of galena that commonly are concentrated near the margins of the patch.

The groundmass is dominated by interlocking plagioclase grains with less abundant interstitial grains and patches of quartz. Sericite forms irregular patches, mainly less than 0.3 mm in size, with a few larger irregular patches up to 1.5 mm across.

Replacement patches range widely in size and mineralogy. Pyrite and high-relief carbonate occur alone or together in irregular patches up to 1 mm across, many of which are within fragments of silicified latite and a lesser number of which are in the groundmass. Some pyrite patches are elongated, some are ragged in outline and some are sharply defined. Many patches contain moderately abundant dusty inclusions, and textures of some of these patches suggest that the pyrite with dusty inclusions is secondary after marcasite (which in turn may have been secondary after pyrrhotite).

Sphalerite forms irregular patches up to 1 mm across intergrown with groundmass and fragments. One large sphalerite-rich patch borders a fragment of hypabyssal latite. Sphalerite is deep reddish brown in colour, indicating a high content of iron.

Chalcopyrite forms anhedral grains up to 0.15 mm across associated with pyrite and with sphalerite.

Carbonate with high relief (possibly smithsonite) commonly is intergrown with pyrite, in part within a subhedral to euhedral outline that suggests that carbonate replaced pyrite.

Quartz occurs in patches up to 1 mm in size alone or with pyrite as aggregates of anhedral, equant grains.

Pale yellow electrum forms an equant inclusion in a large patch of pyrite.

A few wispy veinlets from 0.005-0.01 mm wide are of carbonate and/or pyrite. Several discontinuous veinlets up to 0.2 mm wide are of pyrite and lesser carbonate. One veinlet up to 0.15 mm wide is of carbonate with much less abundant pyrite.

Sample BW-42 95.1 **Porphyritic Latite Tuff/Lapilli Tuff**
Alteration: Biotite-Sericite
Replacement: Pyrrhotite-Sphalerite-Chalcopyrite-Quartz

Fragments of secondary biotite and/or sericite, a few large ones of porphyritic andesite/latite containing phenocrysts of plagioclase (altered completely to biotite-sericite-(quartz), a few small ones of hypabyssal latite, several of phenocrysts of plagioclase (altered completely to biotite-sericite), and a few of K-feldspar are set in a groundmass of extremely fine grained plagioclase-(quartz-sericite-biotite). Replacement patches are of quartz and of pyrrhotite (altered moderately to hematite) with lesser sphalerite and minor chalcopyrite; some of the latter also contain biotite.

mineral	percentage	main grain size range (mm)
fragments		
hypabyssal andesite	8-10%	phenos (0.5-1 mm); gm (0.01-0.03 mm)
hypabyssal latite		
biotite/sericite-rich	15-17	cryptocrystalline-0.02
tremolite/actinolite-rich	2- 3	cryptocrystalline-0.02
phenocrysts		
plagioclase	5- 7	0.3-0.8
K-feldspar	0.5	1-1.2
groundmass		
plagioclase	50-55	0.005-0.01
quartz	4- 5	0.01-0.015
sericite-biotite	1- 2	cryptocrystalline-0.01
zircon	trace	0.02-0.03
replacement		
pyrrhotite	1- 2	0.02-0.07
sphalerite	1- 2	0.03-0.07
pyrite	0.3	0.02-0.05
quartz	0.5-1	0.03-0.08
chalcopyrite	minor	0.01-0.02

A few fragments of porphyritic andesite up to 5 mm long contain euhedral phenocrysts of plagioclase (altered completely to biotite-sericite-quartz), mainly from 0.5-1 mm long, but locally up to a few mm long, in a groundmass of equant plagioclase with much less abundant sericite/biotite and quartz. One andesite fragment contains phenocrysts of hornblende/diopside that were altered completely to dense aggregates of pale green tremolite/actinolite and minor biotite. The groundmass of this fragment is an intergrown of plagioclase with lesser tremolite /actinolite, and contains minor disseminated acicular grains of apatite.

A fragment a few mm across is of extremely fine grained latite that is dominated by sericite with much less abundant plagioclase and biotite and minor disseminated grains of ilmenite.

A few fragments up to 1 mm in size are of altered hypabyssal latite that consist of slightly interlocking quartz grains (0.05-0.2 mm) with ragged patches of biotite-(sericite).

One fragment of latite contains a few phenocrysts of K-feldspar (0.3-0.5 mm) and a few of plagioclase(?; altered completely to extremely fine grained quartz) in a groundmass of extremely fine grained plagioclase with much less abundant disseminated sericite and biotite.

(continued on page 2)

Numerous irregular fragments up to a few mm across are of dense aggregates of biotite, some of these also contain minor to moderately abundant sericite, and a few similar fragments are dominated by sericite. Some similar ragged fragments up to 1 mm in size are dominated by dense aggregates of pale green tremolite/actinolite. Zircon forms a few equant grains in biotite-rich patches.

One fragment 2.5 mm across is of replacement quartz with a few patches up to 1.5 mm across of ilmenite (replaced strongly by biotite with ilmenite along major hexagonal crystallographic directions and in irregular patches), scattered patches of sericite-biotite, and several stubby to elongate subhedral grains of apatite (0.05-0.2 mm).

The groundmass is of cryptocrystalline to extremely fine grained plagioclase with much less abundant quartz and K-feldspar, biotite, and tremolite/actinolite.

A few irregular replacement patches up to 1.5 mm in size are of quartz that ranges widely in grain size from 0.05-0.5 mm.

A few proximal replacement patches up to 1 mm in size have a thin rim of pale to light brown biotite/phlogopite enclosing very fine grained aggregates of pyrrhotite (altered moderately to hematite) with much less abundant sphalerite and chalcopyrite.

Pyrrhotite (altered moderately to hematite) and sphalerite occur together or separately in replacement patches mainly less than 1 mm in size; most are intergrown finely with silicates. Sphalerite is deep reddish brown in colour.

Pyrite forms disseminated patches from 0.05-0.2 mm in size alone or intergrown coarsely with sphalerite.

Chalcopyrite forms minor disseminated grains (0.02-0.05 mm) associated mainly with sphalerite and finer grains (0.01-0.02 mm) included in sphalerite.

Sample BW-42 101.5 **Brecciated Latite Flow**
Matrix: Biotite-Plagioclase-Quartz-Sericite
Replacement: Sphalerite-Biotite-Pyrite-Pyrrhotite

The rock contains fragments up to a few cm across of slightly porphyritic latite that contains scattered plagioclase phenocrysts (altered strongly to sericite) and a few of hornblende (altered completely to tremolite/actinolite) and of quartz in a groundmass of mainly equant plagioclase with patches of biotite and sericite. K-feldspar is concentrated moderately to strongly along margins of some fragments. The latite also contains a few fragments of coarser grained hypabyssal latite. Abundant replacement patches in the host rock fragments are of sphalerite with much less abundant pyrite, locally abundant pyrrhotite, and minor chalcopyrite. The breccia matrix contains minor phenocrysts of K-feldspar and hornblende(?) in a groundmass of secondary biotite-plagioclase-sericite-quartz with scattered patches of pyrite and of sphalerite. A wispy veinlet is of sphalerite with much less abundant pyrite.

mineral	**percentage**	**main grain size range (mm)**	
phenocrysts			
plagioclase	2%	0.3-0.5	(one grain 1.3 mm long)
hornblende	0.2	0.5-0.7	
quartz	minor	0.3-0.5	
groundmass			
plagioclase	35-40	0.02-0.03	
biotite	4- 5	0.02-0.03	
K-feldspar	4- 5	0.02-0.03	
sphalerite	2- 3	0.02-0.05	
sericite	1	0.01-0.02	
quartz	0.3	0.02-0.05	
pyrite	0.3	0.02-0.05	
pyrrhotite	0.1	0.03-0.05	
chlorite	minor	0.015-0.025	
breccia matrix			
phenocrysts			
K-feldspar	0.5	0.3-0.7	
hornblende(?)	0.5	1.5	
groundmass			
biotite	20-25	0.02-0.05	
plagioclase	10-12	0.01-0.03	
quartz	8-10	0.01-0.03	
sericite	3- 4	0.01-0.02	
sphalerite	1- 2	0.02-0.05	
pyrite	1- 2	0.05-0.5	
chalcopyrite	0.1	0.03-0.05	
veinlet			
1) sphalerite-(pyrite)	trace	0.03-0.07	

(continued on page 2)

In the fragments of latite, plagioclase forms scattered subhedral prismatic phenocrysts that were altered moderately to completely to sericite.

Hornblende forms a few subhedral prismatic phenocrysts that were altered completely to extremely fine grained aggregates of pale green tremolite/actinolite, with dusty opaque concentrated moderately near the margins of the phenocrysts.

Quartz forms a few subrounded phenocrysts.

The groundmass is dominated by equant to slightly elongate plagioclase grains and locally shows a weak foliation due to alignment of plagioclase grains. Plagioclase is altered slightly to sericite. Along margins of some fragments, in part associated with replacement patches of sphalerite and biotite, K-feldspar is concentrated moderately to strongly (see stained offcut block).

Disseminated replacement patches in the groundmass consist of intimate intergrowths of pale to light brown biotite, reddish brown sphalerite, lesser pyrite, and minor pale to light apple green chlorite/mariposite. Sphalerite commonly is concentrated near the margins of the fragments against the breccia matrix. Pyrite forms ragged patches associated with sphalerite. Pyrrhotite is concentrated strongly in a few patches in which it is intergrown intimately to moderately with sphalerite; in some patches it is fresh and in some it is altered moderately to strongly to hematite. Chalcopyrite forms disseminated grains mainly associated with sphalerite and locally with pyrite.

A few inclusions up to a few mm across are of hypabyssal latite that consist of equant plagioclase grains (0.02-0.05 mm) with interstitial selvages of sericite and lesser biotite, with minor disseminated ilmenite.

An inclusion 2 mm across is of porphyritic hypabyssal latite/andesite. It contains abundant plagioclase phenocrysts (0.3-0.5 mm) that contain abundant dusty opaque inclusions. These are set in a groundmass of plagioclase (0.1-0.2 mm; altered slightly to moderately to sericite and lesser biotite) with much less abundant quartz and minor sphalerite

The breccia matrix consists mainly of an intergrowth of biotite and plagioclase, with scattered patches of sericite. On the border of the matrix and host rock is a subhedral prismatic phenocryst 2 mm long whose broad core was altered completely to sericite-(biotite) and whose rim was altered completely to biotite-(sericite). Sphalerite forms disseminated patches that are intergrown with silicates. Pyrite is concentrated strongly in a few patches up to 2 mm across. Chalcopyrite forms scattered patches up to 0.07 mm in size mainly included in large patches of pyrite.

A wispy veinlet up to 0.02 mm wide is of sphalerite with minor lenses of pyrite.

Sample BW-42 148.2 **Hypabyssal Latite Flow Breccia**
Replacement: Sphalerite-Pyrite-(Quartz-Carbonate)

The sample contains abundant ragged patches (fragments?) mainly from 1-2.5 mm in size. Many of them are dominated by sericite with lesser disseminated plagioclase and locally quartz, and lesser ones are of intergrowths of sericite and plagioclase. These are intergrown with and partly enclosed in patches of finer grained hypabyssal latite consisting of plagioclase (altered slightly to sericite-opaque) with minor quartz. The origin of the sericite-rich patches and sericite-plagioclase patches is uncertain. Abundant disseminated replacement patches are dominated by sphalerite, with locally abundant pyrite and very locally quartz and high-relief carbonate.

mineral	percentage	main grain size range (mm)	
patches			
sericite	10-12%	0.01-0.02	
plagioclase	1- 3	0.07-0.2	
fragments(?)			
hypabyssal latite	3- 4	0.2-0.5	
groundmass			
plagioclase	50-55	0.1-0.3	
sericite	7- 8	0.01-0.02	
quartz	1- 2	0.1-0.2	(a few up to 0.5 mm)
replacement			
sphalerite	2- 3	0.1-0.3	
pyrite	0.3	0.05-0.15	
quartz	0.1	0.1-0.5	
carbonate	minor	0.03-0.05	

Sericite-rich patches are irregular in outline and range from 0.5-2.5 mm in size. They contain scattered to moderately abundant equant grains of plagioclase (0.07-0.2 mm). Lesser patches are dominated by similar plagioclase with only minor sericite. Grain size of plagioclase varies moderately from place to place. Quartz occurs locally in some of the patches of both types in textures similar to those of plagioclase.

In several places, patches of sericite-plagioclase and patches of coarser grained plagioclase are enclosed in areas of finer grained hypabyssal latite consisting of equant, slightly interlocking plagioclase (altered slightly to sericite and dusty opaque).

Quartz forms patches up to 1 mm in size within plagioclase-rich aggregates. Some of these are angular fragments and some are interstitial to plagioclase. It also forms scattered grains in sericite-rich patches.

Sphalerite and lesser pyrite forms disseminated patches, mainly from 0.3-1 mm in size, with a few up to 2 mm across. Sphalerite is mainly deep brownish red and locally is orangish brown. Many patches, especially larger ones contain 10-5% inclusions up to 0.50 mm I size of pyrrhotite and some also contain 0.1-0.3% inclusions of chalcopyrite (0.01-0.02 mm). A few sphalerite-pyrite patches contain minor high-relief carbonate. One patch 1.2 mm across is of pyrite with a core of quartz and lesser patches of high-relief carbonate.

A strongly braided veinlet up to 0.3 mm wide in one corner of the section is of pyrite.

Sample BW-42 210.9 Slightly Porphyritic Latite
Replacement: Quartz-K-feldspar-Chlorite-Pyrrhotite-Pyrite-Calcite

Scattered phenocrysts of K-feldspar(?; replaced moderately by quartz and clinozoisite) are set in a groundmass dominated by plagioclase with much less abundant chlorite, calcite, K-feldspar, and minor Ti-oxide and apatite. Replacement patches are of widely varying composition between two end-members: quartz-K-feldspar-pyrrhotite-(pyrite) and chlorite-clinozoisite-calcite-(pyrrhotite-pyrite). Pyrite probably is secondary after marcasite, which in turn probably was secondary after pyrrhotite.

mineral	percentage	main grain size range (mm)
phenocrysts		
K-feldspar(?)	2- 3%	0.3-0.7
groundmass		
plagioclase	65-70	0.015-0.025
clinozoisite/epidote	3- 4	0.01-0.03
chlorite	3- 4	0.01-0.02
K-feldspar	3- 4	0.015-0.025
Ti-oxide	0.5	0.01-0.03
calcite	0.3	0.03-0.07
apatite	0.3	0.07-0.1
replacement		
1) quartz-K-feldspar-pyrrhotite-pyrite-(chalcopyrite)	10-12	0.1-0.3 (qz, Kf); 0.2-0.5 (po); 0.05-0.1 (py)
2) chlorite-clinozoisite-(pyrrhotite-pyrite-quartz)	4- 5	0.02-0.05 (cl) cryptocrystalline (cz)

K-feldspar(?) forms scattered anhedral to subhedral phenocrysts that were replaced moderately to aggregates of finer grained quartz and lesser extremely fine grained clinozoisite.

The groundmass is dominated by equant plagioclase with disseminated dusty clinozoisite/epidote and patches, mainly less than 0.2 mm in size, of chlorite and lesser calcite and clinozoisite/epidote.

Ilmenite is concentrated strongly in a few patches up to 0.7 mm in size, in many of which it forms anhedral, equant grains.

A few fragments up to 1.5 mm in size are dominated by equant, slightly interlocking plagioclase. One of these contains a cluster of tabular ilmenite grains (0.3-0.5 mm) and a few equant grains of apatite (0.1-0.2 mm).

Replacement patches up to a few mm across are of two main types. One is dominated by quartz and K-feldspar, with patches of pyrrhotite and lesser pyrite, mainly in the cores of patches. Some of these also contain minor to moderately abundant calcite and minor chlorite and clinozoisite/epidote.

The second type is dominated by chlorite with lesser patches of cryptocrystalline clinozoisite/ epidote and disseminated grains of calcite (0.2-0.5 mm). Some of these also contain patches of pyrrhotite and pyrite, and a few also contain quartz. Pyrite commonly is extremely fine grained and dusty; many textures suggest that it was formed by replacement of pyrrhotite, and maybe secondary after marcasite that was secondary after pyrrhotite. Chalcopyrite forms minor anhedral, mainly equant grains occurs associated with pyrrhotite in some of the replacement patches.

Sample BW-42 222.2 **Porphyritic Andesite**
Replacement: Quartz-Calcite-Pyrrhotite-Marcasite-(Chlorite)
Veinlets: Calcite-K-feldspar-(chlorite)-[K-feldspar]

Phenocrysts of plagioclase (altered moderately to sericite/phlogopite) and of hornblende (altered completely to quartz-chlorite-calcite-[ilmenite-clinozoisite]) are set in a groundmass dominated by plagioclase (altered slightly to sericite-biotite) with much less abundant quartz and minor ilmenite, chlorite, clinozoisite, and high-relief carbonate. Replacement patches are of quartz-calcite-pyrrhotite-marcasite-(chlorite). Veinlets of calcite-K-feldspar-(chlorite) have alteration envelopes containing abundant K-feldspar.

mineral	percentage	main grain size range (mm)
phenocrysts		
plagioclase	7- 8%	0.4-0.7
hornblende	3- 4	0.5-0.8
apatite	trace	0.2-0.3
groundmass		
plagioclase	70-75	0.02-0.04
biotite	5- 7	0.015-0.025
quartz	3- 4	0.02-0.03
ilmenite	0.3	0.01-0.02 (a few up to 0.05 mm)
clinozoisite	0.2	cryptocrystalline
carbonate	0.1	0.03-0.07
replacement		
quartz	2- 3	0.05-0.1
pyrrhotite	1- 2	0.05-0.2
carbonate	1- 2	0.05-0.1
chalcopyrite	trace	0.01-0.02
veinlets		
1) calcite-K-feldspar-(chlorite)	1	0.03-0.07

Plagioclase forms subhedral to euhedral prismatic phenocrysts that were replaced slightly by disseminated flakes of pale brown biotite/phlogopite.

Hornblende forms subhedral prismatic to equant phenocrysts that were replaced completely by aggregates of one or more of quartz, biotite, chlorite, calcite, clinozoisite, and ilmenite. Some also contain distinctive prismatic to acicular inclusions of apatite up to 0.05 mm long.

Apatite forms a few equant subhedral phenocrysts

The groundmass is dominated by extremely fine grained plagioclase that is turbid from slight alteration to sericite/biotite. Quartz forms disseminated grains that are concentrated moderately in certain patches up to a few mm in size. Biotite forms interstitial grains and minor patches, probably secondary after mafic grains. Ilmenite forms disseminated anhedral grains and is concentrated strongly in a few patches up to 0.4 mm in size with interstitial quartz. Clinozoisite forms disseminated patches, mainly less than 0.05 mm in size. Carbonate with relief and reflectivity much higher than those of calcite forms disseminated patches mainly less than 0.1 mm in size.

(continued on page 2)

Irregular replacement patches up to 2 mm in size are of various combinations of quartz, calcite, pyrrhotite, marcasite, and high-relief carbonate; sulphides commonly occur in the cores of the patches.

Marcasite forms a few patches of extremely fine grains with dusty non-reflective inclusions; these probably were formed by replacement of pyrrhotite. It also forms a few clusters from 0.1-0.12 mm across of unoriented elongate grains.

Chalcopyrite occurs in clusters of proximal disseminated grains, generally near but not adjacent to patches of pyrrhotite.

A veinlet 0.2 mm wide and a few smaller veinlets are of calcite and K-feldspar with minor chlorite. The zone of veinlets has an envelope up to several mm wide containing moderately abundant K-feldspar (see stained offcut block).

Sample BW-42 248.35 Hypabyssal Porphyritic Andesite

Abundant phenocrysts of plagioclase (altered slightly to moderately to sericite) and scattered ones of hornblende (altered completely to chlorite-Mineral X are set in a groundmass of plagioclase and much less abundant quartz and biotite, with minor ilmenite, calcite, and Mineral X. Replacement patches are of pyrrhotite/pyrite, K-feldspar, and calcite, with minor sphalerite and trace chalcopyrite and arsenopyrite.

mineral	**percentage**	**main grain size range (mm)**			
phenocrysts					
plagioclase	25-30%	0.5-2			
hornblende	3- 4	0.5-1			
apatite	trace	0.2-0.25			
groundmass				**percentage**	**grain size**
plagioclase	50-55	0.02-0.04	calcite	0.2	0.05-0.1
biotite	5- 7	0.005-0.01	Mineral X	0.2	cryptocrystalline
quartz	3- 4	0.02-0.05	apatite	minor	0.05-0.1
ilmenite	0.5	0.2-0.4			
replacement					
pyrrhotite/pyrite	2- 3	0.05-0.2	sphalerite	0.1	0.03-0.1
K-feldspar	1- 2	0.03-0.05	arsenopyrite	trace	0.1-0.3
calcite	0.5	0.1-0.3	chalcopyrite	trace	0.02-0.03
veinlets					
1) calcite-pyrrhotite-K-feldspar	0.3	0.02-0.05			

Plagioclase forms subhedral to euhedral stubby prismatic phenocrysts that were altered slightly to moderately to disseminated flakes of sericite and biotite.

Hornblende forms stubby prismatic phenocrysts that were altered completely to biotite and/or chlorite with lesser Mineral X, calcite, and ilmenite. Mineral X is cryptocrystalline with high relief and high birefringence. A few hornblende phenocrysts contain inclusions of subhedral prismatic apatite (0.07-0.1 mm long).

Apatite forms a few euhedral prismatic phenocrysts.

The groundmass is dominated by an interlocking intergrowth of equant plagioclase and much less abundant quartz. Biotite forms disseminated flakes and anhedral to subhedral patches up to 0.5 mm in size, probably secondary after hornblende. Mineral X forms disseminated patches, mainly less than 0.07 mm in size. Ilmenite is concentrated in scattered patches up to 0.4 mm in size in which it is intergrown intimately with plagioclase/quartz that is too fine grained to be identified optically. Some of these are associated with hornblende phenocrysts. Apatite forms disseminated subhedral to anhedral prismatic grains.

Replacement patches mainly less than 1 mm in size are of pyrrhotite with minor to moderately abundant calcite and/or K-feldspar. In several large patches, pyrrhotite was replaced completely by pyrite. A few replacement patches contains a few to several grains of sphalerite intergrown coarsely with pyrrhotite and calcite. Chalcopyrite forms minor grains, mainly associated with sphalerite. Arsenopyrite forms a few euhedral grains.

A few wispy veinlets up to 0.02 mm wide are of calcite-K-feldspar-pyrrhotite and of pyrrhotite.

Sample BW-44 85.1 **Latite Lapilli Tuff**
Replacement: Quartz-Sphalerite-Pyrite
Veinlets: Quartz

Angular fragments up to several mm across of latite tuff (dominated by plagioclase, K-feldspar, and sericite in widely varying amounts) are set in a groundmass of extremely fine grained latite dominated by plagioclase with much less abundant K-feldspar and sericite. Diffuse replacement patches are of quartz and lesser sphalerite. A few discontinuous veinlets up to 0.5 mm wide are of quartz.

mineral	**percentage**	**main grain size range (mm)**	
fragments			
latite tuff	30-35%	0.01-0.02 (se; 0.03-0.05 (pl, Kf)	
matrix			
plagioclase	50-55	0.01-0.03	
K-feldspar	2- 3	0.01-0.03	
sericite	2- 3	0.01-0.02	
replacement, veinlets			
quartz	2- 3	0.03-0.1	
sphalerite	2- 3	0.05-0.2	
pyrite	1- 2	0.01-0.03	
sericite	0.1	0.015-0.02	
chalcopyrite	minor	0.01-0.02	(a few up to 0.5 mm)
arsenopyrite	minor	0.02-0.15	
veinlets			
1) quartz	3- 4	0.07-0.3	

Diffuse fragments, mainly from 1-3 mm across and a few up to several mm across are dominated by intergrowths of sericite, plagioclase, and K-feldspar in widely varying amounts. Many of the fragments have a weakly to moderately aligned texture.

One large fragment dominated by sericite with lesser plagioclase and no K-feldspar contains abundant ragged replacement patches of sphalerite and several patches up to 2 mm in size of pyrite.

The matrix of the breccia is dominated by equant plagioclase (altered slightly to sericite) with much less abundant K-feldspar and interstitial sericite.

Quartz forms irregular to lensy replacement patches up to 1 mm in size of equant, slightly interlocking grains.

Sphalerite forms disseminated replacement patches up to 1 mm in size; it is deep brownish red in colour. It contains minor exsolution inclusions of chalcopyrite and locally a few of pyrrhotite. In a few patches, sphalerite is intergrown with lesser quartz.

Pyrite forms disseminated patches up to 2 mm long alone or with sphalerite. Much of the pyrite contains abundant dusty, non-reflective inclusions; textures suggest that it was formed by replacement of pyrrhotite.

Sericite forms a few irregular interstitial patches up to 0.3 mm long.

Arsenopyrite forms a few subhedral to euhedral disseminated grains away from the other sulphide patches.

A few discontinuous veinlets from 0.3-0.7 mm wide are of quartz.

Sample BW-44 95.2 **Latite Lapilli Tuff**

Replacement : Sphalerite-Quartz-Marcasite

Fragments of latite and trachyte tuff (in part probably pumice) up to several mm across are contained in a groundmass of extremely fine grained latite dominated by plagioclase with much less abundant K-feldspar and sericite. Replacement patches consist of sphalerite and quartz with lesser marcasite and trace chalcopyrite and arsenopyrite.

mineral	**percentage**	**main grain size range (mm)**	
fragments			
latite tuff	35-40%	0.005-0.01	
trachyte flow	4- 5	0.01-0.03	
matrix			
plagioclase	40-45	0.02-0.03	
sericite	3- 4	0.005-0.015	
K-feldspar	2- 3	0.02-0.03	
quartz	2- 3	0.02-0.05	
replacement			
sphalerite	2- 3	0.05-0.2	
quartz	2- 3	0.05-0.15	
marcasite	1	0.01-0.02	
chalcopyrite	trace	0.01-0.03	(a few 0.05-0.2 mm)
arsenopyrite	trace	0.02-0.03	

Fragments up to a few mm across are of various types of latite tuff. Some are banded and some probably are of pumaceous origin. The groundmass commonly is dominated by aphanitic feldspar; the stained offcut block indicates that it is dominated by K-feldspar, probably with lesser plagioclase. In some fragments, feldspar grains are oriented in what probably represents a flow-foliation. Sericite is concentrated in patches up to 1 mm in size. Many fragments contain minor to locally moderately abundant ragged patches of cryptocrystalline clinozoisite(?)that is light brown in colour.

Some fragments consist of intergrowths of cryptocrystalline feldspars and sericite with disseminated patches and/or wispy lenses/veinlets of quartz (0.03-0.05 mm).

A few trachyte flow fragments up to a few mm long are dominated by strongly oriented grains of K-feldspar with lesser patches containing moderately abundant sericite and with disseminated patches and stringers of quartz.

A few fragments up to 0.3 mm in size are of unoriented flakes of sericite (0.02 mm).

The matrix is very fine grained latite that is dominated by equant plagioclase with much less abundant K-feldspar and sericite and scattered patches of quartz.

Several replacement patches up to 2 mm in size are dominated by deep reddish brown sphalerite (with 2-5% inclusions of chalcopyrite) with minor to abundant and quartz.

A few replacement patches up to 1.5 mm in size and a few wispy veinlets associated with these patches are of marcasite/pyrite (which may be secondary after pyrrhotite). A few patches of marcasite were replaced moderately to strongly by non-reflective hematite.

Arsenopyrite forms a few disseminated euhedral grains.

Sample BW-44 146.1 **Slightly Porphyritic Latite**
Alteration: Sericite
Replacement:: Pyrite, Sphalerite
Veinlets: Pyrite-Sericite; Jarosite-Pyrite

Scattered phenocrysts of plagioclase (altered completely to sericite/muscovite), a few of biotite (altered completely to pseudomorphic muscovite), and one of quartz are set in a variable groundmass dominated in part by coarser grained, equant plagioclase with interstitial sericite and in part by much finer grained plagioclase with interstitial sericite. Replacement patches are of pyrite and of sphalerite. Veinlets are of pyrite-sericite and of jarosite-pyrite.

mineral	percentage	main grain size range (mm)	
phenocrysts			
plagioclase	2- 3%	0.4-0.8	
biotite	minor	0.2-0.4	
quartz	trace	0.1-0.15	
groundmass			
plagioclase	80-85	0.015-0.03	(locally 0.05-0.08 mm)
sericite	7- 8	0.01-0.02	
quartz	minor	0.07-0.1	
zircon	trace	0.05	
replacement			
pyrite	2- 3	0.2-0.7	
sphalerite	0.5	0.05-0.2	
veinlets			
1) pyrite-sericite	0.1	0.01-0.03	
2) jarosite-pyrite	0.3	0.01-0.05	

Plagioclase forms disseminated euhedral to subhedral prismatic phenocrysts that were altered completely to unoriented to radiating, equant flakes of sericite/muscovite. A few plagioclase phenocrysts were loci for replacement by sphalerite that is intergrown intimately with muscovite.

Biotite forms a few tabular to elongate phenocrysts that were altered completely to pseudomorphic muscovite.

Quartz forms one subhedral phenocryst.

The groundmass is variable in grain size and texture. In much of the section it consists of extremely fine grained plagioclase and lesser sericite. In about 5-10% of the section, it consists of equant plagioclase grains (0.03-0.05 mm) with moderately abundant interstitial sericite. In a few places it contains 10-25% equant plagioclase grains between 0.05-0.08 mm in size that are set in the much finer grained matrix of plagioclase (0.015-0.03 mm) and moderately abundant sericite. In several places, especially towards one end of the section, the groundmass is dominated by equant plagioclase (0.05-0.08 mm) with 5-7% interstitial sericite. Some contacts between textural types are sharp and others are gradational. Locally coarser grained varieties form inclusions in finer grained varieties. Elsewhere, the rock is slightly banded with bands of different grain size and texture.

Sericite forms disseminated grains and patches that are mainly interstitial to plagioclase.

Quartz forms a few interstitial grains.

Zircon forms a subhedral broken prismatic grain.

(continued on page 2)

Pyrite forms disseminated subhedral to euhedral porphyroblastic grains and also occurs as ragged patches intergrown with the groundmass. Numerous pyrite grains contain a few to abundant inclusions (0.01-0.03 mm) of galena. A few of these pyrite grains also contain inclusions up to 0-.1 mm in size of intergrowths of two or more of sphalerite, chalcopyrite, pyrrhotite, and galena. Some finer grained pyrite contain dusty non-reflective inclusions, and may be secondary after pyrrhotite.

Sphalerite forms replacement patches up to 0.5 mm in size of anhedral, deep red-brown grains.

Chalcopyrite forms anhedral grains associated with pyrite.

Medium yellow native gold forms an interstitial grain 30 microns long included in a coarse grain of pyrite.

A few wispy slightly braided veinlets up to 0.1 mm wide are of pyrite and sericite.

A veinlet up to 0.1 mm wide is of jarosite and lesser sphalerite with minor pyrite and chalcopyrite.

Sample BW-46 51 Latite Flow/Dyke
Replacement: Sphalerite-Pyrite

Minor small phenocrysts of quartz are set in a uniform groundmass that is dominated by very fine grained equant plagioclase with much less abundant interstitial sericite and minor grains of quartz and flakes of muscovite. Disseminated replacement patches are of sphalerite and of pyrite. Numerous of these patches have halos that contain moderately abundant limonite along selvages between plagioclase grains. Late veinlets of limonite have similar alteration envelopes in which limonite extends along fractures between plagioclase grains.

mineral	percentage	main grain size range (mm)	
phenocrysts			
quartz	minor	0.2-0.3	
groundmass			
plagioclase	87-90%	0.02-0.04	
sericite	5- 7	0.007-0.015	
quartz	0.5	0.05-0.1	
muscovite	0.1	0.03-0.07	(a few from 0.1-0.25 mm long)
replacement			
pyrite	1- 2	0.05-0.2	
sphalerite	1- 2	0.05-0.15	
chalcopyrite	trace	0.01-0.02	
veinlets, seams			
1) limonite	1- 2	cryptocrystalline-0.01	

Quartz forms a few subhedral to subrounded equant phenocrysts.

In the groundmass, plagioclase forms equant grains that are intergrown with much less abundant interstitial selvages and small patches of sericite. A few diffuse patches up to 1.5 mm in size are finer grained than normal, with plagioclase grains from 0.015-0.025 mm in size.

Quartz forms scattered anhedral grains.

Muscovite forms scattered stubby to elongate flakes. It is concentrated moderately on or near the margins of some sulphide patches, where it forms slender flakes.

Sphalerite forms equant dense to skeletal patches up to 1.5 mm in size and a few elongate lenses of similar length. It is deep brownish red in colour. In many patches, chalcopyrite forms scattered exsolution blebs.

Pyrite occurs alone as elongate lenses up to a few mm long and equant patches, and occurs as subordinate grains in some sphalerite-rich patches. In some elongate patches it contains dusty non-reflective inclusions suggesting that it was formed by replacement of pyrrhotite. Also in some elongate patches, pyrite was altered moderately to hematite/limonite and in places this was removed from the rock leaving, in the extreme case elongate casts.

Limonite/hematite occurs with sericite in interstitial selvages surrounding plagioclase grains in broad halos about many of the pyrite-rich sulphide patches.

Sample BW-50 10.9 **Slightly Porphyritic Hypabyssal Diorite**
Alteration: Biotite
Replacement: Calcite

Scattered elongate prismatic phenocrysts of plagioclase and slightly elongated anhedral ones of hornblende (altered completely to biotite) are contained in a groundmass of finer grained plagioclase (altered slightly to biotite) with much less abundant hornblende (altered completely to biotite) and interstitial patches of quartz, plagioclase, and biotite. Minor patches are of chlorite and chalcopyrite. Calcite forms replacement patches and a lensy veinlet.

mineral	**percentage**	**main grain size range (mm)**			
phenocrysts					
plagioclase	3- 4%	2-5			
hornblende	2- 3	0.8-1.5			
groundmass				**percentage**	**grain size**
plagioclase	70-75%	0.7-2	apatite	0.1	0.05-0.1
plagioclase	4- 5	0.05-0.08	calcite	minor	0.03-0.07
hornblende	4- 5	0.3-0.5	chlorite	minor	0.02-0.04
quartz	4- 5	0.05-0.4	chalcopyrite	trace	0.02-0.05
K-feldspar	3- 4	0.01-0.03	pyrite	trace	0.02-0.05
ilmenite/leucoxene	0.7	0.1-0.3			
replacement, lenses, veinlet					
calcite	2- 3	0.07-0.15			

Plagioclase forms scattered elongate euhedral to subhedral prismatic phenocrysts that were altered slightly to disseminated flakes of biotite and disseminated patches of calcite (0.02-0.03 mm). These grade texturally into finer grained anhedral to subhedral plagioclase that makes up the bulk of the rock and also is altered slightly to moderately to disseminated flakes of biotite.

Hornblende forms anhedral grains that were replaced completely by dense aggregates of biotite with weak pleochroism from pale to very light brown.

Interstitial to these are aggregates of much finer grained quartz, plagioclase, K-feldspar, and biotite. A few patches up to 0.4 mm in size are of even finer grained K-feldspar/plagioclase (0.01-0.02 mm). Several patches up to 0.5 mm in size consist of intimate intergrowths of K-feldspar and quartz.

Ilmenite (altered moderately to strongly to leucoxene) forms disseminated equant patches.

Apatite forms acicular to prismatic grains, mainly associated with interstitial patches of quartz and K-feldspar. It also forms a few subhedral prismatic grains intergrown with coarser grained plagioclase.

Calcite forms scattered interstitial patches, in part associated with chlorite.

Chlorite and chalcopyrite occur together in interstitial patches up to 0.3 mm in size. Chlorite is pleochroic from pale to very light green. Chalcopyrite also forms scattered grains (0.01-0.02 mm) in the rock and in calcite patches.

Calcite forms a few irregular replacement patches up to 1.5 mm across and a lensy veinlet up to 0.2 mm wide. One veinlet of calcite contains a patch of chlorite 0.15 mm across.

A discontinuous somewhat diffuse seam up to 0.3 mm wide consists of extremely fine grained plagioclase; this probably is a zone of cataclastic deformation.

Sample BW-50 26.5 **Felsic Breccia**
Rhyolite/Trachyte fragments in Latite Matrix

Angular fragments up to a few cm in size are of aphanitic, commonly flow-banded rhyolite/ trachyte composed of K-feldspar and lesser sericite, quartz, and clinozoisite(?). Textures suggest that many of the fragments are pumaceous in origin. They are set in an igneous groundmass of extremely fine grained equant plagioclase-(K-feldspar-quartz), with scattered patches of slightly coarser grained quartz.

mineral	percentage	main grain size range (mm)
rhyolite/trachyte fragments		
phenocrysts		
K-feldspar	minor	0.5-0.6
groundmass		
K-feldspar	35-40%	0.005-0.01
sericite	5- 7	0.005-0.01
quartz	5- 7	0.03-0.05
clinozoisite(?)	2- 3	cryptocrystalline
ilmenite	minor	0.01-0.02
pyrite	trace	0.01-0.02
chalcopyrite	trace	0.01-0.02
breccia matrix		
plagioclase	35-40	0.01-0.02
quartz	7- 8	0.01-0.02
K-feldspar	1- 2	0.01-0.02
replacement		
sphalerite	minor	0.05-0.15
chalcopyrite	trace	0.005-0.01

Rhyolite/trachyte fragments are dominated by aphanitic K-feldspar with much less abundant wispy seams and patches of sericite-clinozoisite(?), and minor to generally moderately abundant disseminated grains, lenses, and discontinuous veinlets of coarser grained quartz. K-feldspar forms a few anhedral phenocrysts. Clinozoisite(?) is cryptocrystalline with a medium greyish brown colour and high relief. Some fragments have a banded texture with alternations of diffuse K-feldspar rich bands and bands richer in sericite-clinozoisite(?). Sericite forms a few patches up to 0.3 mm in size of unoriented flakes (0.02-0.03 mm); these may be secondary after small plagioclase phenocrysts. Ilmenite forms disseminated anhedral grains and clusters of a few grains. Pyrite and chalcopyrite each forms minor disseminated equant grains.

The matrix of the breccia consists of a latite flow that is dominated by equant plagioclase, with lesser K-feldspar and quartz. Quartz forms scattered slightly coarser grained patches, mainly less than 0.5 mm across.

Sphalerite forms a patch 0.3 mm across that contains minor exsolution blebs of chalcopyrite (0.005-0.01 mm).

Sample BW-50 28.7 **Felsic Breccia**
Rhyolite/Trachyte Fragments in Latite Matrix

Fragments mainly less than 1.5 mm in size and a few up to a few cm across are of moderately banded rhyolite/trachyte that is dominated by K-feldspar with lesser lenses and bands of sericite-clinozoisite(?) and moderately abundant to minor disseminated coarser grains of quartz. A few fragments are of hypabyssal latite and one is of sericite/muscovite-quartz. Fragments are set in an latite matrix composed of extremely fine grained equant plagioclase with much less abundant quartz and K-feldspar. Quartz forms abundant slightly coarser grained replacement patches in both matrix and fragments.

mineral	percentage	main grain size range (mm)	
fragments			
rhyolite/trachyte			
K-feldspar	30-35%	0.005-0.015	
sericite	5- 7	0.005-0.01	
quartz	3- 4	0.03-0.07	
clinozoisite(?)	1- 2	cryptocrystalline	
hypabyssal latite	2- 3	0.02-0.03; 0.05-0.1	
sericite/muscovite-quartz			
	0.7	0.02-0.05 (se/mu); 0.03-0.1 (qz)	
matrix			
plagioclase	40-45	0.005-0.015	
quartz	4- 5	0.01-0.03	
K-feldspar	1- 2	0.005-0.015	
replacement			
quartz	5- 7	0.03-0.1	(a few up to 0.3 mm)

Most fragments are of moderately banded rhyolite/trachyte that consists of diffuse bands and lenses of K-feldspar alternating with less abundant ones of sericite-(clinozoisite?). Quartz forms minor to moderately abundant coarser grains that in some fragments are aligned in trains parallel to banding. Ilmenite forms minor disseminated spots up to 0.03 mm in size; many of these were altered partly to completely to leucoxene that was stained light yellowish brown by limonite. In a patch 0.5 mm across, a few tabular ilmenite/leucoxene grains (0.05-0.07 mm long) are surrounded by a zone of sericite that was stained bright yellow by limonite.

One fragment 3.5 mm across is of hypabyssal latite dominated by equant, slightly interlocking plagioclase grains (0.02-0.03 mm) with lesser patches of K-feldspar up to 0.3 mm long, much less abundant interstitial patches of K-feldspar-sericite-clinozoisite(?), and minor quartz. One fragment 1 mm across is of hypabyssal latite that consists of equant slightly interlocking plagioclase grains (0.02-0.03 mm) altered slightly to sericite-(clinozoisite?) with minor quartz. One elongate fragment 1 mm long and an equant one 0.8 mm across are of hypabyssal latite that consists of equant, slightly interlocking plagioclase grains (0.05-0.1 mm) that were altered very slightly to sericite.

A few equant fragments from 0.3-0.5 mm in size are of unoriented flakes of sericite/muscovite (0.02-0.03 mm); these probably are secondary after plagioclase phenocrysts. A few fragments contain one or two similar sericite-rich patches.

One fragment 2 mm across is of sericite/muscovite and quartz with minor disseminated leucoxene (after ilmenite).

(continued on page 2)

The matrix is dominated by equant extremely fine grained plagioclase with much less abundant quartz and K-feldspar. Quartz commonly is concentrated in patches of slightly coarser grain size than plagioclase; with increasing grain size these grade into what are interpreted as replacement patches of quartz.

Quartz forms slightly to moderately coarser grained replacement patches up to 1 mm in size. A few of these contain minor patches up to 0.2 mm across of sericite In a few fragments, quartz forms lensy veinlets up to 0.2 mm wide.

Sample BW-50 90.4 **Felsic Breccia**
Fragments of Latite/Andesite, Sericite, Biotite, Rhyolite
Replacement: Sericite-Quartz-Biotite-(Sphalerite-Pyrrhotite)

Half of the section consists of felsic breccia that contains a few fragments of porphyritic latite/andesite, two large fragments of rhyolite, numerous fragments of sericite and biotite, and a few of quartz-biotite replacement. Some biotite-rich fragments contain abundant sphalerite and one also contains pyrrhotite. Fragments are set in a matrix of aphanitic latite dominated by plagioclase with minor quartz and biotite that contains minor phenocrysts of K-feldspar. The other half of the section is a replacement zone dominated by sericite with patches of quartz and of biotite, with minor apatite and patches of sphalerite and ilmenite.

mineral	**percentage**	**main grain size range (mm)**	
breccia (A)			
fragments			
latite/andesite	7- 8%	0.5-1 (phenos); 0.01-0.02 (gm)	
rhyolite	3- 4	0.005-0.02	
sericite	3- 4	0.005-0.01	
biotite	3- 4	0.005-0.01	(locally up to 0.03 mm)
sphalerite	1	0.03-0.07	(mainly with biotite)
pyrrhotite	0.2	0.03-0.05	
ilmenite	0.2	0.01-0.05	
muscovite	trace	0.3	
zircon	trace	0.1	
phenocrysts			
K-feldspar	1	0.5-1	
matrix			
plagioclase	30-35	0.01-0.03	
quartz	1- 2	0.02-0.03	
biotite	1- 2	0.01-0.02	

replacement zone (B)				**percentage**	**grain size**
sericite	30-35	0.02-0.04	ilmenite	0.2	0.02-0.03
quartz	8-10	0.05-0.15	pyrrhotite	0.1	0.03-0.07
biotite	7- 8	0.005-0.25	chalcopyrite	trace	0.01-0.02
sphalerite	1- 2	0.05-0.2	galena	trace	0.02-0.04
apatite	0.3	0.1-0.25	arsenopyrite	trace	0.02-0.03

At one end of the section is a large fragment of porphyritic andesite/latite. It contains subhedral to euhedral phenocrysts of plagioclase (0.05-0.07 mm long; altered completely to sericite with minor to locally moderately abundant biotite) and euhedral to subhedral hornblende phenocrysts up to 1 mm long (altered completely to quartz with minor inclusions of apatite) in a groundmass or equant plagioclase (0.01-0.01 mm) with minor disseminated ilmenite. A few smaller fragments are of this rock type.

(continued on page 2)

A fragment of rhyolite several mm across is dominated by oriented K-feldspar grains with lesser patches of quartz and of biotite. It contains a replacement patch 2 mm across of sphalerite and lesser pyrrhotite and biotite, a few smaller replacement patches of sphalerite and one replacement patch of galena 0.25 mm across. It is cut by a few veinlets up to 0.2 mm wide of quartz.

A fragment of rhyolite dominated by K-feldspar with minor biotite, sericite, and quartz contains irregular replacement patches up to a few mm across of biotite-(quartz-K-feldspar) that contain irregular patches of each of sphalerite-pyrrhotite, sphalerite, and galena.

A few fragments up to 2 mm in size are of quartz (0.1-0.2 mm) and lesser patches of biotite (0.01-0.03 mm).

K-feldspar forms a few subhedral phenocrysts. Adjacent to one of these is a subhedral prismatic grain of zircon.

A few fragments up to 0.5 mm in size are of hypabyssal latite dominated by equant plagioclase grains with much less abundant disseminated sericite.

Muscovite forms one rectangular flake 0.3 mm long.

The matrix of the breccia is dominated by equant plagioclase with lesser, commonly slightly coarser grained quartz and minor to moderately disseminated patches of biotite and lesser ones of sericite.

The replacement zone contains abundant patches from 0.3-0.7 mm in size of equant quartz and a few up to 1.5 mm across. Some of the patches have euhedral outlines but consist of aggregates of anhedral grains, and some contain a few euhedral acicular to prismatic grains of apatite up to 0.07 mm long. These suggest that such quartz was formed by replacement of hornblende (compare with alteration of hornblende phenocryst in fragment of andesite/latite in photo 40). One coarser grained quartz patch 1.7 mm long has a radiating texture of grains at one end. One patch 1 mm across consists of an intimate intergrowth of quartz and lesser biotite.

Biotite forms patches mainly from 0.5-1.5 mm in size, which are mainly cryptocrystalline to extremely fine grained, but locally contain small clusters of equant grains from 0.02-0.03 mm in size. Pleochroism of biotite is from light to medium brown. One fragment 2.5 mm across is dominated by biotite intergrown finely with abundant disseminated sphalerite and minor quartz.

The matrix of the replacement zone consists of unoriented flakes of sericite.

Apatite forms disseminated equant to prismatic, subrounded to subhedral grains.

Ilmenite forms minor to abundant grains and clusters of grains in a few biotite-rich patches.

Sphalerite (deep brownish red colour) forms disseminated patches up to 0.4 mm in size, commonly within biotite patches. A few patches up to 1.5 mm long within coarser grained biotite-rich patches consist of very fine grained aggregates of sphalerite and pyrrhotite that are intergrown with biotite. Some sphalerite patches contain minor exsolution blebs of chalcopyrite (0.005-0.015 mm).

Chalcopyrite forms minor disseminated patches in quartz.

Galena forms a patch 0.04 mm across associated with sphalerite within a patch of quartz and a few patches up to 0.03 mm in size in a small patch of biotite.

Arsenopyrite forms two adjacent euhedral grains in a patch of quartz.

Sample BW-50 95.2 **Felsic Breccia**
Fragments: Trachyte/Latite
Matrix: Latite/Dacite; Quartz

Numerous irregular banded (probably pumaceous) fragments from 1 mm to a few cm in size consist of layers trachyte consisting of aphanitic K-feldspar-(sericite) enclosing lenses and patches of latite dominated by very fine grained equant plagioclase with minor to locally moderately abundant interstitial K-feldspar and minor disseminated sericite. Banding is warped moderately in trachyte layers in many fragments. A few fragments are of biotite (after hornblende phenocrysts?) and a few are of sericite (after plagioclase phenocrysts?). Fragments are set in a matrix of aphanitic latite/dacite dominated by plagioclase with less abundant quartz. Within the matrix are irregular patches of coarser gained quartz with diffuse boundaries; at least some of these probably are of replacement origin.

mineral	**percentage**	**main grain size range (mm)**	
fragments			
trachyte/latite			
K-feldspar	35-40%	0.005-0.01	
plagioclase	7- 8	0.05-0.08	
sericite	3- 4	0.005-0.015	
ilmenite	minor	0.02-0.05	(a few up to 0.1 mm)
pyrite	trace	0.01-0.02	(a few from 0.1-0.15 mm)
biotite	1- 2	0.005-0.02	
sericite	0.3	0.005-0.02	
groundmass			
plagioclase	35-40	0.01-0.02	
quartz	7- 8	0.02-0.03	
replacement			
quartz	4- 5	0.03-0.05	

Many fragments are banded and bands commonly are contorted moderately. Many smaller fragments are dominated by cryptocrystalline K-feldspar with wispy seams and patches of sericite.

Many larger fragments have a core of hypabyssal latite dominated by equant plagioclase with minor to locally moderately abundant interstitial patches of K-feldspar and disseminated flakes of sericite.

Several fragments up to 1 mm in size are of unoriented flakes of biotite; these may be secondary after hornblende phenocrysts.

Scattered angular equant fragments up to 0.3 mm in size are of unoriented sericite/muscovite; these may be secondary after plagioclase phenocrysts.

Ilmenite forms scattered patches up to 0.1 mm in size of single grains and aggregates.

Pyrite forms scattered disseminated grains.

The matrix is dominated by equant, extremely fine grained plagioclase and slightly coarser grained patches of quartz. Scattered still coarser grained diffuse patches of quartz may be of replacement origin. If this quartz were part of the original igneous matrix, the rock would be classified as dacite rather than latite.

Sample BW-51 90.5 **Latite**
Quartz-Sericite-Biotite-(Pyrrhotite-Sphalerite) Replacement

One large patch up to a few mm across and several small ones are of extremely fine grained latite dominated by equant plagioclase with much less abundant quartz and minor coarser K-feldspar. Much of the sample is of replacement origin and is of two textural varieties. The more abundant type consists of anhedral, fine grained quartz with scattered patches dominated by sericite and lesser biotite and with disseminated patches of pyrrhotite and sphalerite, with much less abundant chalcopyrite. Garnet forms scattered grains, in part bordering sulphide patches. The other is of intergrowths of very fine grained quartz and interstitial extremely fine grained sericite and lesser patches of biotite.

mineral	**percentage**	**main grain size range (mm)**	
latite			
plagioclase	7- 8%	0.005-0.02	
quartz	1- 2	0.01-0.02	
K-feldspar	0.3	0.05-0.1	
replacement			
quartz	70-75	0.1-0.5; 0.05-0.2	
sericite	12-15	0.005-0.02	
biotite	4- 5	0.005-0.02	(a few up to 0.05 mm)
pyrrhotite	2	0.02-0.1	
sphalerite	0.7	0.03-0.1	
arsenopyrite	0.1	0.02-0.04	
garnet	minor	0.1-0.2	
muscovite	minor	0.03-0.05	
chalcopyrite	minor	0.01-0.03	
galena	trace	0.02-0.05	
bornite	trace	0.005-0.01	

One irregular patches several mm across and several much smaller patches are of latite that is dominated by equant interlocking plagioclase grains with much less abundant quartz. K-feldspar forms a few moderately coarser anhedral grains (0.1-0.2 mm). Sphalerite forms minor patches up to 0.1 mm in size.

In much of the sample, quartz forms equant, slightly interlocking anhedral grains, most of which contain 1-3% dusty to extremely fine disseminated flakes of sericite. These are intergrown with patches up to 1 mm in size that are dominated by sericite with much less abundant biotite, either disseminated in sericite or in biotite-rich patches enclosed in sericite. A few patches of sericite contain coarser grained, subradiating to radiating aggregates up to 0.1 mm in size of muscovite. A few patches up to 1.5 mm in size of quartz are relatively free of sericite inclusions and may be of later replacement origin.

Part of the sample consists of a patchy intergrowth of quartz and sericite, with much less abundant biotite. In places, intergrowths of sericite and quartz are more intimate and finer grained. Biotite commonly is concentrated in the cores of sericite-rich patches and is pleochroic from light to medium brown.

(continued on page 2)

Pyrrhotite and lesser sphalerite form disseminated patches up to 1.5 mm in size, mainly in the coarser grained replacement patches. About half the patches of sphalerite contain minor exsolution blebs of chalcopyrite. One patch of pyrrhotite contains euhedral inclusions of arsenopyrite and a few anhedral inclusions of chalcopyrite (0.01-0.02 mm). Several patches of pyrrhotite were altered in a zone 0.01 mm wide along their margins to hematite. In one patch, pyrrhotite was partly altered to secondary pyrite and chalcopyrite was replaced moderately by covellite. In the same patch, one grain of chalcopyrite contains a few lensy patches of bornite.

Arsenopyrite forms disseminated euhedral, equant grains, mainly away from sulphide patches.

One isolated sulphide patch 0.1 mm across in quartz-(sericite) is of sphalerite (containing a few inclusions of chalcopyrite) and galena.

Garnet forms a few anhedral grains bordering a few large patches of sphalerite-pyrrhotite and of pyrrhotite and a few smaller grains in quartz.

Sample BW-51 92.6 **Latite**
Replacement: Quartz-Sericite-Biotite-Sphalerite

Minor relic patches are of latite that is dominated by plagioclase with disseminated patches of biotite. Much of the sample is dominated by replacement quartz with lesser sericite and biotite and minor sphalerite and garnet. Arsenopyrite forms moderately abundant disseminated grains in both host rock and replacement patches. A discontinuous veinlet is of quartz and sphalerite with minor chalcopyrite and arsenopyrite.

mineral	percentage	main grain size range (mm)			
latite				**percentage**	**grain size**
plagioclase	3- 4%	0.02-0.03	sericite	0.1	0.005-0.01
quartz	0.3	0.03-0.05	K-feldspar	minor	0.05-0.07
biotite	0.2	0.01-0.02	arsenopyrite	minor	0.02-0.03
replacement					
quartz	80-85	0.05-0.5	arsenopyrite	0.2	0.02-0.05
sericite	7- 8	0.01-0.02	garnet	0.1	0.07-0.4
biotite	3- 4	0.01-0.02	chalcopyrite	trace	0.01-0.02
sphalerite	0.2	0.02-0.05			
veinlet					
1) quartz-sphalerite-(chalcopyrite-arsenopyrite)	0.1	0.02-0.07			

A patch of latite 2.5 mm across consists of interlocking grains of plagioclase with much less abundant interstitial grains of quartz and minor K-feldspar, and wispy patches of biotite and lesser sericite. Arsenopyrite forms disseminated euhedral equant grains and clusters of a few grains.

Much of the replacement consist of intergrowths of very fine grained quartz and interstitial patches of sericite. Some of the finer grained patches have textures similar to but slightly coarser grained than those of the host rock. Quartz also forms less common patches of coarser grains (0.2-0.5 mm) that contain dusty inclusions of sericite and semi-opaque; quartz is intergrown with minor to locally abundant patches of sericite and lesser biotite. A few sericite-rich patches contain slightly coarser grained, in part subradiating aggregates up to 0.1 mm across of muscovite. A few patches up to 1.5 mm in size are of quartz that is free of sericite inclusions and may be of later replacement origin.

Biotite is concentrated in irregular patches, mainly less than 1 mm in size, many of which are included in sericite-rich patches. One area several mm across contains abundant biotite patches. Biotite commonly is pleochroic from light to medium brown and locally is pleochroic from light to medium brownish green. .

Sphalerite occurs in irregular patches, in part enclosed in biotite. It is deep reddish brown in colour and locally semi-opaque. Some grains contain minor exsolution blebs of chalcopyrite.

Arsenopyrite forms disseminated euhedral equant grains and clusters of a few grains.

Garnet forms a few anhedral grains associated with patches of biotite. A large garnet grain contains a few inclusions of sphalerite.

A veinlet up to 0.07 mm wide is of quartz with lenses of sphalerite up to 0.7 mm long; some of the sphalerite lenses contain patches of chalcopyrite (up to 0.03 mm across) and euhedral grains of arsenopyrite (up to 0.02 mm long). Quartz in the veinlet is free of dusty inclusions.

Sample BW-53 145.3 **Heterolithic Breccia**
Replacement: Biotite-Quartz

Many fragments are of a wide variety of volcanic rock types ranging from andesite to trachyte. Several fragments are dominated by biotite and some are dominated by sericite with minor to moderately abundant biotite. A few fragments are of alteration assemblages dominated by quartz, sericite, and biotite, with locally abundant phlogopite and pyrrhotite. These are set in a groundmass of extremely fine grained latite. A large replacement patch of biotite-quartz contains a patch of biotite 1.7 mm across containing abundant ilmenite.

mineral	percentage	main grain size range (mm)
fragments		
hypabyssal latite	5- 7%	
plagioclase	4- 6	0.03-0.1
K-feldspar	1	0.1-0.2
quartz	minor	0.03-0.07
sericite	minor	0.005-0.01
biotite	4- 5	0.005-0.02
trachyte	2- 3	0.005-0.02
groundmass		
plagioclase	65-70	0.01-0.02
quartz	5- 7	0.02-0.03
sericite	1- 2	0.005-0.015
biotite	0.2	0.005-0.015
replacement		
biotite	8-10	0.02-0.05
quartz	2- 3	0.05-0.1
ilmenite	0.5	0.05-0.15
pyrrhotite	0.2	0.02-0.1
arsenopyrite	minor	0.02-0.04
chalcopyrite	trace	0.005-0.01

Hypabyssal latite fragments vary moderately in texture and composition. They are characterized by equant granular to slightly interlocking plagioclase grains (0.03-0.1 mm) that are altered slightly to disseminated flakes of sericite. Some contain 20-25% equant plagioclase grains as described above in a much finer grained groundmass of plagioclase and lesser K-feldspar, with minor sericite and biotite. Some fragments contain interstitial patches up to 0.5 mm in size of K-feldspar. A few contain minor interstitial quartz.

Biotite-rich fragments up to 1.5 mm in size are dominated by dense aggregates of biotite, with pleochroismfromlight to medium orangish brown. Some contain subhedral patches of plagioclase(?) that was altered completely to sericite. One biotite-rich patch contains moderately abundant patches of pyrrhotite and sphalerite.

One trachyte fragment 2 mm long is banded moderately with variation in grain size of K-feldspar and in abundance of quartz between different layers.

(continued)

A few fragments up to 0.6 mm across are of aggregates of a few grains of quartz (0.1-0.2 mm). A few fragments up to 0.7 mm across are of aggregates of moderately interlocking quartz (0.02-0.07 mm). Some of these also contain patches of sericite (0.005-0.01 mm).

One fragment 2.5 mm across of hypabyssal diorite consists of plagioclase with abundant patches of biotite with some interstitial graphic intergrowths of K-feldspar and quartz.

One fragment of andesite 5 mm across contains 5-7% phenocrysts of hornblende (0.7-1 mm; altered completely to biotite) in a groundmass of plagioclase (0.005-0.03 mm). One fragment of andesite 1 mm across consists of very fine grained unoriented plagioclase and 30% disseminated patches of biotite. One fragment 2.5 mm across is intermediate in texture between andesite and latite; it is dominated by interlocking plagioclase with 2-5% disseminated patches of quartz.

A few fragments up to 3.5 mm across are dominated by dense aggregates of sericite with minor to moderately abundant patches of biotite. One of these has a thin rim of quartz.

One fragment 1 mm long is a subhedral prismatic phenocryst of hornblende(?) that was replaced completely by quartz with disseminated patches of biotite and pyrrhotite, with a few inclusions of subhedral ilmenite and apatite.

One fragment 2 mm across is of sericite with 25-30% disseminated rounded grains of quartz (0.02-0.03 mm) and diffuse patches of biotite.

One slightly to moderately banded fragment 4 mm across is of replacement phlogopite-quartz-pyrrhotite-biotite. Phlogopite is pleochroic from pale to very light brownish green.

The matrix of the breccia is extremely fine grained latite dominated by plagioclase with much less abundant quartz and minor disseminated sericite and biotite. It contains scattered patches of slightly to moderately coarser grained quartz and a few of quartz-sericite; a few of these patches have subhedral to euhedral outlines suggesting that they are secondary after hornblende crystals.

Pyrrhotite forms disseminated patches, commonly in biotite-rich zones. A few patches in the matrix consist of intergrowths of pyrrhotite and anhedral to subhedral arsenopyrite.

Chalcopyrite forms a few grains associated with pyrrhotite.

Sample BW-51 133.5 **Latite Breccia**
Replacement: Pyrrhotite/Pyrite-Pyrite-Sphalerite
Veinlets: Pyrrhotite/Pyrite-Sericite-Limonite

Fragments of hypabyssal latite, sericite and sericite-(quartz), and a few alteration assemblages, dominated by quartz and sericite with lesser pyrrhotite and sphalerite, are enclosed in a groundmass of extremely fine grained latite with scattered patches of slightly coarser grained quartz. Pyrite forms disseminated grains. Sphalerite forms disseminated patches. A set of subparallel irregular braided veinlets contain lenses of pyrrhotite (altered completely to pyrite and altered further to limonite) intergrown with sericite, with wispy seams of limonite-sericite.

mineral	percentage	main grain size range (mm)
fragments		
sericite-(quartz)	17-20%	0.005-0.01 (se); 0.03-0.05 (qz)
hypabyssal latite	5- 7	0.05-0.1; 0.02-0.03
quartz-sericite-sphalerite-(tourmaline)	0.5	0.05-0.1
quartz-sericite	0.3	0.2-0.5 (qz); 0.005-0.01 (se)
matrix		
plagioclase	60-65	0.005-0.015
quartz	4- 5	0.01-0.03
replacement		
quartz	2- 3	0.05-0.1
pyrrhotite	1- 2	0.05-0.1
pyrite	0.5	0.05-0.3
sphalerite	0.2	0.1-0.5
tourmaline	trace	0.1-0.15
chalcopyrite	trace	0.02-0.05
arsenopyrite	trace	0.03-0.07
veinlets		
pyrrhotite/pyrite/limonite-sericite	3- 4	0.005-0.03

Sericite-rich fragments range from 0.1-2 mm in size and are massive. Some have a weak foliation and contain disseminated spots of leucoxene that are oriented parallel to a weak foliation. one patch contains a lensy inclusion up to 1 mm long of very fine hypabyssal latite (0.02-0.04 mm). Some sericite-rich fragments contain 2-7% disseminated equant grains of quartz (0.03-0.08 mm) and a few sericite-rich patches contain 15-25% patches and lenses of quartz (0.03-0.08 mm).

Hypabyssal latite fragments consists of slightly interlocking equant grains of plagioclase with disseminated flakes of sericite and dusty semi-opaque and subhedral to euhedral grains of arsenopyrite and pyrite. Some also contain minor equant grains of quartz (0.03-0.05 mm).

One fragment 2 mm across is of very fine hypabyssal latite dominated by equant plagioclase with 10% interstitial patches of sericite.

One fragment 2.5 mm across is of very fine grained replacement quartz with lesser patches of sericite, abundant patches of sphalerite, and minor grains of anhedral tourmaline (pleochroic from pale to medium bluish green), and trace chalcopyrite (with sphalerite) and carbonate.

One fragment is of replacement quartz (0.2-0.5 mm; with dusty inclusions of sericite and semi-opaque) and patches of sericite (0.005-0.01 mm)

(continued on page 2)

The breccia matrix is of extremely fine grained latite consisting of equant pyrite with minor, commonly slightly coarser grained disseminated patches of quartz.

Quartz forms scattered replacement patches up to 0.5 mm in size.

Pyrite forms disseminated subhedral to euhedral grains and clusters of a few to several grains, a few of which contain minor inclusions of galena (0.01-0.03 mm). Some of these contain interstitial patches of sphalerite and chalcopyrite.

Sphalerite forms disseminated irregular patches along and with pyrrhotite and pyrite.

Chalcopyrite forms minor patches, mainly associated with sphalerite.

Arsenopyrite forms scattered euhedral to subhedral grains.

A series of subparallel braided veinlets up to 0.5 mm wide contain patches up to 2 mm long of pyrrhotite that was altered completely to pyrite and later replaced partly along borders of patches by limonite. The veinlets also contain lenses of sericite that commonly is stained yellow-brown by limonite.

Sample BW-59 247.3 Latite Flow
Replacement: Pyrrhotite/Pyrite-Arsenopyrite-Muscovite/Sericite-(Chalcopyrite)
Veinlets: Carbonate; Limonite

The latite flow contains minor small phenocrysts of plagioclase (altered completely to sericite) in a groundmass of plagioclase with much less abundant sericite and scattered grains and patches of quartz. A few fragments are of hypabyssal latite and of sericite-plagioclase-quartz. Abundant commonly elongated disseminated patches are of pyrrhotite (altered completely to marcasite) with much less abundant arsenopyrite, carbonate, and chalcopyrite. A few veinlets are of carbonate (probably ankerite). A few late veinlets are of limonite.

mineral	percentage	main grain size range (mm)
phenocrysts		
plagioclase	0.1%	0.2-0.3
quartz	0.1	0.1-0.35
fragments		
hypabyssal latite	1	0.02-0.05
sericite-plagioclase-quartz	1	0.005-0.01 (se); 0.02-0.03 (pl, qz)
groundmass		
plagioclase	80-85%	0.015-0.03
sericite	5- 7	0.01-0.015
quartz	2- 3	0.02-0.05
amygdules		
sericite-quartz	0.3	0.005-0.01 (se); 0.01-0.03 (qz)
replacement		
pyrrhotite/pyrite	4- 5	0.03-0.05
carbonate	0.7	0.02-0.05
arsenopyrite	0.3	0.05-0.1 (a few up to 0.15 mm)
muscovite/sericite	minor	0.02-0.05
chalcopyrite	minor	0.03-0.07
veinlets		
1) carbonate	0.5	0.01-0.02
2) limonite	0.3	cryptocrystalline-0.01

Plagioclase forms scattered equant phenocrysts that were replaced completely by sericite or sericite/muscovite.

Quartz forms a few equant anhedral phenocrysts.

Hornblende(?) forms a few stubby prismatic phenocrysts that were altered completely to quartz and dusty semi-opaque.

A fragment 1.7 mm across of slightly coarser grained hypabyssal latite is dominated by equant plagioclase (0.01-0.05 mm) with minor sericite. It is rimmed by several elongate patches of pyrrhotite (altered to pyrite with minor dusty non-opaque inclusions) and minor arsenopyrite and chalcopyrite.

A fragment of altered latite 2 x 1 mm in size consist of sericite with lesser equant plagioclase and quartz (0.02-0.03 mm).

(continued on page 2)

A diffuse fragment 1 mm across of slightly coarser grained plagioclase and quartz with minor sericite contains a euhedral phenocryst 0.3 mm across of hornblende (altered completely to quartz and Ti-oxide with minor marcasite and chalcopyrite).

The groundmass is dominated by equant plagioclase with interstitial selvages and patches of sericite. Quartz forms disseminated, commonly slightly coarser grained patches, in part of replacement origin.

Scattered amygdules(?) up to 0.3 mm in size are dominated by a broad core of sericite and a thin rim of quartz.

Commonly elongate replacement patches up to 2 mm long are dominated by pyrrhotite (altered completely to marcasite with minor to locally moderately abundant dusty non-reflective inclusions).

Arsenopyrite forms disseminated euhedral grains and clusters of a few to several grains, mainly associated with elongated patches of pyrrhotite/pyrite.

Chalcopyrite forms disseminated grains associated with pyrrhotite/pyrite patches.

Carbonate forms patches up to 0.5 mm in size, commonly intergrown with chalcopyrite. Carbonate has moderately high relief and may be ankerite.

Muscovite/sericite forms scattered flakes and patches, mainly bordering sulphide patches.

A few irregular veinlets mainly from 0.03-0.07 mm wide and locally up to 0.2 mm wide are of carbonate (probably ankerite).

A few irregular veinlets up to 0.1 mm wide and diffuse patches are of light to dark orange-brown limonite.

Sample BW-59 247.4 Latite Tuff
Replacement: Pyrrhotite/Marcasite-Carbonate-Arsenopyrite-Quartz
Veinlets: Carbonate; Limonite

Numerous fragments of sericite (probably after plagioclase) and lesser ones of aphanitic latite are set in a slightly foliated groundmass of plagioclase with lesser sericite and minor quartz. Pyrrhotite (altered completely to marcasite forms moderately abundant, commonly elongated patches, with associated patches of high-relief carbonate and minor chalcopyrite and arsenopyrite. Veinlets are of carbonate. A few late veinlets are of limonite.

mineral	percentage	main grain size range (mm)
fragments		
sericite	7- 8%	0.01-0.015
latite	3- 4	0.005-0.01
phenocrysts		
plagioclase	1- 2	0.2-0.4
quartz	minor	0.3-0.5
groundmass		
plagioclase	65-70	0.003-0.015
sericite	10-12	0.003-0.015
quartz	2- 3	0.01-0.03
replacement		
pyrrhotite/marcasite	4- 5	0.01-0.02
carbonate	0.7	0.02-0.04
quartz	0.3	0.05-0.1
arsenopyrite	0.1	0.05-0.2
chalcopyrite	minor	0.01-0.03
pyrrhotite	trace	0.02-0.05
veinlets		
1) carbonate	1- 2	0.005-0.02
2) limonite	0.3	cryptocrystalline

Fragments of aphanitic latite are mainly from 0.5-1 mm in size with a few up to a few mm across. They contain minor phenocrysts of plagioclase up to 0.2 mm in size that were altered completely to sericite. These are set in a groundmass of cryptocrystalline to extremely fine grained plagioclase with minor patches of sericite and of quartz, mainly less than 0.1 mm in size.

Sericite-rich fragments from 0.2-1 mm in size range from angular and sharply defined to rounded and somewhat diffuse. The former may represent altered plagioclase phenocrysts.

One fragment 1.7 mm across is of hypabyssal latite that consists of plagioclase (0.02-0.03 mm) with moderately abundant sericite and high-relief carbonate.

A few fragments are of replacement quartz (0.1-0.2 mm) and patches of sericite (0.01-0.015 mm). One of these contains a large patch of high-relief carbonate and minor disseminated marcasite (after pyrrhotite).

A few fragments up to 1 mm in size are of replacement quartz, carbonate, and sericite.

Quartz forms an anhedral phenocryst.

(continued)

The groundmass of the rock is aphanitic latite dominated by plagioclase with much less abundant sericite and patches of quartz. In places the groundmass has a weak foliation defined by orientation of wispy sericite seams.

Elongate replacement patches are dominated by pyrrhotite (altered completely to marcasite) with lesser high-relief carbonate and quartz.

Arsenopyrite forms disseminated euhedral grains and clusters of a few grains. Some of the large arsenopyrite grains contain a few inclusions up to 0.03 mm in size of pyrrhotite and minor chalcopyrite.

Chalcopyrite forms irregular patches, mainly within patches of high-relief carbonate. One patch of carbonate contains a few lenses of fresh pyrrhotite.

A few replacement patches are dominated by quartz with lesser patches of marcasite-carbonate and minor disseminated sericite.

A few irregular veinlets up to 0.3 mm wide are of carbonate.

A few wispy seams up to 0.07 mm wide are of limonite.

List of Photographs

Photo	Section	Description
01	BW-42 71.5	to the right: fragment of hypabyssal latite dominated by interlocking plagioclase grains with disseminated opaque (ilmenite?), a few patches of quartz and of sericite, and a few subhedral to euhedral grains of apatite; lower left: large plagioclase phenocryst (altered completely to sericite); groundmass of extremely fine grained plagioclase with lesser quartz and sericite; minor replacement patches of quartz and of high-relief carbonate, the latter containing minor pyrite.
02	BW-42 71.5	to the left: hypabyssal latite dominated by plagioclase with minor sericite and dusty opaque; in the middle: irregular replacement patch dominated by sphalerite with much less abundant chalcopyrite, pyrite, and quartz; to the right: groundmass plagioclase with lesser quartz and sericite and a few anhedral sericite-rich patches of uncertain origin.
03	BW-42 71.5	groundmass of plagioclase with much less abundant quartz and minor patches of sericite; a few larger patches of sericite of uncertain origin, and one fragment of silicified hypabyssal latite dominated by quartz with lesser sericite; irregular veinlet of pyrite with minor high-relief carbonate.
04	BW-42 71.5	inclusion of light yellow electrum in pyrite that also contains patches of quartz or high-relief carbonate.
05	BW-42 95.1	irregular fragments of sericite, biotite, tremolite/actinolite and (in the lower right corner) quartz-sericite in a groundmass of plagioclase with much less abundant quartz and minor sericite and biotite; replacement patches of sphalerite and of pyrrhotite (altered moderately to strongly to hematite); the latter occurs mainly in patches of biotite-tremolite/actinolite.
06	BW-42 95.1	upper left: replacement patch of quartz with large patch of ilmenite-biotite and disseminated patches of sericite-biotite, and subhedral to euhedral grains of apatite (mainly adjacent to ilmenite-biotite patch); to the right: andesite groundmass: plagioclase with minor quartz, biotite, and sericite, with replacement patch of quartz and (at top) replacement patch of sphalerite.
07	BW-42 95.1	to the left: groundmass of plagioclase with much less abundant quartz, biotite, and sericite, with ragged fragments of biotite, of sericite-biotite, and minor ones of sericite; minor disseminated sphalerite; to the right: fragment of andesite/latite containing phenocrysts of plagioclase (altered completely to sericite-biotite-(quartz) in a groundmass of equant plagioclase with minor interstitial biotite and sericite, and a few grains of apatite; minor replacement patches of quartz.

List of Photographs

Photo	Section	Description
08	BW-42 101.8	phenocryst of plagioclase (altered slightly to sericite) and of hornblende (altered completely to tremolite/actinolite and dusty opaque along its margins) in a groundmass dominated by plagioclase with much less abundant sericite and with disseminated patches of sphalerite and minor pyrite.
09	BW-42 101.8	two phenocrysts of K-feldspar (altered slightly to biotite) and one of plagioclase or hornblende (altered completely to sericite-ilmenite) in a groundmass of biotite with lesser plagioclase, quartz, and sericite, with a few patches of ilmenite.
10	BW-42 101.8	to the left: andesite/latite: plagioclase with much less abundant sericite and quartz with replacement patches of sphalerite and much less abundant biotite; to the right: breccia matrix: biotite-plagioclase-sericite-quartz with minor sphalerite.
11	BW-42 148.2	patches (fragments?) of intergrowths of sericite and plagioclase and a smaller patch dominated by similar plagioclase with an interstitial patch of much finer grained plagioclase (altered slightly to sericite and dusty opaque).
12	BW-42 148.2	to the left: sericite-rich patch with disseminated equant grains of plagioclase; to the right: finer grained slightly interlocking plagioclase with minor quartz; replacement patches of sphalerite with minor clusters of inclusions of pyrrhotite and of chalcopyrite, and a few grains of quartz.
13	BW-42 148.2	intergrowth of plagioclase with interstitial sericite; with plagioclase grain size grading from finer grained in the centre to coarser grained to the left and to the right; cut by a strongly braided veinlet of extremely fine grained pyrite with an elongated texture parallel to the length of the strands of the veinlet.
14	BW-42 210.9	phenocrysts of K-feldspar (?; replaced partly by intergrowths of quartz and clinozoisite) in a groundmass of plagioclase with minor disseminated clinozoisite and ilmenite; replacement patch of quartz-K-feldspar-carbonate-pyrrhotite-pyrite (probably after marcasite) and an adjacent patch with an outer zone dominated by chlorite with minor disseminated clinozoisite/epidote and an inner zone dominated by quartz and pyrrhotite.
15	BW-42 210.9	ragged K-feldspar(?) phenocryst in a groundmass of interlocking plagioclase with disseminated granular grains of clinozoisite; replacement patch of chlorite-clinozoisite-calcite with disseminated grains of pyrrhotite.
16	BW-42 210.9	subhedral to euhedral K-feldspar(?) phenocrysts (altered completely to quartz and clinozoisite/epidote) in a groundmass dominated by plagioclase with much less abundant clinozoisite and chlorite; the main replacement patches are of pyrrhotite, quartz, and pyrite (probably after marcasite), with minor chalcopyrite and trace sphalerite; one replacement patch is of chlorite.

List of Photographs

Photo	Section	Description
17	BW-42 222.2	plagioclase phenocrysts (altered moderately to sericite/biotite with lesser cryptocrystalline clinozoisite and chlorite) in a groundmass of plagioclase with much less abundant disseminated quartz, biotite/sericite, and ilmenite; with a few patches of quartz and a few of chlorite.
18	BW-42 222.2	cluster of hornblende phenocrysts (altered completely to quartz-chlorite-calcite-biotite-clinozoisite-[ilmenite-pyrrhotite]) and one plagioclase phenocryst (altered moderately to sericite/biotite) in a groundmass dominated by plagioclase (altered slightly to moderately to sericite/biotite) with much less abundant quartz and minor disseminated ilmenite.
19	BW-42 222.2	small plagioclase phenocryst (altered slightly to moderately to sericite/biotite) in a groundmass dominated by plagioclase with lesser sericite-biotite and quartz and minor patches of each of sericite, clinozoisite, and high-relief carbonate; replacement patch of quartz-calcite-marcasite-pyrrhotite-(chlorite); veinlet of calcite with envelope of calcite.
20	BW-42 248.35	phenocrysts of plagioclase (altered slightly to moderately to biotite) and phenocrysts of hornblende (altered completely to biotite-calcite-ilmenite-Mineral X) in a groundmass dominated by plagioclase with much less abundant biotite and quartz, and disseminated subhedral grains of apatite; minor replacement patches of K-feldspar-pyrrhotite bordering one hornblende phenocryst.
21	BW-42 248.35	plagioclase phenocrysts (altered moderately to biotite/sericite) and patches of biotite-Mineral X (after hornblende) in a groundmass of plagioclase-(biotite) with disseminated patches of ilmenite; replacement patches and veinlets of pyrrhotite-K-feldspar-calcite.
22	BW-44 85.1	fragments of latite tuff composed of sericite, plagioclase, and K-feldspar in a groundmass of plagioclase with much less abundant K-feldspar and minor sericite; replacement patch of sphalerite with minor exsolution blebs of chalcopyrite.
23	BW-44 85.1	upper left: matrix of breccia: plagioclase with lesser sericite and minor K-feldspar; lower right: large fragment dominated by sericite with lesser plagioclase and K-feldspar; replacement patches of sphalerite-quartz and of pyrite (with dusty inclusions).
24	BW-44 85.1	to the right: large zoned fragment of latite/dacite tuff mainly dominated by extremely fine grained K-feldspar with much less abundant plagioclase and sericite, and with irregular patches that have an outer zone of plagioclase-sericite and cores of quartz; to the left: matrix dominated by plagioclase with much less abundant sericite and K-feldspar.

List of Photographs

Photo	Section	Description
25	BW-44 95.2	to the left: fragment dominated by cryptocrystalline K-feldspar with a zone of plagioclase-sericite along one margin; to the right: fragment of K-feldspar-plagioclase-sericite; in the centre: matrix of extremely fine grained latite dominated by plagioclase with much less abundant K-feldspar, sericite, and quartz (with two small fragments of K-feldspar-sericite); replacement patches and veinlet of marcasite (probably secondary after pyrrhotite).
26	BW-44 95.2	fragment dominated by cryptocrystalline K-feldspar with replacement patches of sphalerite (with exsolution blebs of chalcopyrite) and of pyrite (secondary after pyrrhotite), and minor replacement patches of quartz.
27	BW-44 95.2	flow banded K-feldspar with minor disseminated sericite; veinlets and minor patches of quartz; replacement patches of pyrite (altered moderately to strongly to non-reflective hematite).
28	BW-44 146.1	phenocrysts of plagioclase (altered completely to sericite/muscovite) in a groundmass of extremely fine grained plagioclase with disseminated sericite; euhedral grain of pyrite; wispy veinlet of jarosite.
29	BW-44 146.1	banded rock: finer grained plagioclase-(sericite) above and coarser grained equant plagioclase below with interstitial patches of sericite and a few quartz grains along the sharp contact; to the right: in the finer grained band is a coarse grain of pyrite with a few inclusions of sphalerite; it is bordered by muscovite flakes and a patch of sphalerite; in the coarser grained band is an irregular patch of pyrite with dusty inclusions, suggesting that it was formed by replacement of pyrrhotite.
30	BW-44 146.1	cluster of pyrite grains containing abundant inclusions of galena, and sphalerite and minor ones of two or more of sphalerite, chalcopyrite, pyrrhotite, and galena; one inclusion of medium yellow native gold; surrounded y plagioclase with lesser sericite, with several grains of muscovite along the margins of the sulphide patch.
31	BW-44 146.1	close-up photo of native gold grain in Photo 30.
32	BW-46 51	equant plagioclase with interstitial sericite; replacement patch of sphalerite (with minor exsolution blebs of chalcopyrite) and lesser pyrite; surrounding the replacement patch is a halo containing moderately abundant limonite along sericite selvages between plagioclase grains.

List of Photographs

Photo	Section	Description
33	BW-46 51	equant plagioclase with interstitial sericite and wispy seams of limonite; replacement patches of sulphides: the main patch consists of sphalerite (with minor exsolution blebs of chalcopyrite) and pyrite with a few elongate flakes of muscovite; the large cavity associated with this patch and the smaller elongate cavities to the left with minor limonite/hematite along their margins are interpreted as having been formed by removal of limonite/hematite formed by replacement of pyrite (which in some cases may have been secondary after pyrrhotite).
34	BW-50 10.9	coarse grains of hornblende (altered completely to biotite; with an inclusion of apatite) and of plagioclase (altered slightly to moderately to biotite) with finer grained aggregates of plagioclase, K-feldspar, quartz, and biotite; a few patches of chlorite, one of which contains a few grains of chalcopyrite), and a patch of calcite.
35	BW-50 10.9	plagioclase (altered slightly to moderately to biotite) and much less abundant hornblende (altered completely to biotite) with interstitial patches of graphic intergrowths of quartz and K-feldspar, two patches of calcite, and disseminated grains and patches of ilmenite.
36	BW-50 26.5	two large fragments and many smaller ones of foliated rhyolite/trachyte pumice consisting of K-feldspar-sericite-(clinozoisite?) with lensy patches of quartz parallel to foliation; groundmass is latite consisting of plagioclase with lesser K-feldspar and quartz with a few patches of slightly coarser grained quartz.
37	BW-50 26.5	fragments of trachyte/rhyolite pumice composed of K-feldspar with lesser sericite-clinozoisite(?) lenses and minor lenses of quartz, and one fragment of K-feldspar-sericite-(clinozoisite?) with no quartz in a groundmass of equant plagioclase with lesser K-feldspar and minor quartz.
38	BW-50 28.7	fragments of trachyte/rhyolite: slightly to moderately banded K-feldspar and sericite-(clinozoisite?) with minor disseminated grains of quartz and a coarser replacement patch of quartz; one fragment of sericite/muscovite (probably after a plagioclase phenocryst); matrix of extremely fine grained plagioclase with much less abundant quartz and K-feldspar.
39	BW-50 28.7	large fragment of sericite/muscovite-quartz; smaller fragment of rhyolite (K-feldspar-sericite-quartz-[clinozoisite?]0, and smaller, in part wispy fragments of sericite-K-feldspar-(clinozoisite?); a few small fragments of K-feldspar phenocrysts; matrix of plagioclase with much less abundant quartz and K-feldspar.

List of Photographs

Photo	Section	Description
40	BW-50 28.7	large fragment of latite dominated by equant plagioclase with patches of coarser grained K-feldspar and others of K-feldspar-sericite-(clinozoisite?), with minor disseminated quartz; matrix is of extremely fine grained plagioclase with much less abundant quartz and K-feldspar; it contains several small fragments of K-feldspar-sericite-(clinozoisite?) and a small one of sericite.
41	BW-50 90.4	fragment of andesite/latite: phenocrysts of plagioclase (altered completely to sericite-biotite) and a large phenocryst of hornblende (altered completely to quartz with minor inclusions of apatite and patches of ilmenite and of pyrrhotite); groundmass of plagioclase with minor sericite and a few patches of quartz.
42	BW-50 90.4	fragment of rhyolite dominated by K-feldspar with much less abundant patches of biotite and of sericite and disseminated grains of quartz; replacement patch of biotite-sphalerite-(quartz-K-feldspar-pyrrhotite); veinlet of quartz.
43	BW-50 90.4	upper left (much of photo): breccia: large fragment of quartz-biotite replacement and small fragment of hypabyssal latite (plagioclase-[sericite]) in a groundmass of extremely fine grained plagioclase with much less abundant quartz and scattered patches of biotite; lower right: replacement zone consisting mainly of biotite with lesser sericite and minor quartz.
44	BW-50 90.4	replacement zone: sericite with patches of quartz (some with subhedral outlines and a few with minor inclusions of apatite, suggesting that they may be secondary after hornblende) and of biotite; sphalerite patch intergrown with a coarser grained patch of biotite; minor clusters of ilmenite with two small biotite patches; a grain of chalcopyrite and one of sphalerite in one patch of quartz.
45	BW-50 95.2	contorted banded fragments of K-feldspar with wispy seams of sericite and minor biotite; at lower right the fragment has a core of equant plagioclase with interstitial K-feldspar and minor sericite; the breccia matrix is of extremely fine grained plagioclase and lesser, commonly slightly coarser grained quartz.
46	BW-50 95.2	strongly contorted banded trachyte flow? with bands of K-feldspar, of K-feldspar-sericite, and minor ones of K-feldspar-quartz; a lens in the core of the fragment of plagioclase-K-feldspar, two biotite-rich patches, and minor interstitial patches of plagioclase-quartz-K-feldspar.
47	BW-50 95.2	fragment of zoned trachyte/latite, with core of equant plagioclase and lesser sericite and rim dominated by K-feldspar with lesser sericite and local patches

containing plagioclase; minor ilmenite in each zone; matrix is latite dominated by plagioclase with lesser quartz and with patches of slightly coarser grained quartz which may be secondary in origin.

List of Photographs

Photo	Section	Description
48	BW-51 90.5	below: host rock fragment: plagioclase with much less abundant quartz; a coarser K-feldspar grain bordering the replacement zone; above: replacement zone of quartz with lesser sericite and biotite, minor muscovite, and one euhedral grain of arsenopyrite.
49	BW-51 90.5	patch of sulphides: pyrrhotite (altered partly to hematite and locally to secondary pyrite) and sphalerite (in places intergrown with Mineral X), minor chalcopyrite (in part altered moderately to strongly to covellite, and locally intergrown with minor bornite), and one euhedral grain of arsenopyrite; surrounded by sericite and lesser quartz.
50	BW-51 90.5	cluster of pyrrhotite and sphalerite (with minor exsolution blebs of chalcopyrite) and an anhedral grain of garnet? enclosed in a groundmass of fine grained quartz with patches of sericite and minor biotite.
51	BW-51 92.6	to the left: latite dominated by plagioclase with lesser biotite and sericite and with disseminated patches of quartz and a few disseminated euhedral grains of arsenopyrite; to the right: replacement of quartz and sericite with lesser biotite.
52	BW-51 92.6	replacement: fine grained quartz (with dusty inclusions of sericite and semi-opaque?) with patches of biotite and smaller ones of sericite; cut by veinlet of quartz-sphalerite; quartz in the veinlet is free of dusty inclusions.
53	BW-51 92.6	mafic cluster: garnet, biotite, and sphalerite intergrown with quartz and minor sericite, surrounded by coarser grained quartz with patches of biotite and of sericite and a few euhedral grains of arsenopyrite.
54	BW-53 145.3	fragment of hypabyssal latite dominated by equant plagioclase with lesser sericite and minor interstitial K-feldspar; biotite-rich fragments with minor sericite and pyrrhotite; in a matrix of latite consisting of extremely fine grained plagioclase and much less abundant quartz with minor patches of coarser grained quartz and quartz-sericite, whose subhedral outlines suggest that they may be secondary after hornblende crystals.
55	BW-53 145.3	top left: matrix of plagioclase with much less abundant quartz, with small fragments of biotite surrounded by quartz and of biotite/phlogopite; lower left: trachyte fragment dominated by oriented K-feldspar with minor patches of phlogopite and disseminated sericite; to the right: moderately banded fragment of phlogopite-quartz-biotite-pyrrhotite.

List of Photographs

Photo	Section	Description
56	BW-53 145.3	andesite fragment containing hornblende phenocrysts (altered completely to biotite with local patches of quartz or pyrrhotite) in a groundmass of plagioclase with minor sericite and/or biotite; small fragment of biotite; matrix of latite composed of plagioclase and minor quartz with scattered patches of coarser grained quartz, a few of which have subhedral outlines suggesting that they may be secondary after hornblende.
57	BW-53 145.3	to the left: groundmass of plagioclase with minor sericite and biotite (mainly near the biotite-rich patch) with a few small inclusions of latite (plagioclase aggregates) and scattered small patches of quartz; top centre: patch of biotite-ilmenite with minor sericite; to the right: replacement patch of biotite-quartz with a few acicular to prismatic apatite grains in some patches of quartz.
58	BW-57 133.5	upper left: fragment of hypabyssal latite dominated by plagioclase with minor disseminated sericite, a few grains of quartz and a few grains of pyrite and pyrrhotite (altered to pyrite); lower right: latite matrix dominated by plagioclase with minor slightly coarser grained quartz and one small fragment of sericite-quartz; replacement patch of pyrite with lesser pyrrhotite (altered completely to slightly dusty pyrite) with interstitial patches and inclusions of chalcopyrite and sphalerite and minor interstitial biotite.
59	BW-57 133.5	to the left: latite matrix of plagioclase and much less abundant quartz with fragments of sericite and plagioclase-sericite; to the right: fragment of replacement quartz-sericite-sphalerite with a grain of tourmaline and minor chalcopyrite (associated with sphalerite).
60	BW-57 133.5	fragments of quartz-sericite replacement and of sericite-(quartz) in a matrix of latite consisting of extremely fine grained plagioclase and lesser, commonly slightly coarser grained quartz; fractured replacement grain of pyrite; braided veinlet of pyrrhotite (altered completely to pyrite and then altered partly to limonite) with lesser sericite (commonly stained yellow-brown by limonite. pyrite.
61	BW-59 247.3	fragment of hypabyssal latite dominated by plagioclase with only minor sericite enclosed in groundmass of finer grained latite consisting of plagioclase-(sericite-quartz); replacement patches of marcasite with minor chalcopyrite-carbonate occur mainly along the border of the fragment.
62	BW-59 247.3	plagioclase phenocryst (altered completely to sericite) in a groundmass of plagioclase-(sericite) with a few disseminated grains and patches of quartz and patches of sericite (possibly also secondary after plagioclase); fragment of plagioclase-quartz-(sericite) with a euhedral phenocryst of hornblende (altered completely to quartz-Ti-oxide with minor marcasite and chalcopyrite); elongate patches of marcasite (after pyrrhotite), and a replacement patch of

quartz.

List of Photographs

Photo	Section	Description
63	BW-59 247.3	lensy patch of carbonate containing abundant patches of chalcopyrite and lesser ones of marcasite and arsenopyrite; surrounded by plagioclase-(sericite).
64	BW-59 247.3	plagioclase-(sericite) intergrowth containing patches of marcasite (after pyrrhotite), irregular veinlets of carbonate, and a wispy seam of limonite.
65	BW-59 247.3	groundmass of plagioclase with much less abundant sericite and quartz containing a patch of quartz-carbonate-arsenopyrite-(pyrrhotite-chalcopyrite), a fragment of very fine grained hypabyssal latite, a patch of sericite-quartz-carbonate, and a patch of sericite (possibly after a plagioclase phenocryst). .
66	BW-59 247.4	fragment of latite (plagioclase-sericite) and hypabyssal latite (plagioclase-[sericite]) in a groundmass of aphanitic plagioclase with minor sericite and quartz; elongate replacement patches of pyrrhotite (altered completely to marcasite)-quartz; veinlet of high-relief carbonate; open fracture with moderate yellow-orange stain of limonite along its margins.
67	BW-59 247.4	fragments of sericite (probably secondary after plagioclase phenocrysts) in a groundmass of aphanitic plagioclase with much less abundant sericite and quartz; replacement patches of pyrrhotite altered completely to marcasite) and one euhedral grain of arsenopyrite; veinlet of carbonate; along carbonate veinlet is an open fracture rimmed by a light yellow limonite stain.

John G. Payne, Ph.D., P.Geol.
Tel: (604)-597-1080
Fax: (604)-597-1080 (call first)
email: jgpayne@telus.net

List of Figures - Report 110056:

Figure N.	*Sample ID*			*Lithology*
1	BW	59	560.3	Kaolinite-quartz-albite-white mica, matrix supported, volcanic sandstone
2	BW	64	220.5	White mica-quartz altered rock and pyrite-quartz-sphalerite-chalcopyrite-dolomite-tourmaline-galena vein
3	BW	66	262.6	Quartz-clay-white mica altered rock and quartz-pyrite-tourmaline vein
4	BW	68	202.5	Clay altered rock and quartz-chalcopyrite-pyrite-pyrrhotite-white mica-hematite vein
5	BW	68	407.0	Chlorite-quartz-white mica-garnet-pyrite-pyrrhotite-chalcopyrite and tourmaline altered rock
6	BW	72	161.3	Quartz-sericite, laminated, volcanic mudstone and hydraulic breccia
7	BW	77	125.8	Pyrite-chalcopyrite, volcanic breccia
8	BW	77	281.0	Quartz-oxides, volcanic mudstone and arsenopyrite-pyrrhotite-quartz-chlorite vein
9	BW	77	435.5	Flow banded lava, quartz-garnet-tourmaline-chalcopyrite vein and quartz-pyrite-clino-zoisite veinlet
10	BW	82	213.2	Albite-quartz-white mica altered lava and quartz pyrite-chalcopyrite-sphalerite-pyrrhotite-tourmaline vein
11	BW	86	37.3	Quartz-white mica-pyrite, poorly sorted, polymict, volcanic lithic-breccia
12	BW	86	50.3	Quartz-pyrrhotite-sphalerite-chlorite-white mica, poorly sorted, polymict, volcanic lithic-breccia
13	BW	86	189.8	Biotite-chlorite-white mica-quartz-pyrrhotite-chalcopyrite-sphalerite, andesite(?).
14	BW	96	198.5	Albite-quartz-white mica-pyrite-galena, flow banded lava
15	BW	98	69.8	Quartz-white mica-pyrrhotite-biotite, poorly sorted, polymict, volcanic lithic-breccia
16	BW	98	79.7	Quartz-white mica-pyrrhotite, poorly sorted, polymict, volcanic lithic-breccia
17	BW	98	138.1	Quartz-white mica-garnet schist and quartz-pyrrhotite-biotite-chalcopyrite vein/breccia
18	BW	98	149.5	Quartz-white mica-pyrrhotite-dolomite-chalcopyrite altered rock
19	BW	100	222.8	Quartz (and clay?), volcanic(?) mudstone
20	BW	100	270.2	Pyrrhotite, clast supported, poorly sorted, volcanic lithic breccia
21	BW	104	91.0	Porphyritic andesite

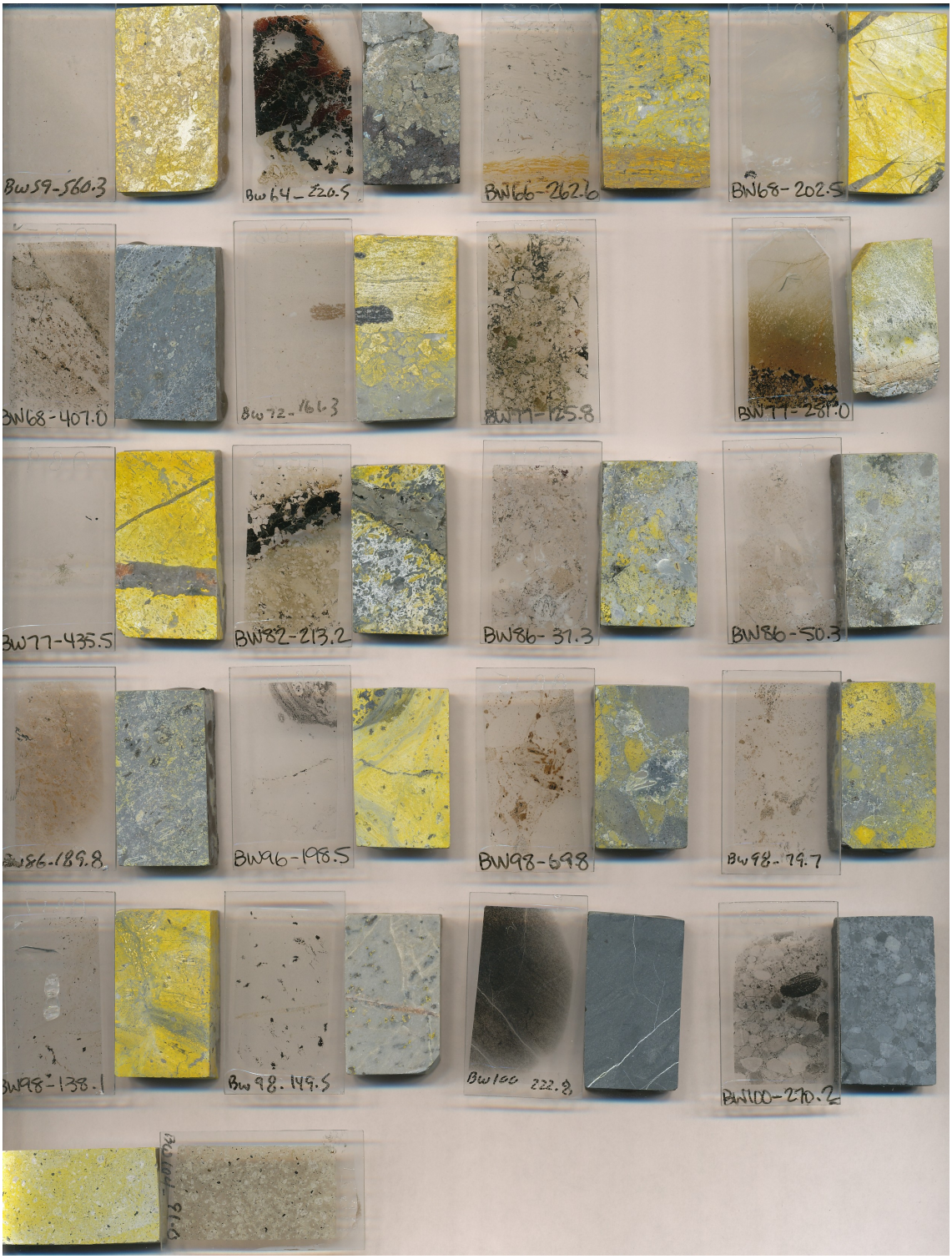


Figure 0: Offcuts and polished thin sections.

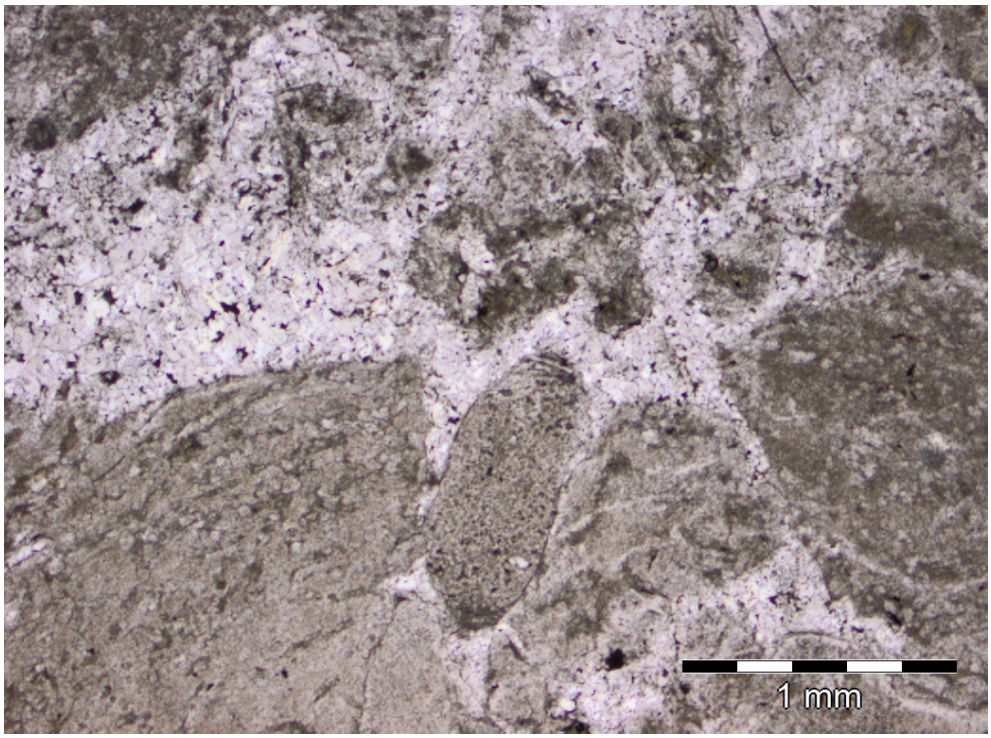


Figure 1: BW 59 560.3 - Kaolinite-quartz-albite-white mica, matrix supported, volcanic sandstone. Photomicrograph showing sub-angular fragments (lower part of the figure), completely substituted by very fine-grained clay and immersed in a fine-grained matrix made up of inequigranular-interlobate quartz and very fine-grained clay. Plane polarized transmitted light.

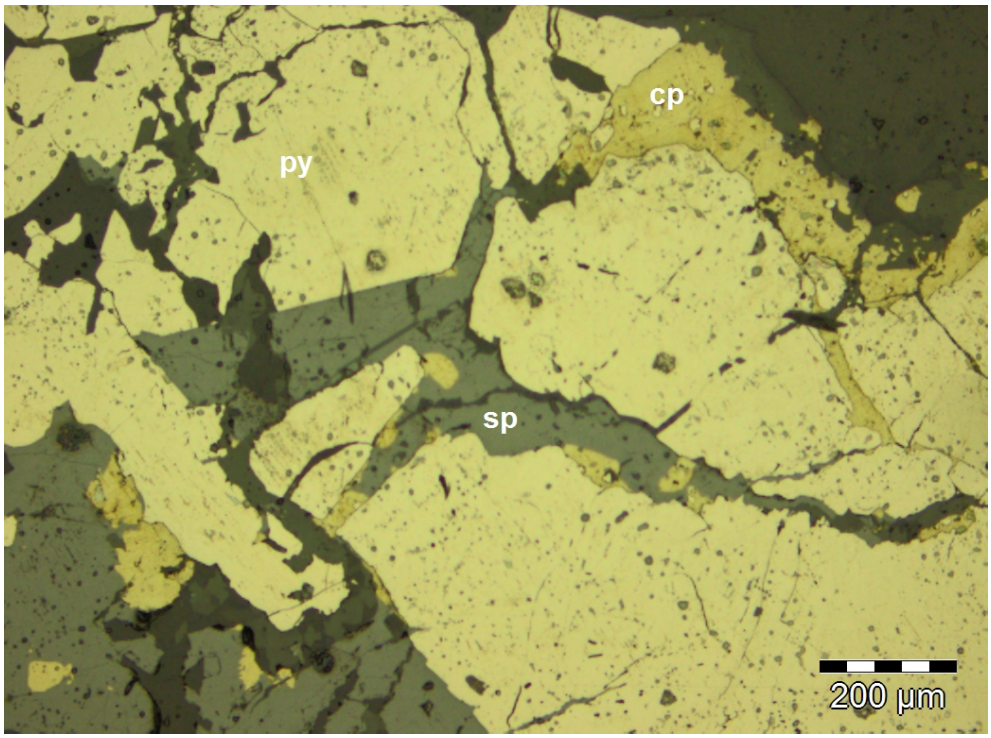


Figure 2: BW 64 220.5 - White mica-quartz altered rock and pyrite-quartz-sphalerite-chalcopyrite-dolomite-tourmaline-galena vein. Photomicrograph showing fractured pyrite (py) and the fractures infilled by sphalerite (sp) and chalcopyrite (cp). Plane polarized reflected light.

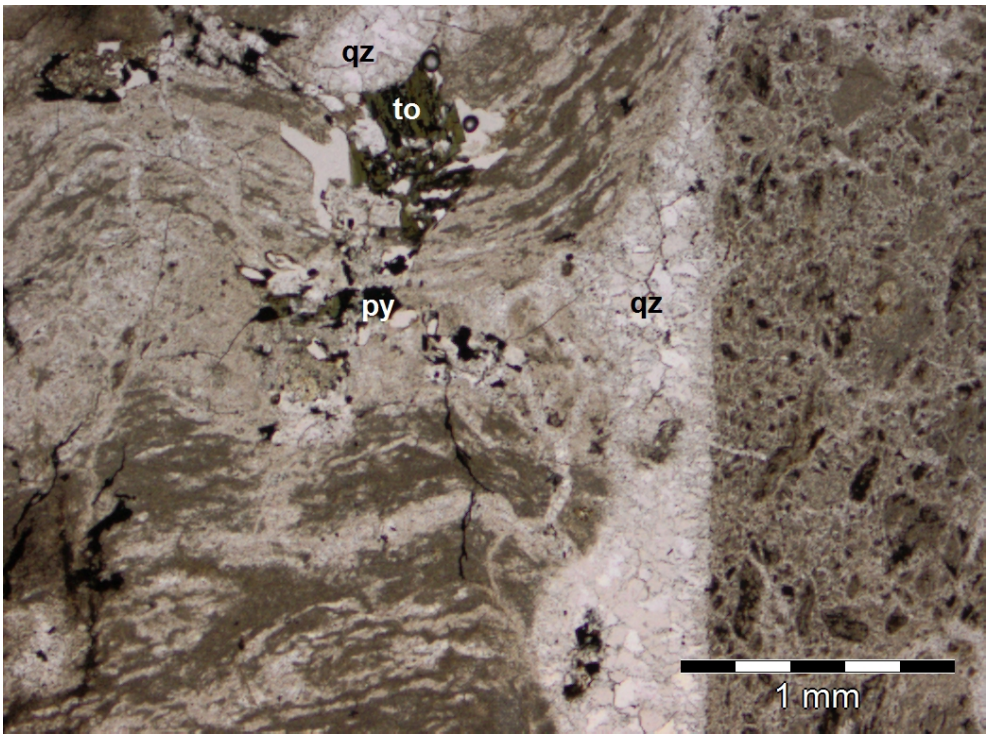


Figure 3: BW 66 262.6 - Quartz-clay-white mica altered rock and quartz-pyrite-tourmaline vein. Photomicrograph showing a well-defined layering within a fragmented rock (left of the figure). The layering is given by alternating domains composed of clay and thin layers of quartz. The rock fragments are infilled, overprinted and partially substituted by quartz (qz), tourmaline (to) and pyrite (py). Plane polarized transmitted light.

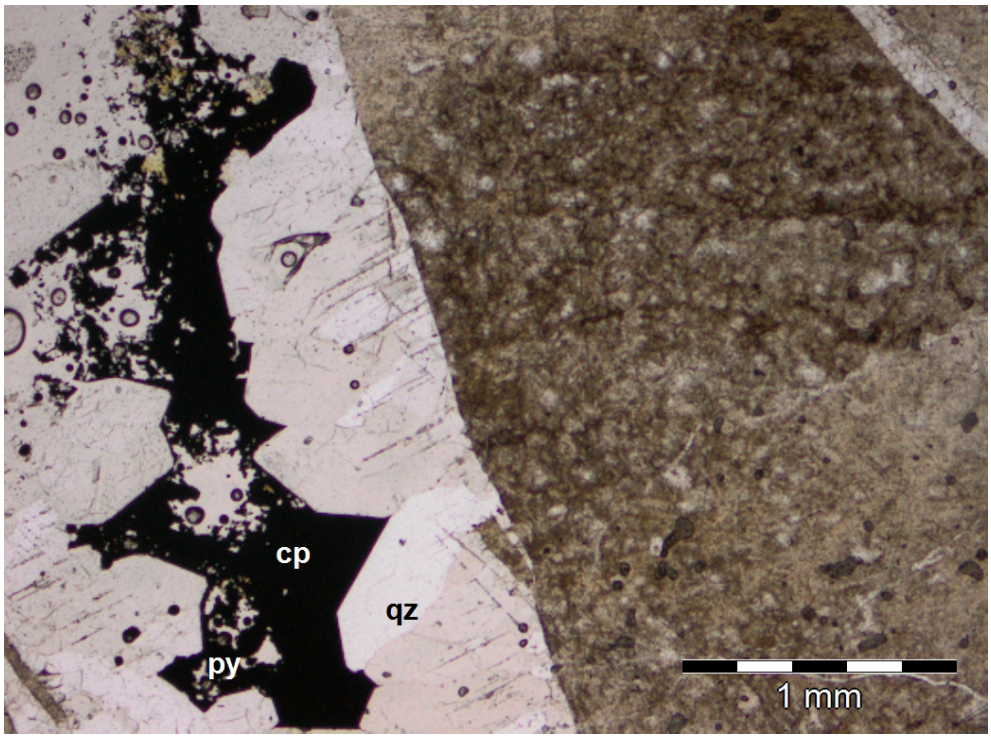


Figure 4: BW 68 202.5 - Clay altered rock and quartz-chalcopyrite-pyrite-pyrrhotite-white mica-hematite vein. Photomicrograph showing a clay-rich domain (right part of the figure) crosscut by quartz (qz), chalcopyrite (cp) and pyrite (py) vein. Plane polarized transmitted light.

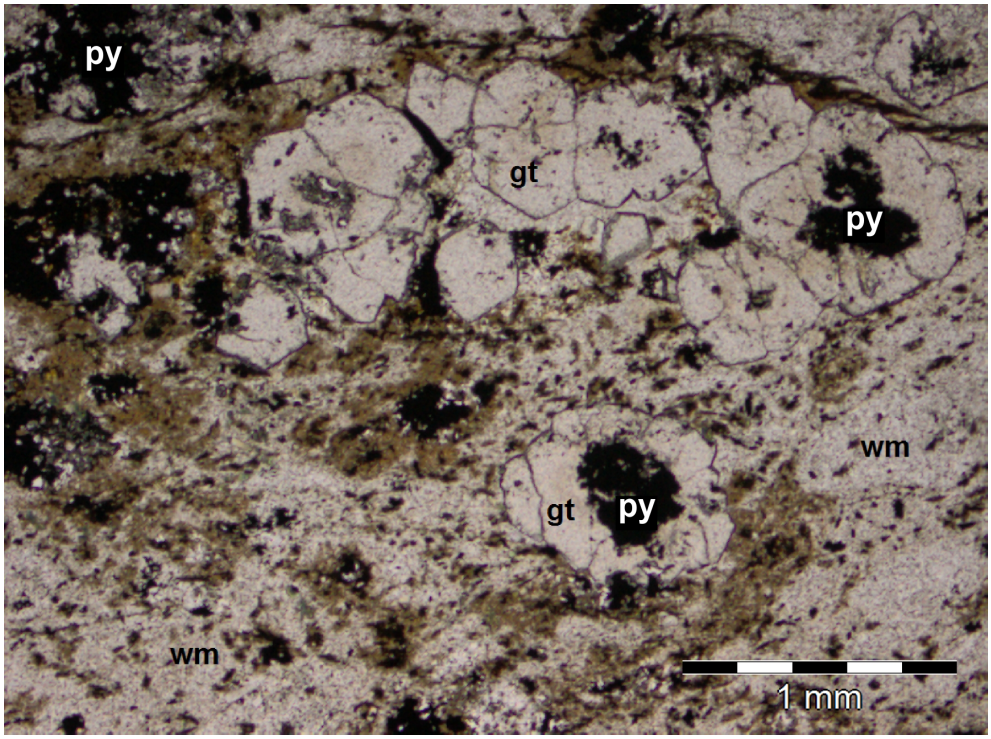


Figure 5: BW 68 407 - Chlorite-quartz-white mica-garnet-pyrite-pyrrhotite-chalcopyrite and tourmaline altered rock. Photomicrograph showing subidioblastic garnet (gt) immersed in a very fine-grained groundmass of white mica (wm), possibly chlorite, pyrite (py), tourmaline and oxides. Plane polarized transmitted light.

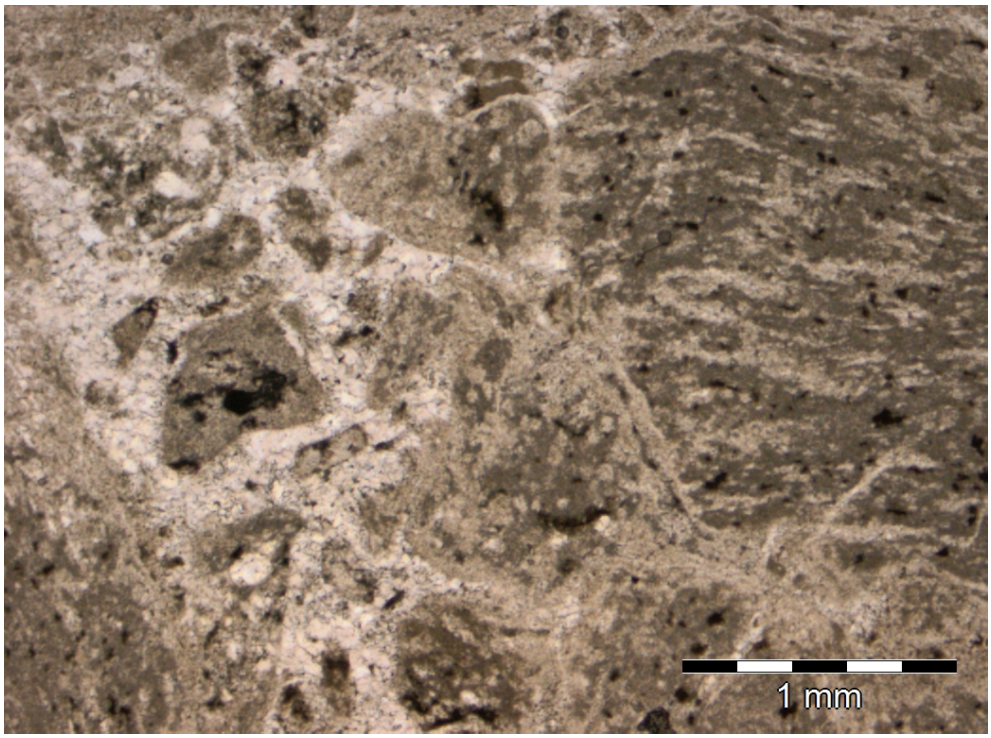


Figure 6: BW 72 161.3 - Quartz-white mica, laminated, volcanic mudstone and hydraulic breccia. Photomicrograph showing fragments of layered clay-rich cryptocrystalline domains and quartzofeldspathic-clay domains fragmented and infilled by quartz-rich infill. Plane polarized transmitted light.

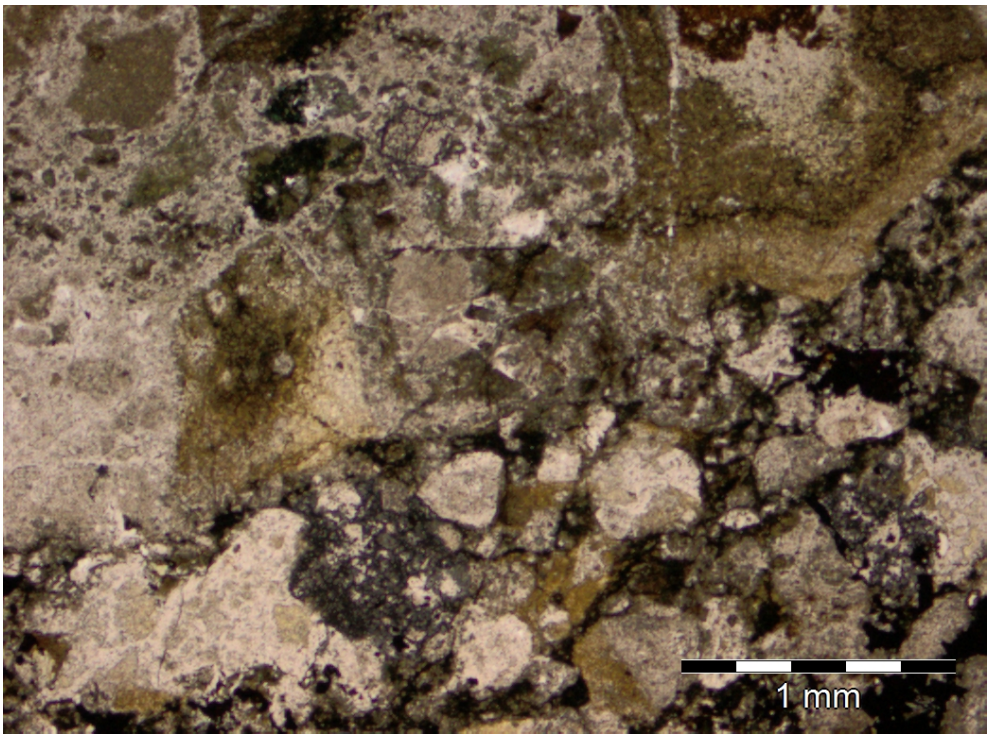


Figure 7: BW 77 125.8 - Pyrite-chalcopyrite, volcanic breccia. Photomicrograph showing sub-angular lithic fragments of intensely clay altered sandstone including white mica altered fragments and lesser quartz. Plane polarized transmitted light.

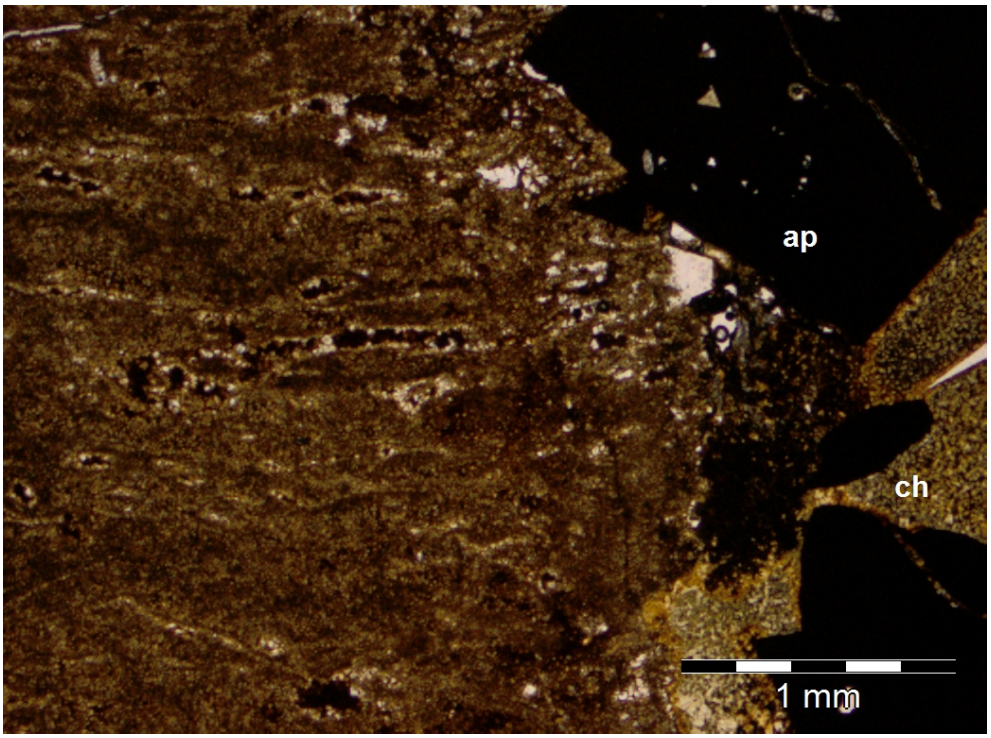


Figure 8: BW 77 281 - Quartz-oxides, volcanic mudstone and arsenopyrite-pyrrhotite-quartz-chlorite vein. Photomicrograph showing a disrupted bedding defined by quartz and oxide domains immersed in a cryptocrystalline aggregate crosscut by the arsenopyrite (ap) chlorite (ch) quartz vein. Plane polarized transmitted light.

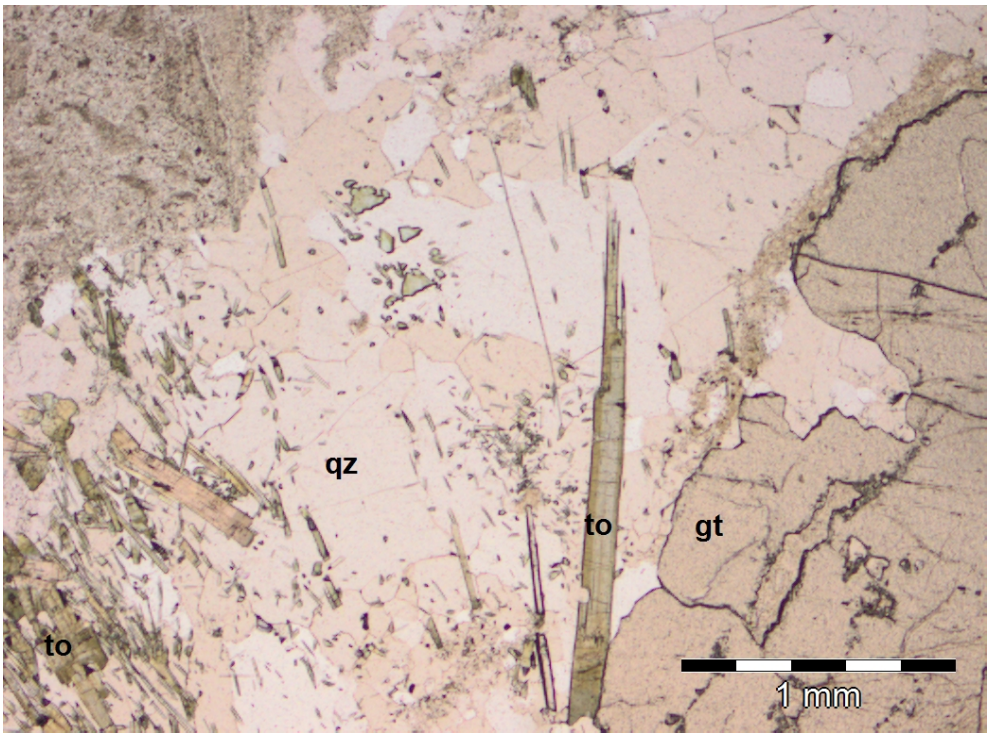


Figure 9: BW 77 435.5 - Flow banded lava, quartz-garnet-tourmaline-chalcopyrite vein and quartz-pyrite-clino-zoisite veinlet. Photomicrograph showing quartz (qz), tourmaline (to) and garnet (gt) within the vein crosscutting the lava (upper left corner of the figure). Plane polarized transmitted light.

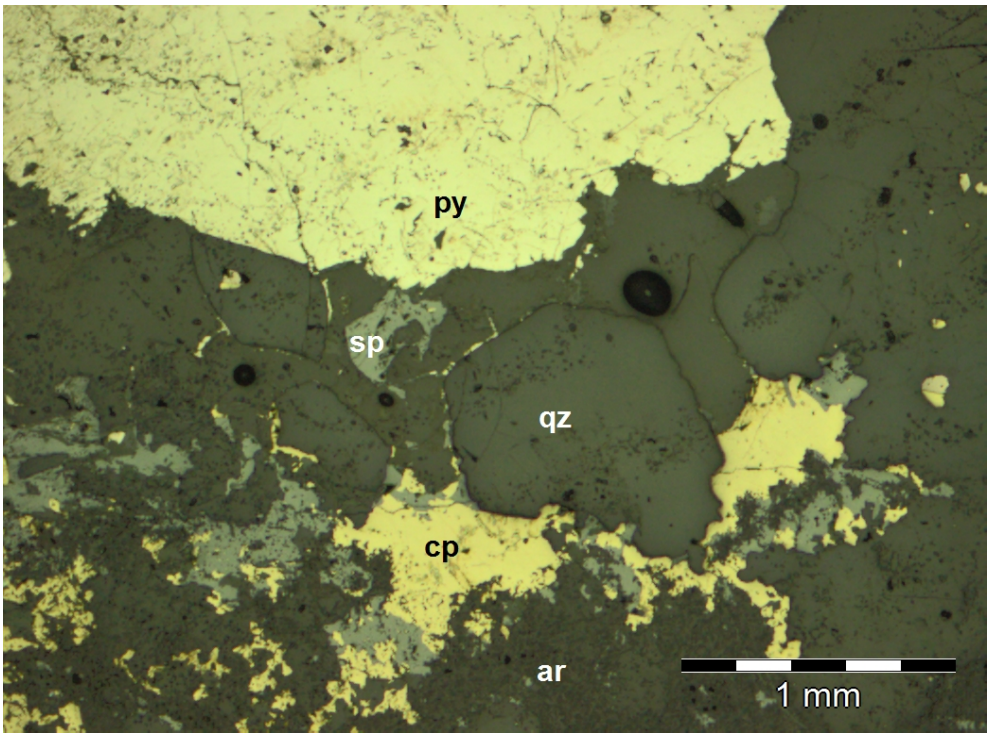


Figure 10: BW 82 213.2 - Albite-quartz-white mica altered lava and quartz pyrite-chalcopyrite-sphalerite-pyrrhotite-tourmaline vein. Photomicrograph showing the quartz (qz), pyrite (py), sphalerite (sp) and chalcopyrite (cp) vein crosscutting the altered rock (ar). Plane polarized reflected light.

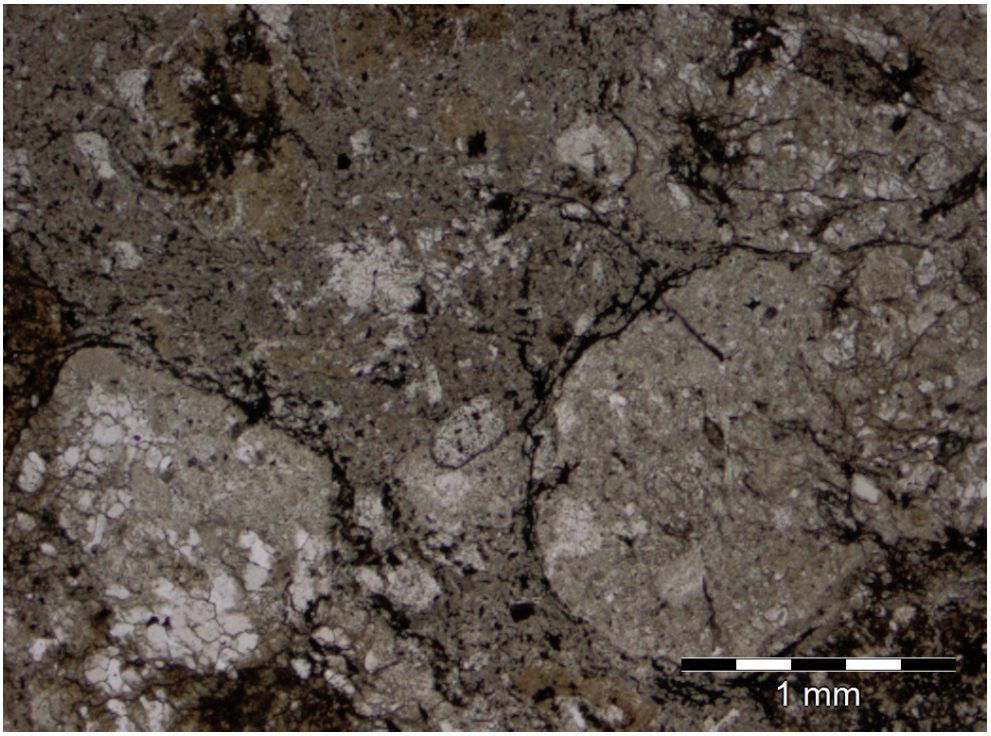


Figure 11: BW 86 37.3 - Quartz-white mica-pyrite, poorly sorted, polymict, volcanic lithic-breccia . Photomicrograph showing inequigranular polymict lithic fragments immersed in a fine-grained aggregate of white mica, quartz, possible chlorite, clay, pyrite and oxides. Plane polarized transmitted light.

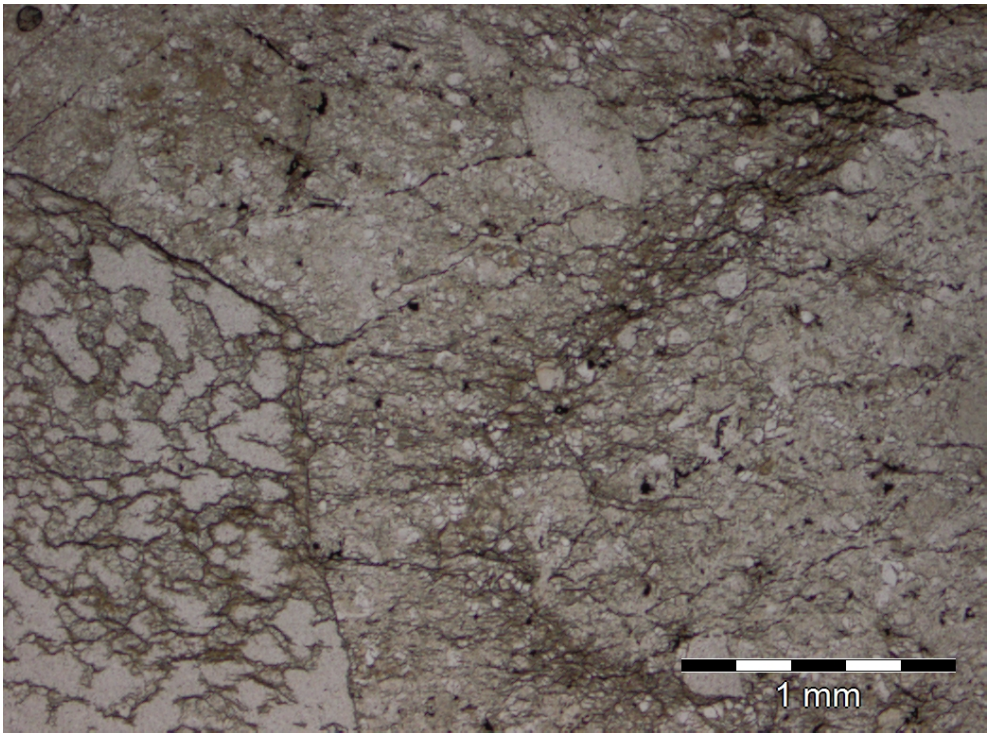


Figure 12: BW 86 50.3 - Quartz-pyrrhotite-sphalerite-chlorite-white mica, poorly sorted, polymict, volcanic lithic-breccia. Photomicrograph showing inequigranular and polymict lithic fragments immersed in a fine-grained matrix of quartz, chlorite and white mica. Plane polarized transmitted light.

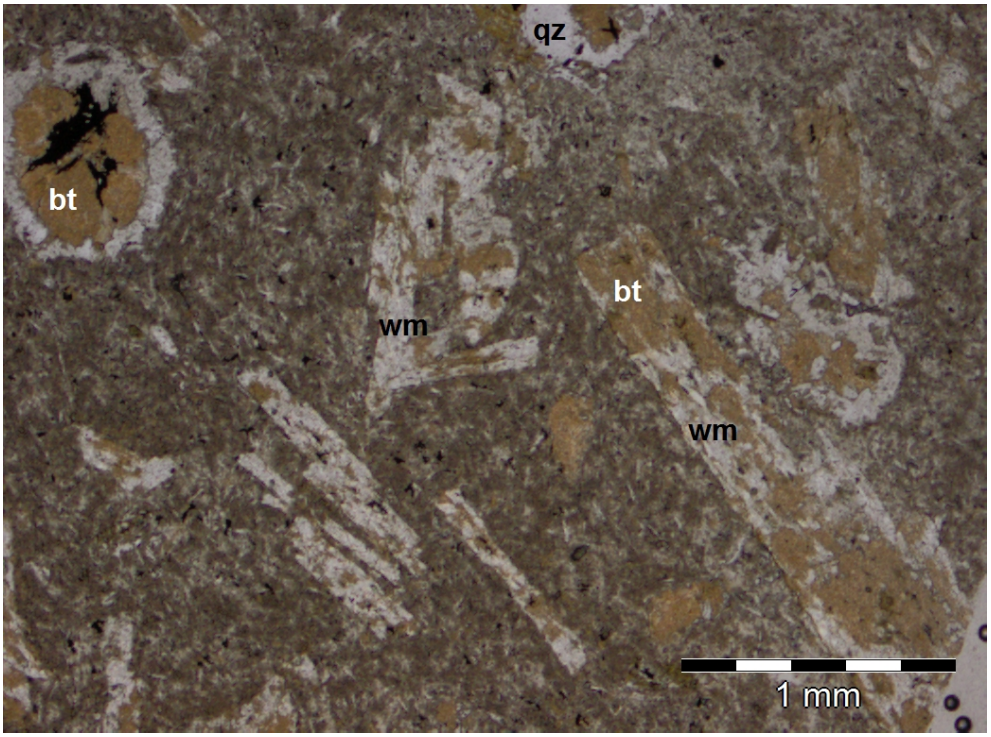


Figure 13: BW 86 189.8 - Biotite-chlorite-white mica-quartz-pyrrhotite-chalcopyrite-sphalerite, andesite(?). Photomicrograph showing subhedral to euhedral phenocrysts of feldspar substituted by white mica (wm) and patches of very fine-grained biotite (bt). The groundmass is made up of fine-grained white mica, mostly after euhedral feldspar laths. Plane polarized transmitted light.

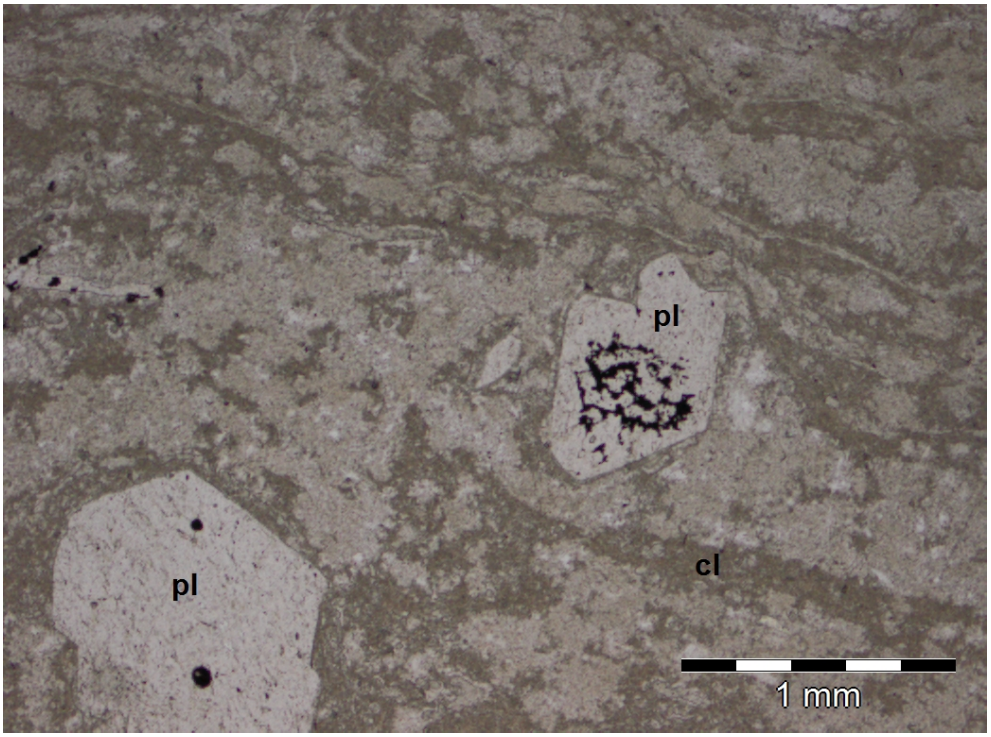


Figure 14: BW 96 198.5 - Albite-quartz-white mica-pyrite-galena, flow banded lava. Photomicrograph showing subhedral phenocrysts of albite (pl) rotated within the layered magmatic rock in which clay-rich layers (cl) can be distinguished from the lighter white mica-rich layers. Plane polarized transmitted light.

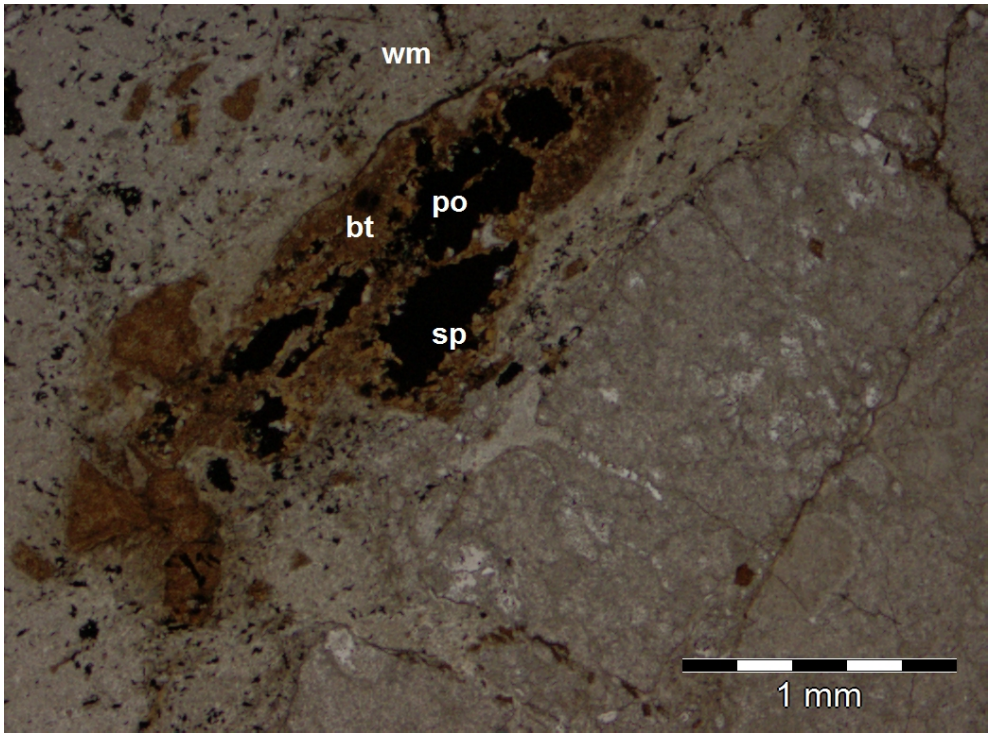


Figure 15: BW 98 69.8 - Quartz-white mica-pyrrhotite-biotite, poorly sorted, polymict, volcanic lithic-breccia. Photomicrograph showing a biotite (bt), pyrrhotite (po) and sphalerite (sp) domain within a white mica-rich lithic fragment. Plane polarized transmitted light.

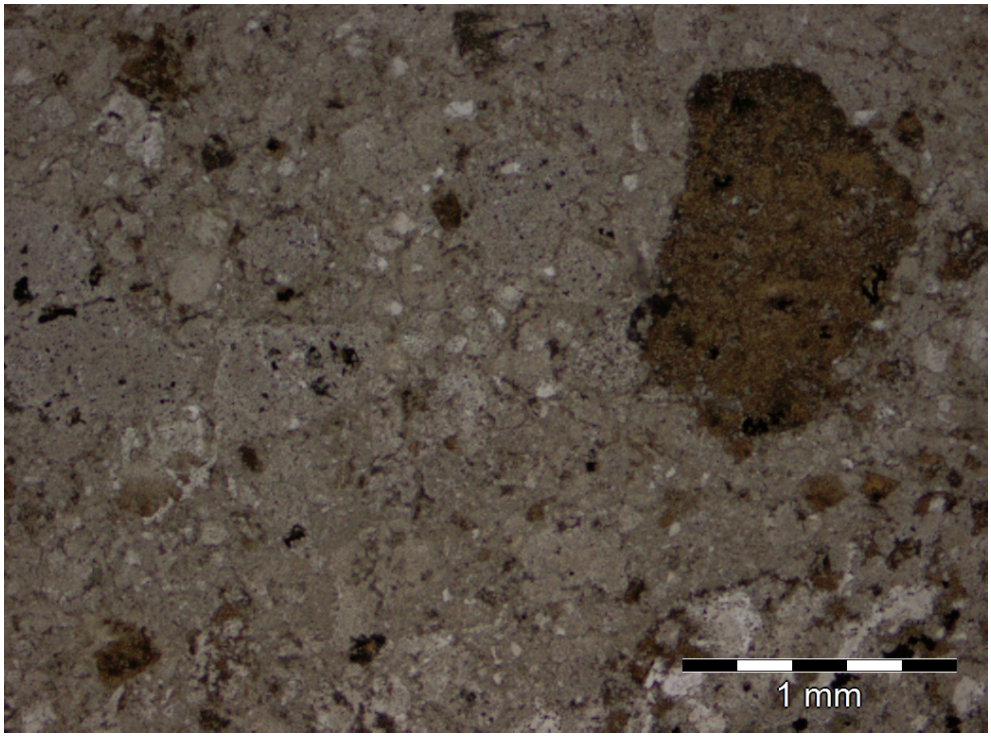


Figure 16: BW 98 79.7 - Quartz-white mica-pyrrhotite, poorly sorted, polymict, volcanic lithic-breccia. Photomicrograph showing poorly-sorted lithic fragments, immersed in a fine-grained quartzofeldspathic aggregate. Lithic fragments are polymictic and consist of variable amounts of quartzofeldspathic aggregates, cryptocrystalline clay, quartz fragments and crystals and pyrite. Plane polarized transmitted light.

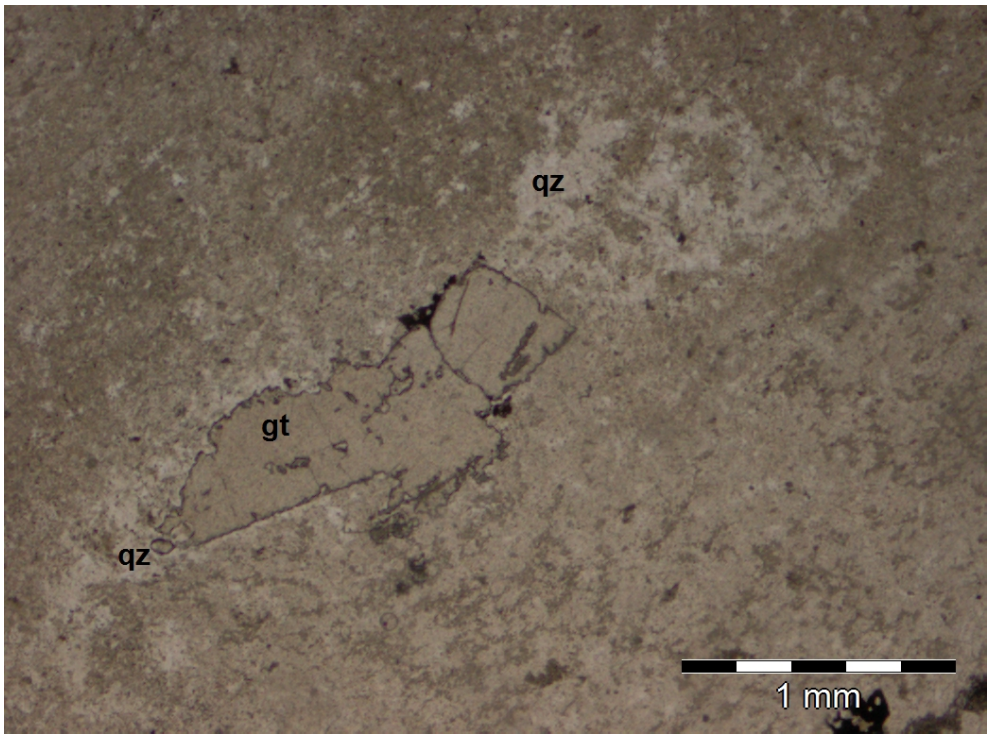


Figure 17: BW 98 138.1 - Quartz-white mica-garnet schist and quartz-pyrrhotite-biotite-chalcopyrite vein/breccia. Photomicrograph showing a xenoblast of garnet (gt) with strain shadows of quartz (qz). Plane polarized transmitted light.

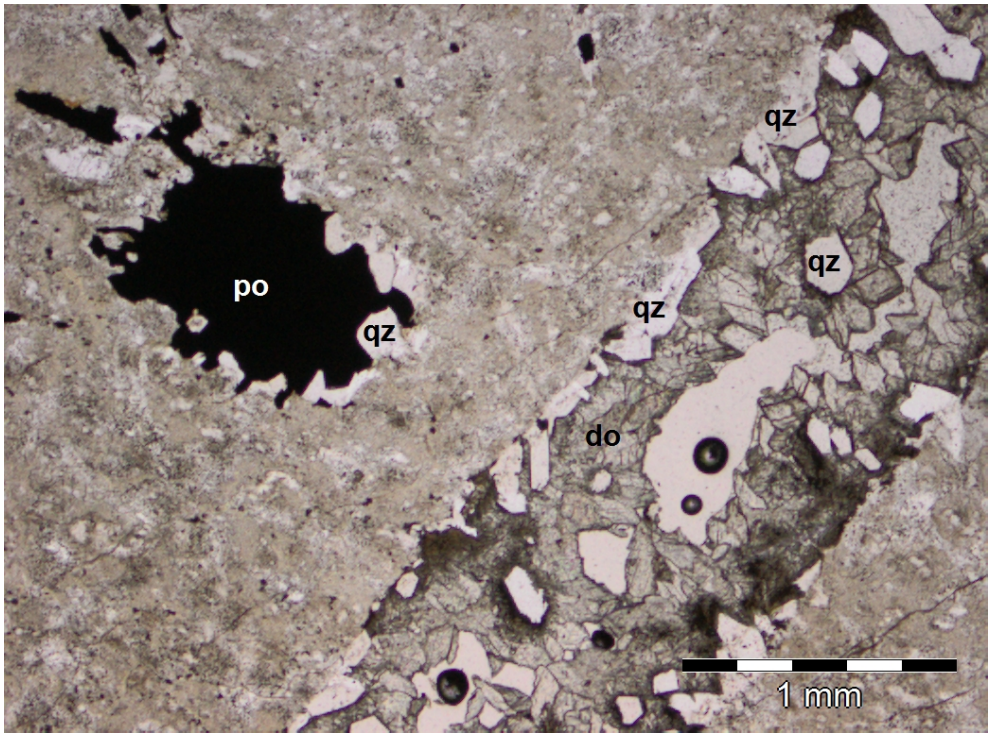


Figure 18: BW 98 149.5 - Quartz-white mica-pyrrhotite-dolomite-chalcopyrite altered rock. Photomicrograph showing a fine-grained aggregate of quartz and very fine-grained white mica, a crystal of anhedral pyrrhotite (po) rimmed by quartz (qz). A dolomite (do) and -quartz vein crosscuts the sample. Plane polarized transmitted light.

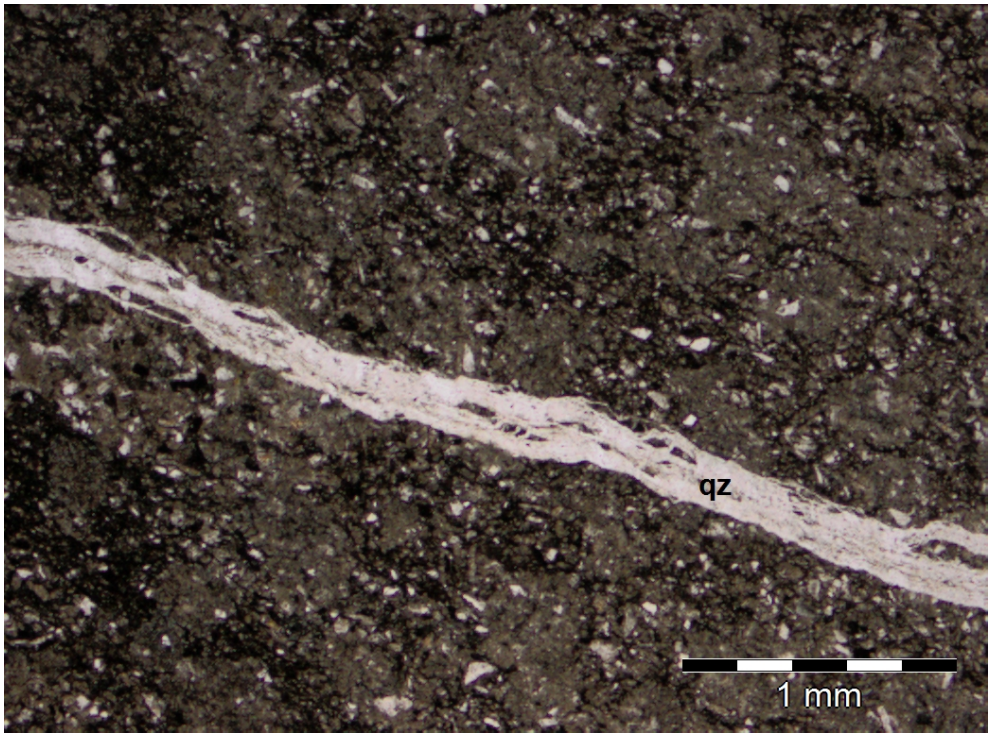


Figure 19: BW 100 222.8 - Quartz (and clay?), volcanic(?) mudstone. Photomicrograph showing a quartz and possibly clay altered mudstone, crosscut by an ataxial veinlet of quartz (qz). Plane polarized transmitted light.

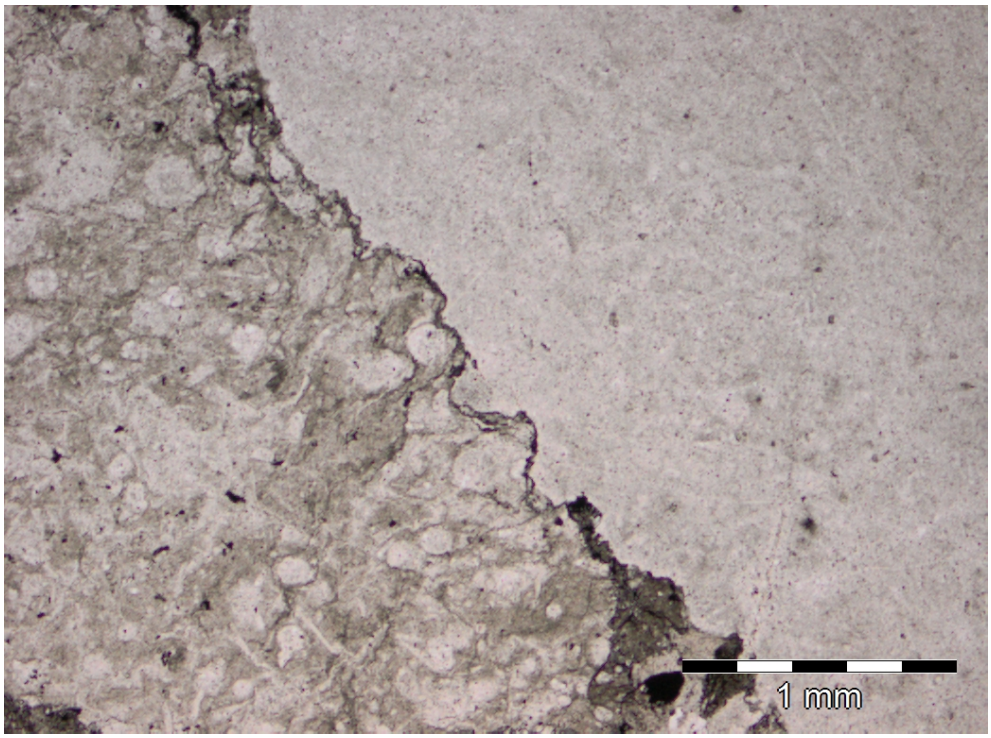


Figure 20: BW 100 270.2 - Pyrrhotite, clast supported, poorly sorted, volcanic lithic breccia . Photomicrograph showing two lithic fragments with interlobated boundaries. Plane polarized transmitted light.

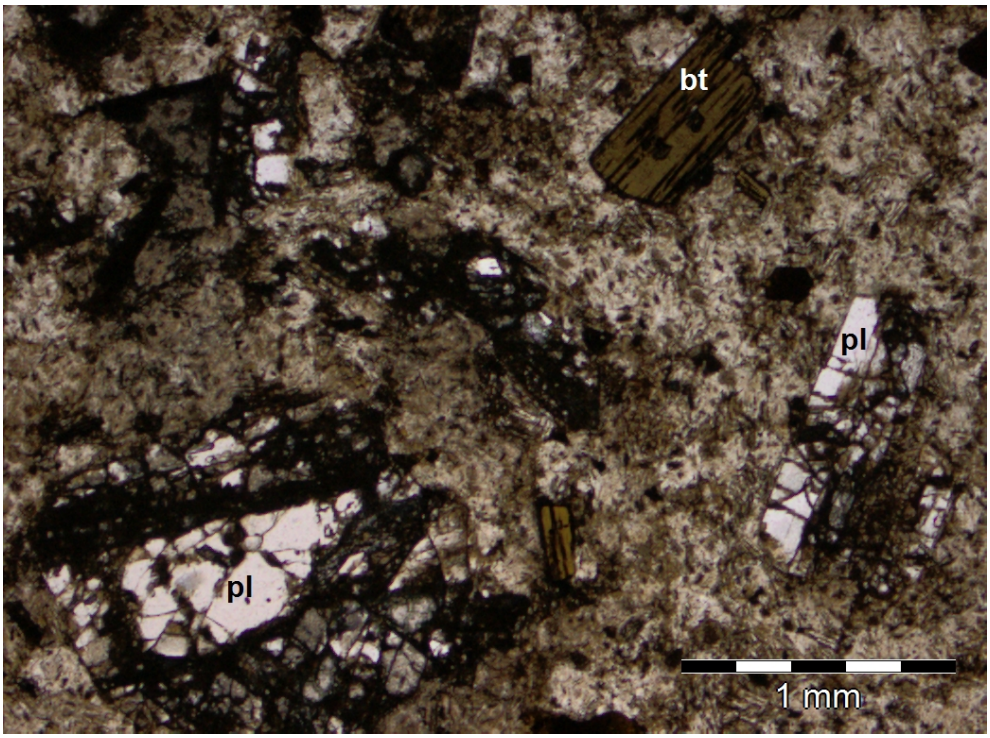


Figure 21: BW 104 91 - Porphyritic andesite. Photomicrograph showing a porphyritic microstructure with euhedral phenocrysts of plagioclase (pl) and biotite (bt) immersed in a fine-grained groundmass mostly made up of fine-grained plagioclase. Plane polarized transmitted light.

Metallurgical Division

Preliminary Metallurgical Testing of Samples from the Richfield Ventures Corp., Blackwater Gold Project of Central British Columbia

Prepared for:

Richfield Ventures Corp.
1013 – 1030 West Georgia St.,
Vancouver, BC V6E 2Y3
and
101 – 242 Reid St.,
Quesnel, BC V2J 2M2

Attention:

Mr. Peter Bernier, President & CEO
Mr. Dirk Tempelman-Kluit, Ph.D., VP of Exploration
Mr. Robert Pease, VP Strategic Planning

Prepared by:

Metallurgical Division
Inspectorate Exploration and Mining Services Ltd.
11620 Horseshoe Way,
Richmond, BC V7A 4V5 Canada

Project No.: 1001302

Alice Shi, Ph.D. General Manager	Boja Grcic, B.Sc. Laboratory Manager	Michael Redfearn, P.Eng. Director Metallurgical Services

Date: February 25, 2011

Table of Contents

Page No.

1 EXECUTIVE SUMMARY

1.1 Objective 3
1.2 Conclusions 3
1.3 Recommendations 5

2 PROJECT DETAILS

2.1 Introduction 6
2.2 Discussion of Results
2.2.1 Head Grade Analysis 7
2.2.2 Mineralogy 9
2.2.3 Work Index (Hardness) Test 10
2.2.4 Diagnostic Leach Test 11
2.2.5 Gravity Concentration 12
2.2.6 Cyanidation 13
2.2.7 Flotation
2.2.7.1 Rougher Flotation - Scoping Tests 16
2.2.7.2 Cleaner Flotation 18
2.2.7.3 Parameter Changes - Rougher/Cleaner 19
2.2.7.4 Flotation Summary 21
2.2.7.5 Flotation Concentrate Analyses 22
2.2.7.6 Flotation Tailing Analyses 22
2.2.8 Analytical Consistency Checks 23
2.3 Conclusions and Recommendations 24

3 APPENDICIES

I Sample Description and Log
II Test Procedures
III Test Results and Balances
IV Size Analysis Data
V Miscellaneous Data
VI Mineralogical Report

1. EXECUTIVE SUMMARY

1.1 Objective

Inspectorate Exploration and Mining Services Ltd., Metallurgical Division submitted a metallurgical testing proposal to Mr. Dirk Tempelman-Kluit on behalf of Richfield Ventures Corporation. The test program for the Blackwater Gold Project was designed to investigate preliminary metallurgical testing on samples for processing purposes.

The test program incorporated a number of recovery processes including gravity separation, cyanidation and flotation.

The objective was to provide a preliminary metallurgical evaluation to assist in future project decisions.

1.2 Conclusions

a. The series of tests conducted in this preliminary metallurgical program indicates positive results in all methods of gold and silver recovery. Initial overall recoveries and concentrate grades fall within the following ranges:

	% Au Recovery	Concentrate Grade
Gravity Concentration	19-37	1000-1500 g/t Au
Cyanidation	89-95	

		% Recovery	Concentrate Grade
Flotation	Au	81-91	108-197 g/t Au
	Ag	61-74	133-392 g/t Ag
	Zn	70-75	10-36 % Zn

b. The Bond ball mill work index of 17.6 kWhr/tonne suggests a moderate hardness.

c. The Diagnostic Leach Test conducted on all three composites indicated high gold recovery by basic cyanidation. There was little or no indication of refractory gold mineralization present.

d. Gravity concentration of coarse gold by Falcon concentrator and panning (simulating a shaking table), produced grades in the range of 1,000 to 1,500 gr/t Au at a recovery range of 19–37%. Silver recoveries in this process were significantly less than that of the gold, probably due to mineralization differences.

e. Standard cyanidation leach tests run on all three samples produced extraction rates in the range 89–95% Au. Silver extraction was significantly lower than that of the gold and quite erratic. Again, this is probably due to differences in mineralization.

f. Combined rougher-scavenger flotation recoveries for gold were all above 90%, ranging as high as 98.8%. Silver was slightly lower in the range of 75–90% recovery, but significantly higher than the figures achieved by either gravity separation or cyanidation. Zinc recovery in this circuit was in the range 80–93%, with increased recoveries at higher feed grades and a finer primary grind. Initial regrind – cleaner circuit flotation tests produced 1st cleaner recoveries of 81–94% Au, 81–86% Ag and 66-78% Zn at corresponding 2nd cleaner concentrate grades of 69-107 g/t Au, 110-268 g/t Ag and 7-17% Zn.

g. Throughout the testing program, a relationship between gold, silver and zinc performance could not be seen. They appear to act quite independently, depending on head grade and composite mineralogy.

1.3 Recommendations

a. The next phase of testing should investigate further flotation options such as the production of two concentrates, pyrite and zinc.

b. It is recommended a combination of gravity separation followed by flotation be investigated as this would appear to be a favourable method at this point.

c. Leaching of the pyrite concentrate should be investigated for precious metal recovery.

2. Project Details

2.1 Introduction

Inspectorate Exploration and Mining Services Ltd. was retained by Mr. Dirk Tempelman-Kluit on behalf of Richfield Ventures Corporation to perform preliminary metallurgical testing on samples from the Blackwater Gold Project.

The Blackwater Gold Project, explored over the last 37 years, is described as a bulk gold deposit located in the Nechako Plateau area of central British Columbia. Sulphide mineralization on the property is associated with phyllic to potassic or kaolinitite alteration of felsic and intermediate volcanic rocks with secondary quartz. This mineralization consists of pyrite, sphalerite, tetrahedrite and arsenopyrite.

The objective of this program was to assess metallurgical response on three drill hole composites, including the following:

- complete head sample characterization
- petrographic analysis
- Bond ball mill work index hardness test
- diagnostic leach test
- gravity testing for free coarse gold recovery
- cyanidation leaching
- test grinding to determine liberation size
- flotation tests
- flotation concentrate analysis
- tailing analysis to study precious metal losses

2.2 Discussion of results

2.2.1 Head Analysis

A representative head sample of each composite was submitted for analysis including fusion ICP-MS 50, whole rock analysis and carbon speciation.

Table 1 Key Elements (Analysis by Inspectorate)

Element	Unit	C-1	C-2	C-3
Au	g/t	5.64	6.24	6.23
Ag	g/t	23.6	12.3	9.7
Fe	%	4.63	5.28	5.94
Zn	%	1.55	0.91	0.43
S (tot)	%	4.50	3.99	3.26

Table 2 Key Elements (Analysis by Client)

Element	Unit	C-1	C-2	C-3
Au	g/t	4.22	7.0	4.81
Ag	g/t	15.4	9.6	4.3

Table 3 Whole Rock Analysis

	Unit	C-1	C-2	C-3
Al_2O_3	%	14.00	13.98	15.26
BaO	%	0.04	0.03	0.08
CaO	%	0.17	0.39	0.20
Fe_2O_3	%	6.55	7.05	8.14
K_2O	%	4.00	3.96	6.43
MgO	%	0.16	0.44	0.69
MnO	%	0.46	0.39	0.36
Na_2O	%	0.07	0.08	0.11
P_2O_5	%	0.11	0.29	0.16
SiO_2	%	69.3	68.2	63.8
TiO_2	%	0.35	0.53	0.55
LOI	%	4.73	4.61	4.17
Total	%	99.94	99.95	99.95

Table 4 ICP-MS 50 Analysis

Element	Unit	C-1	C-2	C-3	Element	Unit	C-1	C-2	C-3
Al	%	7.12	7.26	7.56	Mo	ppm	3.55	5.22	3.14
Sb	ppm	48.5	55.1	23.3	Ni	ppm	12.5	19.4	34.6
As	ppm	466	410	644	Nb	ppm	11.7	12.1	9.8
Ba	ppm	410	270	648	P	ppm	499	1366	696
Be	ppm	2.15	2.36	2.00	K	%	3.72	3.76	5.64
Bi	ppm	25.4	31.0	9.2	Rb	ppm	117.9	123.5	128.4
Cd	ppm	148.9	109.9	32.4	Re	ppm	<0.005	<0.005	<0.005
Ca	%	0.12	0.30	0.16	Sc	ppm	5.3	7.2	7.6
Ce	ppm	31.6	34.4	41.9	Se	ppm	<0.5	<0.5	<0.5
Cs	ppm	8.4	17.0	13.0	Na	%	0.05	0.06	0.07
Cr	ppm	49	57	86	Sr	ppm	112.2	50.2	96.2
Co	ppm	14.2	31.0	18.2	Ta	ppm	2.01	1.90	1.62
Cu	ppm	578	374	838	Te	ppm	0.22	0.86	0.29
Ga	ppm	14.6	17.9	22.9	Tl	ppm	1.92	2.10	2.41
Ge	ppm	0.79	0.88	1.04	Th	ppm	10.7	8.2	8.7
Hf	ppm	2.6	2.4	3.2	Sn	ppm	1.9	2.0	3.5
In	ppm	2.21	2.36	2.07	Ti	%	0.178	0.324	0.253
La	ppm	13.8	15.6	20.7	W	ppm	8.9	23.8	21.7
Pb	ppm	582	326	33	U	ppm	6.4	4.7	4.8
Li	ppm	16.1	26.9	23.1	V	ppm	36	70	70
Mg	%	0.10	0.26	0.39	Y	ppm	10.8	10.6	12.8
Mn	ppm	3713	3483	3157	Zr	ppm	75.0	77.2	104.1
Hg	ppm	<3	<3	<3					

Table 5 Carbon Speciation

	Unit	C-1	C-2	C-3
Total	%	0.12	0.08	0.24
Inorganic	%	<0.01	<0.01	0.04
Graphite	%	0.02	<0.01	<0.01

2.2.2 Mineralogy

A sample of composite C-2 representing drill hole BW-59, individual samples 09-459: 46 to 50 and 198 to 204, was submitted for a petrographic study.

The principal minerals observed in the BW-59 Drill Hole Composite were non-opaque phases (90.02% average by optical analysis), which X-ray diffraction analysis indicates consist primarily of quartz (39.1% average), micas (27.9% average), orthoclase (17.0% average), clays (8.3% average), and minor calcium sulfates (1.8% average) and carbonates (0.5% average). Pyrite (3.96% average), iron oxides (limonite, hematite, magnetite and goethite, 3.88% average) and pyrrhotite (1.14% average) were the principal opaque phases.

Ore minerals included sphalerite (0.77% average), chalcopyrite (0.23% average), cubanite (0.03% average), and traces of tetrahedrite, chalcocite and dioptase. Chalcopyrite and cubanite were occasionally tightly intergrown. Sphalerite rarely alters to bianchite. Principal other minerals included tetrahedrite, chalcocite, dioptase, rutile and ilmenite (traces of each), with a few particles of graphite observed. Sulfides tended to be mostly locked. Hosting minerals were largely non-opaque, with pyrite as a common secondary host, and sphalerite as a rare host.

Gold (6.23ppm) was present primarily as small (<10µm) disseminated occurrences of the native metal (about 5ppm), or rarely as electrum (<1ppm), and was mainly associated with non-opaque phases (94%, average). A few larger particles of gold tellurides (calaverite-krennerite) were also observed (<1ppm).

Statistically, only an average of about 16% of the gold was liberated, while only about 1% by weight was liberated. Secondary gold associations hosted by silicates were diverse, and included pyrite (13% average), sphalerite and

pyrrhotite (9% average, each), chalcopyrite (8% average), tellurides (5% average), iron oxides, and cubanite (4% average, each). However, much of the locked gold was only associated with silicates (38%).

Despite an assay showing 9.7ppm silver, only insignificant traces of silver-bearing minerals, including electrum and silver-gold tellurides, were observed. It is possible that some tetrahedrite group minerals host solid solution silver, that silver is present interstitially within silicates, or that some silver is present as a submicroscopic phase.

A complete mineralogical report can be found in Appendix VI.

2.2.3 Work Index (Hardness) Test

A Bond ball mill work index hardness test was performed on an equal blend composite of the three submitted sample composites using a closing screen size of 150 microns (100 Tyler mesh). This resulted in a work index of 17.6 kWh/tonne, suggesting a moderate hardness. The data and calculations are included in Page 1 of Appendix V.

2.2.4 Diagnostic Leach Test

All three composites were tested individually for gold and silver deportment using a standard 5-stage Diagnostic Leach Test.

The three samples responded very similarly as summarized in Table 6. All samples responded excellently to high gold recovery by simple cyanidation with recoveries in the range of 90.5 to 97.5% Au. It also indicates no pre-treatment would be required in the recovery circuit. Silver recoveries were somewhat lower being in the range of 54.8 to 62.1%. Test details are listed in Appendix III.

Table 6 Diagnostic Leach Testing

	Au g/t	% Au Dist	Ag g/t	% Ag Dist
Test: DL 1 Composite: C-1				
Stage 1 - Cyanide Soluble	4.65	95.4	9.41	58.8
Stage 2 - Primarily associated with carbonaceous minerals	0.04	0.8	0.99	6.2
Stage 3 - Primarily associated with calcite/dolomite/pyrrhotite minerals	0.04	0.8	4.41	27.6
Stage 4 - Primarily associated with base metals sulphides (Labile sulphides)	0.07	1.4	0.55	3.5
Stage 5 - Primarily associated with majority sulphides (Py,AsPy and Marcasite)	0.07	1.4	0.60	3.8
Residue - Insoluble or associated with preg-robbing and other refractory minerals	0.01	0.1	0.04	0.3
Calculated head	4.88	100.0	16.00	100.0
Measured Head	4.98		21.40	
Test: DL 2 Composite: C-2				
Stage 1 - Cyanide Soluble	5.09	97.5	4.47	62.1
Stage 2 - Primarily associated with carbonaceous minerals	0.01	0.1	0.39	5.5
Stage 3 - Primarily associated with calcite/dolomite/pyrrhotite minerals	0.06	1.1	1.50	20.9
Stage 4 - Primarily associated with base metals sulphides (Labile sulphides)	0.03	0.6	0.51	7.1
Stage 5 - Primarily associated with majority sulphides (Py,AsPy and Marcasite)	0.03	0.6	0.28	3.9
Residue - Insoluble or associated with preg-robbing and other refractory minerals	0.00	0.1	0.04	0.6
Calculated head	5.22	100.0	7.19	100.0
Measured Head	6.12		10.50	
Test: DL 3 Composite: C-3				
Stage 1 - Cyanide Soluble	3.80	90.5	3.20	54.8
Stage 2 - Primarily associated with carbonaceous minerals	0.09	2.1	0.27	4.6
Stage 3 - Primarily associated with calcite/dolomite/pyrrhotite minerals	0.07	1.8	0.70	12.0
Stage 4 - Primarily associated with base metals sulphides (Labile sulphides)	0.05	1.1	1.01	17.3
Stage 5 - Primarily associated with majority sulphides (Py,AsPy and Marcasite)	0.18	4.2	0.63	10.7
Residue - Insoluble or associated with preg-robbing and other refractory minerals	0.01	0.3	0.04	0.7
Calculated head	4.20	100.0	5.84	100.0
Measured Head	5.69		7.50	

2.2.5 Gravity Concentration

All three composites were tested on a Falcon SB40 centrifugal concentrator to determine the amount, if any, of coarse free recoverable gold. The Falcon concentrate was subjected to upgrading by hand panning to simulate results that would be obtained using a shaking table in the plant. Between 19 and 37% of the gold was recovered into a higher grade product ranging from roughly 1,000 to 1,500 gr/t (32 to 48 oz/ton).

The results indicate the possibility of scalping a higher grade coarse gold product that would reduce losses in a subsequent recovery circuit. It is recommended further testing be conducted to optimize this particular product.

Table 7 Gravity Concentration Tests

Products	Weight (g)	Weight (%)	Assay Au (g/t)	% Dist Au
Test: GSB1 Composite C-1				
Pan Concentrate	2.11	0.11	1545.32	37.1
Pan Tails	82.3	4.11	24.66	23.1
Total SB40 Concentrate	84.4	4.22	62.67	60.1
GSB Tails	1,915.0	95.78	1.83	39.9
Calculated Head	1,999.4	100.00	4.40	100.0
Measured Head			5.61	
Test: GSB2 Composite C-2				
Pan Concentrate	2.41	0.12	1081.13	21.5
Pan Tails	76.1	3.81	36.82	23.1
Total SB40 Concentrate	78.5	3.93	68.93	44.7
GSB Tails	1,919.8	96.07	3.49	55.3
Calculated Head	1,998.3	100.00	6.06	100.0
Measured Head			6.24	
Test: GSB3 Composite C-3				
Pan Concentrate	1.64	0.08	998.00	18.7
Pan Tails	73.0	3.67	35.85	29.8
Total SB40 Concentrate	74.6	3.75	57.04	48.5
GSB Tails	1,915.6	96.25	2.36	51.5
Calculated Head	1,990.2	100.00	4.41	100.0
Measured Head			6.23	

2.2.6 Cyanidation

Cyanidation tests were run on all three composites at three different grinds to study the effect on degree of extraction.

The finer grinds resulted in increased gold extraction for all three composites. At the coarser grinds of P80 = 130 to 162 microns, % extraction was 91.5%, 88.9% and 92.4% respectively for each composite. This increased at the finer grinds of P80 = 76 – 88 microns to 93.5%, 90.3% and 95.5% extraction.

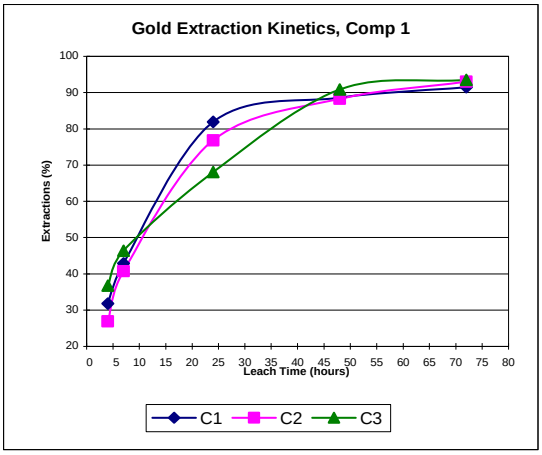
The same relationship for silver extraction was not observed. Further testing would be required to establish the reasons for lower levels of extraction in the range of 37 to 55% and the relationship to grind variability.

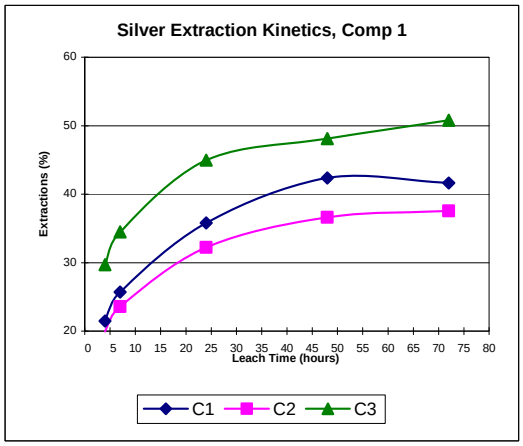
The overall results are compared in Table 8 then graphed in Graphs 1 to 9. Details of each individual test will be found in Appendix III.

Table 8 Cyanidation Testing

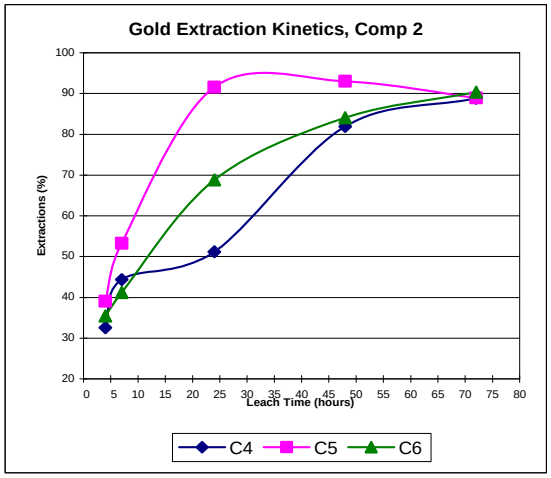
Test No	Comp	Grind	Measured Head		Calculated Head		% Extraction		Residue	
	No.	P80 (µm)	Au (g/t)	Ag (g/t)	Au (g/t)	Ag (g/t)	Au	Ag	Au (g/t)	Ag (g/t)
C1		130	5.61	22.45	3.81	22.4	91.5	41.6	0.33	13.10
C2	1	110	5.61	22.45	4.29	26.3	93.0	37.6	0.30	16.40
C3		76	5.61	22.45	4.64	23.2	93.5	50.8	0.30	11.40
C4		144	6.24	12.30	6.11	10.1	88.9	48.7	0.68	5.20
C5	2	112	6.24	12.30	5.69	11.2	88.9	52.0	0.63	5.40
C6		88	6.24	12.30	6.10	11.8	90.3	43.1	0.59	6.70
C7		162	6.23	9.70	5.23	6.3	92.4	55.5	0.40	2.80
C8	3	103	6.23	9.70	6.38	6.5	94.2	50.7	0.37	3.20
C9		80	6.23	9.70	5.52	8.4	95.5	41.8	0.25	4.90

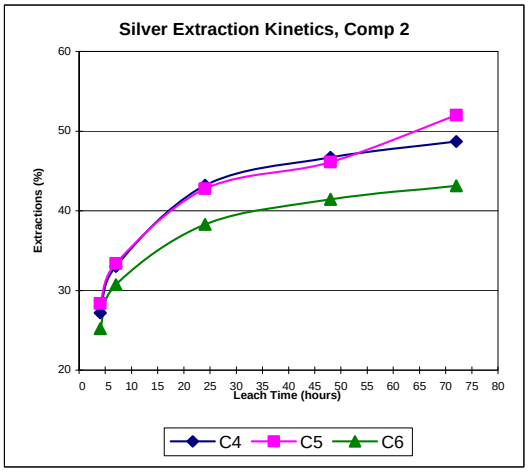
Graphs 1 & 2 Composite 1 Extraction Kinetics



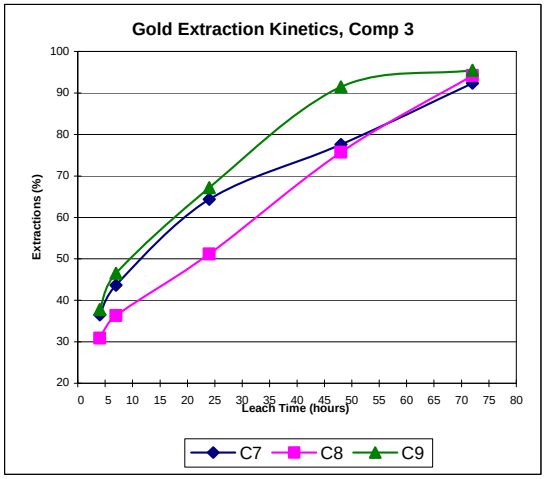


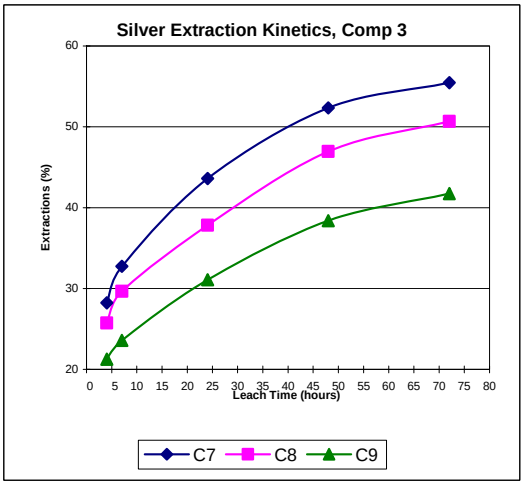
Graphs 3 & 4 Composite 2 Extraction Kinetics





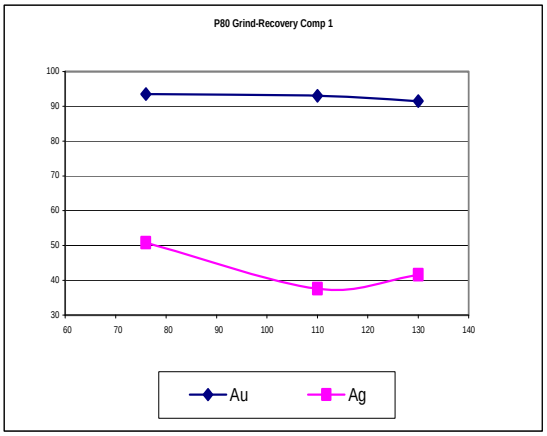
Graphs 5 & 6 Composite 3 Extraction Kinetics



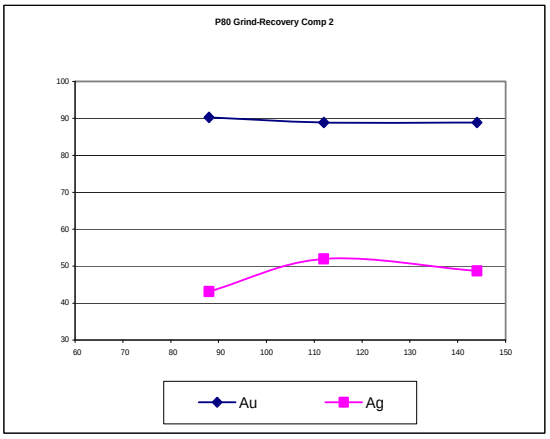


Graphs 7 – 9 Grind vs Recovery – Cyanidation of Au & Ag

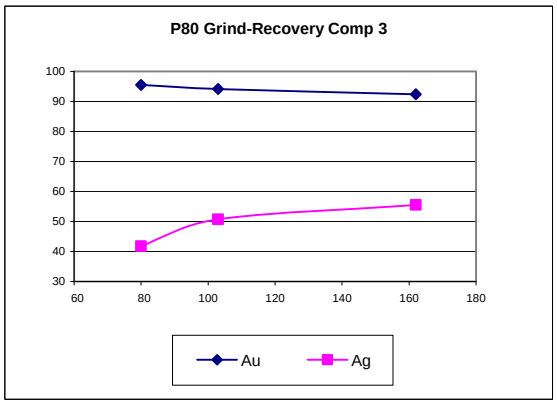
Composite 1



Composite 2



Composite 3



2.2.7 Flotation

A total of 18 flotation tests were run on the three composites under a number of conditions. The individual methods and test results are detailed in Appendix III.

2.2.7.1 Rougher Flotation – Scoping Tests

A series of three standard rougher-scavenger flotation tests were run at various grinds to study the flotation kinetics of each composite. During these initial scoping tests, pH was natural, potassium amyl xanthate (PAX), Aerofloat 208, copper sulphate and MIBC were used across the four roughing stages. Weight pull was constant within each composite, in the range of 18–22%. Tables 9 and 10 compare the results for the 9 tests F1–F9. Table 9 lists the combined grades of the first two rougher stages along with the recovery at the end of the second stage. Table 10 outlines the results for the entire rougher-scavenger four stage circuit. The concentrate grades, in this table, represent the four stage combination along with the corresponding recoveries.

Table 9 Rougher Concentrate (stages 1+2) Metallurgical Results

Test	Comp.	Grind		Combined Rougher Concentrates 1+2 Assays				% Product Recovery			
No.	No.	P80 (µm)	% Wt	Au g / t	Ag g / t	% S	% Zn	Au	Ag	S	Zn
F1	1	145	21.9	19.4	79.2	16.8	4.9	95.0	83.5	86.9	67.2
F2	1	116	20.2	20.5	93.0	19.0	5.1	92.4	84.1	86.4	65.2
F3	1	83	20.1	20.5	91.2	18.7	5.0	95.7	84.9	86.6	61.9
F4	2	139	22.1	25.2	35.4	15.5	2.8	91.2	79.4	84.5	78.4
F5	2	111	22.9	26.0	35.7	14.7	3.0	93.9	85.0	87.0	81.3
F6	2	86	23.6	24.2	36.6	14.7	2.9	94.8	86.7	89.2	83.7
F7	3	154	17.5	29.7	38.9	10.4	1.3	85.5	78.1	58.5	56.5
F8	3	105	18.8	25.6	25.7	11.2	1.2	88.0	70.2	68.5	58.2
F9	3	80	19.2	23.8	27.4	12.1	1.2	88.2	72.8	75.3	60.4

Table 10 Combined Rougher-Scavenger Concentrate Metallurgical Results

Test No.	Comp. No.	Grind P80 (µm)	% Wt	Combined Rougher & Scavenger Conc Assays				% Product Recovery			
				Au g/t	Ag g/t	% S	% Zn	Au	Ag	S	Zn
F1	1	145	30.2	11.5	60.8	13.2	4.8	97.6	88.2	94.6	91.0
F2	1	116	29.3	14.6	67.2	14.3	5.0	95.9	88.3	94.9	91.9
F3	1	83	27.7	15.4	69.5	15.1	5.4	98.8	89.0	95.7	93.4
F4	2	139	31.3	18.4	26.9	11.6	2.2	94.3	85.4	90.2	87.7
F5	2	111	31.9	19.1	27.1	11.1	2.4	96.2	90.1	91.9	89.2
F6	2	86	32.6	17.8	27.6	11.1	2.3	96.6	90.5	93.4	90.2
F7	3	154	25.7	21.5	27.9	9.0	1.2	90.7	82.1	74.4	80.0
F8	3	105	27.1	18.4	18.9	9.2	1.2	91.6	74.6	81.2	84.2
F9	3	80	27.6	17.1	20.1	9.8	1.2	90.9	76.9	88.0	87.5

Table 11 Scoping Test Conditions

Test No.	Comp.	Test Conditiions
F1	1	Initial scoping test to study metal recoveries at various grinds. P80= 145µ
F2	1	Initial scoping test to study metal recoveries at various grinds. P80= 116µ
F3	1	Initial scoping test to study metal recoveries at various grinds. P80= 83µ
F4	2	Initial scoping test to study metal recoveries at various grinds. P80= 139µ
F5	2	Initial scoping test to study metal recoveries at various grinds. P80= 111µ
F6	2	Initial scoping test to study metal recoveries at various grinds. P80= 86µ
F7	3	Initial scoping test to study metal recoveries at various grinds. P80= 154µ
F8	3	Initial scoping test to study metal recoveries at various grinds. P80= 105µ
F9	3	Initial scoping test to study metal recoveries at various grinds. P80= 80µ

Gold grades achieved in the first two rougher concentrate stages were in the range of 19 to 29 g/t, depending on the composite, with recoveries of 85 to 95%. Corresponding silver grades were extremely variable, depending on the original head grades. They ranged from 25 to 38 g/t for composites 2 and 3, up to 79 to 93 g/t in composite 1. Silver recoveries were in the 70 to 86% range. Zinc grades, in composites 1 and 2 were in the ranges of 3 to 5% Zn at recoveries of 65 to 83%.

Analyzing the entire rougher-scavenger circuit, grades of each product decreased slightly as the lower grade concentrate stages were added, however, recoveries in all areas increased correspondingly to 91 to 98% Au, 75 to 90% Ag and 87 to 93% Zn. These figures are all in line with the established grade-recovery curves for these composites.

In plant operation, the lower grade rougher-scavenger products are recycled to improve grade and recovery. The more representative figures would be the combination of concentrate grades from Table 9 and recoveries from Table 10.

2.2.7.2 Cleaner Flotation

Three subsequent tests (F10 to F12), one for each composite were conducted. A mid-range grind of P80 = 104 to 117μ was selected and rougher flotation maintained as in the scoping tests (F1 to F9). The combined rougher concentrates for each composite was reground to a P80 = 25 to 29μ and then floated with two stages of cleaning. Table 12 lists the rougher flotation results and are equivalent to those in Table 10, representing the combined rougher-scavenger concentrates. Table 13 lists the metallurgical results for the 1st cleaner stage, while Table 14 lists the results for the 2nd cleaning stage. In this series of tests, the 1st cleaner concentrate became the feed to the 2nd cleaner stage.

Table 12 Rougher Circuit Results for Test F10 to F12

Test	Comp.	Grind		Combined Rougher Concentrate Assays				% Rougher Recovery			
No.	No.	P80 (μm)	% Wt	Au g/t	Ag g/t	% S	% Zn	Au	Ag	S	Zn
F10	1	112	28.1	14.4	65.2	14.7	5.4	98.3	95.5	94.9	89.8
F11	2	117	26.3	22.6	31.9	13.9	2.8	95.8	95.8	92.3	85.4
F12	3	104	20.8	20.2	21.7	10.9	1.5	89.1	91.9	72.0	75.7

Table 13 1st Cleaner Stage Metallurgical Results

Test	Comp.	Regrind		1st Cleaner Stage Concentrate Assays				% 1st Cleaner Recovery			
No.	No.	P80 (μm)	% Wt	Au g/t	Ag g/t	% S	% Zn	Au	Ag	S	Zn
F10	1	25	7.8	49.7	200.8	35.3	14.3	94.0	81.6	63.2	66.1
F11	2	29	8.4	67.4	89.8	35.8	8.0	91.7	86.6	76.6	78.3
F12	3	26	4.8	79.9	87.0	33.0	5.3	81.3	85.0	50.5	63.1

Table 14 2nd Cleaner Stage Metallurgical Results

Test No.	Comp. No.	Regrind P80 (µm)	% Wt	2nd Cleaner Stage Concentrate Assays				% 2nd Cleaner Recovery			
				Au g/t	Ag g/t	% S	% Zn	Au	Ag	S	Zn
F10	1	25	5.5	69.1	268.2	41.8	17.8	92.1	76.8	52.7	58.3
F11	2	29	6.4	85.3	110.9	42.7	10.0	88.5	81.4	69.6	74.7
F12	3	26	3.4	107.7	116.3	38.2	7.1	77.6	80.4	41.4	60.0

Table 15 Test Conditions F10 to F12

Test No.	Comp.	Test Conditiions
F10	1	Two (2) stage cleaner flotation test after regrinding of combined rougher concentrates.
F11	2	Two (2) stage cleaner flotation test after regrinding of combined rougher concentrates.
F12	3	Two (2) stage cleaner flotation test after regrinding of combined rougher concentrates.

The rougher circuit metallurgical results for these three tests were very similar to those of F1 to F9 confirming the scoping tests very well. The slight differences would be due to variations in weight pull, but only resulted in a movement along the grade-recovery curve.

The cleaner circuit results followed the rougher circuit in producing continued favourable metallurgy. The regrinding to a range of 25-29µ is typical for this type of mineralization. The combination of 2nd cleaner concentrate grades of 69–107 g/t Au and 110–268 g/t Ag with 1st cleaner stage recoveries of 81–94% Au and 81–86% Ag simulate those that would be seen in a plant operation which uses recycle products throughout the circuit.

2.2.7.3 Parameter Changes - Rougher & Cleaner Flotation

The objective for the series of tests F13 to F18 was to change some of the operating parameters in the rougher circuit (pH, collector and weight pull), looking for improvements, followed by standard regrinding and two stage cleaning to confirm the results from tests F10 to F12. The primary grind was maintained in the range of 106-119µ, while regrinding was slightly coarser at 28-40µ

Table 16 Rougher Circuit Results for Test F13 to F18

Test No.	Comp. No.	Grind P80 (µm)	% Wt	Combined Rougher Concentrate Assays				% Rougher Recovery			
				Au g/t	Ag g/t	% S	% Zn	Au	Ag	S	Zn
F13	1	118	15.9	23.6	111.1	24.1	9.1	96.8	89.0	93.1	88.6
F14	1	118	13.3	33.1	130.9	27.5	9.6	96.7	88.6	84.9	78.7
F15	2	114	17.3	33.8	42.0	19.8	4.3	90.7	77.8	86.4	81.9
F16	2	119	13.2	43.0	53.9	23.7	5.4	84.6	75.9	79.8	75.2
F17	3	110	15.7	26.9	29.9	14.1	2.3	88.1	84.8	76.4	83.9
F18	3	106	12.4	35.8	40.6	18.5	2.7	87.7	88.5	76.9	79.6

The rougher circuit parameter changes improved the precious metal grades and recoveries over those of the scoping tests for composite 1, but not composites 2 and 3. Further testing will be required in this area to optimize the basic parameters, particularly weight pull to the concentrates.

Table 17 1st Cleaner Stage Metallurgical Results

Test No.	Comp. No.	Regrind P80 (µm)	% Wt	1st Cleaner Stage Concentrate Assays				% 1st Cleaner Recovery			
				Au g/t	Ag g/t	% S	% Zn	Au	Ag	S	Zn
F13	1	40	5.2	67.8	280.3	36.1	23.3	90.6	73.0	45.4	74.0
F14	1	37	3.5	116.7	370.8	35.8	29.5	90.8	66.7	29.4	64.2
F15	2	33	5.5	98.3	104.6	40.1	11.5	83.6	61.4	55.4	70.0
F16	2	28	3.7	133.8	136.2	39.6	15.9	74.0	53.9	37.5	61.6
F17	3	30	4.2	91.6	97.9	35.1	7.7	80.6	74.5	51.0	74.9
F18	3	30	2.6	151.7	158.9	35.9	10.0	78.4	73.0	31.4	63.2

Table 18 2nd Cleaner Stage Metallurgical Results

Test No.	Comp. No.	Regrind P80 (µm)	% Wt	2nd Cleaner Stage Concentrate Assays				% 2nd Cleaner Recovery			
				Au g/t	Ag g/t	% S	% Zn	Au	Ag	S	Zn
F13	1	40	3.1	108.3	392.5	34.1	36.1	86.8	61.3	25.7	68.7
F14	1	37	2.4	167.4	480.7	34.1	40.8	87.4	58.0	18.8	59.7
F15	2	33	2.2	196.8	180.3	39.8	22.9	67.6	42.8	22.2	56.2
F16	2	28	1.6	256.1	230.1	38.7	30.4	62.9	40.4	16.3	52.5
F17	3	30	2.8	125.0	133.1	38.6	10.5	73.2	67.5	37.4	68.4
F18	3	30	1.4	261.1	266.5	35.6	16.8	72.5	65.8	16.7	57.3

Table 19 Test Conditions F13 to F18

Test No.	Comp.	Test Conditiions
F13	1	Same as F10. Lower mass pull, switch collector from PAX to SIPX. P80= 118µ
F14	1	Same as F13. Lower collector dosage, increased rougher pH to 10. P80= 118µ
F15	2	Same as F11. Lower mass pull, switch collector from PAX to SIPX. P80= 114µ
F16	2	Same as F15. Lower collector dosage, increased rougher pH to 10. P80= 119µ
F17	3	Same as F12. Lower mass pull, switch collector from PAX to SIPX. P80= 110µ
F18	3	Same as F17. Lower collector dosage, increased rougher pH to 10. P80= 106µ

The parameter changes in these six tests were a slightly coarser regrind and lower weight pull. This resulted in higher concentrate grades, but lower recoveries as the metallurgy moves along the grade-recovery curve. These results do not demonstrate any negative points, other than more testing will be required to better understand and optimize the operating parameters.

2.2.7.4 Flotation Summary

The 6 flotation tests (F13 to F18), performed on each composite were scoping in nature using a variety of operating parameters. It is too early to firmly establish a particular parameter as best, or optimized. Table 20 is a summary of the averages for all tests in each composite category. It is intended to illustrate the degree of initial results.

Table 20 Flotation Result Summary

Comp	Flotation	Grind		Concentrate Assays				% Recovery			
No.	Stage	P80 (µm)	% Wt	Au g/t	Ag g/t	% S	% Zn	Au	Ag	S	Zn
1	Rougher	115	24.1	18.8	84.1	18.2	6.6	97.4	89.8	93	88.9
	1st Cleaner	34	5.5	78.1	284.0	35.7	22.4	91.8	73.8	46.0	68.1
	2nd Cleaner		3.7	114.9	380.5	36.7	31.6	88.8	65.4	32.4	62.2
2	Rougher	114	25.4	25.8	34.9	15.2	3.2	93.0	85.9	89.0	84.9
	1st Cleaner	30	5.9	99.8	110.2	38.5	11.8	83.1	67.3	56.5	70.0
	2nd Cleaner		3.4	179.4	173.8	40.4	21.1	73.0	54.9	36.0	61.1
3	Rougher	110	21.6	23.3	26.5	11.9	1.7	89.7	83.1	78.2	81.8
	1st Cleaner	29	3.9	107.7	114.6	34.7	7.7	80.1	77.5	44.3	67.1
	2nd Cleaner		2.5	164.6	172.0	37.5	11.5	74.4	71.2	31.8	61.9

Throughout the testing, a relationship between gold, silver and zinc performance could not be seen. They appear to act quite independently, depending on head grade and composite mineralogy.

2.2.7.5 Flotation Concentrate Analyses

Final concentrates (2nd cleaner concentrate) from flotation tests F14, 16 and 18 were analysed for minor element content which is listed in Table 21. The only assay of note is that of copper which ranged 1.3 - 4.6%, indicating a possible by-product.

Table 21 Concentrate Analyses

Test No.		F14	F16	F18			F14	F16	F18
Comp.		1	2	3			1	2	3
Au	g/t	167.4	256.1	261.1	S	%	34.1	38.7	35.6
Ag	g/t	480.7	230.1	266.5	Zn	%	40.8	30.4	16.8
					Fe	%	18.7	24.9	30.3
Al	%	0.86	0.75	1.33	Ni	ppm	44	92	216
Sb	ppm	332	507	107	Nb	ppm	2.3	4.1	2.8
As	ppm	642	2804	8991	Pd	ppm	0.094	0.038	0.055
Ba	ppm	52	44	54	P	ppm	99	305	178
Be	ppm	1.0	1.4	2.0	Pt	ppm	<0.005	<0.005	<0.005
Bi	ppm	408	247	38	K	%	0.45	0.37	0.78
Cd	ppm	3306	2867	1335	Rb	ppm	15.8	13.9	23.1
Ca	%	0.06	0.08	0.11	Re	ppm	0.003	0.003	0.005
Ce	ppm	20.3	24.9	25.5	Sc	ppm	0.6	0.8	1.3
Cs	ppm	1.0	2.2	2.6	Se	ppm	17.8	14.7	10.9
Cr	ppm	60	37	240	Na	%	<0.01	<0.01	<0.01
Co	ppm	64	158	122	Sr	ppm	18.2	14.3	17.8
Cu	%	1.85	1.39	4.62	Ta	ppm	0.60	0.46	0.35
Ga	ppm	3.6	3.6	5.5	Te	ppm	2.86	4.22	4.63
Ge	ppm	0.7	0.8	1.2	Tl	ppm	1.20	2.95	2.16
Hf	ppm	0.70	0.62	1.22	Th	ppm	4	8	4
In	ppm	252	146	114	Sn	ppm	6.2	2.2	7.8
La	ppm	9.3	11.4	12.1	Ti	%	0.027	0.052	0.055
Pb	ppm	11288	4328	215	W	ppm	1.01	1.13	2.24
Li	ppm	0.9	1.5	4.7	U	ppm	3	6	2
Mg	%	0.02	0.04	0.09	V	ppm	30	36	43
Mn	ppm	8306	3928	2872	Y	ppm	3.4	5.8	5.3
Mo	ppm	11.5	17.4	14.1	Zr	ppm	<0.5	<0.5	25.4

2.2.7.6 Flotation Tailing Analyses

The final flotation tailing product from tests F14, 16 and 18 were screened and each fraction assayed. The complete size by assay distribution tables are located in Appendix V. The results indicate the losses appear to be spread across most size fractions.

2.2.8 Analytical Consistency Checks

The initial Au and Ag head assays, taken as single samples from the composites are slightly higher than the average of the calculated head assays from all the tests. This is not unusual. Sulphur and zinc assays, being much higher in content were very close.

Weighted head assays for all tests were calculated as a check to ensure overall consistency and no major errors.

Table 22 Calculated & Measured Head Grades

Test No.	Head Grades - Composite 1			
	Au g/t	Ag g/t	% S	% Zn
C1	3.81	22.40		
C2	4.29	26.30		
C3	4.64	23.20		
DL1	4.87	16.00		
F1	3.56	20.80	4.23	1.59
F2	4.47	22.30	4.42	1.58
F3	4.32	21.60	4.35	1.61
F10	4.12	19.20	4.35	1.68
F13	3.87	19.90	4.12	1.63
F14	4.55	19.70	4.32	1.63
GSB1	4.40			
Calc. Average	4.26	21.14	4.30	1.62
Measured	5.64	23.60	4.50	1.55
Richfield	4.22	15.40		

Test No.	Head Grades - Composite 2			
	Au g/t	Ag g/t	% S	% Zn
C4	6.11	10.10		
C5	5.69	11.20		
C6	6.10	11.80		
DL2	5.22	7.20		
F4	6.10	9.90	4.04	0.78
F5	6.33	9.60	3.87	0.84
F6	6.00	9.90	3.88	0.82
F11	6.19	8.70	3.94	0.86
F15	6.42	9.30	3.95	0.90
F16	6.70	9.40	3.92	0.95
GSB2	6.06			
Calc. Average	6.08	9.71	3.93	0.86
Measured	6.24	12.30	3.99	0.91
Richfield	7.00	9.60		

Test No.	Head Grades - Composite 3			
	Au g/t	Ag g/t	% S	% Zn
C7	5.23	6.30		
C8	6.38	6.50		
C9	5.52	8.40		
DL3	4.19	5.80		
F7	6.09	8.70	3.12	0.40
F8	5.45	6.90	3.06	0.38
F9	5.18	7.20	3.08	0.39
F12	4.72	4.90	3.14	0.40
F17	4.79	5.50	2.90	0.43
F18	5.07	5.70	2.99	0.41
GSB3	4.41			
Calc. Average	5.18	6.59	3.05	0.40
Measured	6.23	9.70	3.26	0.43
Richfield	4.81	4.30		

2.3 Conclusions and Recommendations

The series of tests conducted in this preliminary metallurgical program indicates positive results in all methods of gold and silver recovery. Initial overall recoveries and concentrate grades fall within the following ranges:

		% Au Recovery	Concentrate Grade
Gravity Concentration		19-37	1000-1500 g/t Au
Cyanidation		89-95	

		% Recovery	Concentrate Grade
Flotation	Au	81-91	108-197 g/t Au
	Ag	61-74	133-392 g/t Ag
	Zn	70-75	10-36 % Zn

The Bond ball mill work index of 17.6 kWhr/tonne suggests a moderate hardness. Further testing on a variety of ore types should be conducted to determine the variation across the mineralized area. In later stages of metallurgical testing, it is recommended the grinding circuit investigation utilize the Starkey SAG Design test, which also incorporates the Bond ball mill work index test.

The Diagnostic Leach Test conducted on all three composites separately is designed to indentify the deportment of the gold and silver mineralization. All three composites indicated high gold recovery by basic cyanidation. Recoveries of CN soluble Au were in the range of 90–97%. There was little or no indication of refractory gold mineralization present.

Gravity concentration of coarse gold by Falcon concentrator and panning (simulating a shaking table), produced grades in the range of 1,000 to 1,500 gr/t Au at a recovery range of 19–37%. Silver recoveries in this process were significantly less than that of the gold, probably due to mineralization differences. Pre-concentration using this method warrents further investigation.

Standard cyanidation leach tests run on all three samples produced extraction rates in the range 89–95% Au. Results indicated slightly higher extraction rates at finer grinds with an increase of 2–3% at the finer grind size. Further testing will be required to establish a more accurate grind versus recovery relationship. Silver extraction was significantly lower than that of the gold and quite erratic. Again, this is probably due to differences in mineralization and would require further work to establish more efficient extraction methods.

Combined rougher-scavenger flotation recoveries for gold were all above 90%, ranging as high as 98.8%. Silver was slightly lower in the range of 75–90% recovery, but significantly higher than the figures achieved by either gravity separation or cyanidation. Zinc recovery in this circuit was in the range 80–93%, with increased recoveries at higher feed grades and a finer primary grind.

Initial regrind – cleaner circuit flotation tests produced 1st cleaner recoveries of 81–94% Au, 81–86% Ag and 66-78% Zn at corresponding 2nd cleaner concentrate grades of 69-107 g/t Au, 110-268 g/t Ag and 7-17% Zn.

A subsequent series of six rougher-cleaner flotation tests were performed with a number of parameter changes such as grind size and weight pull. They did not produce any significant improvements, but provided additional grade-recovery curve data.

Throughout the testing program, a relationship between gold, silver and zinc performance could not be seen. They appear to act quite independently, depending on head grade and composite mineralogy.

The next phase of testing should investigate further flotation options such as the production of two concentrates, pyrite and zinc. It is recommended a combination of gravity separation followed by flotation be investigated as this would appear to be a favourable method at this point. Leaching of the pyrite concentrate should be investigated for precious metal recovery.

METALLURGICAL TESTING OF SAMPLES FROM THE BLACKWATER GOLD PROJECT

APPENDICIES

I	**SAMPLE DESCRIPTION and LOG**
II	**TEST PROCEDURES**
III	**TEST RESULTS and BALANCES**
IV	**SIZE ANALYSIS DATA**
V	**MISCELLANEOUS DATA**
VI	**MINERALOGICAL STUDY**

METALLURGICAL TESTING OF SAMPLES FROM THE BLACKWATER GOLD PROJECT

APPENDIX I

SAMPLE DESCRIPTION and LOG

A shipment of 33 bags of crushed – ¼ " pulp samples weighing 111.8 kg. were received on March 25, 2010 from Richfield Ventures Corp., representing samples for metallurgical testing from the Blackwater Gold Project of central British Columbia.

Instructions were received as to the composites to be prepared representing three (3) drill holes. Following crushing, mixing and splitting, the composites were assayed and compared with the analyses as supplied by the client. Both sets of assays are as follows:

		Assays by Client g/t	Assays by Inspectorate g/t
Composite C-1	Au	4.22	5.64
	Ag	15.4	23.6
Composite C-2	Au	7.0	6.24
	Ag	9.6	12.3
Composite C-3	Au	4.81	6.23
	Ag	4.3	9.7

The following five (5) pages list the samples, descriptions and weights as received, along with client sample numbers and compositing details.

SAMPLE RECEIVING LOG SHEET

Receiving Date: 25-Mar-10	**Project No:** 1001302
Carrier: Freightway	**Client:** Richfield Ventures
Receiver: Joe	**Page:** 1 of 3

Count		Sample Label	Container Type	Sample Type (C, R, P, Sl, S)	Wet /Dry	Top Size	Weight (kg)
1	COMPOSITE 1	0419 13	Plastic Bag	P	Dry	1/4"	0.50
2		0419 14	Plastic Bag	P	Dry	1/4"	1.60
3		0419 15	Plastic Bag	P	Dry	1/4"	1.80
4		0419 93	Plastic Bag	P	Dry	1/4"	4.70
5		0419 94	Plastic Bag	P	Dry	1/4"	3.40
6		0419 95	Plastic Bag	P	Dry	1/4"	4.20
7		0426 9	Plastic Bag	P	Dry	1/4"	4.60
8		0426 10	Plastic Bag	P	Dry	1/4"	3.80
9		0426 11	Plastic Bag	P	Dry	1/4"	4.40
10							
11							
12							
13							
14							
15							
16							
17							
18							
							29.00

Note :

Core, **R**ock, **P**ulp, **Sl**urry, **S**olution

SAMPLE RECEIVING LOG SHEET

Receiving Date: 25-Mar-10	**Project No:** 1001302
Carrier: Freightway	**Client:** Richfield Ventures
Receiver: Joe	**Page:** 2 of 3

Count		Sample Label	Container Type	Sample Type (C, R, P, Sl, S)	Wet /Dry	Top Size	Weight (kg)
1	COMPOSITE 2	0459 46	Plastic Bag	P	Dry	1/4"	2.90
2		0459 47	Plastic Bag	P	Dry	1/4"	3.10
3		0459 48	Plastic Bag	P	Dry	1/4"	4.90
4		0459 49	Plastic Bag	P	Dry	1/4"	3.70
5		0459 50	Plastic Bag	P	Dry	1/4"	1.30
6		0459 198	Plastic Bag	P	Dry	1/4"	3.60
7		0459 199	Plastic Bag	P	Dry	1/4"	3.90
8		0459 200	Plastic Bag	P	Dry	1/4"	1.40
9		0459 201	Plastic Bag	P	Dry	1/4"	1.90
10		0459 202	Plastic Bag	P	Dry	1/4"	4.20
11		0459 203	Plastic Bag	P	Dry	1/4"	3.90
12		0459 204	Plastic Bag	P	Dry	1/4"	4.00
13							
14							
15							
16							
17							
18							
							38.80

Note :

Core, **R**ock, **P**ulp, **Sl**urry, **S**olution

SAMPLE RECEIVING LOG SHEET

Receiving Date: 25-Mar-10	**Project No:** 1001302
Carrier: Freightway	**Client:** Richfield Ventures
Receiver: Joe	**Page:** 3 of 3

Count		Sample Label	Container Type	Sample Type (C, R, P, Sl, S)	Wet /Dry	Top Size	Weight (kg)
1	COMPOSITE 3	0749 2	Plastic Bag	P	Dry	1/4"	3.40
2		0749 3	Plastic Bag	P	Dry	1/4"	3.80
3		0749 4	Plastic Bag	P	Dry	1/4"	4.40
4		0749 5	Plastic Bag	P	Dry	1/4"	4.00
5		0749 6	Plastic Bag	P	Wet	1/4"	2.30
6		0749 7	Plastic Bag	P	Dry	1/4"	4.50
7		0749 97	Plastic Bag	P	Dry	1/4"	2.90
8		0749 98	Plastic Bag	P	Dry	1/4"	1.80
9		0749 99	Plastic Bag	P	Dry	1/4"	4.50
10		0749 100	Plastic Bag	P	Dry	1/4"	3.80
11		0749 101	Plastic Bag	P	Dry	1/4"	3.90
12		0749 102	Plastic Bag	P	Dry	1/4"	4.70
13							
14							
15							
16							
17							
18							
19							
20							
							44.00

Note :

Core, **R**ock, **P**ulp, **Sl**urry, **S**olution

Instructions for Compositing of Samples as Supplied by Client

From: Dirk Tempelman-Kluit [mailto:dirktk@telus.net]
Sent: Fri 4/2/2010 5:58 PM
To: Redfearn, Mike
Cc: 'Christopher Leslie'
Subject: samples you received

Dear Mike

The samples you have received are from three, not four holes. The first set as follows is from one hole

09-419	**13-15**
09-419	**93-95**
09-426	**9-11**

The second set as follows is from a second hole

09-459	**46-50**
09-459	**198-204**

And the third group is

09-749	**2-7**
09-749	**97-102**

The lab had discarded the fourth set of samples and I will work on getting you a replacement set.

Also I know you asked for averages from the assays for the various intervals. I include these in the table below.

				Job #	**Sample #'s**		**Au g/t**	**Ag g/t**
3 samples – tags 7R119311 to 7R119313				**09-419**	**13-15**		1.80	13.6
3 samples - tags 7R119396 to 7R119398				**09-419**	**93-95**		6.96	19.1
3 samples - tags 7R119507 to &R119509				**09-426**	**9-11**		2.33	12.5

5 samples - tags 002-187 to 002-191				**09-459**	**46-50**		4.62	12.7
7 samples - tags 003-89 to 003-95				**09-459**	**198-204**		8.60	7.4
6 samples - tags 009-131 to 009-136				**09-749**	**2-7**		4.76	1.4
7 samples - tags 009-229 to 009-235				**09-749**	**97-102**		4.86	7.3

I trust this is satisfactory.

Dirk Tempelman-Kluit,
VP Exploration, Richfield Ventures Corp
1013-1030 Georgia Street Vancouver V6E 2Y3
604 669 6644

METALLURGICAL TESTING OF SAMPLES FROM THE BLACKWATER GOLD PROJECT

APPENDIX II

TEST PROCEDURES

Procedure	Page
Sample Preparation and Characterization	1
Grinding and Screening	1
Bond Ball Mill Work Index Determination	2
Diagnostic Leach Test	2
Gravity Separation	2
Cyanidation	3
Flotation	3

SAMPLE PREPARATION AND CHARACTERIZATION

A shipment of dry pulp samples was received at the Inspectorate laboratory in March of 2010. Samples were logged in and labels were compared to client provided lists to identify potential discrepancies. The samples were sorted into three (3) composites as requested by the client.

Each individual composite was crushed to -6 mesh, blended three times and a sample split out for work index testing. The remainder of the composites were crushed to -10 mesh, blended three times and split for various tests.

Approximately 100 grams from each composite was pulverized and submitted for analysis including Au, Ag, Fe, Zn, S(tot), whole rock analysis, ICP-MS 50 and carbon speciation. A 300 gram sample (unpulverized) from composite 3 was sent to Inspectorate's Petrographic Division in Belle Chasse, LA for full mineralogical analysis.

GRINDING AND SCREENING

Test charges were ground in a dedicated stainless steel laboratory rod mill for timed durations at a standard pulp density of 65% solids by weight. Calibrating test grinds performed using staged screening and oversize regrind procedures relied on product weights to establish reliable grind size targets. Bench scale tests were conducted on 2 kg whole ore charges.

Particle size distributions were measured using a Rotap™ vibrator, equipped with 20 cm (8") diameter test sieves that were stacked in ascending mesh sizes. The sample was initially wet screened at 37 microns (400 Tyler™ mesh). The +37 micron fraction was then dry screened through the stacked sieves. Each fraction was collected and weighed for calculating the individual and cumulative percent retained. Reground products were handled in a similar manner, but with a 500-mesh bottom size.

BOND BALL MILL WORK INDEX DETERMINATION

The Bond ball-mill work index is measured in a Bico-Braun® laboratory mill, with a standard ball charge medium. The feed size should be 100% passing 6-mesh, and the desired closing screen or “target size” as specified for the product. The bulk density is determined and the feed size distribution is measured to yield undersize, at a specified number of mill revolutions. The product is discharged to sift out the media and perform a screen analysis. The oversize is retained for the next cycle, replacing the weight of the undersize with an equivalent weight of the original feed. The undersize weight minus the feed undersize amount yields the net product weight. The procedures are repeated for each cycle until a constant circulating load is achieved, usually after four to six cycles. The calculation of a ball mill work index from the empirical Bond formula completed the exercise.

DIAGNOSTIC LEACH TEST

A sample weighing 270 grams was pulverized and subjected to a standard diagnostic leach test. The five (5) stages involved consist of various leaching components and a variety of test parameters to study gold association as follows: Stage 1 – cyanide soluble gold and silver; Stage 2 – gold associated with carbonaceous material; Stage 3 – gold associated with calcite / dolomite / pyrrhotite / goethite minerals; Stage 4 – gold associated with base metal sulphide minerals (labile sulphides); and Stage 5 – gold associated with majority sulphide minerals (pyrite, arsenopyrite, marcasite).

GRAVITY SEPARATION

Samples were ground to P80 of 100 mesh and run on a single pass using a Falcon SB40 centrifugal concentrator to obtain a preliminary split. Standard operating conditions were a feed density of 20% solids, gravitational force of 200G, use a 28^{o} bowl, and 1 psig back-water pressure. The heavy concentrate was then hand panned, simulating a shaking table operation. All products were assayed for gold by standard fire assay procedure.

CYANIDATION

The bottle roll cyanide leaching was carried 2 kg charges ground to the required P80 sizing, then pulped to a density of 40% solids. Sodium cyanide concentration was maintained at 1.0 g/L throughout the test, while the alkalinity was adjusted and maintained with the addition of hydrated lime to pH 10.5 – 11.0. Solution samples were removed at the retention times of 2, 7, 24, 48 and 72 hours to determine the free cyanide levels and gold dissolution. The leaching tests were terminated at 72 hours with filtration of the pregnant leachate solution. The solid residue was washed with hot cyanide solution, followed by two hot water displacement washes. The leachate and the final residue were analyzed for gold content. The sodium cyanide concentration was measured by titration against silver nitrate with para-dimethylamino rhodanine as an indicator. The reducing power of the final leachate was also determined.

FLOTATION

Open cycle, flotation tests were conducted using a Denver D12 laboratory flotation machine, with a cell size chosen to yield a typical pulp density of ~35% solids by weight. The solids were pulped in Richmond municipal water at an ambient temperature of ~18 °C. The impeller speed was set at 1800 RPM and the airflow was controlled manually to maintain the froth level. Potasssium amyl xanthate (PAX) in conjunction with Aeroflot 208 were used as collectors. Methyl isobutyl carbinol (MIBC) was used as a frother. The flotation was conducted at the natural pH to produce a bulk concentrate, consisting of three stages of roughing and one stage of scavenging. The combined rougher scavenger concentrate was reground in a ceramic ball mill, followed by two stages of flotation cleaning. All flotation products were filtered, dried, weighed and homogenized prior to analysis. Sulfide concentrates were dried in low-temperature ovens. Metallurgical balances and test procedures that apply to each test are provided in Appendix III.

METALLURGICAL TESTING OF SAMPLES FROM THE BLACKWATER GOLD PROJECT

APPENDIX III

TEST RESULTS and BALANCES

TEST RESULTS and BALANCES

Test	Data	Page
DL1	Diagnostic Leach Parameters & Results	1
DL2	Diagnostic Leach Parameters & Results	2
DL3	Diagnostic Leach Parameters & Results	3
GSB1	Gravity Concentration Parameters & Results	4
GSB2	Gravity Concentration Parameters & Results	5
GSB3	Gravity Concentration Parameters & Results	6
C1	Cyanidation Parameters & Results	7
C2	Cyanidation Parameters & Results	8
C3	Cyanidation Parameters & Results	9
C4	Cyanidation Parameters & Results	10
C5	Cyanidation Parameters & Results	11
C6	Cyanidation Parameters & Results	12
C7	Cyanidation Parameters & Results	13
C8	Cyanidation Parameters & Results	14
C9	Cyanidation Parameters & Results	15
F1	Flotation – Metallurgical Balance	16
	Testing Parameters	17
F2	Flotation – Metallurgical Balance	18
	Testing Parameters	19
F3	Flotation – Metallurgical Balance	20
	Testing Parameters	21
F4	Flotation – Metallurgical Balance	22
	Testing Parameters	23
F5	Flotation – Metallurgical Balance	24
	Testing Parameters	25
F6	Flotation – Metallurgical Balance	26
	Testing Parameters	27
F7	Flotation – Metallurgical Balance	28
	Testing Parameters	29
F8	Flotation – Metallurgical Balance	30
	Testing Parameters	31
F9	Flotation – Metallurgical Balance	32
	Testing Parameters	33
F10	Flotation – Metallurgical Balance	34
	Testing Parameters	35
F11	Flotation – Metallurgical Balance	36
	Testing Parameters	37
F12	Flotation – Metallurgical Balance	38
	Testing Parameters	39
F13	Flotation – Metallurgical Balance	40
	Testing Parameters	41

TEST RESULTS and BALANCES (con't)

Test	Data	Page
F14	Flotation – Metallurgical Balance	42
	Testing Parameters	43
F15	Flotation – Metallurgical Balance	44
	Testing Parameters	45
F16	Flotation – Metallurgical Balance	46
	Testing Parameters	47
F17	Flotation – Metallurgical Balance	48
	Testing Parameters	49
F18	Flotation – Metallurgical Balance	50
	Testing Parameters	51

DIAGNOSTIC LEACH REPORT 1

Client: Richfield Ventures
Test No: DL1
Sample ID : Composite 1

Date : 13-Aug-10
Project : 1001302

Initial sample weight : 270 g

	Au	Ag
Calculated grade :	4.87 g/t	16.0 g/t
Measured grade :	4.98 g/t	21.4 g/t

	Volume (ml)	Weight (g)	Assay Au (mg/L), (g/t)	Au (mg)	Ag (mg/L), (g/t)	Ag (mg)
Stage 1 - CIL leach						
CIL leach solution	388		0.01	0.004	0.23	0.09
CIL leach carbon		9.2	136.02	1.252	266.4	2.45
Stage 2 - Acetonitrile/Cyanide leach						
Acetonitrile/Cyanide leach PLS	345		0.03	0.010	0.77	0.27
Stage 3 - Hydrochloric Acid Leach/CIL leach						
HCl leach PLS*	1139	1140.0	0.005	0.006	0.92	1.05
CIL leach solution*	342		0.005	0.002	0.025	0.01
CIL leach carbon		7.9	0.43	0.003	17.1	0.13
Stage 4 - FeCl3+HCL Leach/CIL leach						
FeCl3+HCl leach PLS	471	444.7	0.03	0.014	0.26	0.12
CIL leach solution*	337		0.005	0.002	0.025	0.01
CIL leach carbon**		7.2	0.49	0.004	2.5	0.02
Stage 5 - Nitric Acid Leach/CIL leach						
HNO3 leach PLS*	813	795.0	0.005	0.004	0.13	0.11
CIL leach solution*	311		0.005	0.002	0.11	0.03
CIL leach carbon**		8.9	1.46	0.013	2.5	0.02
Final leach residue***		218.7	0.007	0.002	0.05	0.01

*Note:Solution Au assays <0.01mg/L, for calculation purpose 0.005mg/L entered; for Ag assay <0.05mg/L (ST3, ST4 CIL solution), 0.025mg/L entered

**Note: For Ag assay of carbon <5g/t, 2.5g/t entered

***Note: Ag assays in final leach residue <0.1ppm, for calculation purpose 0.05ppm entered

SUMMARY	Distribution Au mg	Au %	Ag mg	Ag %
Stage 1 - Cyanide Soluble	1.256	95.4	2.541	58.8
Stage 2 - Primarily associated with carbonaceous minerals	0.010	0.8	0.266	6.2
Stage 3 - Primarily associated with calcite/dolomite/pyrrhotite minerals	0.011	0.8	1.191	27.6
Stage 4 - Primarily associated with base metals sulphides (Labile sulphides)	0.019	1.5	0.149	3.4
Stage 5 - Primarily associated with majority sulphides (Py,AsPy and Marcasite)	0.019	1.4	0.162	3.8
Residue - Insoluble or associated with preg-robbing and other refractory minerals	0.002	0.1	0.011	0.3
Total	**1.316**	**100.0**	**4.320**	**100.0**

DIAGNOSTIC LEACH REPORT 2

Client: Richfield Ventures
Test No: DL2
Sample ID : Composite 2

Date : 13-Aug-10
Project : 1001302

Initial sample weight : 270 g

	Au	Ag
Calculated grade :	5.22 g/t	7.2 g/t
Measured grade :	6.12 g/t	10.5 g/t

	Volume (ml)	Weight (g)	Assay Au (mg/L), (g/t)	Assay Au (mg)	Assay Ag (mg/L), (g/t)	Assay Ag (mg)
Stage 1 - CIL leach						
CIL leach solution	388		0.01	0.004	0.12	0.047
CIL leach carbon		8.8	155.66	1.372	131.6	1.160
Stage 2 - Acetonitrile/Cyanide leach						
Acetonitrile/Cyanide leach PLS*	343		0.005	0.002	0.31	0.106
Stage 3 - Hydrochloric Acid Leach/CIL leach						
HCl leach PLS*	1142	1110.0	0.005	0.006	0.33	0.377
CIL leach solution	339		0.01	0.003	0.025	0.008
CIL leach carbon**		7.8	0.75	0.006	2.5	0.019
Stage 4 - FeCl3+HCL Leach/CIL leach						
FeCl3+HCl leach PLS*	493	458.7	0.005	0.002	0.2	0.099
CIL leach solution*	328		0.005	0.002	0.06	0.020
CIL leach carbon**		7.9	0.45	0.004	2.5	0.020
Stage 5 - Nitric Acid Leach/CIL leach						
HNO3 leach PLS*	746	745.0	0.005	0.004	0.05	0.037
CIL leach solution*	314		0.005	0.002	0.05	0.016
CIL leach carbon**		9.2	0.43	0.004	2.5	0.023
Final leach residue***		216.4	0.006	0.001	0.05	0.011

*Note:Solution Au assays <0.01mg/L, for calculation purpose 0.005mg/L entered; for Ag assay <0.05mg/L (ST3 CIL solution), 0.025mg/L entered

**Note: For Ag assay of carbon <5g/t, 2.5g/t entered

***Note: Ag assays in final leach residue are <0.1ppm, for calculation purpose 0.05ppm entered

SUMMARY	Distribution Au mg	Distribution Au %	Distribution Ag mg	Distribution Ag %
Stage 1 - Cyanide Soluble	1.375	97.5	1.206	62.1
Stage 2 - Primarily associated with carbonaceous minerals	0.002	0.1	0.106	5.5
Stage 3 - Primarily associated with calcite/dolomite/pyrrhotite minerals	0.015	1.1	0.405	20.8
Stage 4 - Primarily associated with base metals sulphides (Labile sulphides)	0.008	0.5	0.138	7.1
Stage 5 - Primarily associated with majority sulphides (Py,AsPy and Marcasite)	0.009	0.7	0.076	3.9
Residue - Insoluble or associated with preg-robbing and other refractory minerals	0.001	0.1	0.011	0.6
Total	**1.410**	**100.0**	**1.942**	**100.0**

DIAGNOSTIC LEACH REPORT 3

Client: Richfield Ventures
Test No: DL3
Sample ID : Composite 3

Date : 13-Aug-10
Project : 1001302

Initial sample weight : 270 g

	Au	Ag
Calculated grade :	4.19 g/t	5.8 g/t
Measured grade :	5.69 g/t	7.5 g/t

	Volume (ml)	Weight (g)	Assay Au (mg/L), (g/t)	Assay Au (mg)	Assay Ag (mg/L), (g/t)	Assay Ag (mg)
Stage 1 - CIL leach						
CIL leach solution*	388		0.005	0.002	0.08	0.031
CIL leach carbon		9.2	110.85	1.023	90.2	0.832
Stage 2 - Acetonitrile/Cyanide leach						
Acetonitrile/Cyanide leach PLS	341		0.07	0.024	0.21	0.072
Stage 3 - Hydrochloric Acid Leach/CIL leach						
HCl leach PLS	1179	1090.0	0.01	0.012	0.11	0.130
CIL leach solution*	334		0.005	0.002	0.025	0.008
CIL leach carbon		7.9	0.84	0.007	6.4	0.051
Stage 4 - FeCl3+HCL Leach/CIL leach						
FeCl3+HCl leach PLS*	552	412.7	0.005	0.003	0.35	0.193
CIL leach solution*	323		0.005	0.002	0.05	0.016
CIL leach carbon		8.8	1.00	0.009	7.1	0.062
Stage 5 - Nitric Acid Leach/CIL leach						
HNO3 leach PLS*	734	650.0	0.005	0.004	0.08	0.059
CIL leach solution*	298		0.005	0.001	0.12	0.036
CIL leach carbon		8.7	4.94	0.043	8.6	0.074
Final leach residue**		212.1	0.012	0.003	0.05	0.011

*Note:Solution Au assays <0.01mg/L, for calculation purpose 0.005mg/L entered; for Ag assay <0.05mg/L (ST3 CIL solution), 0.025mg/L entered

**Note: Ag assays in final leach residue are <0.1ppm, for calculation purpose 0.05ppm entered

SUMMARY	Distribution Au mg	Distribution Au %	Distribution Ag mg	Distribution Ag %
Stage 1 - Cyanide Soluble	1.025	90.5	0.863	54.8
Stage 2 - Primarily associated with carbonaceous minerals	0.024	2.1	0.072	4.5
Stage 3 - Primarily associated with calcite/dolomite/pyrrhotite minerals	0.020	1.8	0.189	12.0
Stage 4 - Primarily associated with base metals sulphides (Labile sulphides)	0.013	1.2	0.272	17.3
Stage 5 - Primarily associated with majority sulphides (Py,AsPy and Marcasite)	0.048	4.2	0.169	10.7
Residue - Insoluble or associated with preg-robbing and other refractory minerals	0.003	0.2	0.011	0.7
Total	**1.132**	**100.0**	**1.575**	**100.0**

GRAVITY CONCENTRATION TEST 4

Client: Richfield Ventures
Test: GSB1
Sample: Composite 1

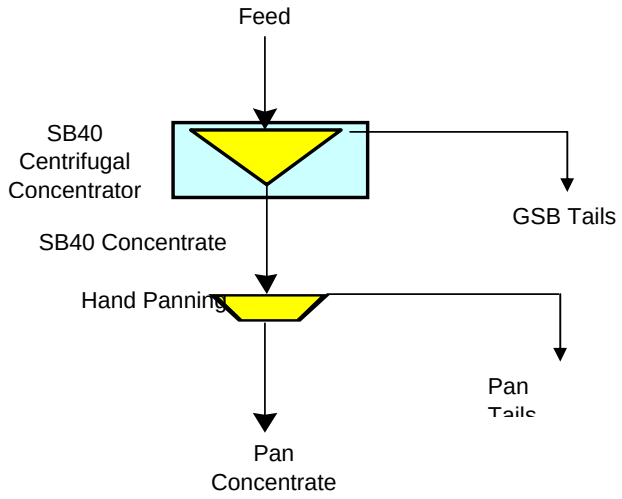
Date: 23-Apr-10
Project: 1001302

Objective: To recover gold by gravity using Falcon SB40 concentrator on sample ground to P80 = 137 µ

Products	Weight		Assay	Distribution
	(g)	(%)	Au (g/t)	Au (%)
Pan Concentrate	2.11	0.11	1545.32	37.1
Pan Tails	82.3	4.11	24.66	23.1
Total SB40 Concentrate	**84.4**	**4.22**	**62.67**	**60.1**
GSB Tails	1,915.0	95.78	1.83	39.9
Total	**1,999.4**	**100.00**	**4.40**	100.0
Measured			5.61	

Test Conditions				
Feed pulp Density	**Pressure**	**Bowl**	**Rotation Speed**	
20%	1.0	28°	59 Hz	150G

FALCON SB40 SINGLE PASS TEST PROCEDURE



GRAVITY CONCENTRATION TEST 5

Client: Richfield Ventures
Test: GSB2
Sample: Composite 2

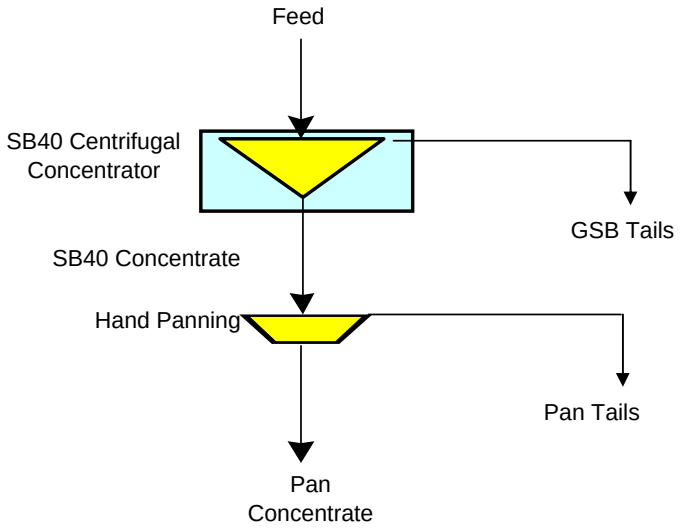
Date: 23-Apr-10
Project: 1001302

Objective: To recover gold by gravity using Falcon SB40 concentrator on sample ground to P80 = 138 µ

Products	Weight		Assay	Distribution
	(g)	(%)	Au (g/t)	Au (%)
Pan Concentrate	2.41	0.12	1081.13	21.5
Pan Tails	76.1	3.81	36.82	23.1
Total SB40 Concentrate	**78.5**	**3.93**	**68.93**	**44.7**
GSB Tails	1,919.8	96.07	3.49	55.3
Total	**1,998.3**	**100.00**	**6.06**	100.0
Measured			6.24	

Test Conditions				
Feed pulp Density	**Pressure**	**Bowl**	**Rotation Speed**	
20%	1.0	28°	59 Hz	150G

FALCON SB40 SINGLE PASS TEST PROCEDURE



GRAVITY CONCENTRATION TEST 6

Client: Richfield Ventures
Test: GSB3
Sample: Composite 3

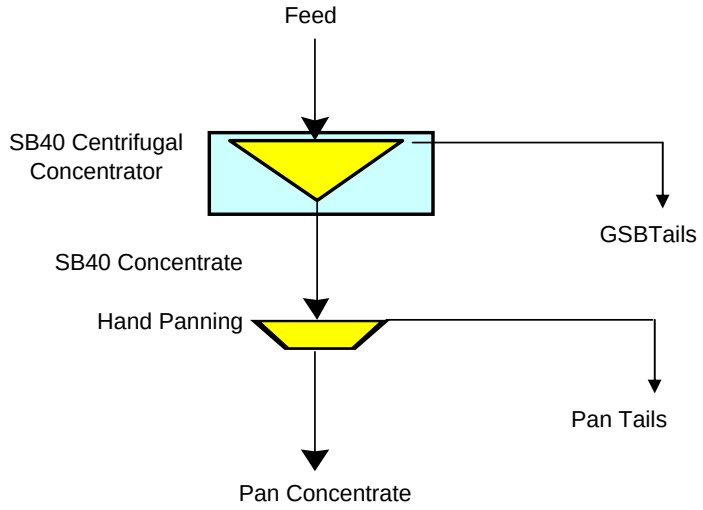
Date: 23-Apr-10
Project: 1001302

Objective: To recover gold by gravity using Falcon SB40 concentrator on sample ground to P80 = 152 µ

Products	Weight		Assay	Distribution
	(g)	(%)	Au (g/t)	Au (%)
Pan Concentrate	1.64	0.08	998.00	18.7
Pan Tails	73.0	3.67	35.85	29.8
Total SB40 Concentrate	**74.6**	**3.75**	**57.04**	**48.5**
GSB Tails	1,915.6	96.25	2.36	51.5
Total	**1,990.2**	**100.00**	**4.41**	100.0
Measured			6.23	

Test Conditions				
Feed pulp Density	**Pressure**	**Bowl**	**Rotation Speed**	
20%	1.0	28°	59 Hz	150G

FALCON SB40 SINGLE PASS TEST PROCEDURE



CYANIDATION TEST REPORT 7

Client: Richfield Ventures
Test: C1
Sample: Composite 1

Date: 4-May-10
Project: 1001302

Objective: Bottle roll cyanide leach in 1.0 g/L NaCN on composite samples at three grind sizes

TEST CONDITIONS

Solids:	1,997	g
Solution:	3,000	g
Solids:	40	%
Grind Size - P_{80}:	130	µm
Initial NaCN:	1.0	g/L
Target pH:	10.5 -11.0	
Test Duration:	72	hours

TEST DESCRIPTION

- repulped to 40% solids
- adjusted to and maintained pH 10.5-11.0
- adjusted to and maintained at 1.0g/L NaCN
- sampled at 4,7,24 and 48 hours
- test ended after 72 hours
- filtered and displacement washed with hot cyanide solution followed by two hot water displacement washes
- solution and solids assayed for Au, Ag content

HEAD GRADE

	Au	Ag
Calculated Total:	3.8 g/t	22.4 g/t
Measured Total:	5.6 g/t	22.5 g/t

LEACH TEST DATA

Time	NaCN		Lime	pH		dO_2	Slurry	Solution					
							Weight	Vol.	Assay Vol.	Au		Ag	
(hours)	(g/L)	(g)	(g)	before	after	(mg/L)	(g)	(mL)	(mL)	(mg/L)	(mg)	(mg/L)	(mg)
0	1.00	3.00	1.98	5.3	10.6		4,997	3,000					
2	0.80	0.60		10.9					5				
4	0.90	0.30		10.9		5.1	5,000	3,003	30	0.81	2.4	3.20	9.6
7	0.97	0.09		10.8			4,998	3,001	30	1.08	3.3	3.80	11.5
24	0.80	0.60		10.7		6.7	4,982	2,985	30	2.07	6.2	5.30	16.0
30	0.90	0.30		10.6					5				
48	0.80	0.60		10.7		6.9	4,992	2,995	30	2.21	6.8	6.20	19.0
54	0.97	0.09		10.5					5				
72	0.80			10.5		6.9	5,000	3,003		2.25	7.0	6.00	18.6
Total		5.58	1.98										

SOLIDS

Time	Total Residue				
	Weight	Au		Ag	
(hours)	(g)	(g/t)	(mg)	(g/t)	(mg)
72	1,997	0.33	0.65	13.1	26.2

CYANIDATION RESULTS

Time	Distribution		Reagent Consumption		Reducing Power
	Au	Ag	NaCN	$Ca(OH)_2$	0.1 N $KMnO_4$/L
(hours)	(%)	(%)	(kg/t)	(kg/t)	(mL)
4	31.8	21.5	0.45		
7	42.9	25.7	0.50		
24	81.9	35.8	0.80		
48	88.7	42.4	1.25		
72	91.5	41.6	1.59	0.99	400
Residue	8.5	58.4			
Total	100.0	100.0			

CYANIDATION TEST REPORT 8

Client: Richfield Ventures
Test: C2
Sample: Composite 1

Date: 4-May-10
Project: 1001302

Objective: Bottle roll cyanide leach in 1.0 g/L NaCN on composite samples at three grind sizes

TEST CONDITIONS

Solids:	2,003	g
Solution:	3,000	g
Solids:	40	%
Grind Size - $P_{80:}$	110	µm
Initial NaCN:	1.0	g/L
Target pH:	10.5 -11.0	
Test Duration:	72	hours

TEST DESCRIPTION

- repulped to 40% solids
- adjusted to and maintained pH 10.5-11.0
- adjusted to and maintained at 1.0g/L NaCN
- sampled at 4,7,24 and 48 hours
- test ended after 72 hours
- filtered and displacement washed with hot cyanide solution followed by two hot water displacement washes
- solution and solids assayed for Au, Ag content

HEAD GRADE

	Au	Ag
Calculated Total:	4.3 g/t	26.3 g/t
Measured Total:	5.6 g/t	22.5 g/t

LEACH TEST DATA

Time	NaCN		Lime	pH		dO_2	Slurry	Solution					
							Weight	Vol.	Assay Vol.	Au		Ag	
(hours)	(g/L)	(g)	(g)	before	after	(mg/L)	(g)	(mL)	(mL)	(mg/L)	(mg)	(mg/L)	(mg)
0	1.00	3.00	1.98	5.4	10.6		5,003	3,000					
2	0.82	0.54		10.9					5				
4	0.96	0.12		10.9		5.6	5,000	2,997	30	0.77	2.3	3.50	10.5
7	0.90	0.30		10.8			4,998	2,995	30	1.16	3.5	4.10	12.4
24	0.88	0.36		10.6		6.3	4,990	2,987	30	2.19	6.6	5.60	17.0
30	0.90	0.30	0.12	10.4	10.8				5				
48	0.81	0.57		10.6		6.5	4,992	2,989	30	2.49	7.6	6.30	19.3
54	0.95	0.15	0.12	10.5	10.7				5				
72	0.89			10.5		7.6	5,036	3,033		2.56	8.0	6.30	19.8
Total		5.34	2.22										

SOLIDS

Time	Total Residue				
	Weight	Au		Ag	
(hours)	(g)	(g/t)	(mg)	(g/t)	(mg)
72	2,003	0.30	0.60	16.4	32.9

CYANIDATION RESULTS

Time	Distribution		Reagent Consumption		Reducing Power
	Au	Ag	NaCN	$Ca(OH)_2$	0.1 N $KMnO_4$/L
(hours)	(%)	(%)	(kg/t)	(kg/t)	(mL)
4	26.9	20.0	0.33		
7	40.7	23.6	0.48		
24	76.8	32.2	0.66		
48	88.2	36.6	1.10		
72	93.0	37.6	1.32	1.11	415
Residue	7.0	62.4			
Total	100.0	100.0			

CYANIDATION TEST REPORT 9

Client: Richfield Ventures
Test: C3
Sample: Composite 1

Date: 4-May-10
Project: 1001302

Objective: Bottle roll cyanide leach in 1.0 g/L NaCN on composite samples at three grind sizes

TEST CONDITIONS

Solids:	2,005	g
Solution:	3,000	g
Solids:	40	%
Grind Size - $P_{80:}$	76	µm
Initial NaCN:	1.0	g/L
Target pH:	10.5 -11.0	
Test Duration:	72	hours

TEST DESCRIPTION

- repulped to 40% solids
- adjusted to and maintained pH 10.5-11.0
- adjusted to and maintained at 1.0g/L NaCN
- sampled at 4,7,24 and 48 hours
- test ended after 72 hours
- filtered and displacement washed with hot cyanide solution followed by two hot water displacement washes
- solution and solids assayed for Au, Ag content

HEAD GRADE

	Au	Ag
Calculated Total:	4.6 g/t	23.2 g/t
Measured Total:	5.6 g/t	22.5 g/t

LEACH TEST DATA

Time	NaCN		Lime	pH		dO_2	Slurry Weight	Solution					
								Vol.	Assay Vol.	Au		Ag	
(hours)	(g/L)	(g)	(g)	before	after	(mg/L)	(g)	(mL)	(mL)	(mg/L)	(mg)	(mg/L)	(mg)
0	1.00	3.00	1.88	5.5	10.6		5,005	3,000					
2	0.80	0.60		10.9					5				
4	0.95	0.15		10.9		5.1	5,001	2,996	30	1.14	3.4	4.60	13.8
7	0.91	0.27		10.8			4,997	2,992	30	1.43	4.3	5.30	16.0
24	0.81	0.57		10.6		6.6	4,985	2,980	30	2.10	6.3	6.90	20.9
30	0.92	0.24	0.10	10.5	10.7				5				
48	0.84	0.48	0.06	10.5	10.7	6.9	4,989	2,984	30	2.78	8.5	7.30	22.3
54	0.95	0.15		10.6					5				
72	0.90			10.4		7.7	5,001	2,996		2.82	8.7	7.60	23.6
Total		5.46	2.04										

SOLIDS

Time	Total Residue				
	Weight	Au		Ag	
(hours)	(g)	(g/t)	(mg)	(g/t)	(mg)
72	2,005	0.30	0.60	11.4	22.9

CYANIDATION RESULTS

Time	Distribution		Reagent Consumption		Reducing Power
	Au	Ag	NaCN	$Ca(OH)_2$	0.1 N $KMnO_4$/L
(hours)	(%)	(%)	(kg/t)	(kg/t)	(mL)
4	36.8	29.7	0.38		
7	46.4	34.5	0.51		
24	68.1	45.0	0.80		
48	90.8	48.1	1.16		
72	93.5	50.8	1.38	1.02	440
Residue	6.5	49.2			
Total	100.0	100.0			

CYANIDATION TEST REPORT 10

Client: Richfield Ventures
Test: C4
Sample: Composite 2

Date: 4-May-10
Project: 1001302

Objective: Bottle roll cyanide leach in 1.0 g/L NaCN on composite samples at three grind sizes

TEST CONDITIONS

Solids:	2,004	g
Solution:	3,000	g
Solids:	40	%
Grind Size - $P_{80:}$	144	µm
Initial NaCN:	1.0	g/L
Target pH:	10.5 -11.0	
Test Duration:	72	hours

TEST DESCRIPTION

- repulped to 40% solids
- adjusted to and maintained pH 10.5-11.0
- adjusted to and maintained at 1.0g/L NaCN
- sampled at 4,7,24 and 48 hours
- test ended after 72 hours
- filtered and displacement washed with hot cyanide solution followed by two hot water displacement washes
- solution and solids assayed for Au, Ag content

HEAD GRADE

	Au	Ag
Calculated Total:	6.1 g/t	10.1 g/t
Measured Total:	6.2 g/t	12.3 g/t

LEACH TEST DATA

Time	NaCN		Lime	pH		dO_2	Slurry	Solution					
							Weight	Vol.	Assay Vol.	Au		Ag	
(hours)	(g/L)	(g)	(g)	before	after	(mg/L)	(g)	(mL)	(mL)	(mg/L)	(mg)	(mg/L)	(mg)
0	1.00	3.00	3.38	5.0	10.9		5,004	3,000					
2	0.81	0.57		11.0					5				
4	0.94	0.18		10.9		6.1	5,000	2,996	30	1.33	4.0	1.84	5.5
7	0.96	0.12		10.8			4,998	2,994	30	1.80	5.4	2.22	6.7
24	0.80	0.60	0.16	10.2	10.7	6.9	4,984	2,980	30	2.07	6.3	2.90	8.8
30	0.98	0.06		10.6					5				
48	0.85	0.45	0.14	10.4	10.9	7.3	4,990	2,986	30	3.30	10.0	3.10	9.5
54	0.95	0.15	0.06	10.5	10.7				5				
72	0.90			10.3		7.4	4,988	2,984		3.55	10.9	3.20	9.9
Total		5.13	3.74										

SOLIDS

Time	Total Residue				
	Weight	Au		Ag	
(hours)	(g)	(g/t)	(mg)	(g/t)	(mg)
72	2,004	0.68	1.36	5.2	10.4

CYANIDATION RESULTS

Time	Distribution		Reagent Consumption		Reducing Power
	Au	Ag	NaCN	$Ca(OH)_2$	0.1 N $KMnO_4$/L
(hours)	(%)	(%)	(kg/t)	(kg/t)	(mL)
4	32.6	27.2	0.38		
7	44.4	33.0	0.44		
24	51.2	43.2	0.74		
48	81.9	46.7	0.99		
72	88.9	48.7	1.22	1.87	310
Residue	11.1	51.3			
Total	100.0	100.0			

CYANIDATION TEST REPORT 11

Client: Richfield Ventures
Test: C5
Sample: Composite 2

Date: 4-May-10
Project: 1001302

Objective: Bottle roll cyanide leach in 1.0 g/L NaCN on composite samples at three grind sizes

TEST CONDITIONS

Solids:	2,008	g
Solution:	3,000	g
Solids:	40	%
Grind Size - $P_{80:}$	112	µm
Initial NaCN:	1.0	g/L
Target pH:	10.5 -11.0	
Test Duration:	72	hours

TEST DESCRIPTION

- repulped to 40% solids
- adjusted to and maintained pH 10.5-11.0
- adjusted to and maintained at 1.0g/L NaCN
- sampled at 4,7,24 and 48 hours
- test ended after 72 hours
- filtered and displacement washed with hot cyanide solution followed by two hot water displacement washes
- solution and solids assayed for Au, Ag content

HEAD GRADE

	Au	Ag
Calculated Total:	5.7 g/t	11.2 g/t
Measured Total:	6.2 g/t	12.3 g/t

LEACH TEST DATA

Time	NaCN		Lime	pH		dO_2	Slurry	Solution					
							Weight	Vol.	Assay Vol.	Au		Ag	
(hours)	(g/L)	(g)	(g)	before	after	(mg/L)	(g)	(mL)	(mL)	(mg/L)	(mg)	(mg/L)	(mg)
0	1.00	3.00	3.26	5.0	10.6		5,008	3,000					
2	0.80	0.60		11.0					5				
4	0.95	0.15		10.9		6.4	4,998	2,990	30	1.49	4.5	2.14	6.4
7	0.94	0.18		10.8			4,995	2,987	30	2.02	6.1	2.50	7.5
24	0.80	0.60	0.14	10.2	10.7	6.9	4,981	2,973	30	3.48	10.5	3.20	9.7
30	0.95	0.15	0.10	10.6	10.7				5				
48	0.90	0.30	0.12	10.4	10.8	7.2	4,993	2,985	30	3.48	10.6	3.40	10.4
54	0.95	0.15	0.08	10.5	10.7				5				
72	0.88			10.3		7.1	4,997	2,989		3.28	10.2	3.80	11.7
Total		5.13	3.70										

SOLIDS

Time	Total Residue				
	Weight	Au		Ag	
(hours)	(g)	(g/t)	(mg)	(g/t)	(mg)
72	2,008	0.63	1.26	5.4	10.8

CYANIDATION RESULTS

Time	Distribution		Reagent Consumption		Reducing Power
	Au	Ag	NaCN	$Ca(OH)_2$	0.1 N $KMnO_4$/L
(hours)	(%)	(%)	(kg/t)	(kg/t)	(mL)
4	39.1	28.4	0.38		
7	53.3	33.4	0.47		
24	91.6	42.8	0.77		
48	93.0	46.1	0.99		
72	88.9	52.0	1.24	1.84	310
Residue	11.1	48.0			
Total	100.0	100.0			

CYANIDATION TEST REPORT 12

Client: Richfield Ventures
Test: C6
Sample: Composite 2

Date: 4-May-10
Project: 1001302

Objective: Bottle roll cyanide leach in 1.0 g/L NaCN on composite samples at three grind sizes

TEST CONDITIONS

Solids:	2,008	g
Solution:	3,000	g
Solids:	40	%
Grind Size - $P_{80:}$	88	µm
Initial NaCN:	1.0	g/L
Target pH:	10.5 -11.0	
Test Duration:	72	hours

TEST DESCRIPTION

- repulped to 40% solids
- adjusted to and maintained pH 10.5-11.0
- adjusted to and maintained at 1.0g/L NaCN
- sampled at 4,7,24 and 48 hours
- test ended after 72 hours
- filtered and displacement washed with hot cyanide solution followed by two hot water displacement washes
- solution and solids assayed for Au, Ag content

HEAD GRADE

	Au	Ag
Calculated Total:	6.1 g/t	11.8 g/t
Measured Total:	6.2 g/t	12.3 g/t

LEACH TEST DATA

Time	NaCN		Lime	pH		dO_2	Slurry	Solution					
							Weight	Vol.	Assay Vol.	Au		Ag	
(hours)	(g/L)	(g)	(g)	before	after	(mg/L)	(g)	(mL)	(mL)	(mg/L)	(mg)	(mg/L)	(mg)
0	1.00	3.00	3.26	5.1	10.7		5,008	3,000					
2	0.80	0.60		10.9					5				
4	0.94	0.18		10.8		6.1	4,999	2,991	30	1.45	4.3	1.99	6.0
7	0.92	0.24		10.7			4,998	2,990	30	1.67	5.0	2.41	7.3
24	0.85	0.45	0.14	10.3	10.7	6.6	4,983	2,975	30	2.80	8.4	3.00	9.1
30	0.90	0.30	0.10	10.5	10.7				5				
48	0.90	0.30	0.10	10.5	10.7	7.0	4,995	2,987	30	3.38	10.3	3.20	9.8
54	0.97	0.09	0.12	10.4	10.7				5				
72	0.81			10.3		7.7	4,993	2,985		3.60	11.1	3.30	10.2
Total		5.16	3.72										

SOLIDS

Time	Total Residue				
	Weight	Au		Ag	
(hours)	(g)	(g/t)	(mg)	(g/t)	(mg)
72	2,008	0.59	1.18	6.7	13.5

CYANIDATION RESULTS

Time	Distribution		Reagent Consumption		Reducing Power
	Au	Ag	NaCN	$Ca(OH)_2$	0.1 N $KMnO_4$/L
(hours)	(%)	(%)	(kg/t)	(kg/t)	(mL)
4	35.5	25.2	0.39		
7	41.2	30.7	0.51		
24	68.8	38.3	0.74		
48	84.0	41.4	1.04		
72	90.3	43.1	1.37	1.85	310
Residue	9.7	56.9			
Total	100.0	100.0			

CYANIDATION TEST REPORT 13

Client: Richfield Ventures
Test: C7
Sample: Composite 3

Date: 4-May-10
Project: 1001302

Objective: Bottle roll cyanide leach in 1.0 g/L NaCN on composite samples at three grind sizes

TEST CONDITIONS

Solids:	2,008	g
Solution:	3,000	g
Solids:	40	%
Grind Size - $P_{80:}$	162	µm
Initial NaCN:	1.0	g/L
Target pH:	10.5 -11.0	
Test Duration:	72	hours

TEST DESCRIPTION

- repulped to 40% solids
- adjusted to and maintained pH 10.5-11.0
- adjusted to and maintained at 1.0g/L NaCN
- sampled at 4,7,24 and 48 hours
- test ended after 72 hours
- filtered and displacement washed with hot cyanide solution followed by two hot water displacement washes
- solution and solids assayed for Au, Ag content

HEAD GRADE

	Au	Ag
Calculated Total:	5.2 g/t	6.3 g/t
Measured Total:	6.2 g/t	9.7 g/t

LEACH TEST DATA

Time	NaCN		Lime	pH		dO_2	Slurry	Solution					
							Weight	Vol.	Assay Vol.	Au		Ag	
(hours)	(g/L)	(g)	(g)	before	after	(mg/L)	(g)	(mL)	(mL)	(mg/L)	(mg)	(mg/L)	(mg)
0	1.00	3.00	3.30	5.4	11.0		5,008	3,000					
2	0.80	0.60		11.0					5				
4	0.97	0.09		11.0		5.1	4,998	2,990	30	1.28	3.8	1.19	3.6
7	0.94	0.18		10.9			4,996	2,988	30	1.52	4.6	1.37	4.1
24	0.79	0.63	0.10	10.4	10.7	5.7	4,988	2,980	30	2.24	6.8	1.82	5.5
30	0.80	0.60	0.06	10.5	10.7				5				
48	0.81	0.57		10.5		6.2	4,984	2,976	30	2.68	8.1	2.17	6.6
54	0.95	0.15	0.12	10.4	10.7				5				
72	0.82			10.4		7.4	4,994	2,986		3.16	9.7	2.27	7.0
Total		5.82	3.58										

SOLIDS

Time	Total Residue				
	Weight	Au		Ag	
(hours)	(g)	(g/t)	(mg)	(g/t)	(mg)
72	2,008	0.40	0.80	2.8	5.6

CYANIDATION RESULTS

Time	Distribution		Reagent Consumption		Reducing Power
	Au	Ag	NaCN	$Ca(OH)_2$	0.1 N $KMnO_4$/L
(hours)	(%)	(%)	(kg/t)	(kg/t)	(mL)
4	36.5	28.2	0.35		
7	43.7	32.8	0.44		
24	64.4	43.6	0.75		
48	77.5	52.3	1.34		
72	92.4	55.5	1.68	1.78	425
Residue	7.6	44.5			
Total	100.0	100.0			

CYANIDATION TEST REPORT 14

Client: Richfield Ventures
Test: C8
Sample: Composite 3

Date: 4-May-10
Project: 1001302

Objective: Bottle roll cyanide leach in 1.0 g/L NaCN on composite samples at three grind sizes

TEST CONDITIONS

Solids:	2,008	g
Solution:	3,000	g
Solids:	40	%
Grind Size - $P_{80:}$	103	µm
Initial NaCN:	1.0	g/L
Target pH:	10.5 -11.0	
Test Duration:	72	hours

TEST DESCRIPTION

- repulped to 40% solids
- adjusted to and maintained pH 10.5-11.0
- adjusted to and maintained at 1.0g/L NaCN
- sampled at 4,7,24 and 48 hours
- test ended after 72 hours
- filtered and displacement washed with hot cyanide solution followed by two hot water displacement washes
- solution and solids assayed for Au, Ag content

HEAD GRADE

	Au	Ag
Calculated Total:	6.4 g/t	6.5 g/t
Measured Total:	6.2 g/t	9.7 g/t

LEACH TEST DATA

Time	NaCN		Lime	pH		dO_2	Slurry Weight	Solution					
								Vol.	Assay Vol.	Au		Ag	
(hours)	(g/L)	(g)	(g)	before	after	(mg/L)	(g)	(mL)	(mL)	(mg/L)	(mg)	(mg/L)	(mg)
0	1.00	3.00	3.26	5.5	11.0		5,008	3,000					
2	0.81	0.57		11.1					5				
4	0.94	0.18		11.0		4.6	4,998	2,990	30	1.32	4.0	1.12	3.4
7	0.95	0.15		10.9			4,996	2,988	30	1.54	4.6	1.28	3.9
24	0.78	0.66		10.5		5.5	4,984	2,976	30	2.17	6.6	1.63	4.9
30	0.84	0.48		10.5					5				
48	0.81	0.57		10.6		6.0	4,982	2,974	30	3.20	9.7	2.01	6.1
54	0.89	0.33	0.08	10.5	10.7				5				
72	0.81			10.5		6.9	4,988	2,980		3.95	12.1	2.15	6.6
Total		5.94	3.34										

SOLIDS

Time	Total Residue				
	Weight	Au		Ag	
(hours)	(g)	(g/t)	(mg)	(g/t)	(mg)
72	2,008	0.37	0.74	3.2	6.4

CYANIDATION RESULTS

Time	Distribution		Reagent Consumption		Reducing Power
	Au	Ag	NaCN	$Ca(OH)_2$	0.1 N $KMnO_4$/L
(hours)	(%)	(%)	(kg/t)	(kg/t)	(mL)
4	30.9	25.8	0.38		
7	36.3	29.7	0.45		
24	51.2	37.8	0.79		
48	75.7	46.9	1.31		
72	94.2	50.7	1.76	1.66	480
Residue	5.8	49.3			
Total	100.0	100.0			

CYANIDATION TEST REPORT 15

Client: Richfield Ventures
Test: C9
Sample: Composite 3

Date: 4-May-10
Project: 1001302

Objective: Bottle roll cyanide leach in 1.0 g/L NaCN on composite samples at three grind sizes

TEST CONDITIONS

Solids:	2,011	g
Solution:	3,000	g
Solids:	40	%
Grind Size - $P_{80:}$	80	µm
Initial NaCN:	1.0	g/L
Target pH:	10.5 -11.0	
Test Duration:	72	hours

TEST DESCRIPTION

- repulped to 40% solids
- adjusted to and maintained pH 10.5-11.0
- adjusted to and maintained at 1.0g/L NaCN
- sampled at 4,7,24 and 48 hours
- test ended after 72 hours
- filtered and displacement washed with hot cyanide solution followed by two hot water displacement washes
- solution and solids assayed for Au, Ag content

HEAD GRADE

	Au	Ag
Calculated Total:	5.5 g/t	8.4 g/t
Measured Total:	6.2 g/t	9.7 g/t

LEACH TEST DATA

Time	NaCN		Lime	pH		dO_2	Slurry	Solution					
							Weight	Vol.	Assay Vol.	Au		Ag	
(hours)	(g/L)	(g)	(g)	before	after	(mg/L)	(g)	(mL)	(mL)	(mg/L)	(mg)	(mg/L)	(mg)
0	1.00	3.00	3.10	5.6	11.0		5,011	3,000					
2	0.88	0.36		11.0					5				
4	0.90	0.30		10.9		4.5	5,001	2,990	30	1.40	4.2	1.20	3.6
7	0.95	0.15		10.8			4,999	2,988	30	1.71	5.2	1.32	4.0
24	0.79	0.63	0.17	10.4	10.7	5.7	4,987	2,976	30	2.47	7.5	1.74	5.3
30	0.80	0.60	0.08	10.5	10.7				5				
48	0.80	0.60	0.06	10.5	10.6	6.1	4,991	2,980	30	3.34	10.1	2.13	6.5
54	0.90	0.30	0.10	10.5	10.7				5				
72	0.81			10.5		7.0	4,999	2,988		3.44	10.6	2.29	7.1
Total		5.94	3.51										

SOLIDS

Time	Total Residue				
	Weight	Au		Ag	
(hours)	(g)	(g/t)	(mg)	(g/t)	(mg)
72	2,011	0.25	0.50	4.9	9.9

CYANIDATION RESULTS

Time	Distribution		Reagent Consumption		Reducing Power
	Au	Ag	NaCN	$Ca(OH)_2$	0.1 N $KMnO_4$/L
(hours)	(%)	(%)	(kg/t)	(kg/t)	(mL)
4	37.8	21.2	0.33		
7	46.5	23.6	0.41		
24	67.2	31.1	0.73		
48	91.5	38.4	1.32		
72	95.5	41.8	1.75	1.75	490
Residue	4.5	58.2			
Total	100.0	100.0			

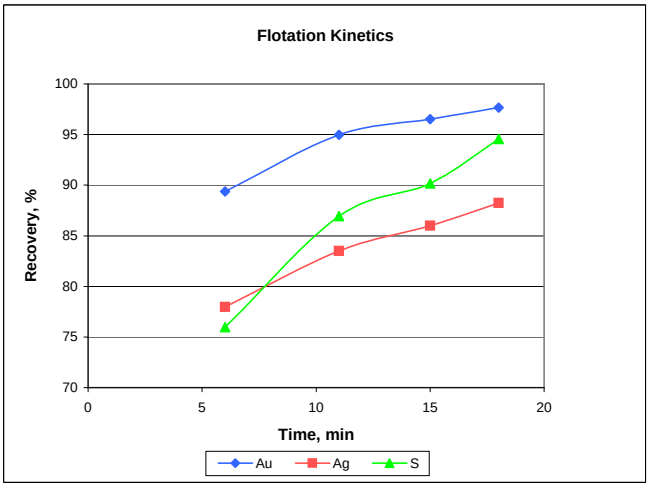
FLOTATION TEST METALLURGICAL BALANCE 16

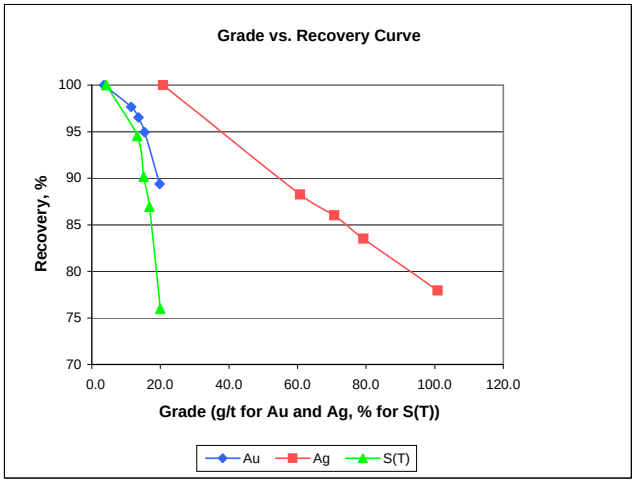
Client: Richfield Ventures
Test: F1
Sample: Composite 1

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 145microns

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
Rougher Concentrate 1	312.7	16.1	19.81	100.9	20.00	5.48	89.4	78.0	76.0	55.3
Rougher Concentrate 2	114.0	5.9	3.40	19.7	7.90	3.26	5.6	5.5	10.9	12.0
Rougher Concentrate 1+2	**426.7**	**21.9**	**15.43**	**79.2**	**16.77**	**4.89**	**95.0**	**83.5**	**86.9**	**67.2**
Rougher Concentrate 3	65.4	3.4	1.66	15.5	4.09	2.02	1.6	2.5	3.2	4.2
Total Rougher Concentrate	**492.1**	**25.3**	**13.60**	**70.7**	**15.08**	**4.51**	**96.5**	**86.0**	**90.2**	**71.5**
Scavenger Concentrate	95.6	4.9	0.81	9.5	3.76	6.35	1.1	2.2	4.4	19.6
Total Flotation Concentrate	**587.8**	**30.2**	**11.52**	**60.8**	**13.24**	**4.81**	**97.6**	**88.2**	**94.6**	**91.0**
Final Tails	1,359.2	69.8	0.12	3.5	0.33	0.20	2.4	11.8	5.4	9.0
Calculated Head	**1,947.0**	**100.0**	**3.56**	**20.8**	**4.23**	**1.59**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			4.98	21.4	4.54	1.68				





FLOTATION TEST PROCEDURE 17

Client: Richfield Ventures
Test: F1
Sample: Composite 1

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 145microns

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	9'15"	5.30			to target P80 ~100mesh
Rougher Flotation					5L cell
					at natural pH
Condition	1	5.44	PAX	25	
Rougher Float 1	6	5.83	MIBC	17	brownish froth appearance
Condition	1		PAX	20	
			A208	10	
Rougher Float 2	5	5.97	MIBC	2	to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	6.09	MIBC	3	to barren
Condition	1		CuSO4	100	
			PAX	10	
Scavenger Float 1	3	5.69	MIBC	3	
					assay products for Au, Stot, ICPM

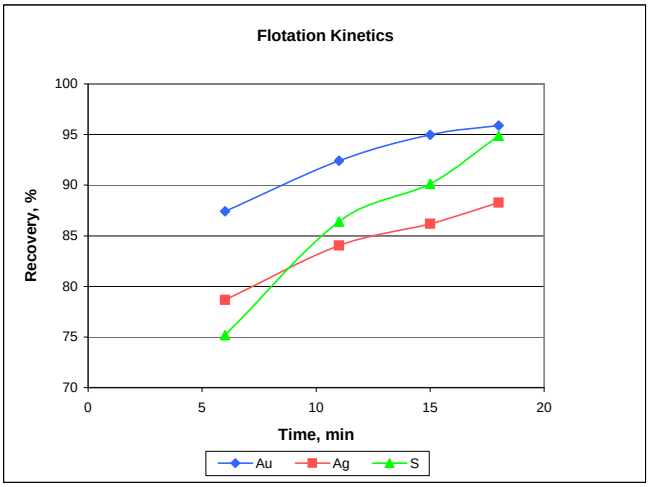
FLOTATION TEST METALLURGICAL BALANCE 18

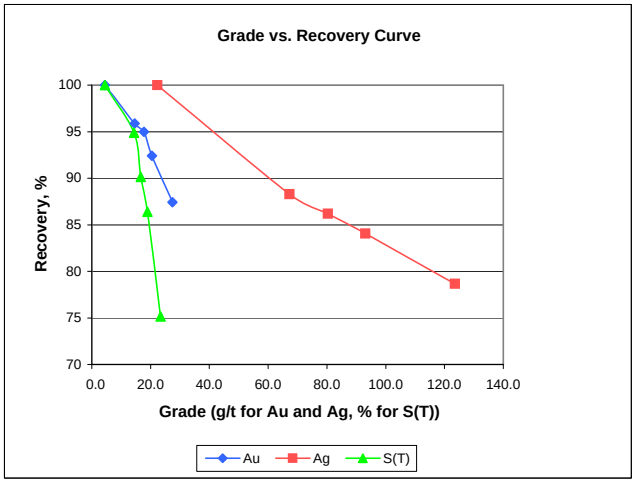
Client: Richfield Ventures
Test: F2
Sample: Composite 1

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 116microns

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
Rougher Concentrate 1	278.2	14.2	27.48	123.6	23.40	5.68	87.4	78.7	75.2	51.1
Rougher Concentrate 2	116.7	6.0	3.76	20.2	8.34	3.73	5.0	5.4	11.2	14.1
Rougher Concentrate 1+2	**394.8**	**20.2**	**20.47**	**93.0**	**18.95**	**5.11**	**92.4**	**84.1**	**86.4**	**65.2**
Rougher Concentrate 3	74.1	3.8	3.01	12.5	4.37	2.12	2.6	2.1	3.7	5.1
Total Rougher Concentrate	**468.9**	**23.9**	**17.71**	**80.3**	**16.65**	**4.63**	**95.0**	**86.2**	**90.1**	**70.2**
Scavenger Concentrate	104.9	5.4	0.76	8.8	3.91	6.40	0.9	2.1	4.7	21.7
Total Flotation Concentrate	**573.9**	**29.3**	**14.61**	**67.2**	**14.32**	**4.96**	**95.9**	**88.3**	**94.9**	**91.9**
Final Tails	1,384.1	70.7	0.26	3.7	0.32	0.18	4.1	11.7	5.1	8.1
Calculated Head	**1,958.0**	**100.0**	**4.47**	**22.3**	**4.42**	**1.58**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			4.98	21.4	4.54	1.68				





FLOTATION TEST PROCEDURE 19

Client: Richfield Ventures
Test: F2
Sample: Composite 1

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 116microns

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	11	5.37			to target P80 ~150mesh
Rougher Flotation					5L cell
					at natural pH
Condition	1	5.55	PAX	25	
Rougher Float 1	6	5.81	MIBC	20	
Condition	1		PAX	20	
			A208	10	
Rougher Float 2	5	5.98	MIBC	5	to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	6.07	MIBC	3	to barren
Condition	1		CuSO4	100	
			PAX	10	
Scavenger Float 1	3	5.71	MIBC	3	
					assay products for Au, Stot, ICPM

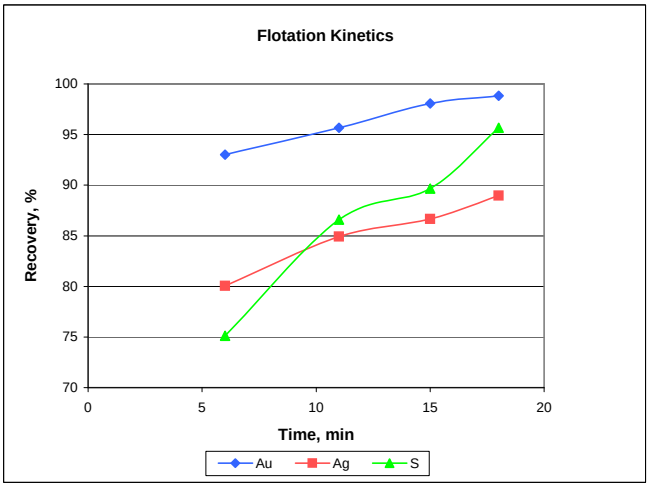
FLOTATION TEST METALLURGICAL BALANCE 20

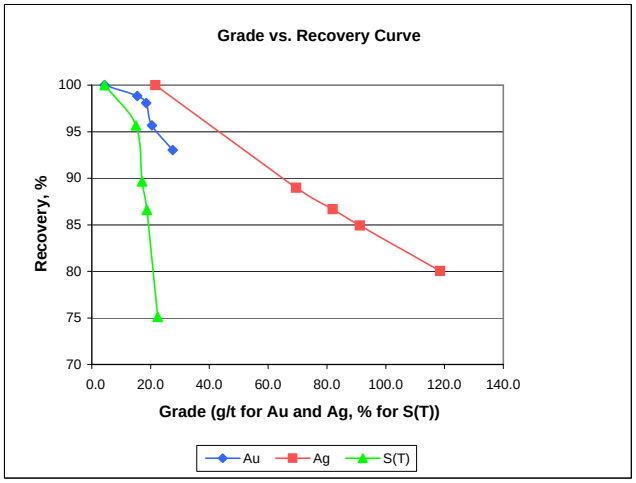
Client: Richfield Ventures
Test: F3
Sample: Composite 1

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 83microns

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
Rougher Concentrate 1	285.3	14.6	27.49	118.5	22.40	5.50	93.0	80.0	75.1	49.9
Rougher Concentrate 2	107.9	5.5	2.08	19.1	9.05	3.49	2.7	4.9	11.5	12.0
Rougher Concentrate 1+2	**393.3**	**20.1**	**20.52**	**91.2**	**18.74**	**4.95**	**95.7**	**84.9**	**86.6**	**61.9**
Rougher Concentrate 3	53.4	2.7	3.79	13.8	4.90	2.82	2.4	1.7	3.1	4.8
Total Rougher Concentrate	**446.7**	**22.9**	**18.52**	**82.0**	**17.08**	**4.69**	**98.1**	**86.7**	**89.7**	**66.7**
Scavenger Concentrate	93.8	4.8	0.67	10.3	5.45	8.92	0.7	2.3	6.0	26.6
Total Flotation Concentrate	**540.5**	**27.7**	**15.42**	**69.5**	**15.06**	**5.43**	**98.8**	**89.0**	**95.7**	**93.4**
Final Tails	1,413.6	72.3	0.07	3.3	0.26	0.15	1.2	11.0	4.3	6.6
Calculated Head	**1,954.1**	**100.0**	**4.32**	**21.6**	**4.35**	**1.61**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			4.98	21.4	4.54	1.68				





FLOTATION TEST PROCEDURE 21

Client: Richfield Ventures
Test: F3
Sample: Composite 1

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 83microns

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	14'20"	5.37			to target P80 ~200mesh
Rougher Flotation					5L cell
					at natural pH
Condition	1	5.60	PAX	25	
Rougher Float 1	6	5.85	MIBC		at this grind size more
					metallic (py) type froth appearance
Condition	1	5.88	PAX	20	
			A208	10	
Rougher Float 2	5	5.98	MIBC		to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	6.05	MIBC		to barren
Condition	1		CuSO4	100	
			PAX	10	
Scavenger Float 1	3	5.71	MIBC		
					assay products for Au, Stot, ICPM

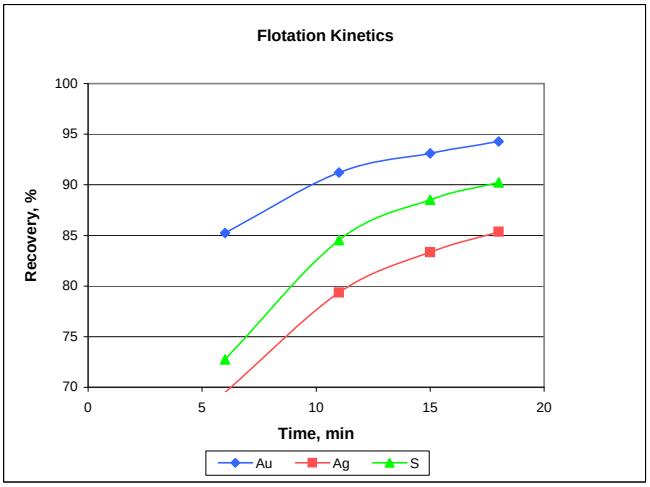
FLOTATION TEST METALLURGICAL BALANCE 22

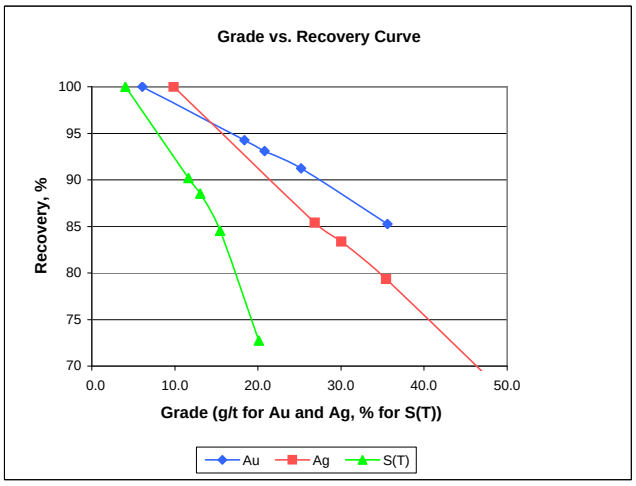
Client: Richfield Ventures
Test: F4
Sample: Composite 2

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 139microns

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
Rougher Concentrate 1	285.4	14.6	35.61	46.9	20.10	3.66	85.3	69.5	72.8	68.7
Rougher Concentrate 2	146.0	7.5	4.88	13.0	6.36	1.00	6.0	9.9	11.8	9.7
Rougher Concentrate 1+2	**431.3**	**22.1**	**25.21**	**35.4**	**15.45**	**2.76**	**91.2**	**79.4**	**84.5**	**78.4**
Rougher Concentrate 3	102.6	5.3	2.18	7.5	3.06	0.58	1.9	4.0	4.0	3.9
Total Rougher Concentrate	**533.9**	**27.3**	**20.78**	**30.1**	**13.07**	**2.34**	**93.1**	**83.4**	**88.5**	**82.3**
Scavenger Concentrate	78.1	4.0	1.77	5.0	1.72	1.04	1.2	2.0	1.7	5.3
Total Flotation Concentrate	**612.1**	**31.3**	**18.36**	**26.9**	**11.62**	**2.17**	**94.3**	**85.4**	**90.2**	**87.7**
Final Tails	1,340.7	68.7	0.51	2.1	0.58	0.14	5.7	14.6	9.8	12.3
Calculated Head	**1,952.7**	**100.0**	**6.10**	**9.9**	**4.04**	**0.78**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			6.24	12.3	3.99	0.90				





FLOTATION TEST PROCEDURE 23

Client: Richfield Ventures
Test: F4
Sample: Composite 2

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 139microns

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	5'30"	4.73			to target P80 ~100mesh
Rougher Flotation					5L cell
		5.63	Lime	100	natural pH<5 added lime to bring pH>5.5
Condition	1	5.70	PAX	25	
Rougher Float 1	6	5.89	MIBC	17	silvery colour froth appearance
Condition	1		PAX	20	
			A208	10	
Rougher Float 2	5	5.93	MIBC	7	to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	5.96	MIBC	5	to barren
Condition	1		CuSO4	100	
			PAX	10	
Scavenger Float 1	3	5.76	MIBC	13	
					assay products for Au, Stot, ICPM

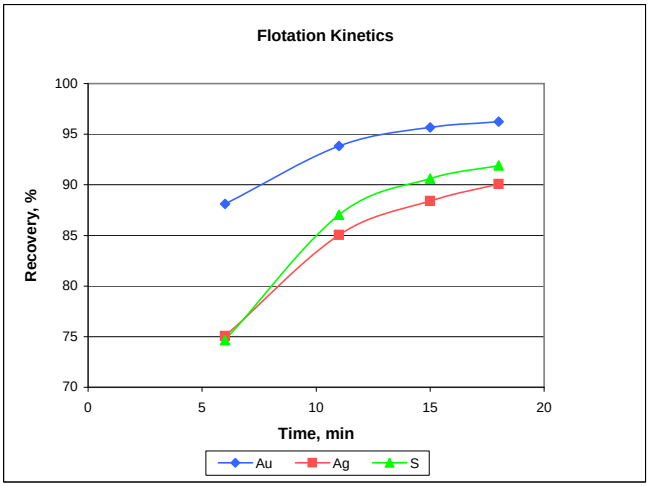
FLOTATION TEST METALLURGICAL BALANCE 24

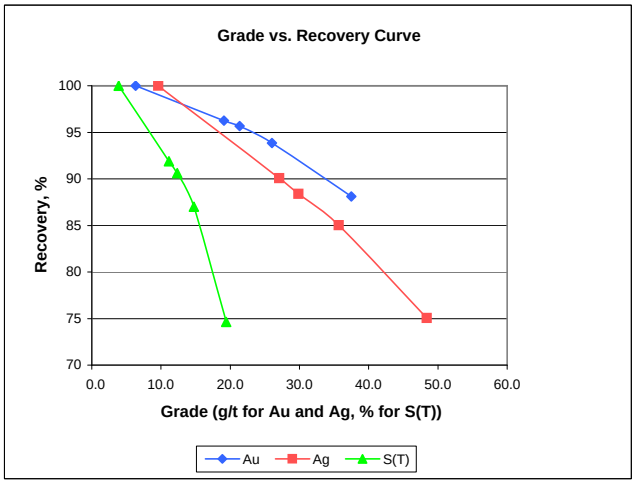
Client: Richfield Ventures
Test: F5
Sample: Composite 2

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 111microns

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
Rougher Concentrate 1	291.0	14.9	37.50	48.4	19.40	4.08	88.1	75.1	74.7	72.4
Rougher Concentrate 2	156.0	8.0	4.55	12.0	6.00	0.94	5.7	10.0	12.4	9.0
Rougher Concentrate 1+2	**447.0**	**22.9**	**26.00**	**35.7**	**14.72**	**2.99**	**93.9**	**85.0**	**87.0**	**81.3**
Rougher Concentrate 3	108.4	5.5	2.08	5.8	2.51	0.54	1.8	3.4	3.6	3.6
Total Rougher Concentrate	**555.4**	**28.4**	**21.33**	**29.9**	**12.34**	**2.51**	**95.7**	**88.4**	**90.6**	**84.9**
Scavenger Concentrate	68.8	3.5	1.02	4.6	1.41	1.01	0.6	1.7	1.3	4.2
Total Flotation Concentrate	**624.2**	**31.9**	**19.10**	**27.1**	**11.14**	**2.35**	**96.2**	**90.1**	**91.9**	**89.2**
Final Tails	1,331.0	68.1	0.35	1.4	0.46	0.13	3.8	9.9	8.1	10.8
Calculated Head	**1,955.1**	**100.0**	**6.33**	**9.6**	**3.87**	**0.84**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			6.24	12.3	3.99	0.90				





FLOTATION TEST PROCEDURE 25

Client: Richfield Ventures
Test: F5
Sample: Composite 2

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 111microns

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	6'40"	4.80			to target P80 ~150mesh
Rougher Flotation					5L cell
		5.76	Lime	100	natural pH<5 added lime to bring pH>5.5
Condition	1	5.85	PAX	25	
Rougher Float 1	6	5.96	MIBC	17	appears more slime in comparison with F4
Condition	1		PAX	20	
			A208	10	
Rougher Float 2	5	5.98	MIBC	17	to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	6.02	MIBC	5	to barren
Condition	1		CuSO4	100	
			PAX	10	
Scavenger Float 1	3	5.82	MIBC	8	assay products for Au, Stot, ICPM

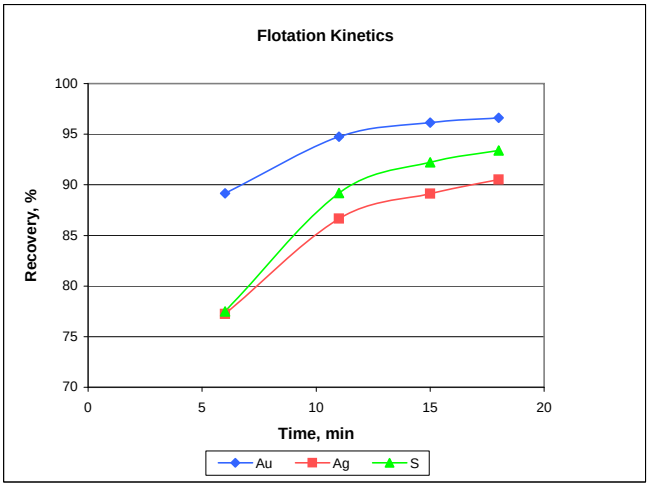
FLOTATION TEST METALLURGICAL BALANCE 26

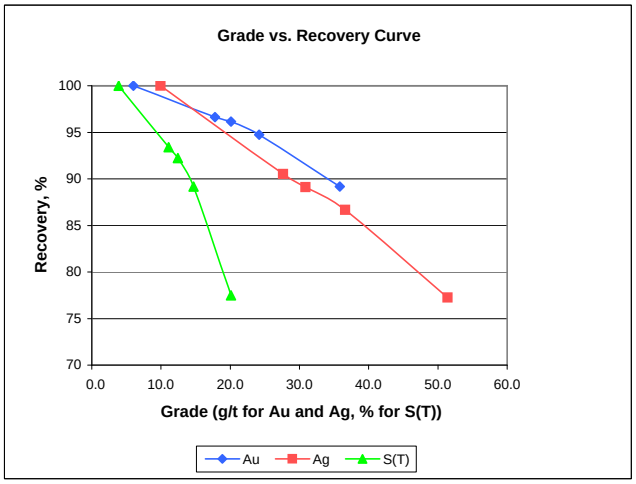
Client: Richfield Ventures
Test: F6
Sample: Composite 2

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 86microns

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
Rougher Concentrate 1	292.3	15.0	35.81	51.4	20.10	3.98	89.2	77.2	77.5	72.9
Rougher Concentrate 2	168.2	8.6	3.90	10.9	5.27	1.02	5.6	9.4	11.7	10.8
Rougher Concentrate 1+2	**460.5**	**23.6**	**24.16**	**36.6**	**14.68**	**2.90**	**94.8**	**86.7**	**89.2**	**83.7**
Rougher Concentrate 3	101.1	5.2	1.60	4.7	2.28	0.46	1.4	2.4	3.0	2.9
Total Rougher Concentrate	**561.6**	**28.7**	**20.10**	**30.9**	**12.45**	**2.46**	**96.1**	**89.1**	**92.2**	**86.6**
Scavenger Concentrate	75.8	3.9	0.77	3.6	1.17	0.77	0.5	1.4	1.2	3.6
Total Flotation Concentrate	**637.4**	**32.6**	**17.80**	**27.6**	**11.11**	**2.26**	**96.6**	**90.5**	**93.4**	**90.2**
Final Tails	1,317.8	67.4	0.30	1.4	0.38	0.12	3.4	9.5	6.6	9.8
Calculated Head	**1,955.2**	**100.0**	**6.00**	**9.9**	**3.88**	**0.82**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			6.24	12.3	3.99	0.90				





FLOTATION TEST PROCEDURE 27

Client: Richfield Ventures
Test: F6
Sample: Composite 2

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 86microns

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	8'45"	4.90			to target P80 ~200mesh
Rougher Flotation					5L cell
		5.60	Lime	100	natural pH<5 added lime to bring pH>5.5
Condition	1		PAX	25	
Rougher Float 1	6	5.87	MIBC	17	
Condition	1	5.88	PAX	20	
			A208	10	
Rougher Float 2	5	5.94	MIBC	8	to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	5.98	MIBC	8	to barren
Condition	1		CuSO4	100	
			PAX	10	
Scavenger Float 1	3	5.92	MIBC	8	
					assay products for Au, Stot, ICPM

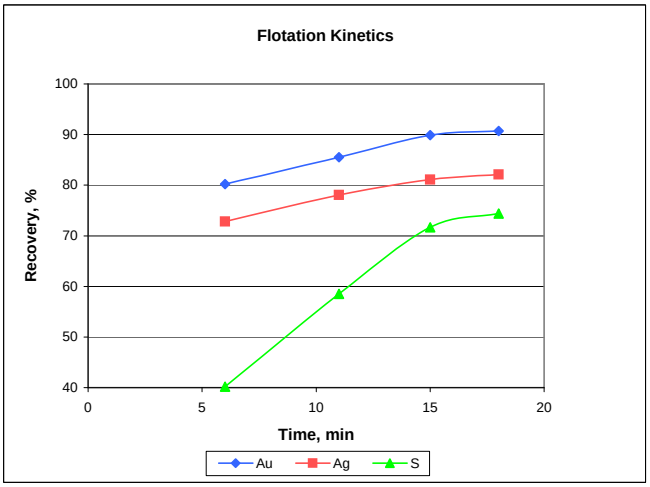
FLOTATION TEST METALLURGICAL BALANCE 28

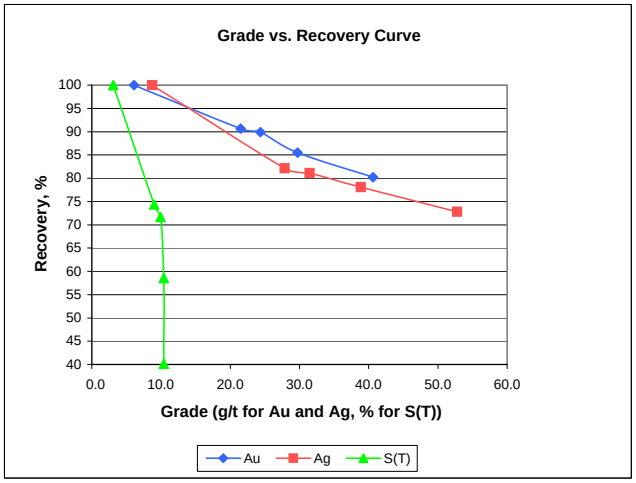
Client: Richfield Ventures
Test: F7
Sample: Composite 3

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 154microns

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
Rougher Concentrate 1	234.8	12.0	40.63	52.8	10.40	1.51	80.2	72.8	40.2	45.8
Rougher Concentrate 2	107.5	5.5	5.87	8.4	10.40	0.77	5.3	5.3	18.4	10.7
Rougher Concentrate 1+2	**342.3**	**17.5**	**29.72**	**38.9**	**10.40**	**1.28**	**85.5**	**78.1**	**58.5**	**56.5**
Rougher Concentrate 3	96.7	5.0	5.37	5.3	8.24	0.63	4.4	3.0	13.1	7.8
Total Rougher Concentrate	**439.0**	**22.5**	**24.35**	**31.5**	**9.92**	**1.13**	**89.9**	**81.1**	**71.7**	**64.3**
Scavenger Concentrate	63.0	3.2	1.47	2.8	2.63	1.92	0.8	1.0	2.7	15.6
Total Flotation Concentrate	**502.0**	**25.7**	**21.48**	**27.9**	**9.01**	**1.23**	**90.7**	**82.1**	**74.4**	**80.0**
Final Tails	1,449.2	74.3	0.77	2.1	1.08	0.11	9.3	17.9	25.6	20.0
Calculated Head	**1,951.2**	**100.0**	**6.09**	**8.7**	**3.12**	**0.40**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			6.23	9.7	3.26	0.42				





FLOTATION TEST PROCEDURE 29

Client: Richfield Ventures
Test: F7
Sample: Composite 3

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 154microns

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	15	5.10			to target P80 ~100mesh
Rougher Flotation					5L cell
		5.67	Lime	50	natural pH~5 added lime to bring pH>5.5
Condition	1	5.70	PAX	25	
Rougher Float 1	6	5.89	MIBC	25	py type froth
Condition	1		PAX	20	
			A208	10	darker grey, less mineralized from Ro 1
Rougher Float 2	5	5.94	MIBC	8	to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	6.02	MIBC	0	to barren
Condition	1		CuSO4	100	
			PAX	10	
Scavenger Float 1	3	5.74	MIBC	8	
					assay products for Au, Stot, ICPM

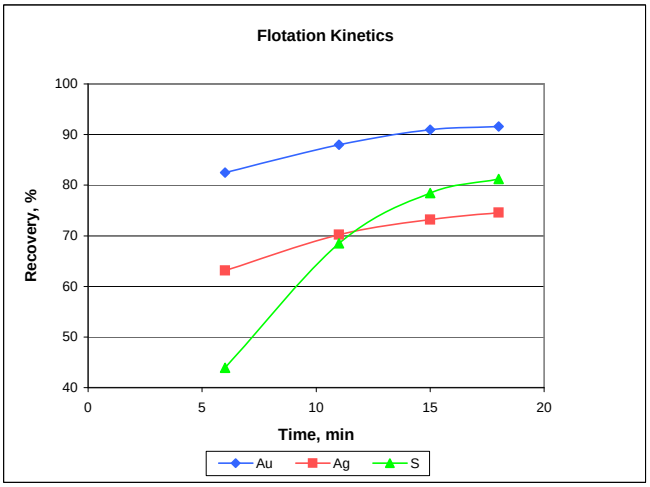
FLOTATION TEST METALLURGICAL BALANCE 30

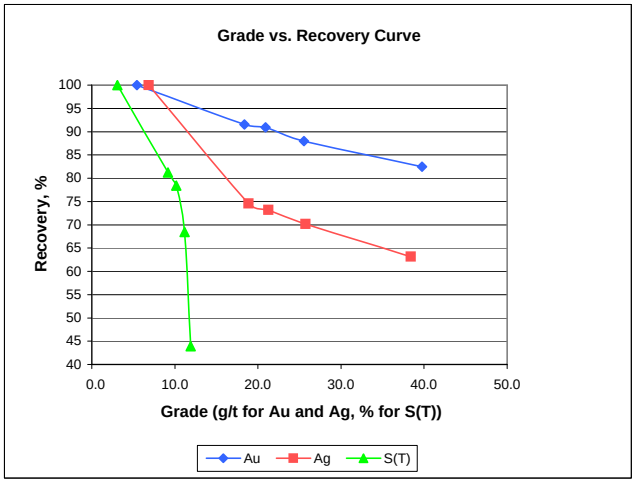
Client: Richfield Ventures
Test: F8
Sample: Composite 3

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 105microns

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
Rougher Concentrate 1	220.7	11.3	39.77	38.4	11.90	1.50	82.5	63.1	43.9	44.4
Rougher Concentrate 2	145.7	7.5	4.00	6.5	10.10	0.71	5.5	7.1	24.6	13.9
Rougher Concentrate 1+2	**366.4**	**18.8**	**25.55**	**25.7**	**11.18**	**1.18**	**88.0**	**70.2**	**68.5**	**58.2**
Rougher Concentrate 3	95.8	4.9	3.30	4.2	6.21	0.59	3.0	3.0	9.9	7.6
Total Rougher Concentrate	**462.2**	**23.7**	**20.93**	**21.3**	**10.15**	**1.06**	**90.9**	**73.2**	**78.4**	**65.8**
Scavenger Concentrate	67.6	3.5	1.01	2.7	2.47	2.03	0.6	1.4	2.8	18.5
Total Flotation Concentrate	**529.8**	**27.1**	**18.39**	**18.9**	**9.17**	**1.18**	**91.6**	**74.6**	**81.2**	**84.2**
Final Tails	1,422.6	72.9	0.63	2.4	0.79	0.08	8.4	25.4	18.8	15.8
Calculated Head	**1,952.3**	**100.0**	**5.45**	**6.9**	**3.06**	**0.38**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			6.23	9.7	3.26	0.42				





FLOTATION TEST PROCEDURE 31

Client: Richfield Ventures
Test: F8
Sample: Composite 3

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 105microns

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	19	5.29			to target P80 ~150mesh
Rougher Flotation					5L cell
		5.86	Lime	50	natural pH~5 added lime to bring pH>5.5
Condition	1		PAX	25	
Rougher Float 1	6	6.03	MIBC	25	
Condition	1		PAX	20	
			A208	10	
Rougher Float 2	5	6.10	MIBC	8	to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	6.16	MIBC	8	to barren
Condition	1		CuSO4	100	
			PAX	10	
Scavenger Float 1	3	5.91	MIBC	8	
					assay products for Au, Stot, ICPM

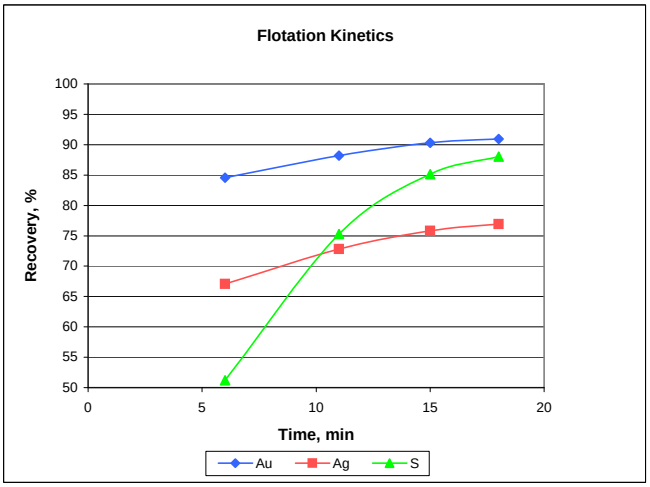
FLOTATION TEST METALLURGICAL BALANCE 32

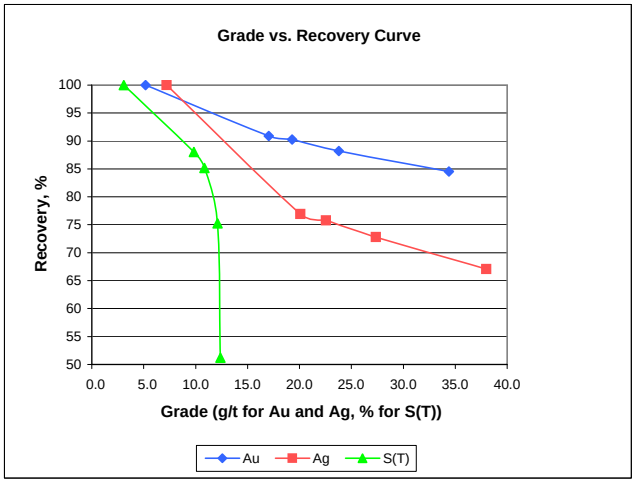
Client: Richfield Ventures
Test: F9
Sample: Composite 3

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 80microns

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
Rougher Concentrate 1	249.5	12.7	34.40	38.0	12.40	1.51	84.6	67.1	51.2	49.3
Rougher Concentrate 2	126.6	6.5	2.90	6.4	11.50	0.67	3.6	5.7	24.1	11.1
Rougher Concentrate 1+2	**376.1**	**19.2**	**23.80**	**27.4**	**12.10**	**1.23**	**88.2**	**72.8**	**75.3**	**60.4**
Rougher Concentrate 3	98.7	5.0	2.16	4.3	6.05	0.61	2.1	3.0	9.9	7.9
Total Rougher Concentrate	**474.8**	**24.2**	**19.30**	**22.6**	**10.84**	**1.10**	**90.3**	**75.8**	**85.1**	**68.2**
Scavenger Concentrate	66.6	3.4	0.97	2.4	2.62	2.22	0.6	1.1	2.9	19.3
Total Flotation Concentrate	**541.3**	**27.6**	**17.05**	**20.1**	**9.83**	**1.24**	**90.9**	**76.9**	**88.0**	**87.5**
Final Tails	1,418.7	72.4	0.65	2.3	0.51	0.07	9.1	23.1	12.0	12.5
Calculated Head	**1,960.0**	**100.0**	**5.18**	**7.2**	**3.08**	**0.39**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			6.23	9.7	3.26	0.42				





FLOTATION TEST PROCEDURE 33

Client: Richfield Ventures
Test: F9
Sample: Composite 3

Date: 27-Apr-10
Project: 1001302

Objective: Scoping flotation test to recover gold and silver at target P80 grind of 80microns

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	22'30"	5.24			to target P80 ~200mesh
Rougher Flotation					5L cell
		5.90	Lime	50	natural pH~5 added lime to bring pH>5.5
Condition	1		PAX	25	
Rougher Float 1	6	6.08	MIBC	25	
Condition	1	6.09	PAX	20	
			A208	10	
Rougher Float 2	5	6.16	MIBC	8	to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	6.20	MIBC	8	to barren
Condition	1		CuSO4	100	
			PAX	10	
Scavenger Float 1	3	5.95	MIBC	8	
					assay products for Au, Stot, ICPM

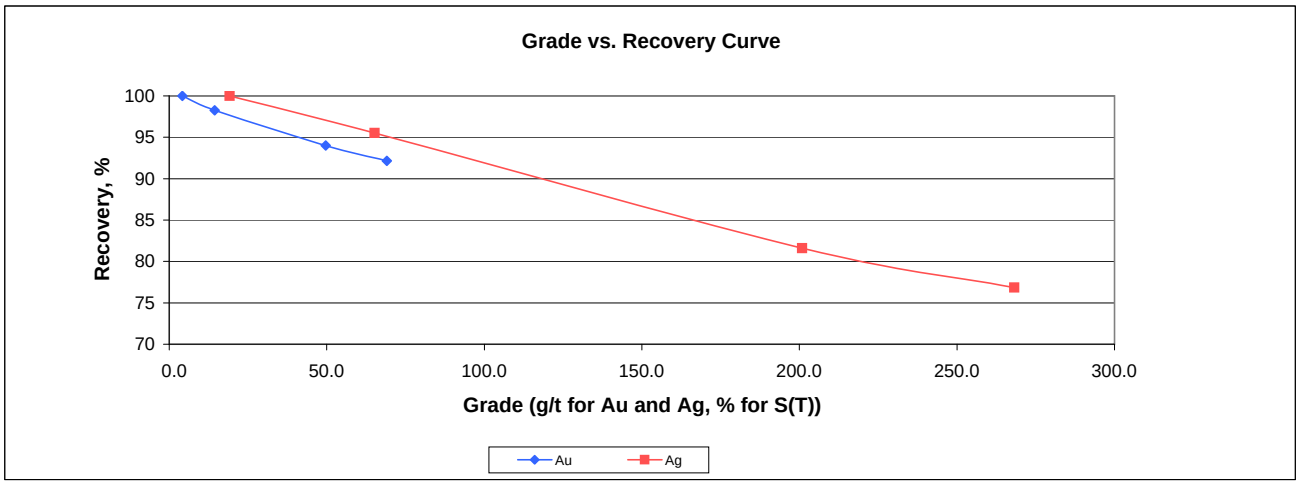
FLOTATION TEST METALLURGICAL BALANCE 34

Client: Richfield Ventures
Test: F10
Sample: Composite 1

Date: 7-Jun-10
Project: 1001302

Objective: Cleaner flotation test after regrinding of combined rougher concentrates

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
2nd Cleaner Concentrate	107.2	5.5	69.07	268.2	41.80	17.84	92.1	76.8	52.7	58.3
2nd Cleaner Tails	44.8	2.3	3.32	39.8	19.80	5.69	1.9	4.8	10.4	7.8
1st Cleaner Concentrate	**152.0**	**7.8**	**49.68**	**200.8**	**35.31**	**14.25**	**94.0**	**81.6**	**63.2**	**66.1**
1st Cleaner Tails	396.1	20.3	0.87	13.1	6.80	1.96	4.3	13.9	31.7	23.7
Total Rougher Concentrate	**548.1**	**28.1**	**14.40**	**65.2**	**14.70**	**5.37**	**98.3**	**95.5**	**94.9**	**89.8**
Final Tails	1,402.4	71.9	0.10	1.2	0.31	0.24	1.7	4.5	5.1	10.2
Calculated Head	**1,950.5**	**100.0**	**4.12**	**19.2**	**4.35**	**1.68**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			4.98	21.4	4.54	1.68				



FLOTATION TEST PROCEDURE 35

Client: Richfield Ventures
Test: F10
Sample: Composite 1

Date: 7-Jun-10
Project: 1001302

Objective: Cleaner flotation test after regrinding of combined rougher concentrates

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	11	5.37			to P80 = 112 µ
Rougher Flotation					5L cell
					at natural pH
Condition	1	5.32	PAX	25	
Rougher Float 1	6	5.50	MIBC	8	
Condition	1		PAX	20	
			A208	10	
Rougher Float 2	5	5.64	MIBC	5	to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	5.78	MIBC	2	to barren
Condition	1		CuSO4	100	
			PAX	10	
Rougher Float 4	3	5.46	MIBC	2	Combine all rougher conc for regrind
					and cleaning
Cleaner Flotation on Ro Conc 1-4 regrind to target P80~270mesh					
					wet:699g
Regrind	17	5.56			in ceramic mill with steel balls
					P80 = 25 µ
Condition	3	10.00	Lime	290	cleaning at pH10
	1		PAX	10	
Cleaner Float 1	10	10.00	MIBC	2	
Condition	3	10.50	Lime	60	cleaning at pH10.5
	1		PAX	5	
Cleaner Float 2	6	10.42	MIBC	2	
					assay for Au, Ag, Stot, ICPM

FLOTATION TEST METALLURGICAL BALANCE 36

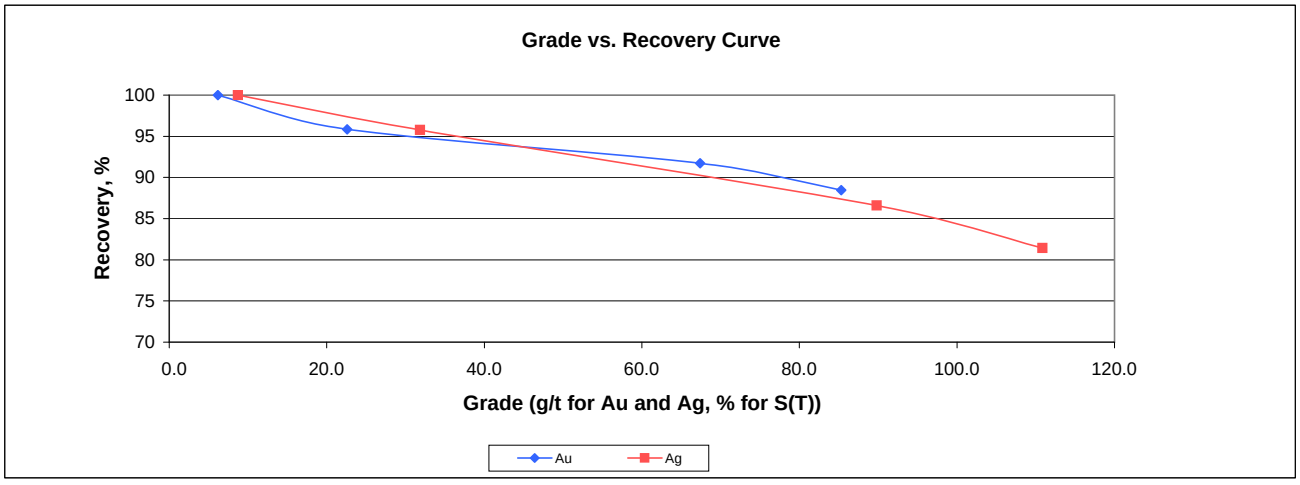
Client: Richfield Ventures
Test: F11
Sample: Composite 2

Date: 7-Jun-10
Project: 1001302

Objective: Cleaner flotation test after regrinding of combined rougher concentrates

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
2nd Cleaner Concentrate	125.5	6.4	85.31	110.9	42.70	10.03	88.5	81.4	69.6	74.7
2nd Cleaner Tails	39.2	2.0	10.03	22.5	13.80	1.56	3.3	5.2	7.0	3.6
1st Cleaner Concentrate	**164.7**	**8.4**	**67.38**	**89.8**	**35.81**	**8.01**	**91.7**	**86.6**	**76.6**	**78.3**
1st Cleaner Tails	348.8	17.8	1.43	4.5	3.48	0.34	4.1	9.2	15.7	7.1
Total Rougher Concentrate	**513.5**	**26.3**	**22.58**	**31.9**	**13.85**	**2.80**	**95.8**	**95.8**	**92.3**	**85.4**
Final Tails	1,440.9	73.7	0.35	0.5	0.41	0.17	4.2	4.2	7.7	14.6
Calculated Head	**1,954.3**	**100.0**	**6.19**	**8.7**	**3.94**	**0.86**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			6.24	12.3	3.99	0.90				

Note: Ag assay in final tails <0.5g/t; for calculation purpose 0.5g/t entered



FLOTATION TEST PROCEDURE 37

Client: Richfield Ventures
Test: F11
Sample: Composite 2

Date: 7-Jun-10
Project: 1001302

Objective: Cleaner flotation test after regrinding of combined rougher concentrates

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	6'40"	5.00			to P80 = 117 µ
Rougher Flotation					5L cell
					pH<5 and lime added to bring pH above 6
Condition	1	6.08	Lime	100	
			PAX	25	
Rougher Float 1	6	6.00	MIBC	5	
Condition	1		PAX	20	
			A208	10	
Rougher Float 2	5	6.20	MIBC	3	to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	6.23	MIBC	2	to barren
Condition	1		CuSO4	100	
			PAX	10	
Rougher Float 4	3	6.04	MIBC	2	Combine all rougher conc for regrind
					and cleaning
Cleaner Flotation on Ro Conc 1-4 regrind to target P80~270mesh					
					wet:629g
Regrind	15	6.33			in ceramic mill with steel balls
					P80 = 29 µ
Condition	3	10.00	Lime	280	cleaning at pH10
	1		PAX	10	
Cleaner Float 1	9	9.92	MIBC	2	
Condition	3	10.50	Lime	50	cleaning at pH10.5
	1		PAX	5	
Cleaner Float 2	7	10.45	MIBC	2	
					assay for Au, Ag, Stot, ICPM

FLOTATION TEST METALLURGICAL BALANCE 38

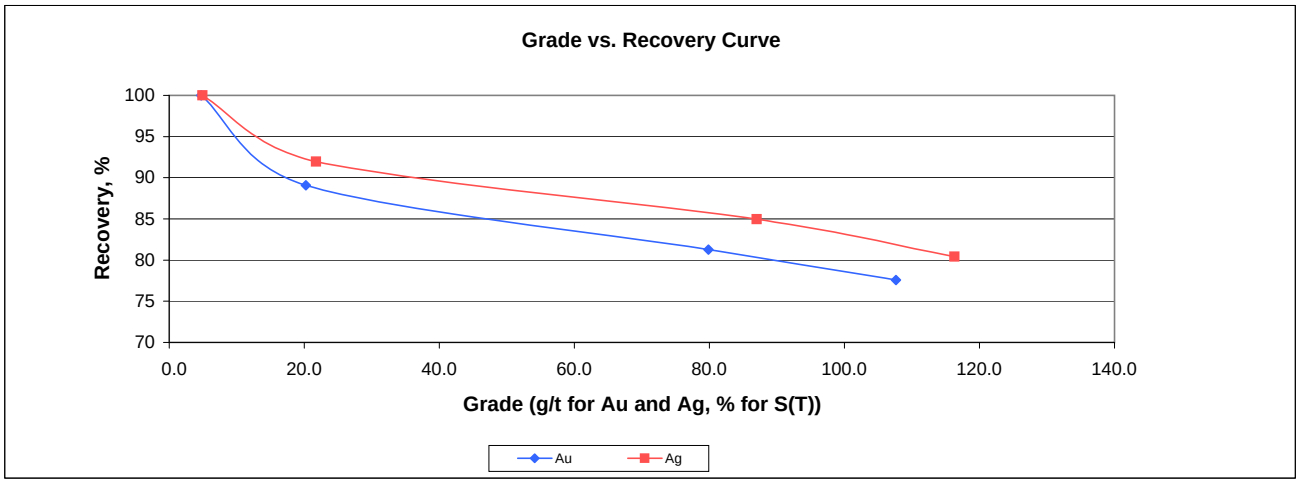
Client: Richfield Ventures
Test: F12
Sample: Composite 3

Date: 7-Jun-10
Project: 1001302

Objective: Cleaner flotation test after regrinding of combined rougher concentrates

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
2nd Cleaner Concentrate	66.4	3.4	107.65	116.3	38.20	7.08	77.6	80.4	41.4	60.0
2nd Cleaner Tails	27.4	1.4	12.38	16.0	20.40	0.88	3.7	4.5	9.1	3.1
1st Cleaner Concentrate	**93.7**	**4.8**	**79.85**	**87.0**	**33.01**	**5.27**	**81.3**	**85.0**	**50.5**	**63.1**
1st Cleaner Tails	312.1	16.0	2.31	2.2	4.23	0.32	7.8	7.0	21.5	12.6
Total Rougher Concentrate	**405.9**	**20.8**	**20.22**	**21.7**	**10.88**	**1.46**	**89.1**	**91.9**	**72.0**	**75.7**
Final Tails	1,546.1	79.2	0.65	0.5	1.11	0.12	10.9	8.1	28.0	24.3
Calculated Head	**1,952.0**	**100.0**	**4.72**	**4.9**	**3.14**	**0.40**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			6.23	9.7	3.26	0.42				

Note: Ag assay in final tails <0.5g/t; for calculation purpose 0.5g/t entered



FLOTATION TEST PROCEDURE 39

Client: Richfield Ventures
Test: F12
Sample: Composite 3

Date: 7-Jun-10
Project: 1001302

Objective: Cleaner flotation test after regrinding of combined rougher concentrates

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	19	5.25			to P80 = 104 µ
Rougher Flotation					5L cell
					pH~5 and lime added to bring pH above 5.5
Condition	1	5.74	Lime	50	
			PAX	25	
Rougher Float 1	6	5.70	MIBC	8	
Condition	1		PAX	20	
			A208	10	
Rougher Float 2	5	5.74	MIBC	2	to barren
Condition	1		PAX	10	
			A208	10	
Rougher Float 3	4	5.81	MIBC	2	to barren
Condition	1		CuSO4	100	
			PAX	10	
Rougher Float 4	3	5.85	MIBC	2	Combine all rougher conc for regrind
					and cleaning
Cleaner Flotation on Ro Conc 1-4 regrind to target P80~270mesh					
					wet:524g
Regrind	13	5.70			in ceramic mill with steel balls
					P80 = 26 µ
Condition	3	10.00	Lime	280	cleaning at pH10
	1		PAX	10	
Cleaner Float 1	8	9.91	MIBC	3	
Condition	3	10.50	Lime	50	cleaning at pH10.5
	1		PAX	5	
Cleaner Float 2	7	10.42	MIBC	2	
					assay for Au, Ag, Stot, ICPM

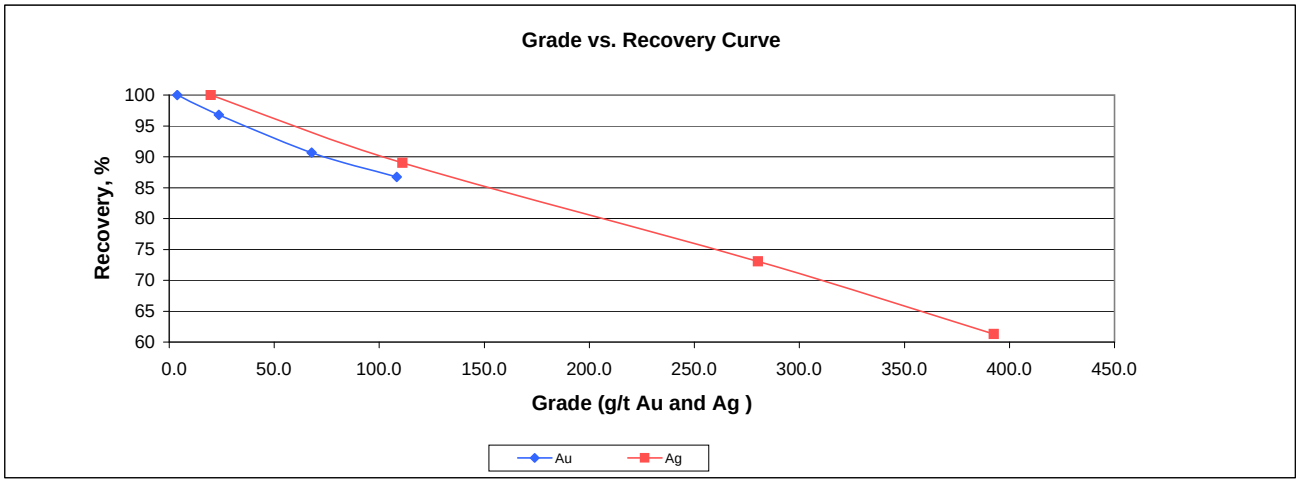
FLOTATION TEST METALLURGICAL BALANCE 40

Client: Richfield Ventures
Test: F13
Sample: Composite 1

Date: 9-Aug-10
Project: 1001302

Objective: Lower collector dosage to lower mass pull, SIPX instead PAX and cleaner after regrinding of combined rougher concentrates

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
2nd Cleaner Concentrate	60.1	3.1	108.28	392.5	34.10	36.13	86.8	61.3	25.7	68.7
2nd Cleaner Tails	40.2	2.1	7.28	112.4	39.20	4.21	3.9	11.7	19.7	5.3
1st Cleaner Concentrate	**100.3**	**5.2**	**67.83**	**280.3**	**36.14**	**23.34**	**90.6**	**73.0**	**45.4**	**74.0**
1st Cleaner Tails	208.1	10.7	2.22	29.5	18.30	2.21	6.2	16.0	47.7	14.5
Total Rougher Concentrate	**308.4**	**15.9**	**23.56**	**111.1**	**24.10**	**9.08**	**96.8**	**89.0**	**93.1**	**88.6**
Final Tails	1,628.3	84.1	0.15	2.6	0.34	0.22	3.2	11.0	6.9	11.4
Calculated Head	**1,936.7**	**100.0**	**3.87**	**19.9**	**4.12**	**1.63**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			4.98	21.4	4.54	1.68				



FLOTATION TEST PROCEDURE 41

Client: Richfield Ventures
Test: F13
Sample: Composite 1

Date: 9-Aug-10
Project: 1001302
Operator: JM

Objective: Lower collector dosage to lower mass pull, SIPX instead PAX and cleaner after regrinding of combined rougher concentrates

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	11				P80 = 118 µ
Rougher Flotation					5L cell
					pH<5 and lime added to bring pH above 6
Condition	1	6.10	Lime	100	
			SIPX	10	
Rougher Float 1	6	6.23	MIBC	8	
Condition	1		SIPX	5	
			A208	5	
Rougher Float 2	5	6.21	MIBC	3	to barren
Condition	1		SIPX	5	
			A208	5	
Rougher Float 3	4	6.20	MIBC	3	to barren
Condition	1		CuSO4	100	
			SIPX	5	
Rougher Float 4	3	5.97	MIBC	0	Combine all rougher conc for regrind
					and cleaning
					WET WEIGHT Ro TOTAL =370g
Cleaner Flotation on Ro Conc 1-4 regrind to target P80~270mesh					
Regrind	10	5.63			in ceramic mill with steel balls
					P80 = 40 µ
Condition	3	10.50	Lime	210	cleaning at pH10.5
	1		SIPX	5	
Cleaner Float 1	9	10.42	MIBC	5	
Condition	3	11.00	Lime	90	cleaning at pH11
Cleaner Float 2	7	10.86	MIBC	0	
					assay for Au, Ag, Stot, ICPM

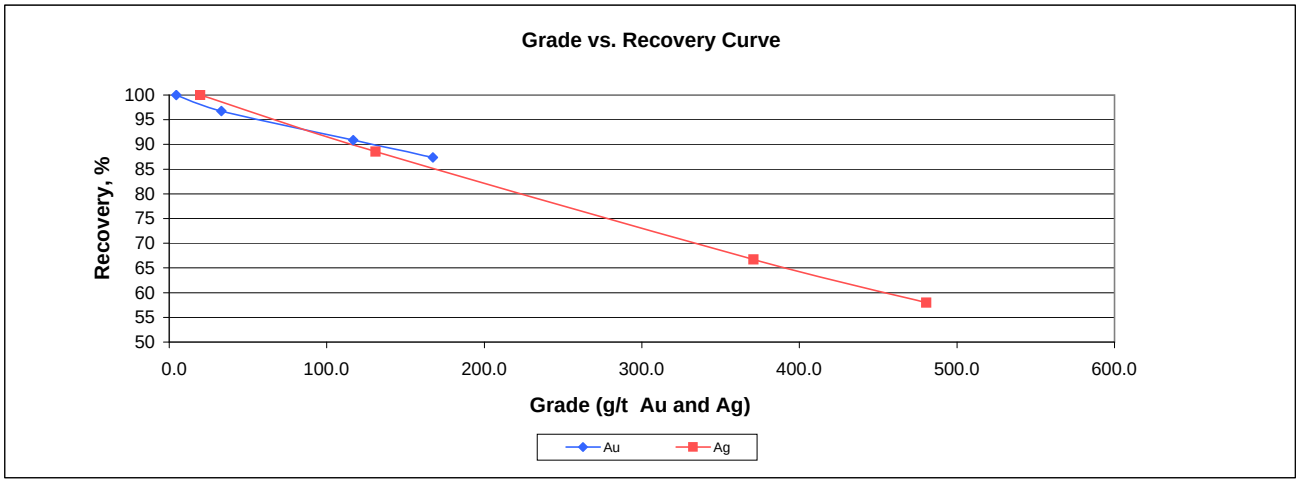
FLOTATION TEST METALLURGICAL BALANCE 42

Client: Richfield Ventures
Test: F14
Sample: Composite 1

Date: 9-Aug-10
Project: 1001302

Objective: As F13 with lower collector dosage, but rougher float at pH 10 and cleaner after regrinding of combined rougher concentrates

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
2nd Cleaner Concentrate	46.3	2.4	167.36	480.7	34.10	40.83	87.4	58.0	18.8	59.7
2nd Cleaner Tails	22.8	1.2	13.61	147.3	39.30	6.31	3.5	8.7	10.6	4.5
1st Cleaner Concentrate	**69.0**	**3.5**	**116.69**	**370.8**	**35.81**	**29.45**	**90.8**	**66.7**	**29.4**	**64.2**
1st Cleaner Tails	190.5	9.8	2.75	44.0	24.50	2.40	5.9	21.8	55.5	14.5
Total Rougher Concentrate	**259.5**	**13.3**	**33.06**	**130.9**	**27.51**	**9.60**	**96.7**	**88.6**	**84.9**	**78.7**
Final Tails	1,687.3	86.7	0.17	2.6	0.75	0.40	3.3	11.4	15.1	21.3
Calculated Head	**1,946.8**	**100.0**	**4.55**	**19.7**	**4.32**	**1.63**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			4.98	21.4	4.54	1.68				



FLOTATION TEST PROCEDURE 43

Client: Richfield Ventures
Test: F14
Sample: Composite 1

Date: 9-Aug-10
Project: 1001302
Operator: JM

Objective: As F13 with lower collector dosage, but rougher float at pH 10 and cleaner after regrinding of combined rougher concentrates

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	11				P80 = 118 µ
Rougher Flotation					5L cell
					Rougher at pH 10
Condition	1	10.00	Lime	880	
			SIPX	10	
Rougher Float 1	6	10.00	MIBC	8	
Condition	1	10.00	SIPX	5	
			A208	5	
Rougher Float 2	5	10.00	MIBC	3	to barren
Condition	1	10.00	SIPX	5	
			A208	5	
Rougher Float 3	4	9.65	MIBC	0	to barren
Condition	1		CuSO4	100	
		10.00	SIPX	5	
Rougher Float 4	3	9.48	MIBC	3	Combine all rougher conc for regrind
					and cleaning
					WET WEIGHT Ro TOTAL =312g
Cleaner Flotation on Ro Conc 1-4 regrind to target P80~270mesh					
					wet:
Regrind	10	8.50			in ceramic mill with steel balls
					P80 = 32 µ
Condition	3	10.50	Lime	130	cleaning at pH10.5
	1		SIPX	5	
Cleaner Float 1	9	10.50	MIBC	3	
Condition	3	11.00	Lime	100	cleaning at pH11
Cleaner Float 2	7	11.00	MIBC	3	
					assay for Au, Ag, Stot, ICPM

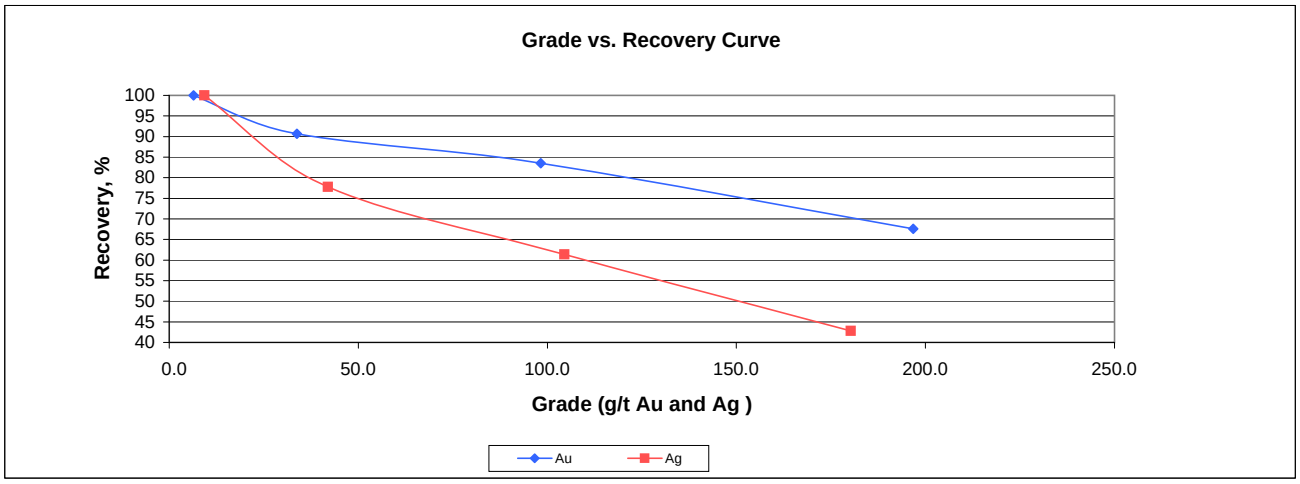
FLOTATION TEST METALLURGICAL BALANCE 44

Client: Richfield Ventures
Test: F15
Sample: Composite 2

Date: 9-Aug-10
Project: 1001302

Objective: Lower collector dosage to lower mass pull, SIPX instead PAX and cleaner after regrinding of combined rougher concentrates

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
2nd Cleaner Concentrate	43.1	2.2	196.75	180.3	39.80	22.86	67.6	42.8	22.2	56.2
2nd Cleaner Tails	63.6	3.3	31.47	53.2	40.30	3.81	15.9	18.6	33.2	13.8
1st Cleaner Concentrate	**106.7**	**5.5**	**98.27**	**104.6**	**40.10**	**11.51**	**83.6**	**61.4**	**55.4**	**70.0**
1st Cleaner Tails	230.4	11.8	3.88	13.0	10.40	0.90	7.1	16.4	31.0	11.9
Total Rougher Concentrate	**337.1**	**17.3**	**33.77**	**42.0**	**19.80**	**4.26**	**90.7**	**77.8**	**86.4**	**81.9**
Final Tails	1,617.2	82.7	0.72	2.5	0.65	0.20	9.3	22.2	13.6	18.1
Calculated Head	**1,954.3**	**100.0**	**6.42**	**9.3**	**3.95**	**0.90**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			6.12	10.5	3.99	0.90				



FLOTATION TEST PROCEDURE 45

Client: Richfield Ventures
Test: F15
Sample: Composite 2

Date: 9-Aug-10
Project: 1001302
Operator: JM

Objective: Lower collector dosage to lower mass pull, SIPX instead PAX and cleaner after regrinding of combined rougher concentrates

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	6'40"	4.50			P80 = 114 µ
Rougher Flotation					5L cell
					pH<5 and lime added to bring pH above 6
Condition	1	6.28	Lime	250	
			SIPX	10	
Rougher Float 1	6	6.46	MIBC	8	
Condition	1		SIPX	5	
			A208	5	
Rougher Float 2	5	6.48	MIBC	0	to barren
Condition	1		SIPX	5	
			A208	5	
Rougher Float 3	4	6.48	MIBC	3	to barren
Condition	1		CuSO4	100	
			SIPX	5	
Rougher Float 4	3	6.28	MIBC	2	Combine all rougher conc for regrind
					and cleaning
					WET WEIGHT Ro TOTAL =422g
Cleaner Flotation on Ro Conc 1-4 regrind to target P80~270mesh					
Regrind	10	6.70			in ceramic mill with steel balls
					P80 = 33 µ
Condition	3	10.50	Lime	200	cleaning at pH10.5
	1		SIPX	5	
Cleaner Float 1	9	10.46	MIBC	3	
Condition	3	11.00	Lime	80	cleaning at pH11
Cleaner Float 2	7	10.92	MIBC	2	
					assay for Au, Ag, Stot, ICPM

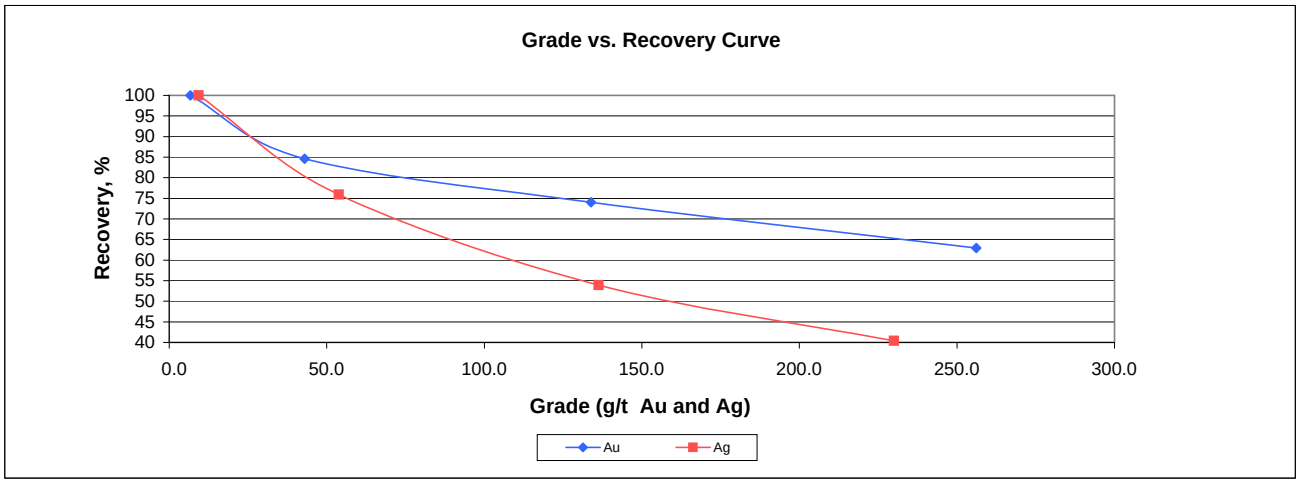
FLOTATION TEST METALLURGICAL BALANCE 46

Client: Richfield Ventures
Test: F16
Sample: Composite 2

Date: 9-Aug-10
Project: 1001302

Objective: As F15 with lower collector dosage, but rougher float at pH 10 and cleaner after regrinding of combined rougher concentrates

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
2nd Cleaner Concentrate	32.3	1.6	256.11	230.1	38.70	30.43	62.9	40.4	16.3	52.5
2nd Cleaner Tails	40.5	2.1	36.21	61.4	40.30	4.23	11.1	13.5	21.2	9.1
1st Cleaner Concentrate	**72.8**	**3.7**	**133.83**	**136.2**	**39.59**	**15.86**	**74.0**	**53.9**	**37.5**	**61.6**
1st Cleaner Tails	186.4	9.5	7.48	21.7	17.50	1.37	10.6	22.0	42.4	13.6
Total Rougher Concentrate	**259.2**	**13.2**	**42.96**	**53.9**	**23.70**	**5.44**	**84.6**	**75.9**	**79.8**	**75.2**
Final Tails	1,703.7	86.8	1.19	2.6	0.91	0.27	15.4	24.1	20.2	24.8
Calculated Head	**1,962.9**	**100.0**	**6.70**	**9.4**	**3.92**	**0.95**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			6.12	10.5	3.99	0.90				



FLOTATION TEST PROCEDURE 47

Client: Richfield Ventures
Test: F16
Sample: Composite 2

Date: 9-Aug-10
Project: 1001302
Operator: JM

Objective: As F15 with lower collector dosage, but rougher float at pH 10 and cleaner after regrinding of combined rougher concentrates

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	6'40"	4.70			P80 = 119 µ
Rougher Flotation					5L cell
					Rougher at pH 10
Condition	1	10.00	Lime	1300	
			SIPX	10	
Rougher Float 1	6	10.00	MIBC	8	
Condition	1	10.00	SIPX	5	
			A208	5	
Rougher Float 2	5	10.00	MIBC	0	to barren
Condition	1	10.00	SIPX	5	
			A208	5	
Rougher Float 3	4	9.60	MIBC	0	to barren
Condition	1		CuSO4	100	
		10.00	SIPX	5	
Rougher Float 4	3	9.70	MIBC	3	Combine all rougher conc for regrind
					and cleaning
					WET WEIGHT Ro TOTAL =327g
Cleaner Flotation on Ro Conc 1-4 regrind to target P80~270mesh					
					wet:
Regrind	10	8.70			in ceramic mill with steel balls
					P80 = 28 µ
Condition	3	10.50	Lime	120	cleaning at pH10.5
	1		SIPX	5	
Cleaner Float 1	9	10.36	MIBC	3	
Condition	3	11.00	Lime	80	cleaning at pH11
Cleaner Float 2	7	10.85	MIBC	2	
					assay for Au, Ag, Stot, ICPM

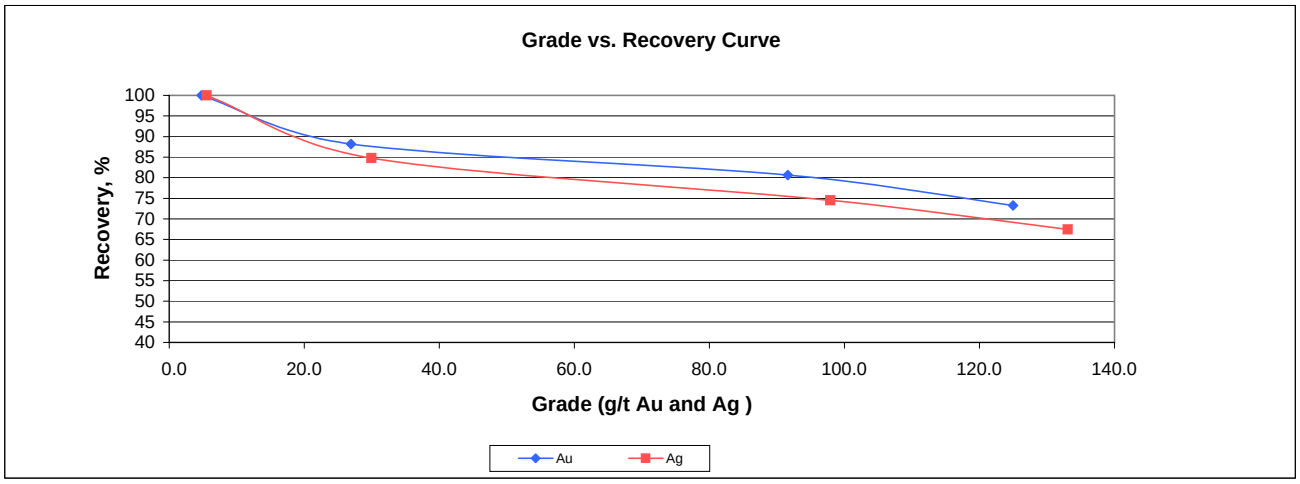
FLOTATION TEST METALLURGICAL BALANCE 48

Client: Richfield Ventures
Test: F17
Sample: Composite 3

Date: 9-Aug-10
Project: 1001302

Objective: Lower collector dosage to lower mass pull, SIPX instead PAX and cleaner after regrinding of combined rougher concentrates

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
2nd Cleaner Concentrate	54.7	2.8	124.99	133.1	38.60	10.52	73.2	67.5	37.4	68.4
2nd Cleaner Tails	27.4	1.4	25.07	27.8	28.10	1.98	7.4	7.1	13.6	6.5
1st Cleaner Concentrate	**82.1**	**4.2**	**91.62**	**97.9**	**35.09**	**7.67**	**80.6**	**74.5**	**51.0**	**74.9**
1st Cleaner Tails	223.3	11.5	3.15	5.0	6.42	0.34	7.5	10.2	25.4	9.0
Total Rougher Concentrate	**305.4**	**15.7**	**26.92**	**29.9**	**14.13**	**2.31**	**88.1**	**84.8**	**76.4**	**83.9**
Final Tails	1,642.6	84.3	0.67	1.0	0.81	0.08	11.9	15.2	23.6	16.1
Calculated Head	**1,948.0**	**100.0**	**4.79**	**5.5**	**2.90**	**0.43**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			5.69	7.5	3.26	0.42				



FLOTATION TEST PROCEDURE 49

Client: Richfield Ventures
Test: F17
Sample: Composite 3

Date: 9-Aug-10
Project: 1001302
Operator: JM

Objective: Lower collector dosage to lower mass pull, SIPX instead PAX and cleaner after regrinding of combined rougher concentrates

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	19	4.93			P80 = 110 µ
Rougher Flotation					5L cell
					pH<5 and lime added to bring pH above 6
Condition	1	5.80	Lime	100	
			SIPX	10	
Rougher Float 1	6	5.85	MIBC	8	
Condition	1		SIPX	5	
			A208	5	
Rougher Float 2	5	5.85	MIBC	3	to barren
Condition	1		SIPX	5	
			A208	5	
Rougher Float 3	4	5.85	MIBC	0	to barren
Condition	1		CuSO4	100	
			SIPX	5	
Rougher Float 4	3	5.80	MIBC	0	Combine all rougher conc for regrind
					and cleaning
					WET WEIGHT Ro TOTAL =386g
Cleaner Flotation on Ro Conc 1-4 regrind to target P80~270mesh					
Regrind	10	5.24			in ceramic mill with steel balls
					P80 = 30 µ
Condition	3	10.50	Lime	300	cleaning at pH10.5
	1		SIPX	5	
Cleaner Float 1	9	10.42	MIBC	3	
Condition	3	11.00	Lime	120	cleaning at pH11
Cleaner Float 2	7	10.92	MIBC	0	
					assay for Au, Ag, Stot, ICPM

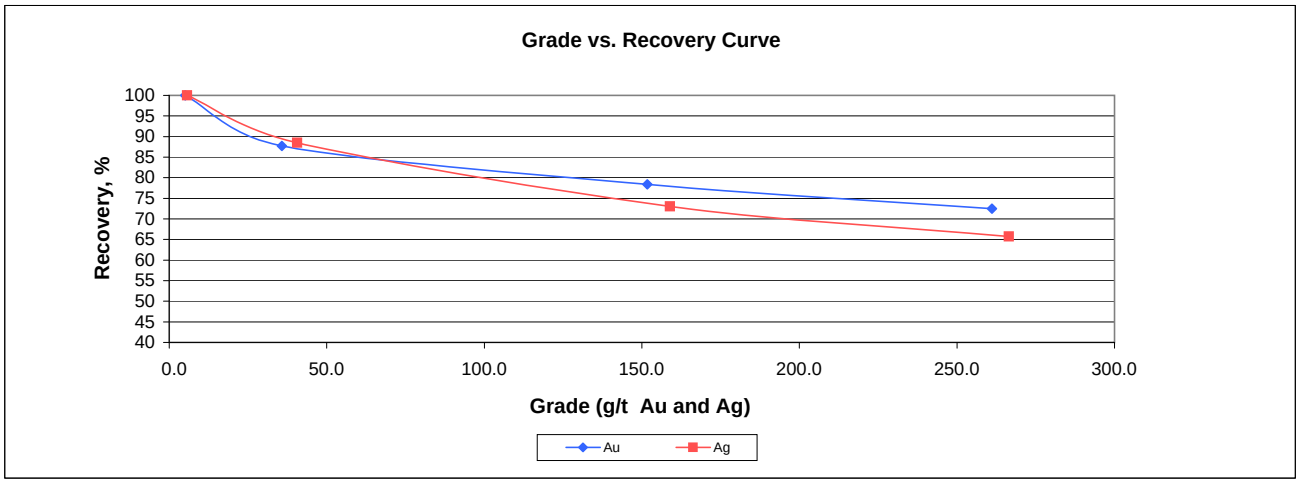
FLOTATION TEST METALLURGICAL BALANCE 50

Client: Richfield Ventures
Test: F18
Sample: Composite 3

Date: 9-Aug-10
Project: 1001302

Objective: As F18 with lower collector dosage, but rougher float at pH 10 and cleaner after regrinding of combined rougher concentrates

Product	Weight		Assay				Distribution			
			Au	Ag	S(T)	Zn	Au	Ag	S(T)	Zn
	g	%	g/t	g/t	%	%	%	%	%	%
2nd Cleaner Concentrate	27.6	1.4	261.14	266.5	35.60	16.80	72.5	65.8	16.7	57.3
2nd Cleaner Tails	23.8	1.2	24.70	34.1	36.30	2.03	5.9	7.3	14.7	6.0
1st Cleaner Concentrate	**51.3**	**2.6**	**151.70**	**158.9**	**35.92**	**9.96**	**78.4**	**73.0**	**31.4**	**63.2**
1st Cleaner Tails	192.0	9.8	4.81	9.0	13.90	0.69	9.3	15.5	45.5	16.4
Total Rougher Concentrate	**243.3**	**12.4**	**35.79**	**40.6**	**18.54**	**2.65**	**87.7**	**88.5**	**76.9**	**79.6**
Final Tails	1,716.1	87.6	0.71	0.8	0.79	0.10	12.3	11.5	23.1	20.4
Calculated Head	**1,959.4**	**100.0**	**5.07**	**5.7**	**2.99**	**0.41**	**100.0**	**100.0**	**100.0**	**100.0**
Measured Head			5.69	7.5	3.26	0.42				



FLOTATION TEST PROCEDURE 51

Client: Richfield Ventures
Test: F18
Sample: Composite 3

Date: 9-Aug-10
Project: 1001302
Operator: JM

Objective: As F18 with lower collector dosage, but rougher float at pH 10 and cleaner after regrinding of combined rougher concentrates

STAGE	TIME (min)	pH	ADDITION		COMMENTS
			Reagent	g/tonne	
Grind (2.0kg) in Mill#4	19	5.00			P80 = 106 µ
Rougher Flotation					5L cell
					Rougher at pH 10
Condition	1	10.00	Lime	900	
			SIPX	10	
Rougher Float 1	6	10.00	MIBC	8	
Condition	1	10.00	SIPX	5	
			A208	5	
Rougher Float 2	5	10.00	MIBC	0	to barren
Condition	1	10.00	SIPX	5	
			A208	5	
Rougher Float 3	4	9.64	MIBC	3	to barren
Condition	1		CuSO4	100	
			SIPX	5	
Rougher Float 4	3	9.64	MIBC	3	Combine all rougher conc for regrind
					and cleaning
					WET WEIGHT Ro TOTAL =300g
Cleaner Flotation on Ro Conc 1-4 regrind to target P80~270mesh					
					wet:
Regrind	10	8.70			in ceramic mill with steel balls
					P80 = 30 µ
Condition	3	10.50	Lime	150	cleaning at pH10.5
	1		SIPX	5	
Cleaner Float 1	9	10.36	MIBC	3	
Condition	3	11.00	Lime	110	cleaning at pH11
Cleaner Float 2	7	10.85	MIBC	0	
					assay for Au, Ag, Stot, ICPM

METALLURGICAL TESTING OF SAMPLES FROM THE BLACKWATER GOLD PROJECT

APPENDIX IV

SIZE ANALYSIS DATA

Test No.	Product	P80 (μ)	Page
GSB1	Centrifugal Gravity Tailing	127	1
GSB2	Centrifugal Gravity Tailing	138	2
GSB3	Centrifugal Gravity Tailing	152	3
C1	Cyanidation Residue	130	4
C2	Cyanidation Residue	110	5
C3	Cyanidation Residue	76	6
C4	Cyanidation Residue	144	7
C5	Cyanidation Residue	112	8
C6	Cyanidation Residue	88	9
C7	Cyanidation Residue	162	10
C8	Cyanidation Residue	103	11
C9	Cyanidation Residue	80	12
F1	Flotation Feed	145	13
F2	Flotation Feed	116	14
F3	Flotation Feed	83	15
F4	Flotation Feed	139	16
F5	Flotation Feed	111	17
F6	Flotation Feed	86	18
F7	Flotation Feed	154	19
F8	Flotation Feed	105	20
F9	Flotation Feed	80	21
F10	Flotation Feed	112	22
	1st Cleaner Tailings	25	23
F11	Flotation Feed	117	24
	1st Cleaner Tailings	29	25
F12	Flotation Feed	104	26
	1st Cleaner Tailings	26	27

SIZE ANALYSIS DATA (con't)

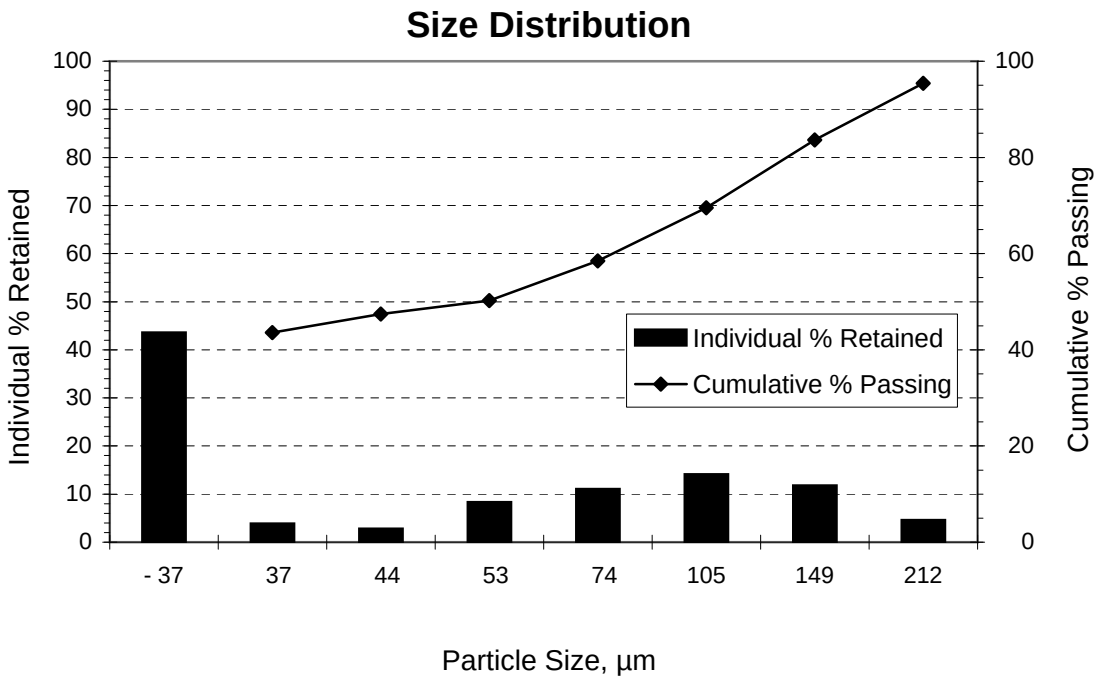
Test No.	Product	P80 (μ)	Page
F13	Flotation Feed	118	28
	1st Cleaner Tailings	40	29
F14	Flotation Feed	118	30
	1st Cleaner Tailings	37	31
F15	Flotation Feed	114	32
	1st Cleaner Tailings	33	33
F16	Flotation Feed	119	34
	1st Cleaner Tailings	28	35
F17	Flotation Feed	110	36
	1st Cleaner Tailings	30	37
F18	Flotation Feed	106	38
	1st Cleaner Tailings	30	39

SIZE ANALYSIS REPORT 1

Client: Richfield Ventures **Date:** 23-Apr-10
Test: GSB1 **Project:** 1001302
Sample: GSB1 Tails (Comp 1)
Grind: 2kg sample for 9.25 minutes @65%solids in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
65	212	4.6	95.4
100	149	11.8	83.6
150	105	14.1	69.5
200	74	11.0	58.5
270	53	8.3	50.2
325	44	2.8	47.4
400	37	3.8	43.6
Undersize	- 37	43.6	-
TOTAL:		100.0	

80 % Passing Size (µm) = 137

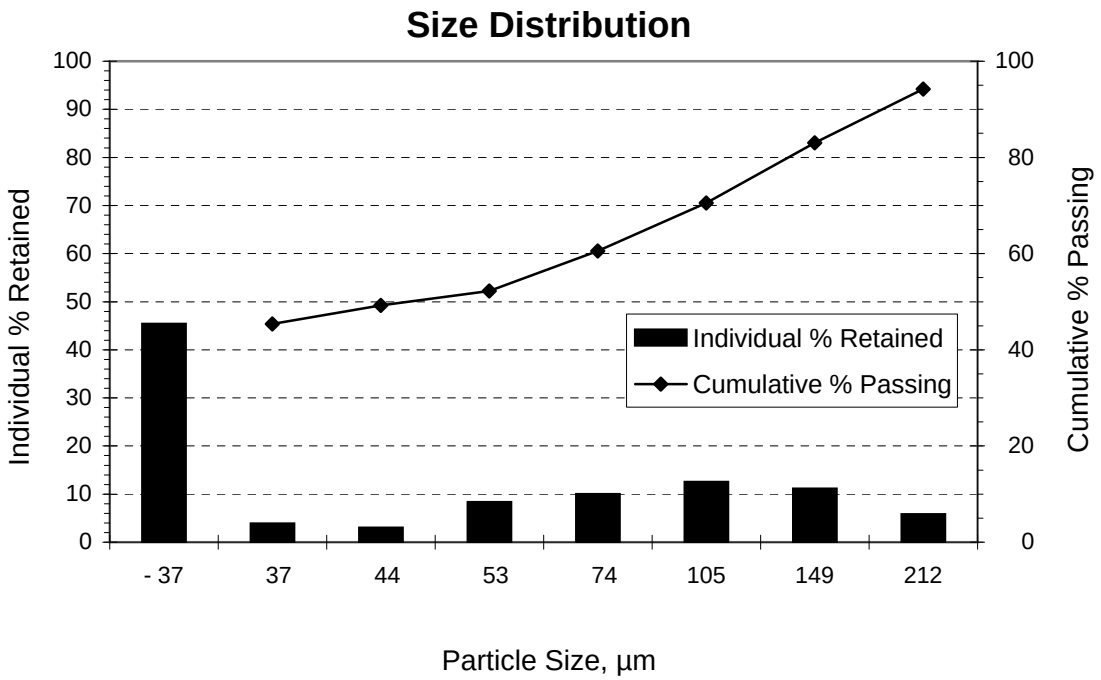


SIZE ANALYSIS REPORT 2

Client: Richfield Ventures **Date:** 23-Apr-10
Test: GSB2 **Project:** 1001302
Sample: GSB2 Tails (Comp 2)
Grind: 2kg sample for 5.5 minutes @65%solids in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
65	212	5.8	94.2
100	149	11.1	83.0
150	105	12.5	70.5
200	74	10.0	60.5
270	53	8.3	52.2
325	44	3.0	49.3
400	37	3.9	45.4
Undersize	- 37	45.4	-
TOTAL:		100.0	

80 % Passing Size (µm) = 138

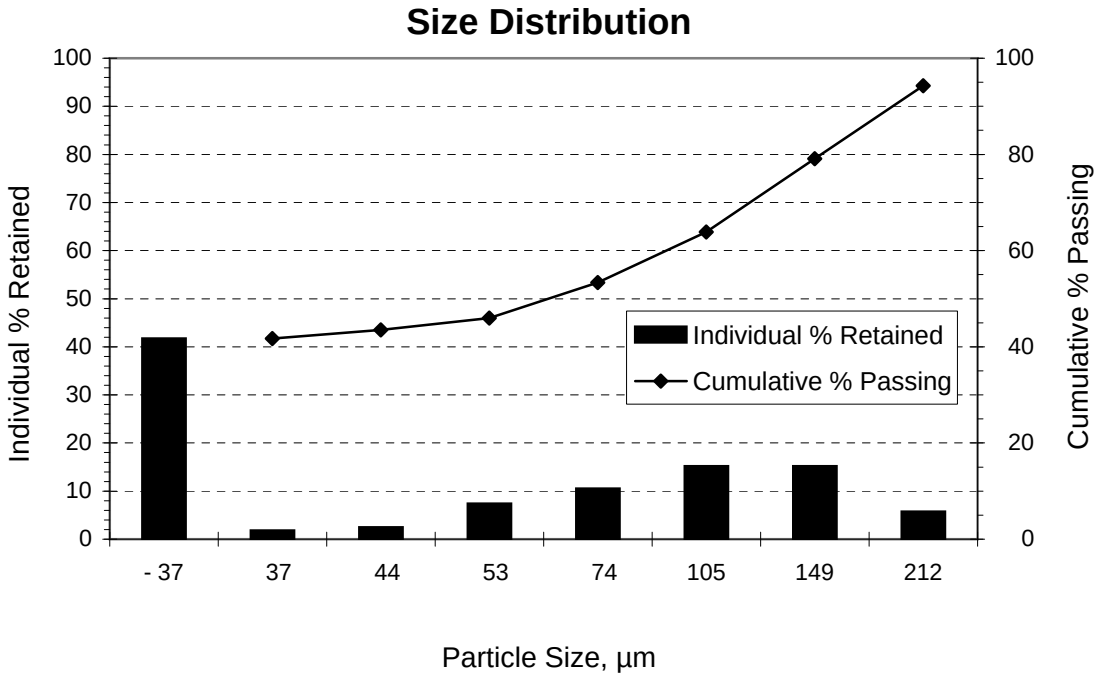


SIZE ANALYSIS REPORT 3

Client: Richfield Ventures **Date:** 23-Apr-10
Test: GSB3 **Project:** 1001302
Sample: GSB3 Tails (Comp 3)
Grind: 2kg sample for 15 minutes @65%solids in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
65	212	5.7	94.3
100	149	15.2	79.1
150	105	15.2	63.9
200	74	10.5	53.4
270	53	7.4	46.0
325	44	2.5	43.5
400	37	1.8	41.7
Undersize	- 37	41.7	-
TOTAL:		100.0	

80 % Passing Size (µm) = 152



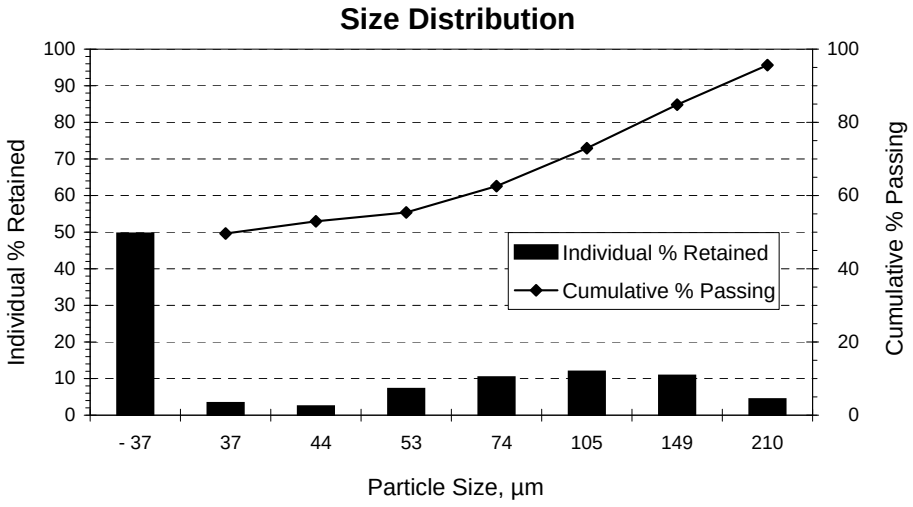
SIZE ANALYSIS REPORT

Client: Richfield Ventures
Test: C1
Sample: Cyanidation Residue
Grind: 2 kg for 9'15" @ 65% solids in stainless steel mill #4

Date: 23-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	4.4	95.6
100	149	10.8	84.8
150	105	11.9	72.9
200	74	10.4	62.6
270	53	7.2	55.4
325	44	2.4	53.0
400	37	3.3	49.6
Undersize	- 37	49.6	-
TOTAL:		100.0	

80 % Passing Size (µm) = 130

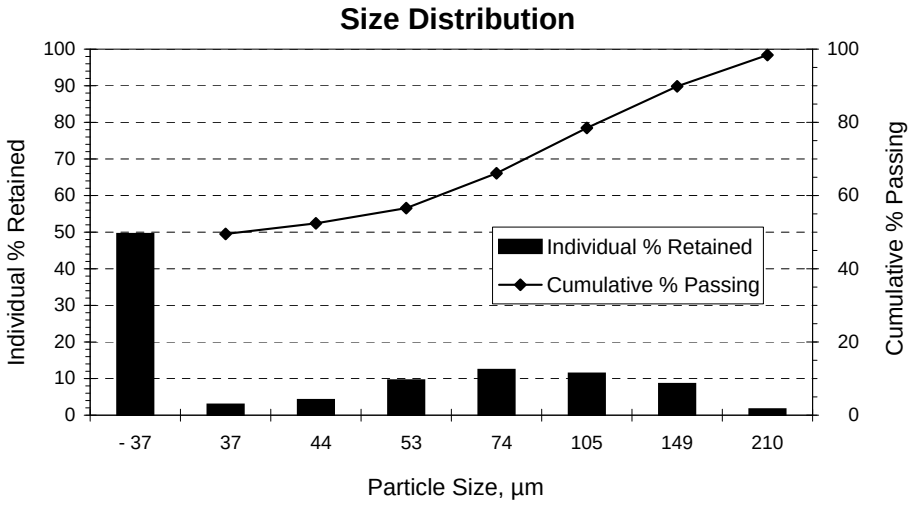


SIZE ANALYSIS REPORT 5

Client: Richfield Ventures **Date:** 23-Apr-10
Test: C2 **Project:** 1001302
Sample: Cyanidation Residue
Grind: 2 kg for 11 minutes @ 65% solids in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
65	210	1.6	98.4
100	149	8.5	89.8
150	105	11.4	78.5
200	74	12.4	66.1
270	53	9.5	56.6
325	44	4.2	52.4
400	37	2.9	49.5
Undersize	- 37	49.5	-
TOTAL:		100.0	

80 % Passing Size (µm) = 110



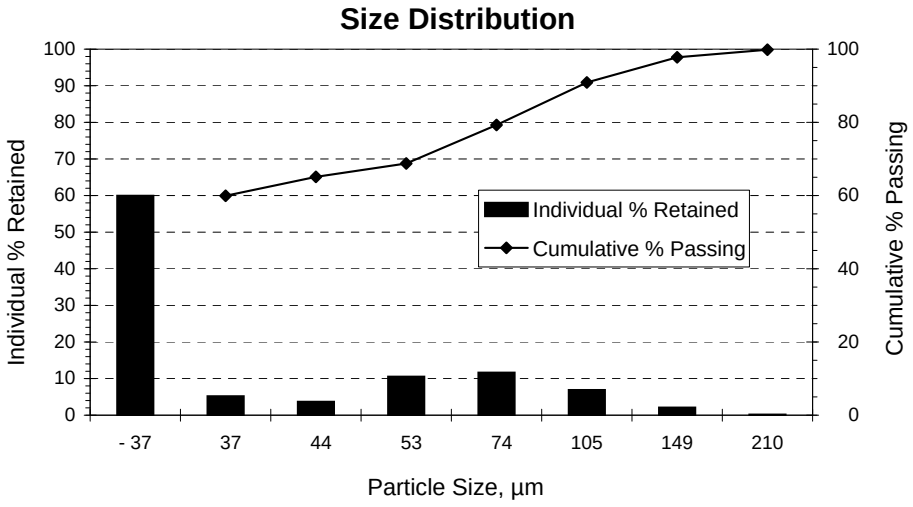
SIZE ANALYSIS REPORT

Client: Richfield Ventures
Test: C3
Sample: Cyanidation Residue
Grind: 2 kg for 14'20" @ 65% solids in stainless steel mill #4

Date: 23-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	0.2	99.8
100	149	2.1	97.8
150	105	6.9	90.9
200	74	11.6	79.3
270	53	10.5	68.8
325	44	3.7	65.1
400	37	5.2	59.9
Undersize	- 37	59.9	-
TOTAL:		100.0	

80 % Passing Size (µm) = 76

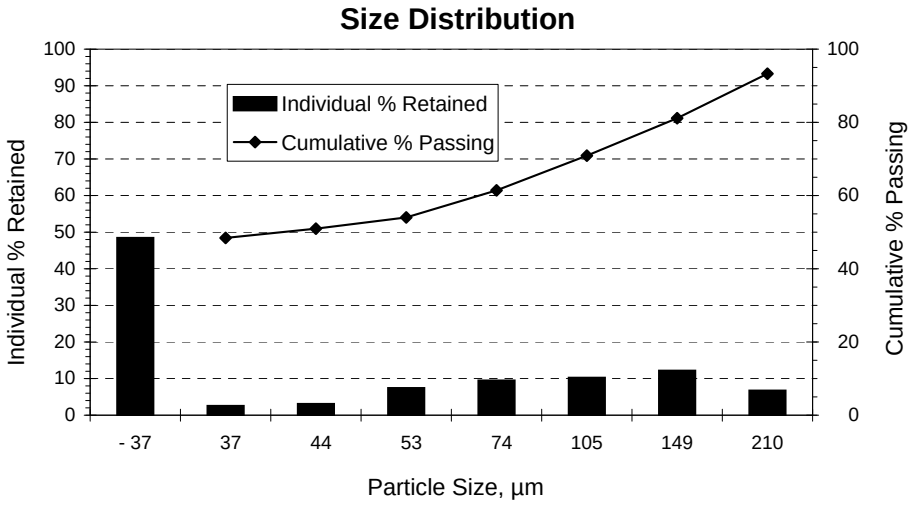


SIZE ANALYSIS REPORT 7

Client: Richfield Ventures **Date:** 23-Apr-10
Test: C4 **Project:** 1001302
Sample: Cyanidation Residue
Grind: 2 kg for 5'30" @ 65% solids in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
65	210	6.7	93.3
100	149	12.2	81.1
150	105	10.2	70.9
200	74	9.5	61.4
270	53	7.4	54.0
325	44	3.1	51.0
400	37	2.5	48.4
Undersize	- 37	48.4	-
TOTAL:		100.0	

80 % Passing Size (µm) = 144

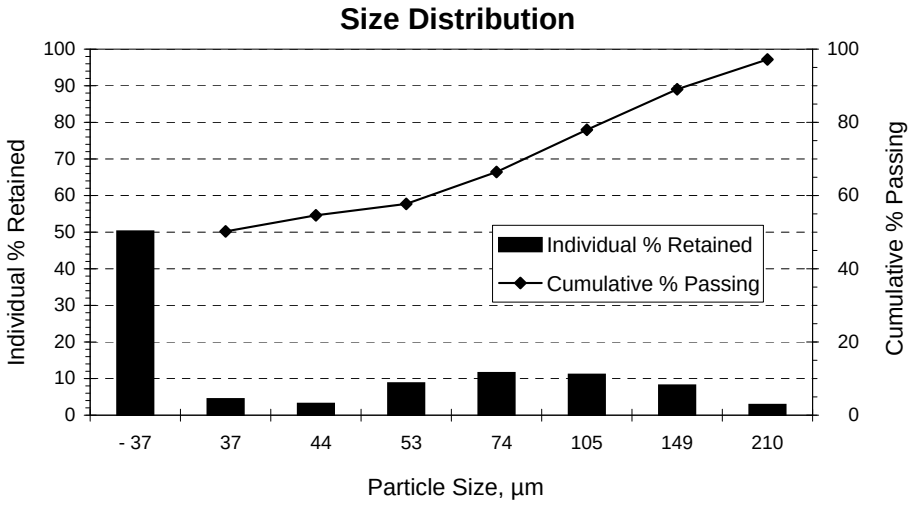


Client: Richfield Ventures
Test: C5
Sample: Cyanidation Residue
Grind: 2 kg for 6'40" @ 65% solids in stainless steel mill #4

Date: 23-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	2.8	97.2
100	149	8.1	89.0
150	105	11.1	78.0
200	74	11.5	66.4
270	53	8.7	57.7
325	44	3.1	54.6
400	37	4.4	50.2
Undersize	- 37	50.2	-
TOTAL:		100.0	

80 % Passing Size (µm) = 112



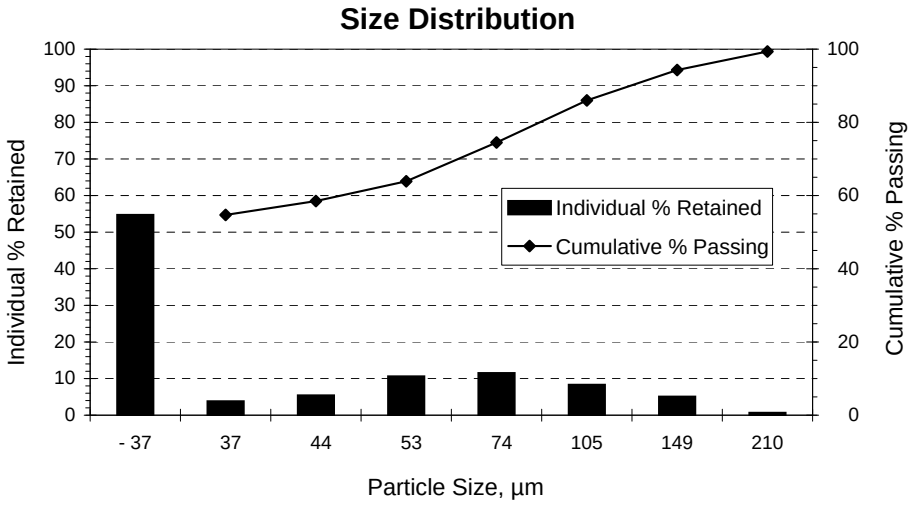
SIZE ANALYSIS REPORT

Client: Richfield Ventures
Test: C6
Sample: Cyanidation Residue
Grind: 2 kg for 8'45" @ 65% solids in stainless steel mill #4

Date: 23-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	0.6	99.4
100	149	5.1	94.3
150	105	8.3	86.0
200	74	11.5	74.5
270	53	10.6	63.9
325	44	5.4	58.5
400	37	3.8	54.7
Undersize	- 37	54.7	-
TOTAL:		100.0	

80 % Passing Size (µm) = 88

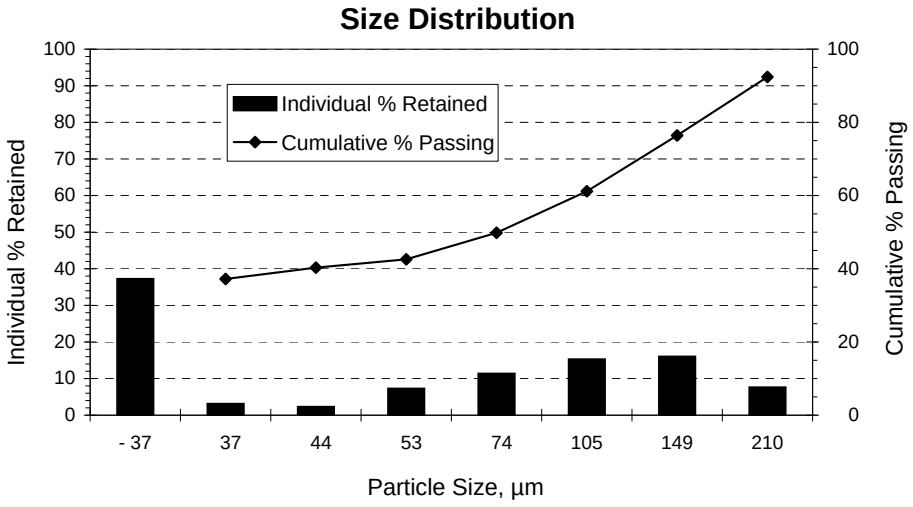


SIZE ANALYSIS REPORT 10

Client: Richfield Ventures **Date:** 23-Apr-10
Test: C7 **Project:** 1001302
Sample: Cyanidation Residue
Grind: 2 kg for 15 min @ 65% solids in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
65	210	7.6	92.4
100	149	16.0	76.4
150	105	15.3	61.2
200	74	11.3	49.8
270	53	7.2	42.6
325	44	2.3	40.3
400	37	3.1	37.2
Undersize	- 37	37.2	-
TOTAL:		100.0	

80 % Passing Size (µm) = 162



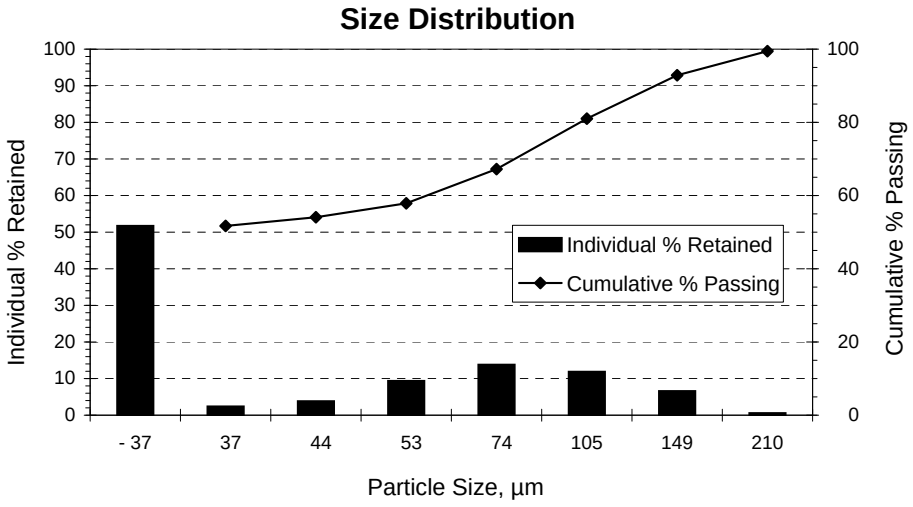
SIZE ANALYSIS REPORT

Client: Richfield Ventures
Test: C8
Sample: Cyanidation Residue
Grind: 2 kg for 19 min @ 65% solids in stainless steel mill #4

Date: 23-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	0.6	99.4
100	149	6.6	92.9
150	105	11.9	81.0
200	74	13.8	67.2
270	53	9.4	57.9
325	44	3.8	54.1
400	37	2.4	51.7
Undersize	- 37	51.7	-
TOTAL:		100.0	

80 % Passing Size (µm) = 103



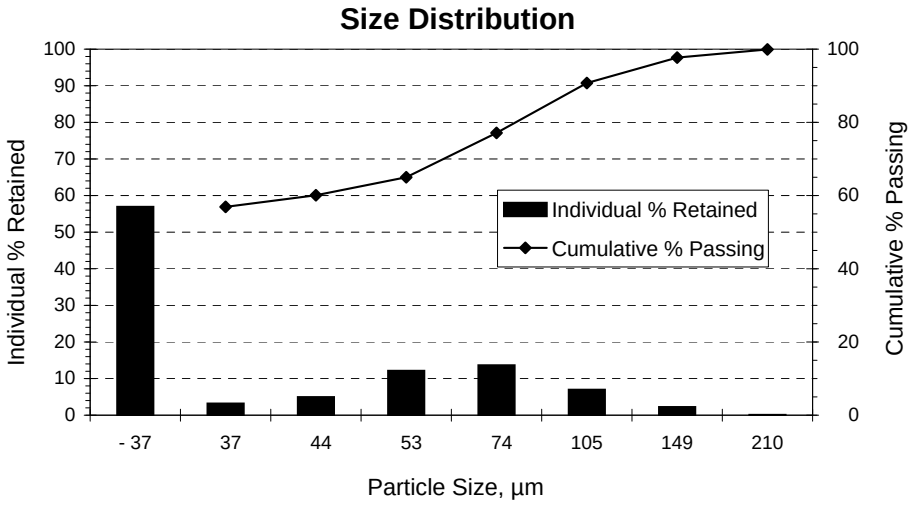
SIZE ANALYSIS REPORT

Client: Richfield Ventures
Test: C9
Sample: Cyanidation Residue
Grind: 2 kg for 22'30" @ 65% solids in stainless steel mill #4

Date: 23-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	0.1	99.9
100	149	2.2	97.7
150	105	7.0	90.7
200	74	13.6	77.1
270	53	12.1	65.0
325	44	4.9	60.1
400	37	3.2	56.9
Undersize	- 37	56.9	-
TOTAL:		100.0	

80 % Passing Size (µm) = 80



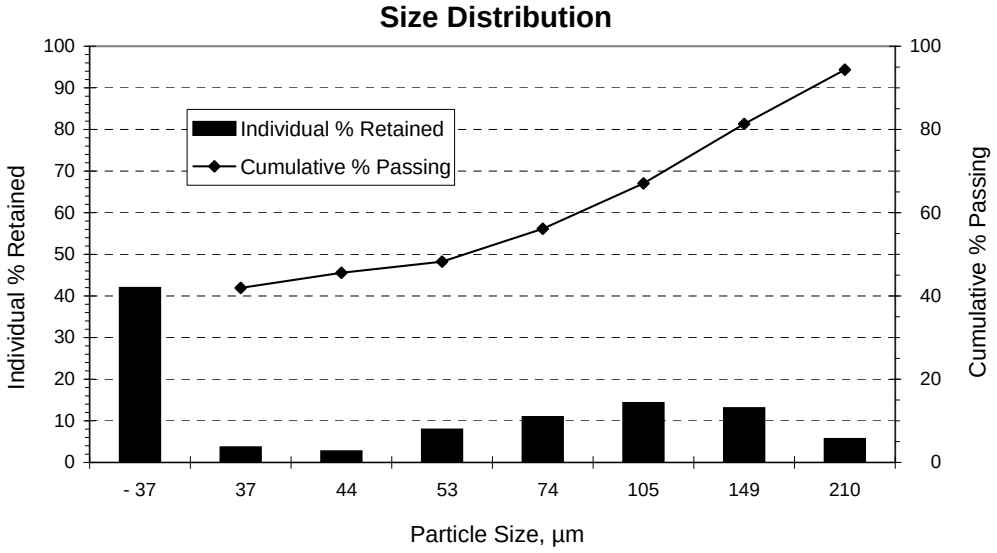
SIZE ANALYSIS REPORT 13

Client: Richfield Ventures
Test: F1
Sample: Composite 1

Date: 27-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	5.6	94.4
100	149	13.0	81.3
150	105	14.3	67.0
200	74	10.9	56.1
270	53	7.9	48.2
325	44	2.7	45.6
400	37	3.6	41.9
Undersize	- 37	41.9	-
TOTAL:		100.0	

80 % Passing Size (µm) = 145



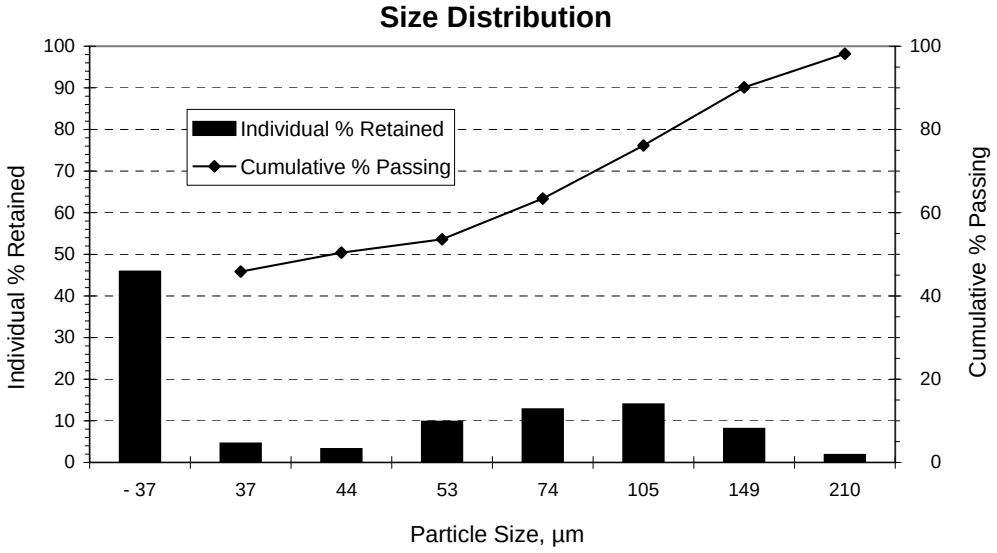
SIZE ANALYSIS REPORT 14

Client: Richfield Ventures
Test: F2
Sample: Composite 1

Date: 27-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	1.8	98.2
100	149	8.1	90.1
150	105	14.0	76.2
200	74	12.8	63.4
270	53	9.8	53.6
325	44	3.2	50.4
400	37	4.5	45.9
Undersize	- 37	45.9	-
TOTAL:		100.0	

80 % Passing Size (µm) = 116



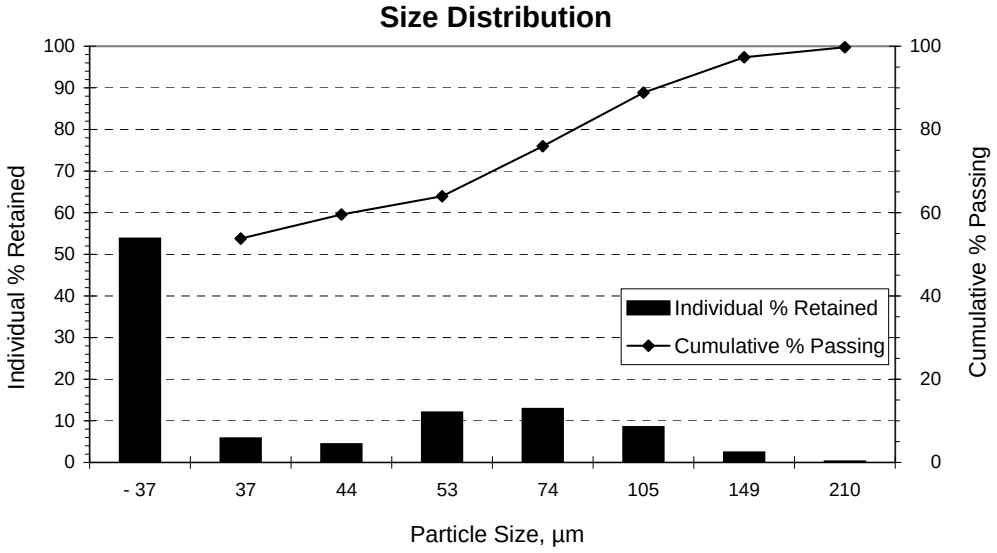
SIZE ANALYSIS REPORT 15

Client: Richfield Ventures
Test: F3
Sample: Composite 1

Date: 27-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	0.2	99.8
100	149	2.4	97.3
150	105	8.5	88.8
200	74	12.9	76.0
270	53	12.0	64.0
325	44	4.4	59.6
400	37	5.8	53.8
Undersize	- 37	53.8	-
TOTAL:		100.0	

80 % Passing Size (µm) = 83



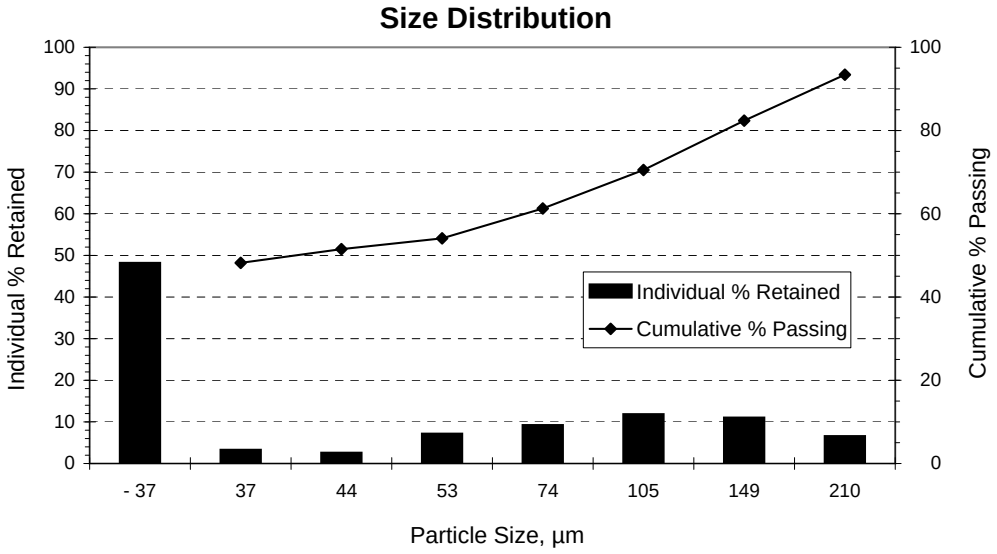
SIZE ANALYSIS REPORT 16

Client: Richfield Ventures
Test: F4
Sample: Composite 2

Date: 27-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	6.6	93.4
100	149	11.0	82.4
150	105	11.9	70.5
200	74	9.2	61.3
270	53	7.2	54.1
325	44	2.6	51.5
400	37	3.3	48.2
Undersize	- 37	48.2	-
TOTAL:		100.0	

80 % Passing Size (µm) = 139



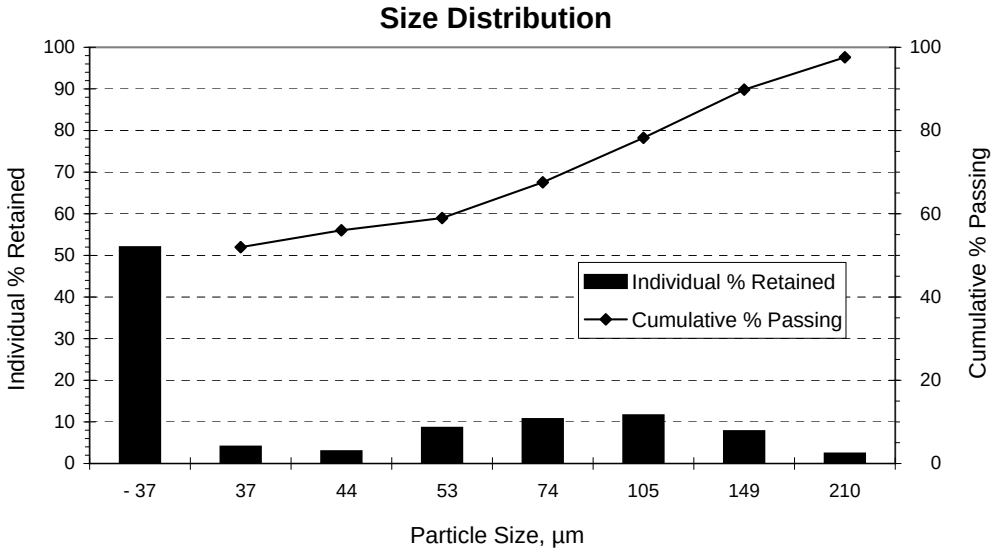
SIZE ANALYSIS REPORT 17

Client: Richfield Ventures
Test: F5
Sample: Composite 2

Date: 27-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	2.4	97.6
100	149	7.8	89.8
150	105	11.6	78.2
200	74	10.7	67.6
270	53	8.6	59.0
325	44	2.9	56.0
400	37	4.1	52.0
Undersize	- 37	52.0	-
TOTAL:		100.0	

80 % Passing Size (µm) = 111



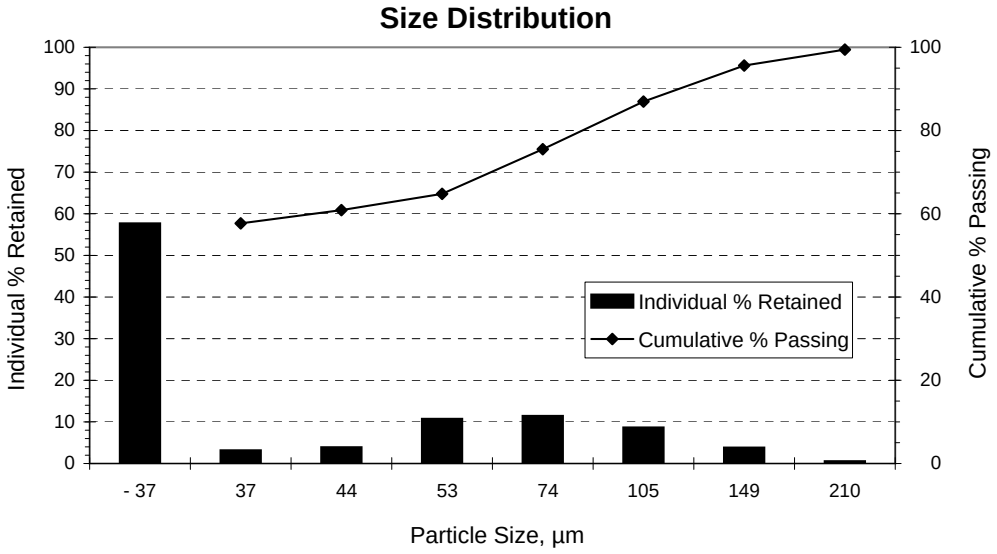
SIZE ANALYSIS REPORT 18

Client: Richfield Ventures
Test: F6
Sample: Composite 2

Date: 27-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	0.6	99.4
100	149	3.8	95.6
150	105	8.7	87.0
200	74	11.4	75.5
270	53	10.7	64.8
325	44	3.9	60.9
400	37	3.2	57.7
Undersize	- 37	57.7	-
TOTAL:		100.0	

80 % Passing Size (µm) = 86



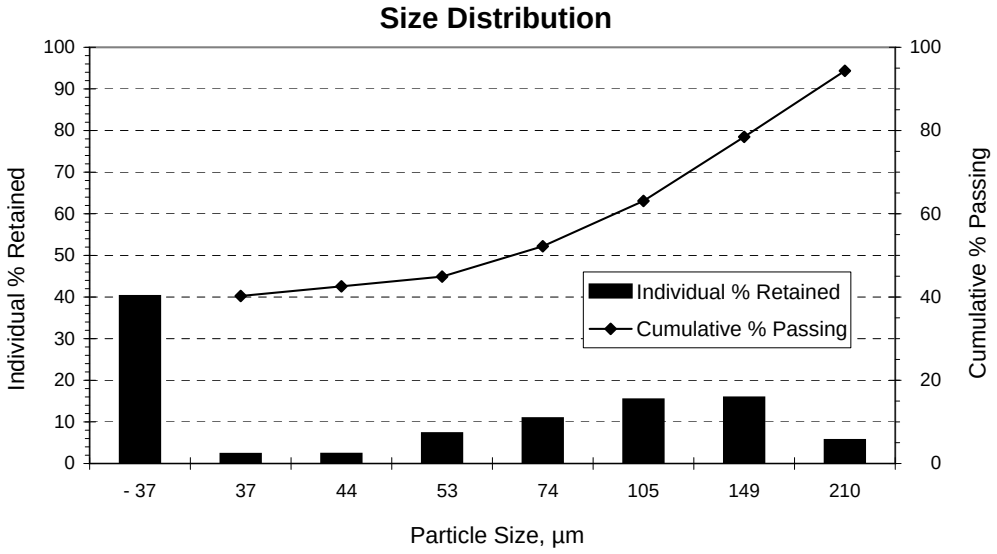
SIZE ANALYSIS REPORT 19

Client: Richfield Ventures
Test: F7
Sample: Composite 3

Date: 27-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	5.6	94.4
100	149	15.9	78.5
150	105	15.4	63.1
200	74	10.9	52.2
270	53	7.3	44.9
325	44	2.3	42.6
400	37	2.3	40.2
Undersize	- 37	40.2	-
TOTAL:		100.0	

80 % Passing Size (µm) = 154



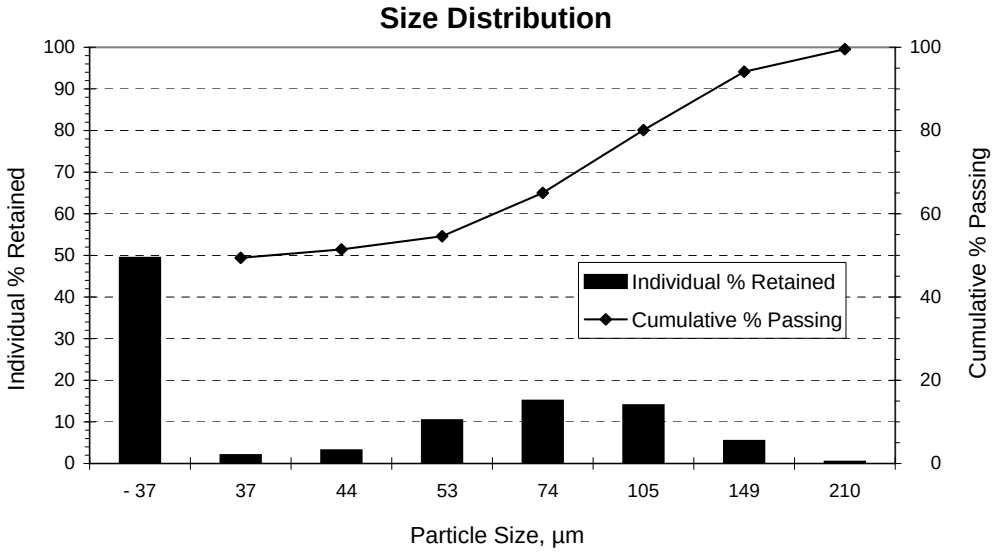
SIZE ANALYSIS REPORT 20

Client: Richfield Ventures
Test: F8
Sample: Composite 3

Date: 27-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	0.4	99.6
100	149	5.4	94.1
150	105	14.0	80.1
200	74	15.1	65.0
270	53	10.4	54.6
325	44	3.2	51.4
400	37	2.0	49.4
Undersize	- 37	49.4	-
TOTAL:		100.0	

80 % Passing Size (µm) = 105



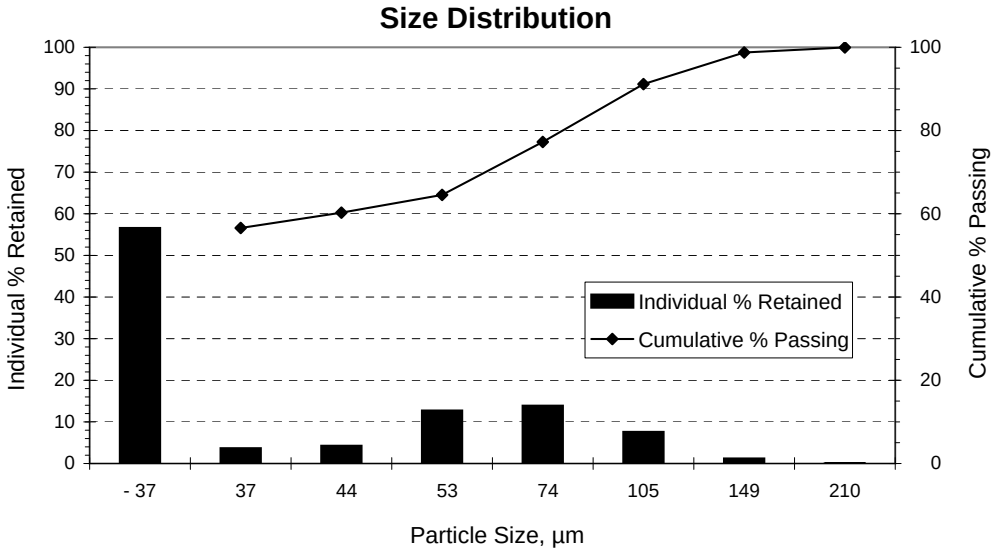
SIZE ANALYSIS REPORT 21

Client: Richfield Ventures
Test: F9
Sample: Composite 3

Date: 27-Apr-10
Project: 1001302

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	0.0	100.0
100	149	1.2	98.8
150	105	7.6	91.2
200	74	13.9	77.3
270	53	12.7	64.5
325	44	4.3	60.3
400	37	3.7	56.6
Undersize	- 37	56.6	-
TOTAL:		100.0	

80 % Passing Size (µm) = 80

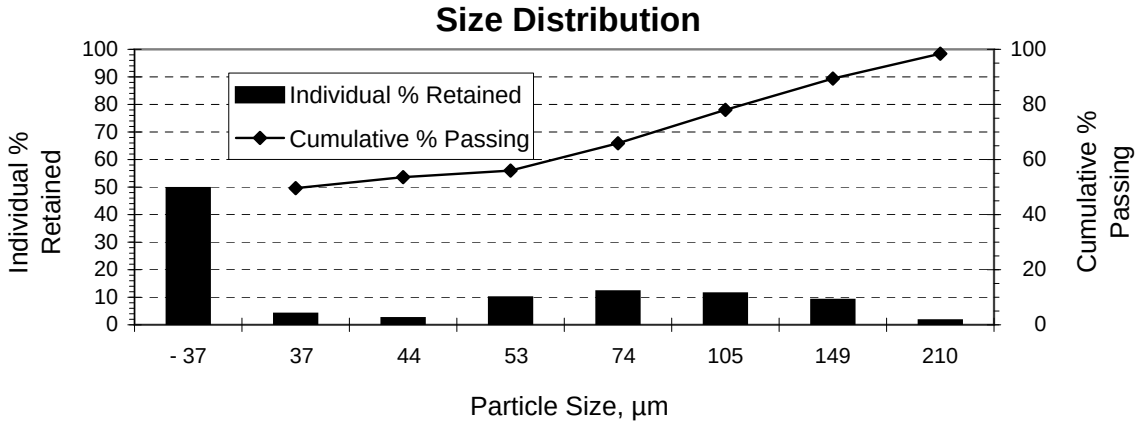


SIZE ANALYSIS REPORT 22

Client: Richfield Ventures **Date:** 7-Jun-10
Test: F10 **Project:** 1001302
Sample: Composite 1
Grind: 2kg sample ground @65%solids for 11 minutes in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	1.6	98.4
100	149	9.0	89.4
150	105	11.4	78.0
200	74	12.1	65.9
270	53	9.9	56.0
325	44	2.4	53.6
400	37	4.0	49.6
Undersize	- 37	49.6	-
TOTAL:		100.0	

80 % Passing Size (µm) = 112

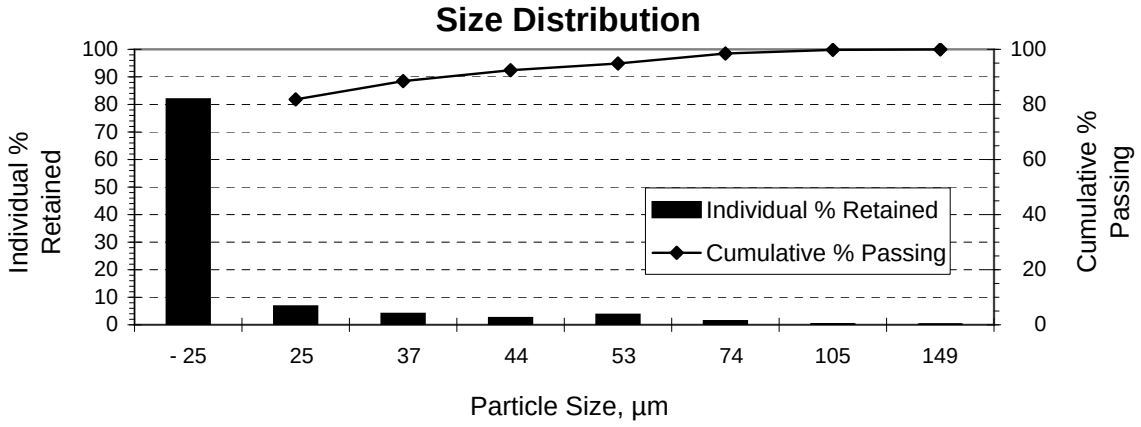


SIZE ANALYSIS REPORT 23

Client: Richfield Ventures **Date:** 7-Jun-10
Test: F10 **Project:** 1001302
Sample: 1st Cleaner Tails
Grind: 699g of wet Ro conc reground for 17 minutes in ceramic ball mill

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
100	149	0.0	100.0
150	105	0.2	99.8
200	74	1.3	98.5
270	53	3.6	94.9
325	44	2.4	92.4
400	37	4.0	88.5
500	25	6.7	81.8
Undersize	- 25	81.8	-
TOTAL:		100.0	

82 % Passing Size (µm) = 25

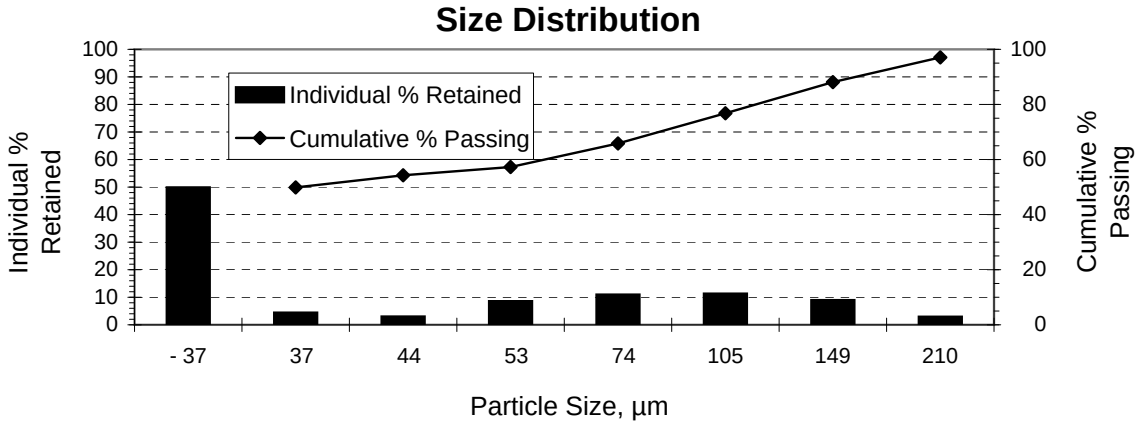


SIZE ANALYSIS REPORT 24

Client: Richfield Ventures **Date:** 7-Jun-10
Test: F11 **Project:** 1001302
Sample: Composite 1
Grind: 2kg sample ground @65%solids for 6'40" minutes in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	2.9	97.1
100	149	9.0	88.1
150	105	11.3	76.8
200	74	11.0	65.8
270	53	8.6	57.3
325	44	3.0	54.3
400	37	4.4	49.9
Undersize	- 37	49.9	-
TOTAL:		100.0	

80 % Passing Size (µm) = 117

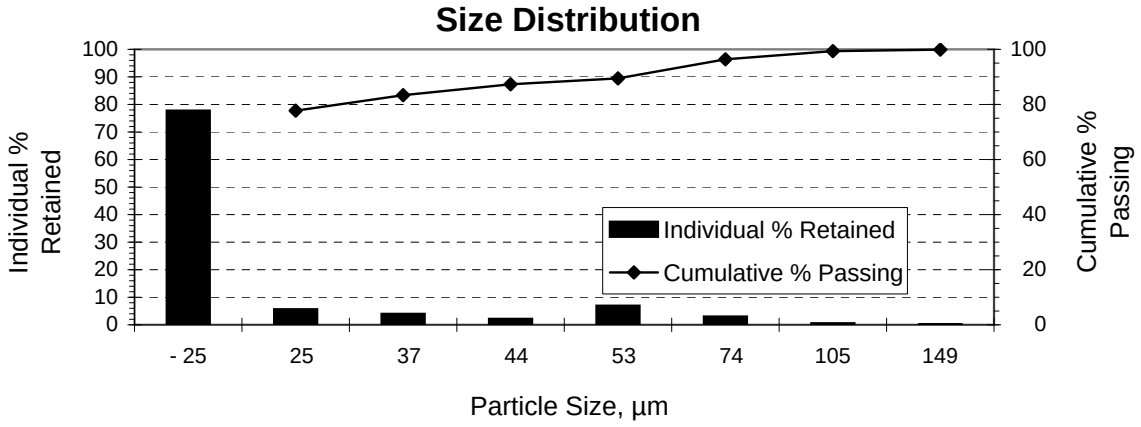


SIZE ANALYSIS REPORT 25

Client: Richfield Ventures **Date:** 7-Jun-10
Test: F11 **Project:** 1001302
Sample: 1st Cleaner Tails
Grind: Wet 629g of Ro conc 1-4 ground @65%solids for 15 minutes in ceramic ball mill

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
100	149	0.1	99.9
150	105	0.5	99.4
200	74	3.0	96.4
270	53	6.9	89.5
325	44	2.1	87.3
400	37	4.0	83.4
500	25	5.6	77.7
Undersize	- 25	77.7	-
TOTAL:		100.0	

80 % Passing Size (µm) = 29

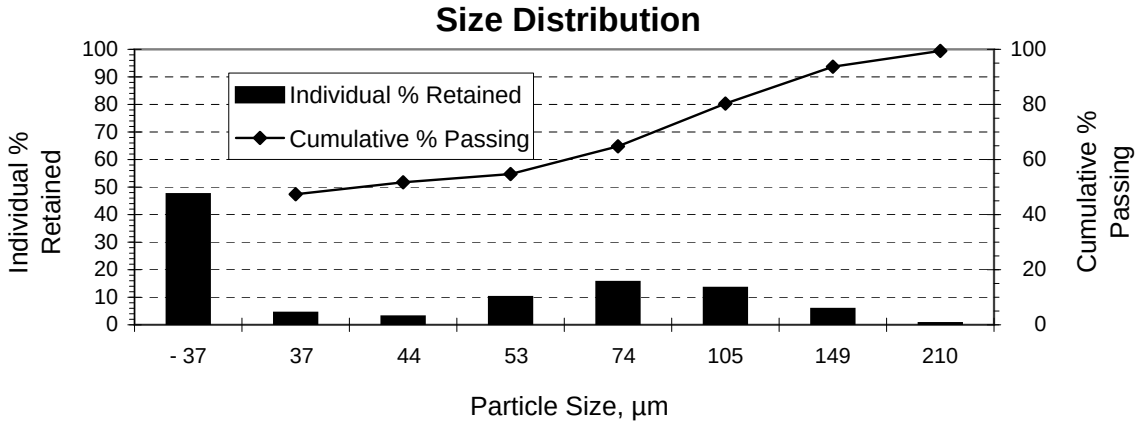


SIZE ANALYSIS REPORT 26

Client: Richfield Ventures **Date:** 7-Jun-10
Test: F12 **Project:** 1001302
Sample: Composite 1
Grind: 2kg sample ground @65%solids for 19 minutes in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	0.6	99.4
100	149	5.7	93.7
150	105	13.4	80.3
200	74	15.5	64.8
270	53	10.1	54.7
325	44	3.0	51.7
400	37	4.3	47.4
Undersize	- 37	47.4	-
TOTAL:		100.0	

80 % Passing Size (µm) = 104

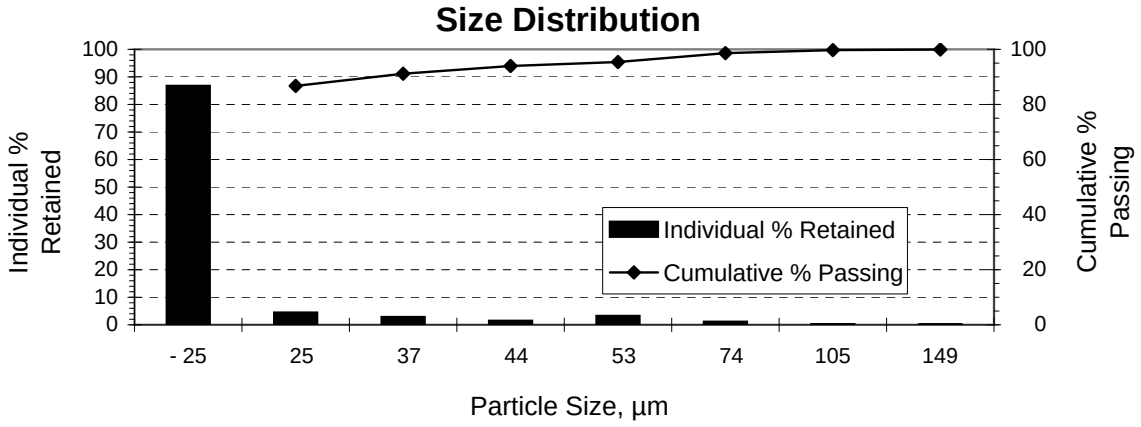


SIZE ANALYSIS REPORT 27

Client: Richfield Ventures **Date:** 7-Jun-10
Test: F12 **Project:** 1001302
Sample: 1st Cleaner Tails
Grind: Wet 524g of Ro conc 1-4 ground @65%solids for 13 minutes in ceramic ball mill

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
100	149	0.1	99.9
150	105	0.2	99.7
200	74	1.1	98.6
270	53	3.2	95.4
325	44	1.4	94.0
400	37	2.8	91.1
500	25	4.4	86.7
Undersize	- 25	86.7	-
TOTAL:		100.0	

87 % Passing Size (µm) = 26

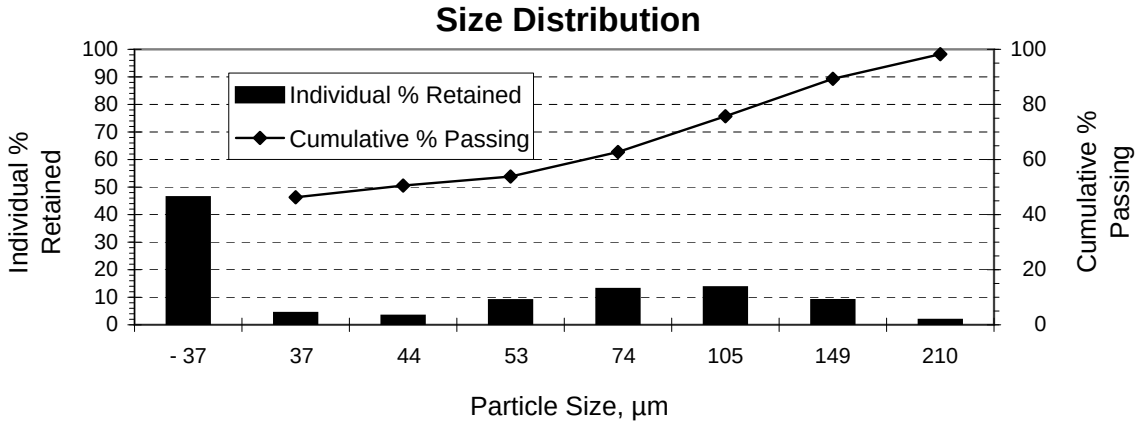


SIZE ANALYSIS REPORT 28

Client: Richfield Ventures **Date:** 7-Aug-10
Test: F13 **Project:** 1001302
Sample: F13 Head (Composite 1)
Grind: 2kg sample ground @65%solids for 11 minutes in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
65	210	1.8	98.2
100	149	8.9	89.3
150	105	13.6	75.7
200	74	13.0	62.7
270	53	8.9	53.8
325	44	3.3	50.6
400	37	4.3	46.3
Undersize	- 37	46.3	-
TOTAL:		100.0	

80 % Passing Size (µm) = 118

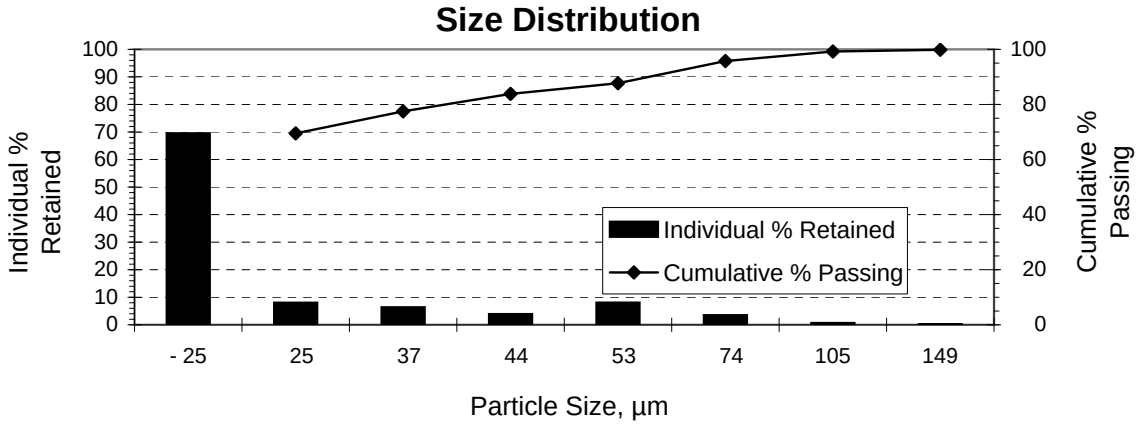


SIZE ANALYSIS REPORT 29

Client: Richfield Ventures **Date:** 9-Aug-10
Test: F13 **Project:** 1001302
Sample: F13 1st Cleaner Tails (Composite 1)
Grind: Wet 370g of Ro conc 1-4 ground @65%solids for 10 minutes in ceramic ball mill

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
100	149	0.2	99.8
150	105	0.6	99.2
200	74	3.5	95.7
270	53	8.0	87.7
325	44	3.9	83.8
400	37	6.3	77.5
500	25	8.0	69.5
Undersize	- 25	69.5	-
TOTAL:		100.0	

80 % Passing Size (µm) = 40

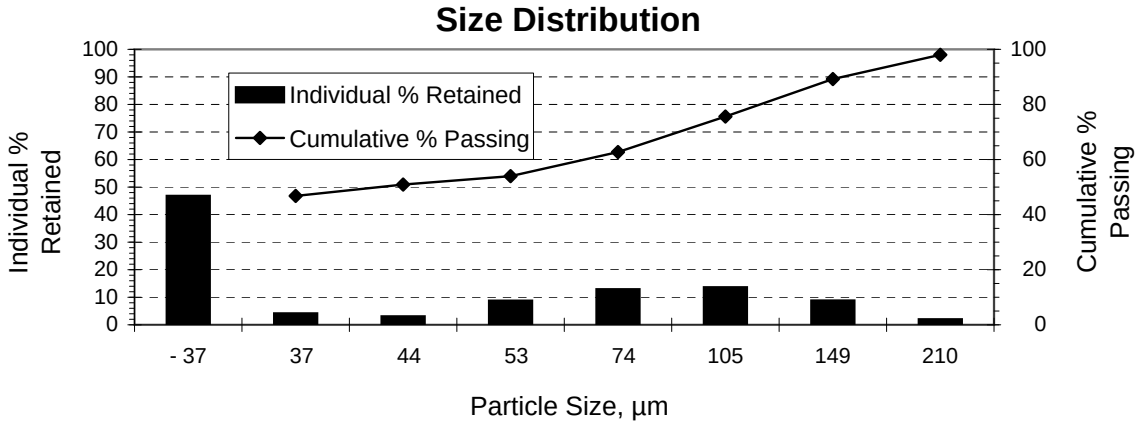


SIZE ANALYSIS REPORT 30

Client: Richfield Ventures **Date:** 7-Aug-10
Test: F14 **Project:** 1001302
Sample: F14 Head (Composite 1)
Grind: 2kg sample ground @65%solids for 11 minutes in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
65	210	2.0	98.0
100	149	8.8	89.2
150	105	13.6	75.6
200	74	12.9	62.7
270	53	8.7	54.0
325	44	3.0	50.9
400	37	4.1	46.8
Undersize	- 37	46.8	-
TOTAL:		100.0	

80 % Passing Size (µm) = 118

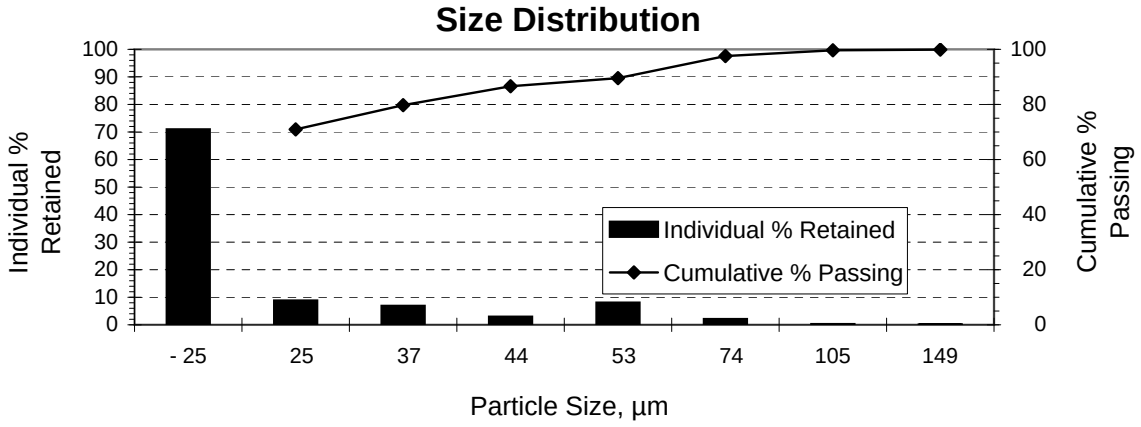


SIZE ANALYSIS REPORT 31

Client: Richfield Ventures **Date:** 9-Aug-10
Test: F14 **Project:** 1001302
Sample: F14 1st Cleaner Tails (Composite 1)
Grind: Wet 312g of Ro conc 1-4 ground @65%solids for 10 minutes in ceramic ball mill

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
100	149	0.1	99.9
150	105	0.3	99.6
200	74	2.1	97.6
270	53	8.0	89.5
325	44	2.9	86.6
400	37	6.9	79.7
500	25	8.8	70.9
Undersize	- 25	70.9	-
TOTAL:		100.0	

80 % Passing Size (µm) = 37

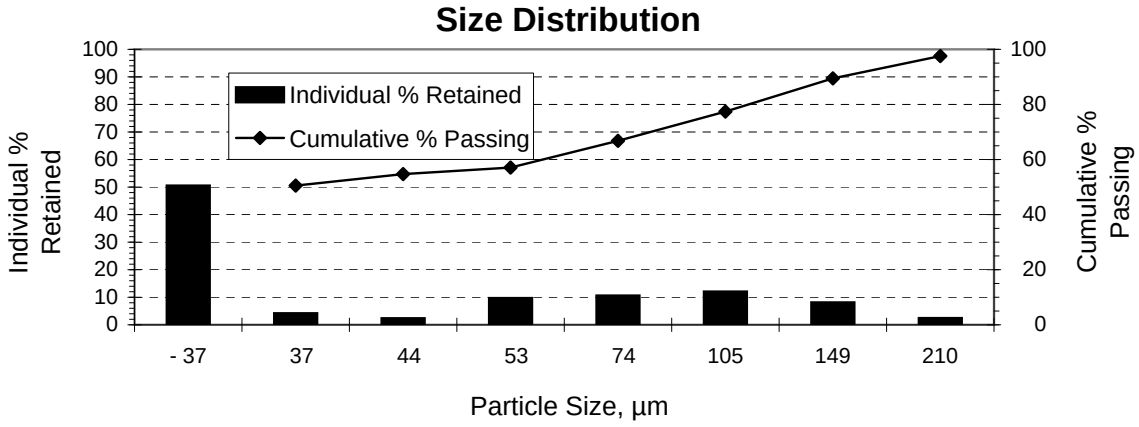


SIZE ANALYSIS REPORT 32

Client: Richfield Ventures **Date:** 7-Aug-10
Test: F15 **Project:** 1001302
Sample: F15 Head (Composite 2)
Grind: 2kg sample ground @65%solids for 6'40" minutes in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	2.4	97.6
100	149	8.1	89.4
150	105	12.1	77.4
200	74	10.6	66.8
270	53	9.7	57.1
325	44	2.4	54.7
400	37	4.2	50.5
Undersize	- 37	50.5	-
TOTAL:		100.0	

80 % Passing Size (µm) = 114

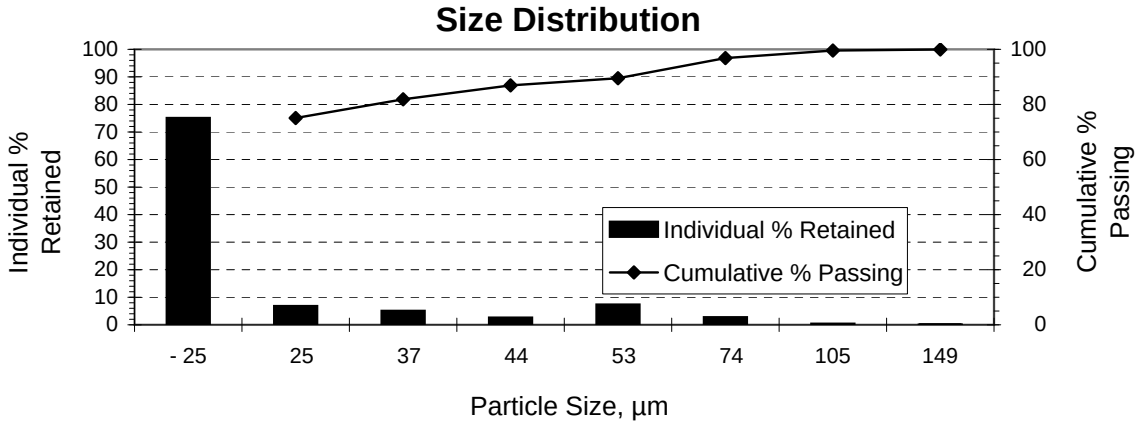


SIZE ANALYSIS REPORT 33

Client: Richfield Ventures **Date:** 9-Aug-10
Test: F15 **Project:** 1001302
Sample: F15 1st Cleaner Tails (Composite 2)
Grind: Wet 422g of Ro conc 1-4 ground @65%solids for 10 minutes in ceramic ball mill

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
100	149	0.1	99.9
150	105	0.4	99.6
200	74	2.7	96.8
270	53	7.3	89.5
325	44	2.6	86.9
400	37	5.0	81.9
500	25	6.8	75.1
Undersize	- 25	75.1	-
TOTAL:		100.0	

80 % Passing Size (µm) = 33

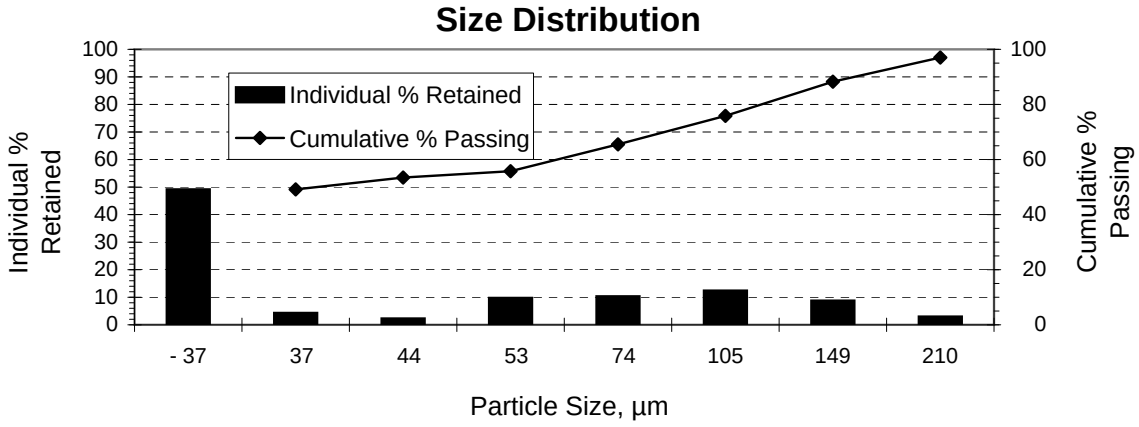


SIZE ANALYSIS REPORT 34

Client: Richfield Ventures **Date:** 7-Aug-10
Test: F16 **Project:** 1001302
Sample: F16 Head (Composite 2)
Grind: 2kg sample ground @65%solids for 6'40" minutes in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
65	210	3.0	97.0
100	149	8.8	88.3
150	105	12.4	75.8
200	74	10.3	65.5
270	53	9.7	55.8
325	44	2.3	53.5
400	37	4.3	49.2
Undersize	- 37	49.2	-
TOTAL:		100.0	

80 % Passing Size (µm) = 119

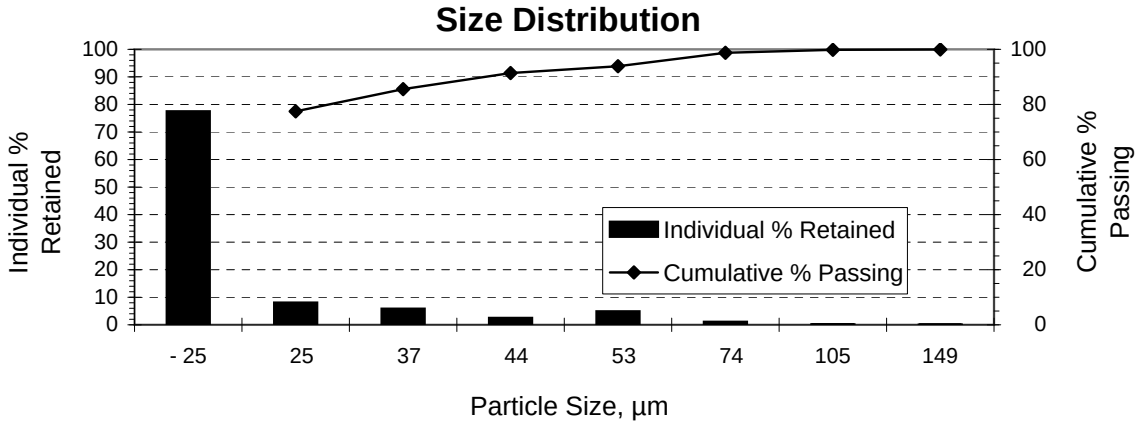


SIZE ANALYSIS REPORT 35

Client: Richfield Ventures **Date:** 9-Aug-10
Test: F16 **Project:** 1001302
Sample: F16 1st Cleaner Tails (Composite 2)
Grind: Wet 327g of Ro conc 1-4 ground @65%solids for 10 minutes in ceramic ball mill

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
100	149	0.0	100.0
150	105	0.1	99.8
200	74	1.1	98.7
270	53	4.9	93.9
325	44	2.5	91.4
400	37	5.8	85.5
500	25	8.1	77.5
Undersize	- 25	77.5	-
TOTAL:		100.0	

80 % Passing Size (µm) = 28

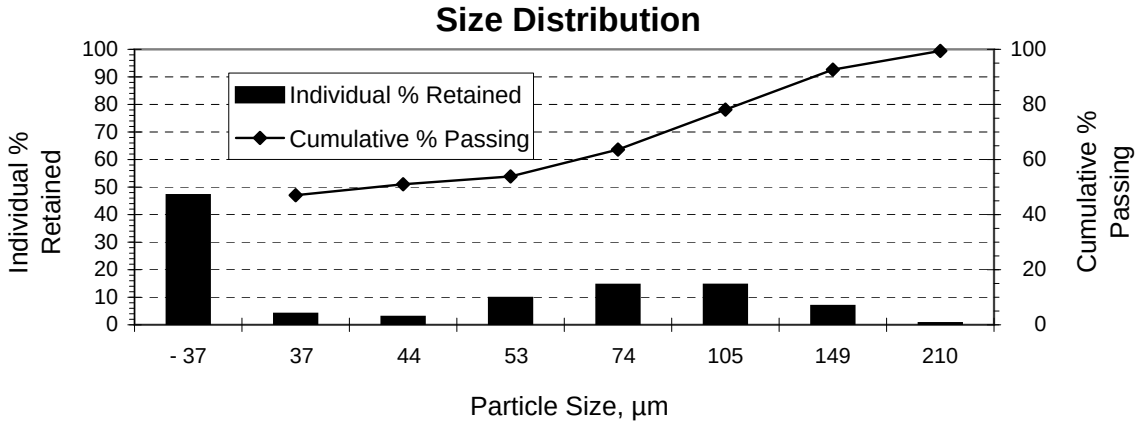


SIZE ANALYSIS REPORT 36

Client: Richfield Ventures **Date:** 7-Aug-10
Test: F17 **Project:** 1001302
Sample: F17 Head (Composite 3)
Grind: 2kg sample ground @65%solids for 19 minutes in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	0.6	99.4
100	149	6.8	92.6
150	105	14.5	78.1
200	74	14.5	63.6
270	53	9.7	53.9
325	44	2.9	51.0
400	37	4.0	47.0
Undersize	- 37	47.0	-
TOTAL:		100.0	

80 % Passing Size (µm) = 110

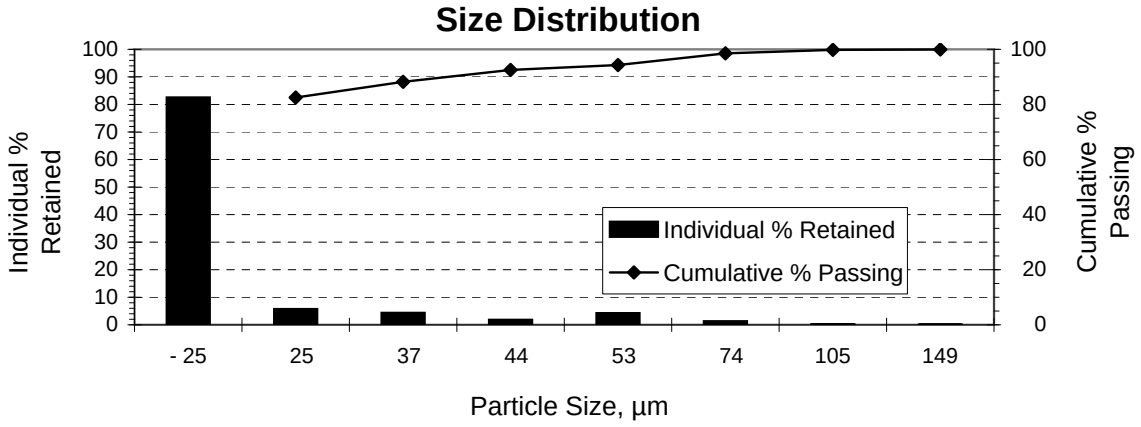


SIZE ANALYSIS REPORT 37

Client: Richfield Ventures **Date:** 9-Aug-10
Test: F17 **Project:** 1001302
Sample: F17 1st Cleaner Tails (Composite 3)
Grind: Wet 386g of Ro conc 1-4 ground @65%solids for 10 minutes in ceramic ball mill

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
100	149	0.1	99.9
150	105	0.1	99.8
200	74	1.3	98.5
270	53	4.2	94.3
325	44	1.8	92.5
400	37	4.3	88.2
500	25	5.7	82.5
Undersize	- 25	82.5	-
TOTAL:		100.0	

85 % Passing Size (µm) = 30

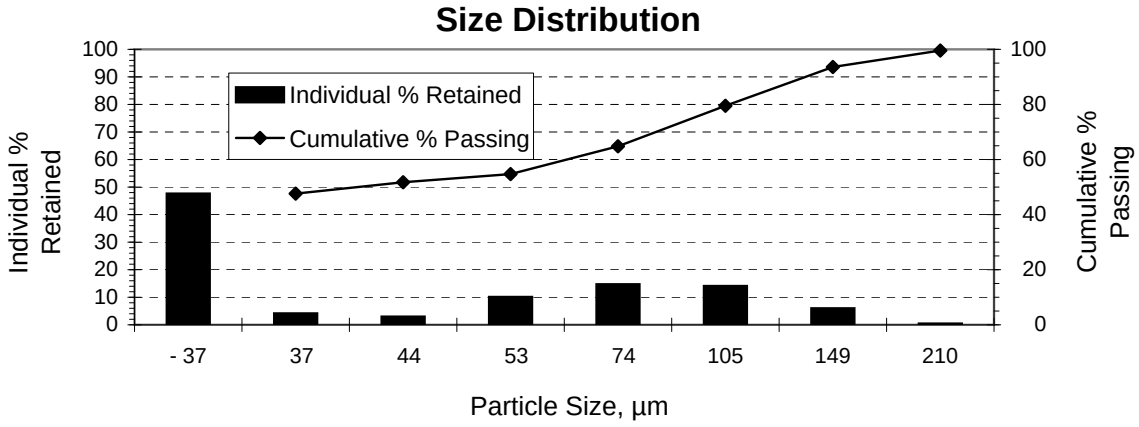


SIZE ANALYSIS REPORT 38

Client: Richfield Ventures **Date:** 7-Aug-10
Test: F18 **Project:** 1001302
Sample: F18 Head (Composite 3)
Grind: 2kg sample ground @65%solids for 19 minutes in stainless steel mill #4

Sieve Size		Individual	Cumulative
Tyler Mesh	**Micrometers**	**% Retained**	**% Passing**
65	210	0.4	99.6
100	149	6.0	93.6
150	105	14.1	79.5
200	74	14.7	64.8
270	53	10.1	54.7
325	44	3.0	51.8
400	37	4.1	47.6
Undersize	- 37	47.6	-
TOTAL:		100.0	

80 % Passing Size (µm) = 106

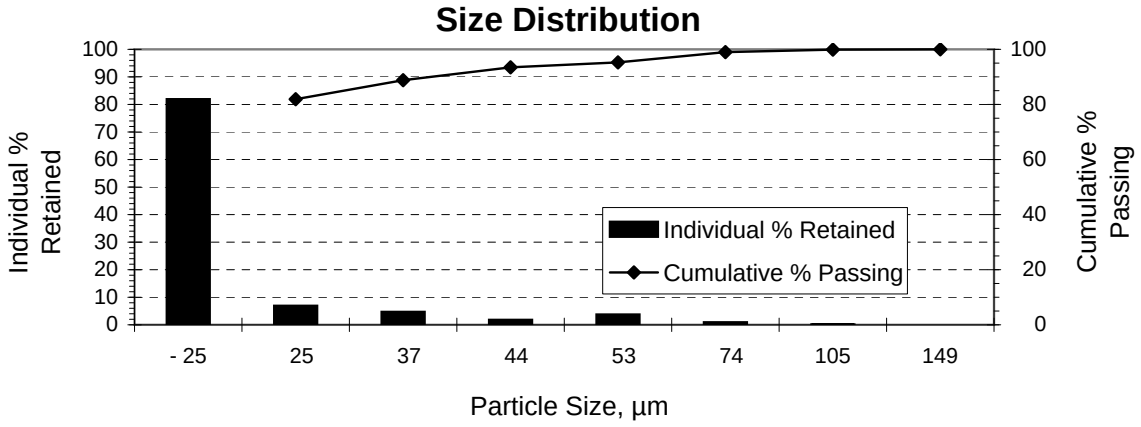


SIZE ANALYSIS REPORT 39

Client: Richfield Ventures **Date:** 9-Aug-10
Test: F18 **Project:** 1001302
Sample: F18 1st Cleaner Tails (Composite 3)
Grind: Wet 300g of Ro conc 1-4 ground @65%solids for 10 minutes in ceramic ball mill

Sieve Size		Individual	Cumulative
Tyler Mesh	Micrometers	% Retained	% Passing
100	149	0.0	100.0
150	105	0.1	99.9
200	74	0.9	99.0
270	53	3.7	95.3
325	44	1.8	93.5
400	37	4.7	88.8
500	25	6.9	81.9
Undersize	- 25	81.9	-
TOTAL:		100.0	

85 % Passing Size (µm) = 30



METALLURGICAL TESTING OF SAMPLES FROM THE BLACKWATER GOLD PROJECT

APPENDIX V

MISCELLANEOUS DATA

Test No.	Product	Data	Page
BI-1	Blended (3 composites)	Work Index	1
F14	Final Tailing	Size x Assay	2
F16	Final Tailing	Size x Assay	3
F18	Final Tailing	Size x Assay	4

BOND MILL GRINDABILITY TEST REPORT 1

Client: Richfield Ventures
Test: BI-1
Sample: Blended Composite

Date: 7-Feb-11
Project: 1001302

TEST CONDITIONS

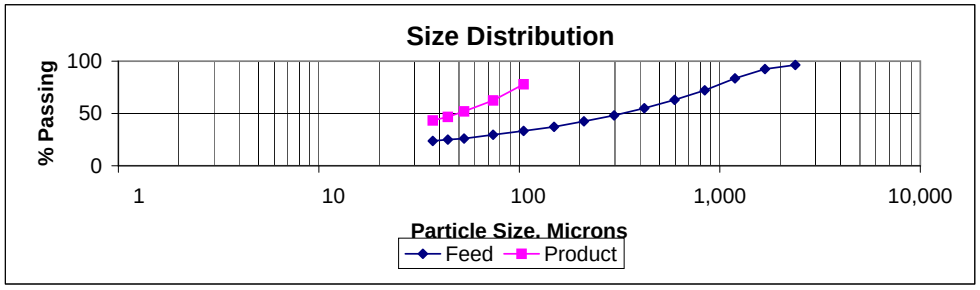
Cycle	Oversize Wt. grams	Product Wt. grams	Feed Undersize grams	Net Product grams	Product per Rev. grams/rev.	Required Rev. rev.
1	806.91	640.74	538.48	102.26	1.0226	100
2	982.86	464.79	238.33	226.46	1.3212	171
3	1014.58	433.07	172.89	260.18	1.4279	182
4	1042.50	405.15	161.09	244.06	1.3711	178
5	1027.72	419.93	150.70	269.23	1.4041	192
6	1021.88	425.77	156.20	269.57	1.4704	183
7	1039.76	407.89	158.37	249.52	1.4374	174

SIZE ANALYSIS

Sieve Size		% Passing	
Tyler mesh	µm	Feed	Product
8	2,380	96.4	
10	1,680	92.5	
14	1,190	83.6	
20	841	72.2	
28	595	63.0	
35	420	55.0	
48	297	48.2	
65	210	42.5	
100	149	37.2	
150	105	33.3	77.9
200	74	29.6	62.5
270	53	26.0	52.0
325	44	25.0	46.7
400	37	23.7	43.3

TEST RESULTS

Material Charge Wt.-700 mL(g) = 1,447.7
Test Screen (µm) = 150
Undersize in Feed (%)= 37.2
Circulating Load (%) = 255
Gbp (ave.) = 1.44
Product P_{80} (µm) = 109
Feed F_{80} (µm) = 1,073
W (kWh/ton) = 16.0
W (kWh/tonne) = 17.6

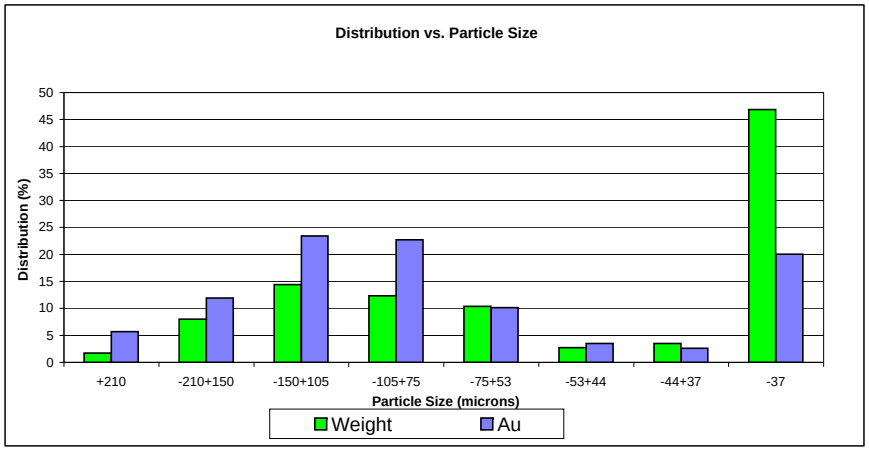


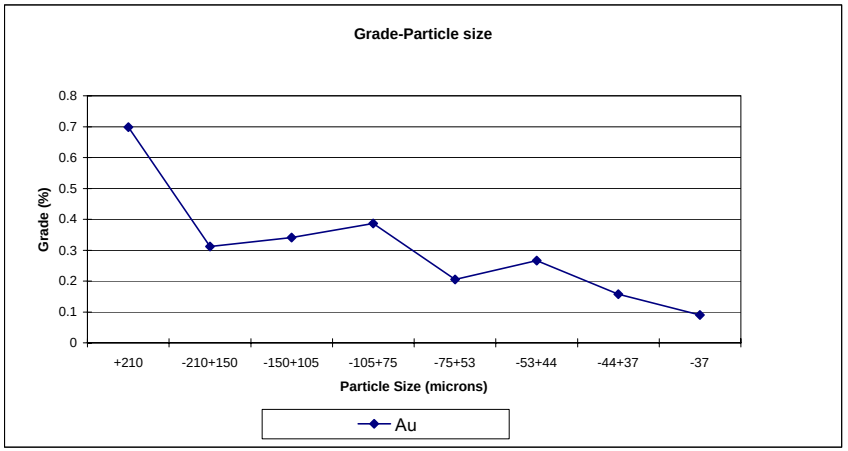
SIZE-ASSAY ANALYSIS REPORT

Client: Richfield Ventures
Test: F14 (Composite 1)
Sample: F14 Flotation Tailings

Date: 3-Feb-11
Project: 1001302

Size Fraction		Weight		Assay,g/t or %				Distribution, %		
Mesh	Microns	(g)	(%)	Au	Ag	S	Zn	Au	Ag	S
+65	+210	3.6	1.7	0.70	5.40	1.82	0.07	5.7	3.3	4.5
-65+100	-210+150	17.0	8.0	0.31	4.80	1.44	0.08	11.9	13.8	16.7
-100+150	-150+105	30.6	14.4	0.34	4.60	1.12	0.08	23.4	23.8	23.3
-150+200	-105+75	26.2	12.3	0.39	3.30	0.91	0.06	22.7	14.6	16.2
-200+270	-75+53	22.0	10.4	0.21	2.00	0.52	0.03	10.1	7.4	7.8
-270+325	-53+44	5.8	2.7	0.27	1.70	0.32	<0.01	3.5	1.7	1.3
-325+400	-44+37	7.4	3.5	0.16	1.50	0.27	<0.01	2.6	1.9	1.4
-400	-37	99.4	46.9	0.09	2.00	0.43	<0.01	20.1	33.6	29.0
Total		**212.1**	**100.0**	**0.21**	**2.79**	**0.69**		**100.0**	100.0	100.0
Measured				0.17	2.60	0.75	0.40			



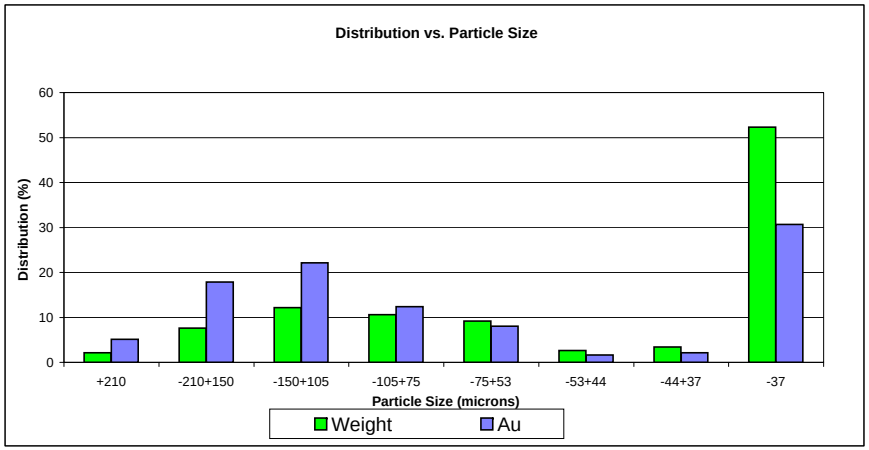


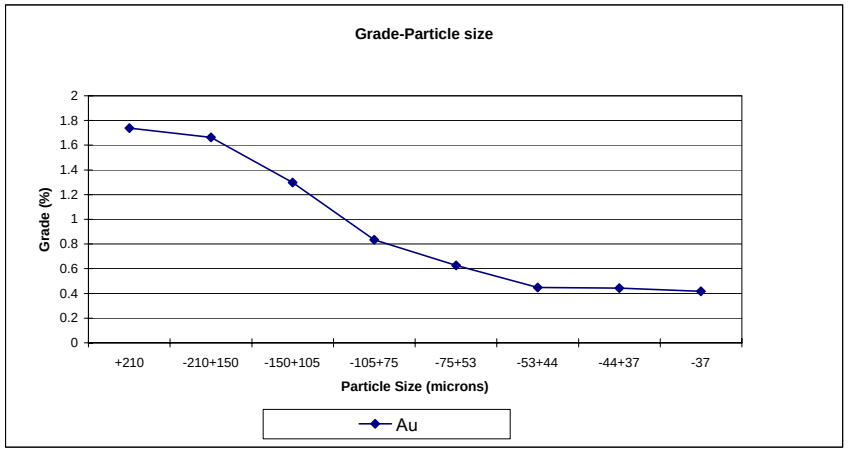
SIZE-ASSAY ANALYSIS REPORT

Client: Richfield Ventures
Test: F16 (Composite 2)
Sample: F16 Flotation Tailings

Date: 3-Feb-11
Project: 1001302

Size Fraction		Weight		Assay,g/t or %				Distribution, %		
Mesh	Microns	(g)	(%)	Au	Ag	S	Zn	Au	Ag	S
+65	+210	4.4	2.1	1.74	9.90	2.22	0.04	5.2	9.7	5.5
-65+100	-210+150	15.7	7.6	1.66	3.40	1.83	0.04	17.8	12.1	16.5
-100+150	-150+105	25.0	12.2	1.30	2.90	1.60	0.04	22.2	16.4	22.9
-150+200	-105+75	21.8	10.6	0.83	2.80	1.04	0.03	12.4	13.8	13.0
-200+270	-75+53	18.9	9.2	0.63	2.70	0.74	<0.01	8.1	11.5	8.0
-270+325	-53+44	5.4	2.6	0.45	1.40	0.50	<0.01	1.6	1.7	1.5
-325+400	-44+37	7.0	3.4	0.44	1.90	0.43	<0.01	2.1	3.0	1.7
-400	-37	107.7	52.3	0.42	1.30	0.50	<0.01	30.6	31.7	30.8
Total		**205.8**	**100.0**	**0.71**	**2.15**	**0.85**		**100.0**	100.0	100.0
Measured				1.19	2.60	0.91	0.27			





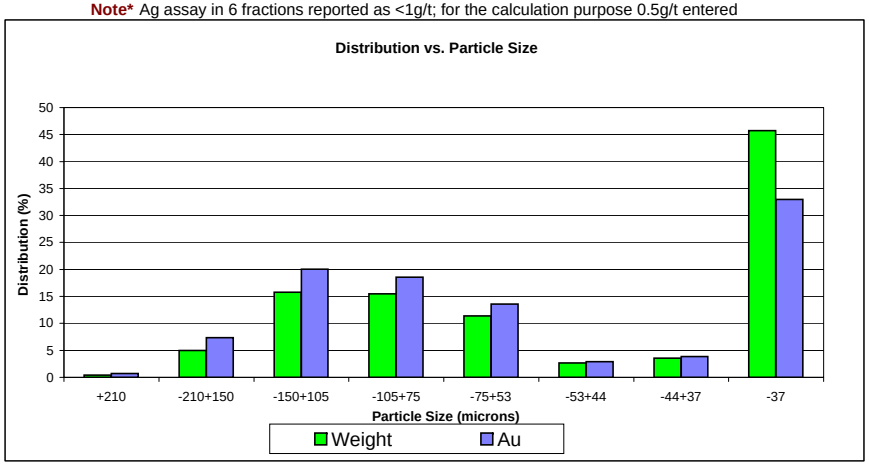
SIZE-ASSAY ANALYSIS REPORT

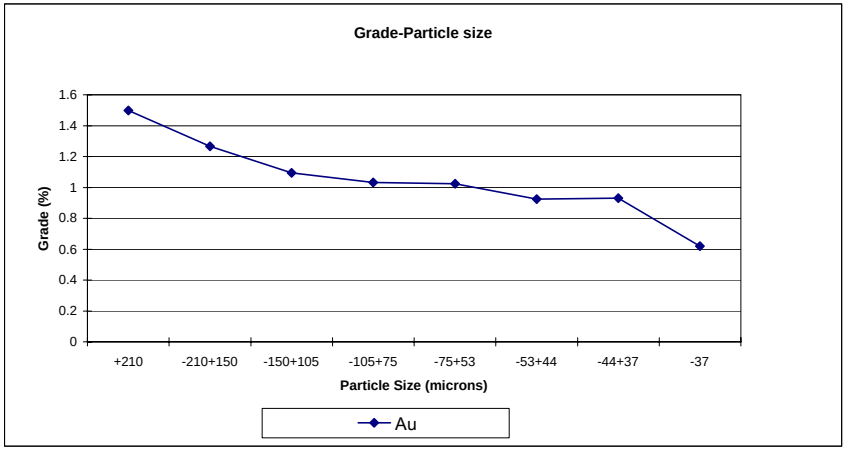
Client: Richfield Ventures
Test: F18 (Composite 3)
Sample: F18 Flotation Tailings

Date: 3-Feb-11
Project: 1001302

Size Fraction		Weight		Assay,g/t or %				Distribution, %		
Mesh	Microns	(g)	(%)	Au	Ag*	S	Zn	Au	Ag*	S
+65	+210	0.8	0.4	1.50	0.50	1.94	<0.01	0.7	0.3	0.9
-65+100	-210+150	10.5	5.0	1.27	1.80	1.71	<0.01	7.4	13.3	9.9
-100+150	-150+105	32.9	15.8	1.09	1.20	1.40	<0.01	20.1	28.0	25.5
-150+200	-105+75	32.3	15.5	1.03	0.50	1.13	<0.01	18.6	11.4	20.1
-200+270	-75+53	23.8	11.4	1.02	0.50	0.78	<0.01	13.6	8.4	10.3
-270+325	-53+44	5.6	2.7	0.93	0.50	0.61	<0.01	2.9	2.0	1.9
-325+400	-44+37	7.4	3.5	0.93	0.50	0.60	<0.01	3.8	2.6	2.5
-400	-37	95.5	45.8	0.62	0.50	0.55	<0.01	33.0	33.9	29.0
Total		**208.72**	**100.0**	**0.86**	**0.68**	**0.87**		**100.0**	100.0	100.0
Measured				0.71	0.75	0.79	0.10			

Note* Ag assay in 6 fractions reported as <1g/t; for the calculation purpose 0.5g/t entered





newgold™

Blackwater Gold Project: Mineralogical Characterization of Waste Rock & Tailings

Report prepared for:
New Gold Inc.
Suite 1800, Two Bentall Centre 555 Burrard Street
Vancouver, B.C., V7X 1M9

Report prepared by:
Lorax Environmental Services
2289 Burrard St.
Vancouver, B.C., V6J 3H9

September 23, 2013

FINAL

LORAX ENVIRONMENTAL

Table of Contents

newgold™

Table of Contents

TABLE OF CONTENTS I

1. INTRODUCTION 1-1

2. METHODS 2-1
   2.1 SAMPLE SELECTION 2-1
   2.2 ANALYTICAL METHODS 2-2

3. MINERALOGY AND MINERAL CHEMISTRY 3-1
   3.1 WASTE ROCK SAMPLES 3-1
      3.1.1 PETROGRAPHIC OVERVIEW 3-1
      3.1.2 SEM-RESULTS 3-4
         3.1.2.1 BW-ARD2-10 (TYPE 1 - PAG) 3-4
         3.1.2.2 BW-ARD-510 (TYPE 2 - PAG) 3-9
         3.1.2.3 BW-ARD-648 (TYPE 3 - NAG) 3-9
         3.1.2.4 BW-ARD-468 (TYPE 4 - NAG) 3-17
         3.1.2.5 BW-ARD-473 (TYPE 3 - NAG) 3-17
   3.2 TAILINGS SAMPLES 3-25
      3.2.1 PETROGRAPHIC OVERVIEW 3-25
      3.2.2 SEM RESULTS 3-29
         3.2.2.1 CND 2-4 (SULFIDE TAILINGS) 3-29
         3.2.2.2 CND 1-5 (TRANSITION TAILINGS) 3-30

4. CONCLUSIONS 4-1

REFERENCES R-1

LIST OF FIGURES

FIGURE 3-1 PHOTOMICROGRAPHS SHOWING A) TYPICAL RECRYSTALLIZED QUARTZ-FELDSPAR-MATRIX WITH SERICITE-FILLED PATCHES (TYPE 1, PAG) B) BIOTITE-ALTERED GROUNDMASS WITH SUBHEDRAL PYRITE (TYPE 2, PAG) AND C) IRREGULARLY-SHAPED PYRITE-SPHALERITE CO-PRECIPITATE IN BIOTITE-SERICITE-MATRIX (TYPE 3, NAG). FIELD OF VIEW = 0.75 MM 3-3

FIGURE 3-2 BSE-IMAGE OF A SPHALERITE GRAIN IN WASTE ROCK SAMPLE BW-ARD2-10 (TYPE 1 – PAG), SHOWING (1) CHALCOPYRITE, (2) SPHALERITE, (3) QUARTZ-FELDSPAR MATRIX 3-5

FIGURE 3-3 EELEMENTAL MAPS FOR CU, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-2 (WASTE ROCK SAMPLE BW-ARD2-10; TYPE 1 – PAG). 3-5

FIGURE 3-4 BSE-IMAGE OF PARTIALLY WEATHERED SPHALERITE-PYRITE AGGREGATE IN WASTE ROCK SAMPLE BW-ARD2-10 (TYPE I – PAG), SHOWING (1) SPHALERITE, (2) QUARTZ, (3) BIOTITE, (4) PYRITE, (5) FE-HYDROXIDE. 3-6

FIGURE 3-5 ELEMENTAL MAPS FOR SI, O, S, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-4 (WASTE ROCK SAMPLE BW-ARD2-10; TYPE I – PAG) 3-7

FIGURE 3-6 BSE-IMAGE OF PYRITE FILLING MICROFACTURES IN A QUARTZ-SERICITE GROUNDMASS IN WASTE ROCK SAMPLE BW-ARD2-10 (TYPE 1 – PAG). 3-8

FIGURE 3-7 ELEMENTAL MAPS FOR FE, S, ZN AND CD OF AREA SHOWN IN FIGURE 3-6 (WASTE ROCK SAMPLE BW-ARD2-10; TYPE I – PAG). 3-8

FIGURE 3-8 BSE-IMAGE OF PYRITE (1) GRAINS EMBEDDED IN CALCITE (2) IN WASTE ROCK SAMPLE BW-ARD-510 (TYPE 2 – PAG) 3-10

FIGURE 3-9 ELEMENTAL MAPS FOR S, O, CA, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-8 (WASTE ROCK SAMPLE BW-ARD-510; TYPE 2 – PAG). 3-11

FIGURE 3-10 ANHEDRAL PYRITE AGGEGRAGTE IN WASTE ROCK SAMPLE BW-ARD-510 (TYPE 2 – PAG). 3-12

FIGURE 3-11 SELECTED ELEMENTAL MAPS OF AREA SHOWN IN FIGURE 3-10 (WASTE ROCK SAMPLE BW-ARD-510; TYPE 2 – PAG). 3-12

FIGURE 3-12 BSE IMAGE SHOWING SPHALERITE (1)-PYRRHOTITE (2) ASSEMBLAGE EMBEDDED IN CHLORITE (3) MATRIX IN WASTE ROCK SAMPLE BW-ARD-648 (TYPE 3 – NAG). 3-13

FIGURE 3-13 ELEMENTAL MAPS FOR S, O, FE, CU, ZN AND CD OF AREA SHOWN IN FIGURE 3-12 (WASTE ROCK SAMPLE BW-ARD-648; TYPE 3 – NAG). 3-14

FIGURE 3-14 EDX-SPECTRUM OF SPHALERITE GRAIN IN WASTE ROCK SAMPLE BW-ARD-648 (TYPE 3 – NAG) SHOWING PRESENCE OF CD, MN AND FE. 3-15

FIGURE 3-15 BSE-IMAGE AND COUNTS-VS-DISCTANCE PLOT SHOWING THE LOCATION AND RELATIVE ELEMENTAL ABUNDANCES (ZN, S, CU, FE AND CD) IN AN EDX LINE-SCAN RUNNING FROM SPHALERITE INTO PYRROTHITE IN WASTE ROCK SAMPLE BW-ARD-648 (TYPE 3 – NAG). 3-16

FIGURE 3-16 BSE-IMAGE OF A MASSIVE PYRITE GRAIN IN WASTE ROCK SAMPLE BW-ARD-468 (TYPE 4 – NAG). 3-18

FIGURE 3-17 SELECTED ELEMENTAL FOR S, O, SI, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-16 (WASTE ROCK SAMPLE BW-ARD-468; TYPE 4 – NAG). 3-19

FIGURE 3-18 EDX-SPECTRUM OF A REPRESENTATIVE SPHALERITE GRAIN IN WASTE ROCK SAMPLE BW-ARD-468 (TYPE 4 – NAG) HIGHLIGHTING THE PARTITIONING OF CD, MN, AND FE INTO THE CRYSTAL LATTICE. 3-20

FIGURE 3-19 BSE-IMAGE OF FRAGMENT CONTAINING LIKELY MN-FE-CA CARBONATE (1; RHODOCHROSITE) IN WASTE ROCK SAMPLE BW-ARD-473 (TYPE 3 – NAG). OTHER MINERALS ARE (2) CHLORITE, (3) QUARTZ, AND (4) SERICITE. 3-20

FIGURE 3-20 SELECTED ELEMENTAL MAPS FOR FE, O, S, CA, CD AND ZN OF AREA SHOWN IN FIGURE 3-18 (WASTE ROCK SAMPLE BW-ARD-473; TYPE 3 – NAG). 3-21

FIGURE 3-21 EDX-SPECTRUM OF MINERAL 1 IN FIGURE 3-19, SUGGESTING A MN-FE-CA-CARBONATE WITH CONSIDERABLE ZN CONTENT IN WASTE ROCK SAMPLE BW-ARD-473 (TYPE 3 – NAG). 3-22

FIGURE 3-22 BSE-IMAGE OF POLYMETALLIC SULFIDE CLUSTER (1) ENCLOSED BY RHODOCHROSITE (2) IN SAMPLE BW-ARD-473 (TYPE 3 – NAG). 3-22

FIGURE 3-23 ELEMENTAL MAPS FOR FE, S, O, CU, ZN AND CD OF AREA SHOWN IN FIGURE 3-22 (WASTE ROCK SAMPLE BW-ARD-473; TYPE 5 – NAG). 3-23

FIGURE 3-24 BSE- IMAGE AND EDX SPECTRUM SHOWING LOCATION AND QUALITATIVE CHEMISTRY OF A CD-SULFIDE PHASE (1) IN WASTE ROCK SAMPLE BW-ARD 473 (BW-ARD-473; TYPE 3 – NAG). 3-24

FIGURE 3-25 BSE-IMAGE SHOWING FE-HYDROXIDE RIM (1) ADJACENT TO QUARTZ-BIOTITE (2) MATRIX IN WASTE ROCK SAMPLE BW-ARD-473 (TYPE 3 – NAG). 3-26

FIGURE 3-26 ELEMENTAL MAPS S, O, SI, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-25 (WASTE ROCK SAMPLE BW-ARD-473; TYPE 3 – NAG). 3-27

FIGURE 3-27 BSE-IMAGE AND COUNTS-VS-DISCTANCE PLOT SHOWING THE LOCATION AND RELATIVE ELEMENTAL ABUNDANCES IN AN EDX LINE-SCAN RUNNING FROM A SECONDARY FE-HYDROXIDE INTO THE ADJACENT QUARTZ-BIOTITE-MATRIX IN WASTE ROCK SAMPLE BW-ARD-473 (TYPE 3 – NAG). 3-28

FIGURE 3-28 BSE-IMAGE OF A TYPICAL FRAGMENT ASSEMBLAGE SEEN IN TAILINGS SAMPLE CND 2-4 SHOWING (1) ALTERED ARSENOPYRITE (?) AND (2) SPHALERITE. 3-31

FIGURE 3-29 EELEMENTAL MAPS FOR SI, S, MG, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-28 (TAILINGS SAMPLE CND 2-4). 3-32

FIGURE 3-30 BSE-IMAGE OF FRAGMENT ASSEMBLAGE IN TAILINGS SAMPLE CND 2-4 SHOWING (1) SPHALERITE, (2) ARSENOPYRITE, (3) PYRITE AND (4) ALUMINOSILICATE WITH FE-HYDROXIDE RIM. 3-33

FIGURE 3-31 EELEMENTAL MAPS FOR SI, S, MG, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-30 (TAILINGS SAMPLE CND 2-4). 3-34

FIGURE 3-32 EDX-SPECTRUM OF ARSENOPYRITE GRAIN IN TAILINGS SAMPLE CND 2-4 SHOWING DETECTABLE FE, AS, SB, AND S. 3-35

FIGURE 3-33 BSE-IMAGE OF TAILINGS SAMPLE CND 2-4 SHOWING CO-PRECIPIATETD PYRITE (1) AND SPHALERITE (2). GANGUE MINERALS ARE BIOTITE (3) AND MUSCOVITE (4). 3-35

FIGURE 3-34 ELEMENTAL MAPS FOR FE, S, ZN AND CD OF AREA SHOWN IN FIGURE 3-33 (TAILINGS SAMPLE CND 2-4). 3-36

FIGURE 3-35 BSE-IMAGE OF TAILINGS SAMPLE CND 1-5 SHOWING A RELATAIVELY LOW-MAGNIFICATION OVERVIEW OF A FRAGMENT ASSEMBLAGE. 3-36

FIGURE 3-36 ELEMENTAL MAPS FOR S, SI, O, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-35 (TAILINGS SAMPLE CND 1-5). 3-37

FIGURE 3-37 BSE-IMAGE OF TAILINGS SAMPLE 1-5 SHOWING BIOTITE CLUSTER WITH SECONDARY PRECIPITATES ALONG GRAIN BOUNDARIES. 3-38

FIGURE 3-38 ELEMENTAL MAPS OF AREA SHOWN IN FIGURE 3-37 (TAILINGS SAMPLE CND 1-5)..... 3-38

FIGURE 3-39 BSE-IMAGE OF TAILINGS SAMPLE 1-5 SHOWING NETWORK OF REPLACIVE FE-HYDROXIDE IN POLYMINERALIC FRAGMENT (TAILINGS SAMPLE CND 1-5) 3-39

FIGURE 3-40 ELEMENTAL MAPS OF AREA SHOWN IN FIGURE 3-39 (TAILINGS SAMPLE CND 1-5)..... 3-39

LIST OF TABLES

TABLE 2-1 CLASSIFICATIONS AND ABA RESULTS FOR WASTE ROCK AND TAILINGS SAMPLES SELECTED FOR MINERALOGICAL CHARACTERIZATION 2-1

TABLE 3-1 RIETVELD XRD RESULTS FOR TWO OF THE FIVE WASTE ROCK SAMPLES FROM THE BLACKWATER DEPOSIT (IN %)..... 3-1

1. Introduction

newgold™

1. Introduction

Newgold's Blackwater Gold Project targets an epithermal gold deposit that is expected to produce approximately 450 Mt of waste rock and 243 Mt of tailings over a 10-year production period of open-pit mining. As part of environmental planning for the site, the management of metal leaching (ML) and acid rock drainage (ARD) represents a key focus. Geochemical testwork conducted to date indicates that Zn and Cd will likely be the main elements of concern with respect to mine waste management. Based on acid-base accounting characteristics as well as Zn content, the following five major waste rock types have been established to support ML/ARD characterization and management:

Type 1 - NPR < 1.0 (PAG)

Type 2 - 1.0 < NPR < 2.0 (PAG)

Type 3 - NPR > 2.0 and Zn > 1000 ppm (NAG)

Type 4 - NPR > 2.0 and 600 ppm < Zn < 1000 ppm (NAG)

Type 5 - NPR > 2.0 and Zn < 600 ppm (NAG)

In this classification, the risk of the different waste rock types to produce environmentally harmful drainage decreases with increasing waste type number. Waste rock of Types 1, 2 and 3 will be disposed of subaqueously into the TSF pond while Types 4 and 5 will be used for construction with residual waste rock stored in two out-of-pit waste rock dumps. For the tailings, classifications of oxide, transition and sulfide, have been adopted to reflect the weathering profile through the deposit. The bulk of the tailings to be generated are derived from the milling of sulfide ores and, to a much lesser extent, transition and oxide ore.

In order to support the ML/ARD assessment, and to provide further insight into the geochemical controls governing the remobilization of metals in both subaerial and subaqueous settings, detailed mineralogical assessment of waste rock and tailings samples was conducted. A specific goal of this study was to gain a better understanding of the general mineralogical composition and texture of waste rock and tailings materials, with a special focus on the partitioning behaviour of Zn and Cd within the various assemblages. For that purpose, five waste rock samples (one from each class) and two tailings samples were studied using optical as well as a scanning-electron microscopy (SEM) for textural observations and qualitative insight into mineral chemistry, respectively. The results of this assessment have relevance to the ML/ARD characterization program, the weathering characteristics associated with subaerially exposed materials, chemical stability in saturated settings, and mine waste management.

2. Methods

newgold™

2. Methods

2.1 Sample Selection

Characteristics and acid-base-accounting (ABA) results for samples analyzed as part the mineralogical assessment are summarized in Table 2-1. Five waste rock samples, representing waste rock classification Types 1-4, were characterized. Initially it was thought that sample BW-ARD-473 belonged to waste type 5, however it was found that this sample was in fact misclassified and now falls into the Type 3 category. It should be noted however that this sample differs from the other Type 3 waste rock sample (BW-ARD-648) as it was recovered from the transition zone while all other samples originated from the sulfide zone. Two tailings samples, one representing transition zone material (CND 1-5) and the other originating from the sulfide zone (CND 2-4), were also examined. Both tailings samples were previously subjected to cyanide leaching and cyanide destruction. Sulfide tailings will represent over 80% of the total materials generated at the site, with transition tailings (~18%) and oxide tailings (~2%) representing much small fractions.

Table 2-1:
Classifications and ABA Results for Waste rock and Tailings Samples Selected for Mineralogical Characterization

Sample ID	Sample Type	Sub Class	Paste pH	TIC	CaNP	NP	Total S	Sulfate S	Sulfide S	MAP	NPR	NPR
				% CO2	kg CaCO3/t	kg CaCO3/t	%	%	%	kg CaCO3/t	NP/ TAP	CaNP/ TAP
BW-ARD2-10	Waste rock	Type 1 (Sulfide Zone; PAG)	5.2	0.18	4.2	4.0	1.1	0.010	1.1	34	0.12	0.12
BW-ARD-510	Waste rock	Type 2 (Sulfide Zone; PAG)	8.6	0.33	7.5	14	0.35	0.020	0.35	11	1.3	0.69
BW-ARD-648	Waste rock	Type 3 (Sulfide Zone; NAG)	8.3	1.1	25	37	0.45	0.010	0.45	14	2.6	1.8
BW-ARD-473	Waste rock	Type 3 (Transition Zone; NAG)	7.8	2.5	57	27	0.080	0.010	0.070	2.5	11	23
BW-ARD-468	Waste rock	Type 4 (Sulfide Zone; NAG)	7.4	0.99	23	13	0.16	0.010	0.14	5.0	2.6	4.5
CND 2-4	Tailings	Sulfide Zone	7.9	0.40	33	11	0.81	0.030	0.78	25	0.43	1.3
CND 1-5	Tailings	Transition Zone	7.6	0.20	17	4.0	0.45	0.050	0.40	14	0.28	1.2

Notes: TIC = total inorganic carbon; NP = neutralization potential; CaNP = carbonate NP; MAP = maximum acid potential; NPR = net potential ratio; sample BW-ARD-473 was initially misclassified as Type 5.

2.2 Analytical Methods

X-ray diffraction (XRD) was conducted at the University of British Columbia (UBC) using a Siemens D5000 detector with Bruker D8 Focus (LynxEye detector) diffractometers. XRD, with Rietveld refinement, allows for semi-quantitative determinations of mineral abundance. XRD identifies minerals by measuring the angle at which a mineral diffracts incident X-rays, which is in turn dependent on the arrangement of atoms within the crystal lattice of minerals. Due to the fact that amorphous materials contain no regularly ordered crystal lattice, these materials do not diffract X-rays and are therefore unidentifiable by XRD (*e.g.*, Raudsepp and Pani, 2003).

Optical microscopy was undertaken using a Nikon Optiphot polarizing microscope at Lorax Environmental Services Ltd. Photomicrographs were taken using a AmScope MD900E camera. Based on the findings of the petrographic analysis, areas of interest were specified and marked for analysis using scanning electron microscopy (SEM). The latter was conducted at UBC using a Philips XL-30 scanning electron microscope with a Bruker Quanta 200 energy-dispersion X-ray (EDX) system. Samples were observed in back-scattered electron (BSE) mode at a voltage of 15 kV for imaging purposes.

SEM is used to gain both physical and chemical information of solid materials. Imaging on the SEM provides information on grain size, texture, and mineralogical associations. In addition, the relative greyscale intensity shown in back scatter electron (BSE) images corresponds to the average atomic number such that bright areas indicate relatively high atomic numbers (*e.g.*, ZnS) while darker areas indicate low atomic numbers (*e.g.*, SiO_2). Elemental analysis was conducted using point energy dispersive X-ray spectroscopy (EDX) and by producing 2-D elemental maps. Under optimized EDX experimental setups, the volume of beam interaction can be as small as 1 x 1 x 3 µm. Point EDX analyses produce spectra which are processed to reveal the elements that are present within the volume of beam interaction as well as their relative quantity. While not quantitative, the production of 2-D elemental maps is useful in visualizing elemental distributions and elemental associations over a given area.

3. Mineralogy and Mineral Chemistry

newgold™

3. Mineralogy and Mineral Chemistry

3.1 Waste Rock Samples

3.1.1 Petrographic Overview

Blackwater waste rock samples were examined by X-ray diffraction (XRD) and optical methods in order to gain a general understanding of mineralogy and texture and to select areas of interest for SEM analysis. Mineral abundances measured by Rietveld XRD-analysis are given in Table 3-1. The following section provides a general description of textural relationships and major minerals, and is not intended to give a detailed petrographic representation.

Table 3-1:
Rietveld XRD results for two of the five waste rock samples from the Blackwater deposit (in %)

Mineral	Ideal Formula	BW-ARD-2-10	BW-ARD-510	BW-ARD-648	BW-ARD-473	BW-ARD-468
Biotite	$K(Mg,Fe^{2+})_3AlSi_3O_{10}(OH)_2$		7.7	7.9	1.7	4.6
Calcite	$CaCO_3$			0.1		13
Chlorite	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$		2.8	7.4	2.9	4.9
Diopside	$CaMgSi_2O_6$				2.5	
Grossular	$Ca_3Al_2(SiO_4)_3$		0.9			
Halite	NaCl				1.4	
Kaolinite	$Al_2Si_2O_5(OH)_4$		1.1			
K-feldspar	$KAlSi_3O_8$	33.1	19.9	9.6	10.1	
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	19.4	17.9		10.7	18.3
Plagioclase	$NaAlSi_3O_8 - CaAl_2Si_2O_8$		13.9	38.4	21.4	
Pyrite	FeS_2	0.5				2.9
Quartz	SiO_2	46.3	35.8	36.6	44.4	56.3
Rhodochrosite	$MnCO_3$				5	
Sphalerite	(Zn,Fe)S	0.7				
Total		100	100	100	100	100

Features pertinent to all studied samples include the presence of a pervasively altered, partly to fully recrystallized quartz-feldspar groundmass with fine to medium grain sizes of granoblastic to sutured texture (Figure 3-1a). Relict igneous textures are only rarely preserved, and if so, they occur as partly to fully replaced feldspar phenocrysts. All samples have been pervasively altered/recrystallized with the primary alteration assemblages being secondary feldspar, sericite/muscovite, chlorite and biotite (Figure 3-1a,b) with the exception of the Type 1 (PAG) sample (BW-ARD2-10)..This alteration is varitextured and was found primarily as fine-grained irregular patches, schlieren, honeycomb-networks and pseudomorphs after feldspar. Sample BW-ARD-510 (Type 2, PAG) and NAG samples are somewhat more mafic than BW-ARD2-10 (Type 1, PAG) and display additional chlorite and amphibole (likely actinolite; not detected by XRD) alteration. As to be expected, carbonate minerals were observed in the three NAG samples. In sample BW-ARD-473 (Type 3, NAG) a considerable proportion of the carbonate assemblage was identified to be rhodochrosite, thus limiting the acid-buffering potential of this material. In many cases, alteration assemblages were too fine-grained and pervasive to identify the exact mineral composition, although XRD-analysis suggests that clay-minerals (*e.g.*, kaolinite), grossular and halite are additional minor components within the Blackwater waste rock samples.

Sulfide mineralogy and texture were found to be variable between the different waste rocks samples with the Type 1 (PAG) sample (BW-ARD2-10) showing the highest abundance of sphalerite, generally occurring as medium- to coarse-grained masses (typically ~0.5 mm in diameter) with relatively straight grain boundaries. In this sample, sphalerite may be present within the groundmass or co-precipitated with quartz in veinlets. Although less abundant, medium- to coarse-grained sphalerite aggregates were also identified in the Type 3 (NAG) sample (BW-WRD-648) (Figure 3-1c) which is consistent with this sample having the second highest solid-phase Zn content (1180 ppm) of all waste rock samples. In all other samples, sphalerite is relatively rare and was found primarily as fine (<25 μm) anhedral grains dispersed throughout the fragments. The dominant sulfide mineral in samples other than the Type 1 (PAG) is pyrite, which varies in textural appearance between samples. In the Type 1 (PAG) sample, pyrite is most commonly found in coarse networks of elongated and oriented schlieren-like aggregates with highly corroded grain boundaries. Some fragments in Type 4 (NAG) sample show similar pyrite occurrences; however, in other Blackwater waste rock samples, anhedral, fine- to medium-grained disseminated pyrite embedded within the recrystallized matrix and associated with sericite and/or biotite is the most typical occurrence. Rare pyrrhotite co-precipitated with sphalerite was additionally found in sample BW-ARD-648 (Type 3, NAG).

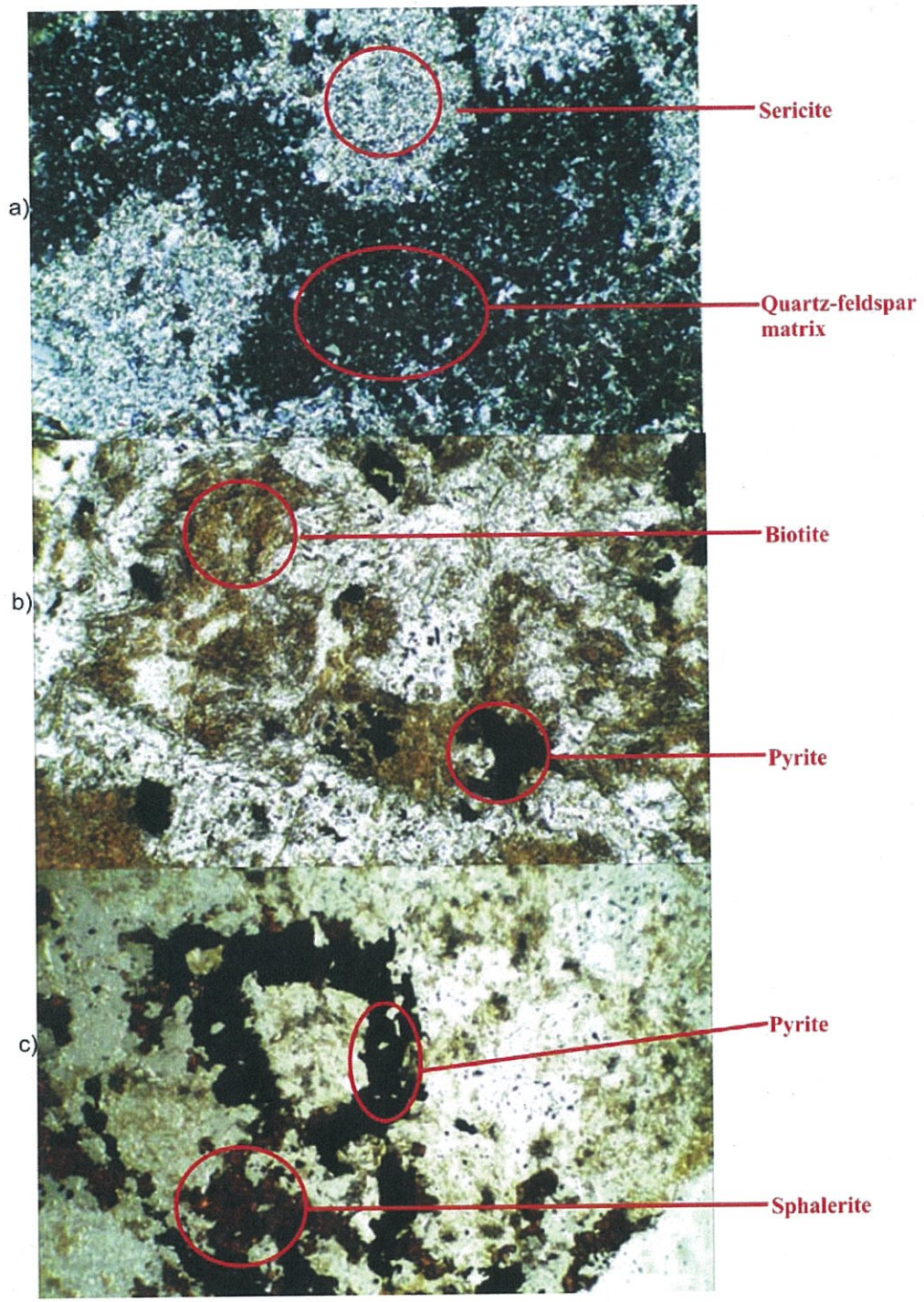


Figure 3-1: **Photomicrographs showing a) typical recrystallized quartz-feldspar-matrix with sericite-filled patches (Type 1, PAG) b) biotite-altered groundmass with subhedral pyrite (Type 2, PAG) and c) irregularly-shaped pyrite-sphalerite co-precipitate in biotite-sericite-matrix (Type 3, NAG). Field of view = 0.75 mm.**

3.1.2 SEM-Results

3.1.2.1 BW-ARD2-10 (Type 1 - PAG)

Relatively large, anhedral to subhedral sphalerite grains are a common feature in sample BW-ARD2-10, and may occur as replacive aggregates within the silicate groundmass of the rock or as co-precipitates in veins. A BSE-image of a replacive grain is provided in Figure 3-2 where contrast and brightness were adjusted to make subtle differences in sulfide-mineralogy discernible. In this figure, slightly darker inclusions (1) within the sphalerite (2) grain are represented by chalcopyrite that exsolved during cooling of the rock or replaced sphalerite (Barton and Bethke, 1987). The surrounding, black phases are silicate minerals with low heavy metal content. A map of selected elements within this grain is shown in Figure 3-3 and nicely illustrates the location of chalcopyrite where the intensity of Cu-signals is high. The iron content in this sphalerite is considerable, and both Cu and Cd were detected at minor concentrations.

An example of a sphalerite grain (1) that precipitated within a vein is shown in Figure 3-4. The surrounding silicates phases are quartz (*e.g.*, mineral 2) and biotite (3). Where in contact with quartz (left side, Figure 3-4), the grain appears unweathered with relatively straight grain boundaries. In contrast, the contact on the right side, is more corroded and elemental mapping (Figure 3-5) suggests some co-precipitation of pyrite (4) as well as incipient sphalerite replacement by Fe-hydroxides (5). Closer examination of the Cd and Zn signatures in this assemblage reveals that both of these elements are only at background levels in minerals other than sphalerite, indicating that their affinity to pyrite and secondary Fe-phases is limited in this sample.

Pyrite-filled cracks that show sub-parallel orientation were identified in several areas within the studied sample. Pyrite of this texture may form in response to remobilization of pre-existing S-bearing phases and commonly precipitates as fine-grained aggregates (*e.g.*, Craig *et al.*, 1998) that are prone to fast weathering and acid generation. The BSE image and elemental distribution for elements of interest are shown in Figure 3-6 and Figure 3-7, respectively, and suggest that this pyrite occurrence is a relatively pure phase with no detectable Zn or Cd incorporated in the crystal lattice.

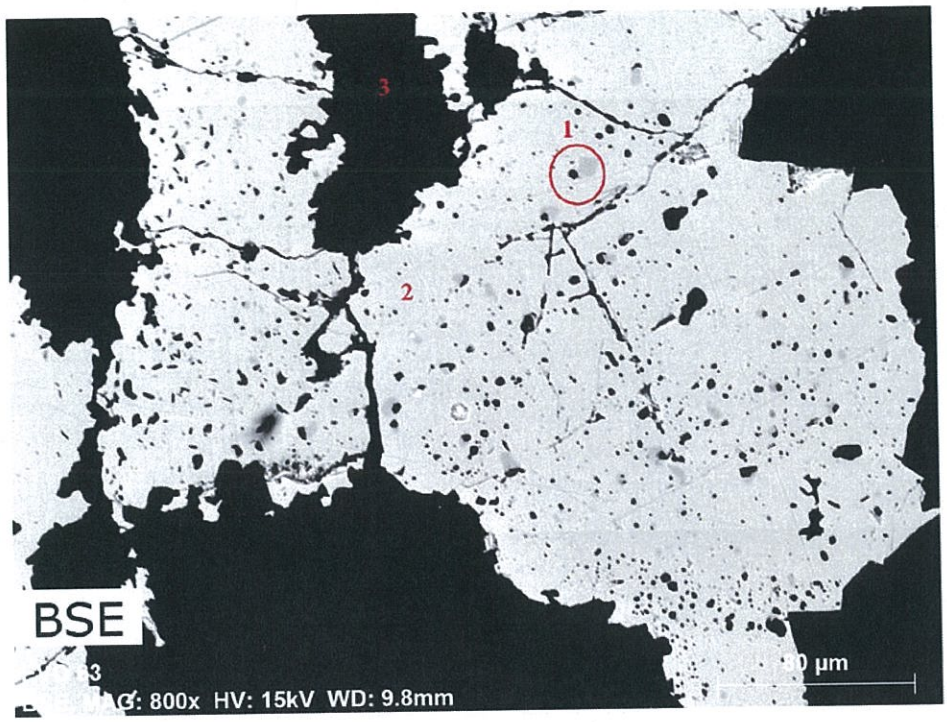


Figure 3-2: BSE-image of a sphalerite grain in waste rock sample BW-ARD2-10 (Type 1 – PAG), showing (1) chalcopyrite, (2) sphalerite, (3) quartz-feldspar matrix.

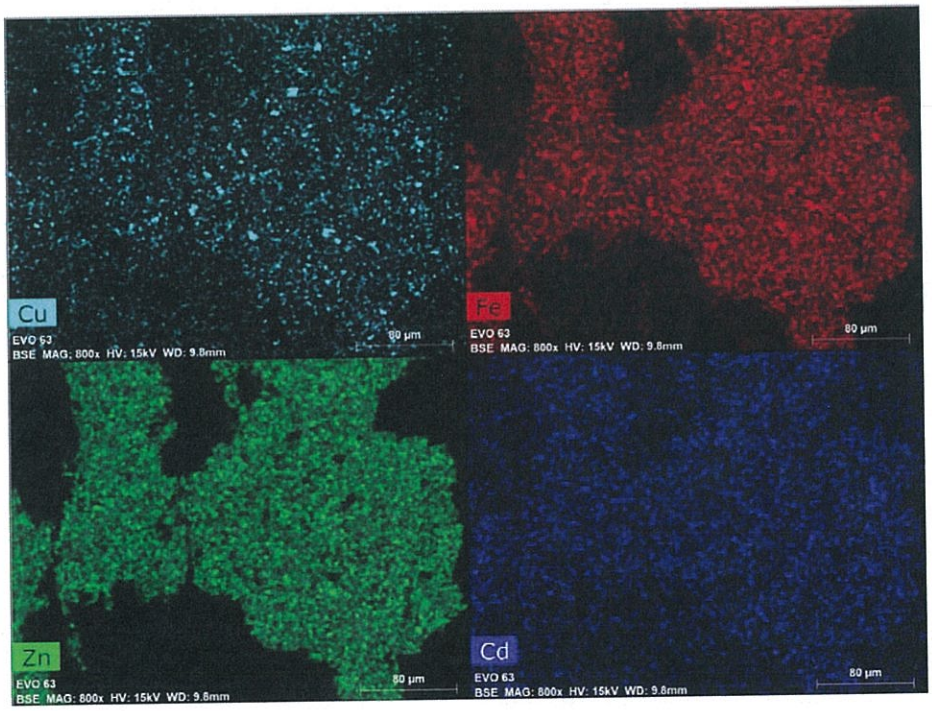


Figure 3-3: Eelemental maps for Cu, Fe, Zn and Cd of area shown in Figure 3-2 (waste rock sample BW-ARD2-10; Type 1 – PAG).

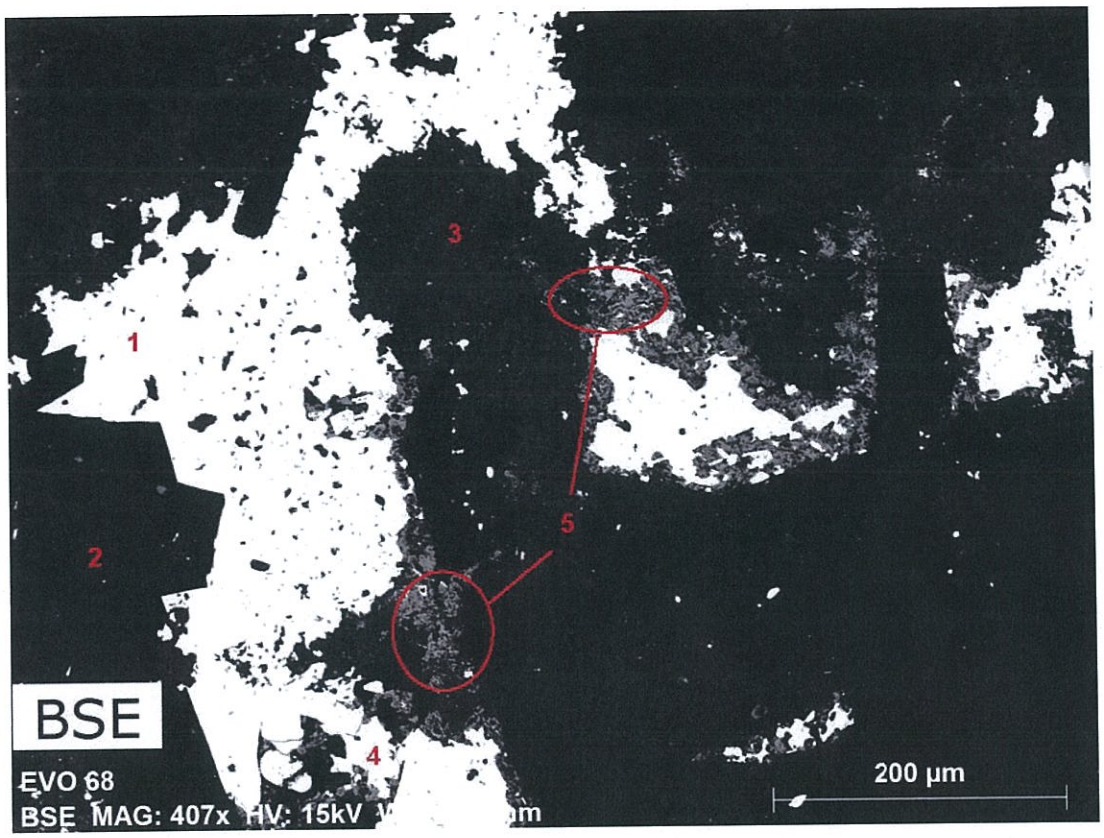


Figure 3-4: **BSE-image of partially weathered sphalerite-pyrite aggregate in waste rock sample BW-ARD2-10 (Type I – PAG), showing (1) sphalerite, (2) quartz, (3) biotite, (4) pyrite, (5) Fe-hydroxide.**

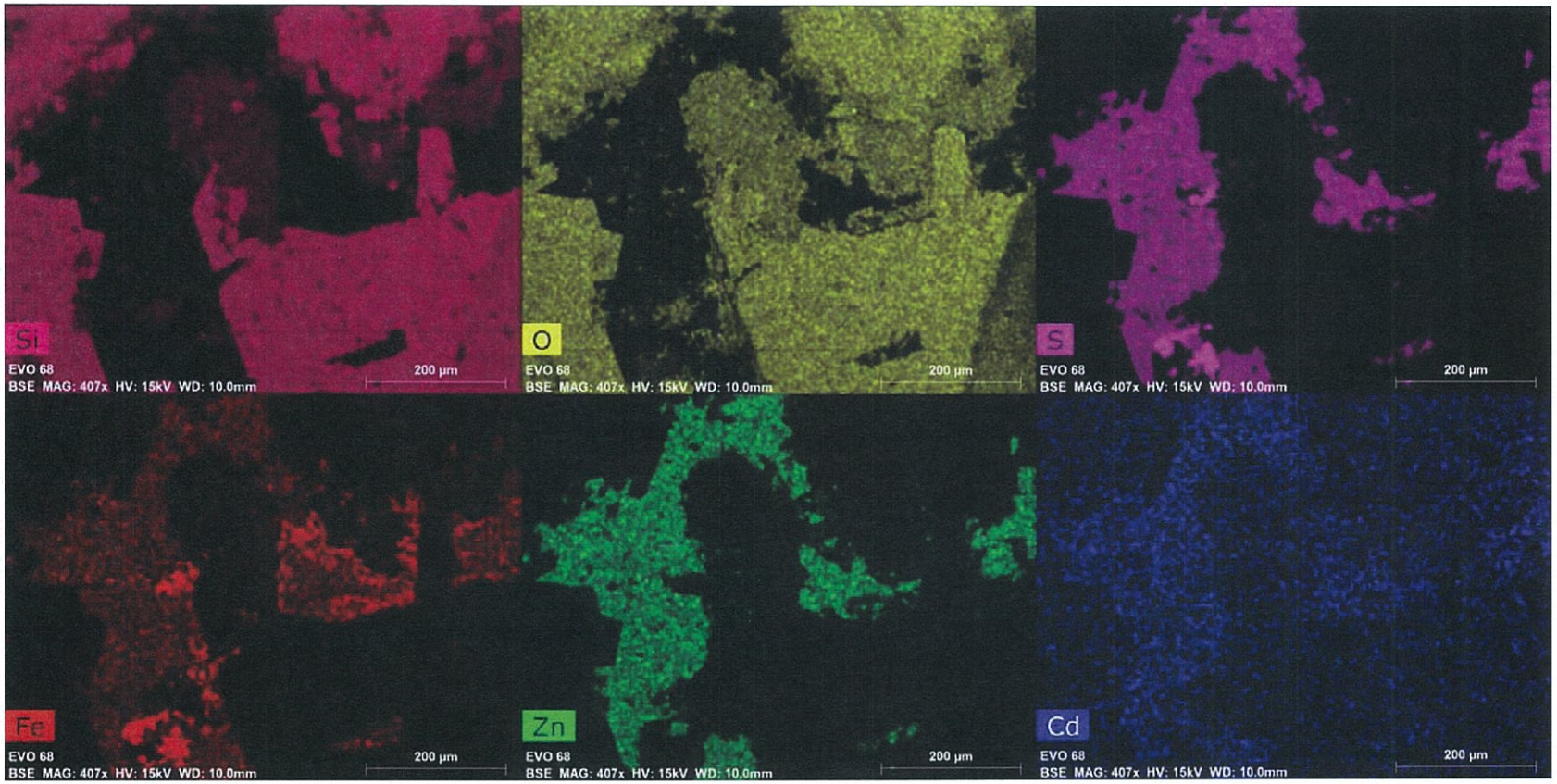


Figure 3-5: Elemental maps for Si, O, S, Fe, Zn and Cd of area shown in Figure 3-4 (waste rock sample BW-ARD2-10; Type I – PAG)

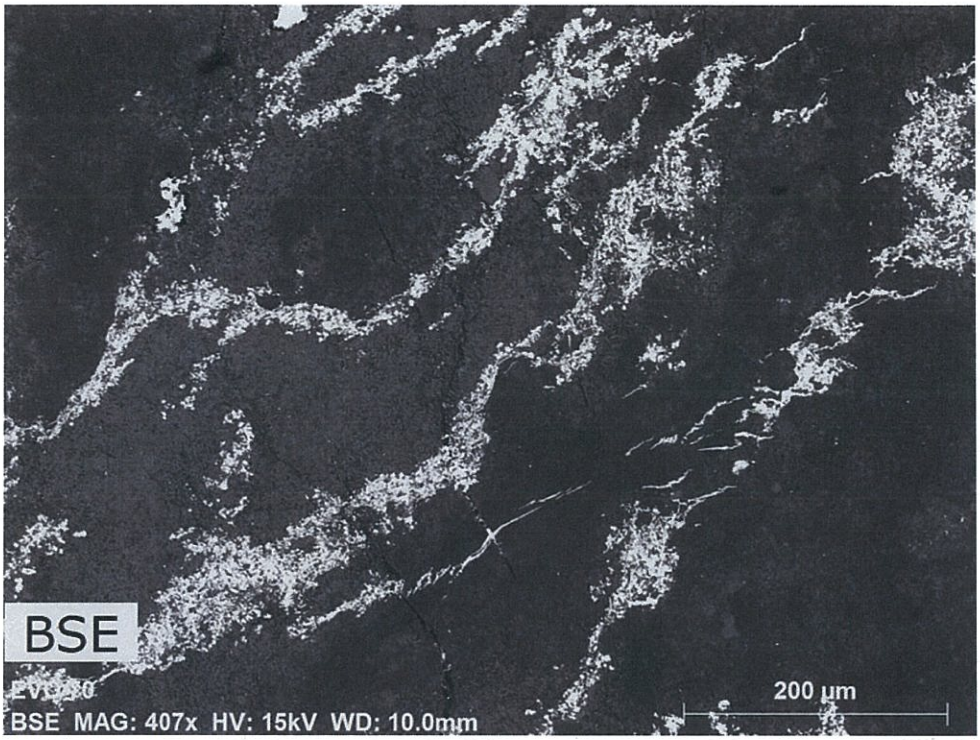


Figure 3-6: BSE-image of pyrite filling microfactures in a quartz-sericite groundmass in waste rock sample BW-ARD2-10 (Type 1 – PAG).

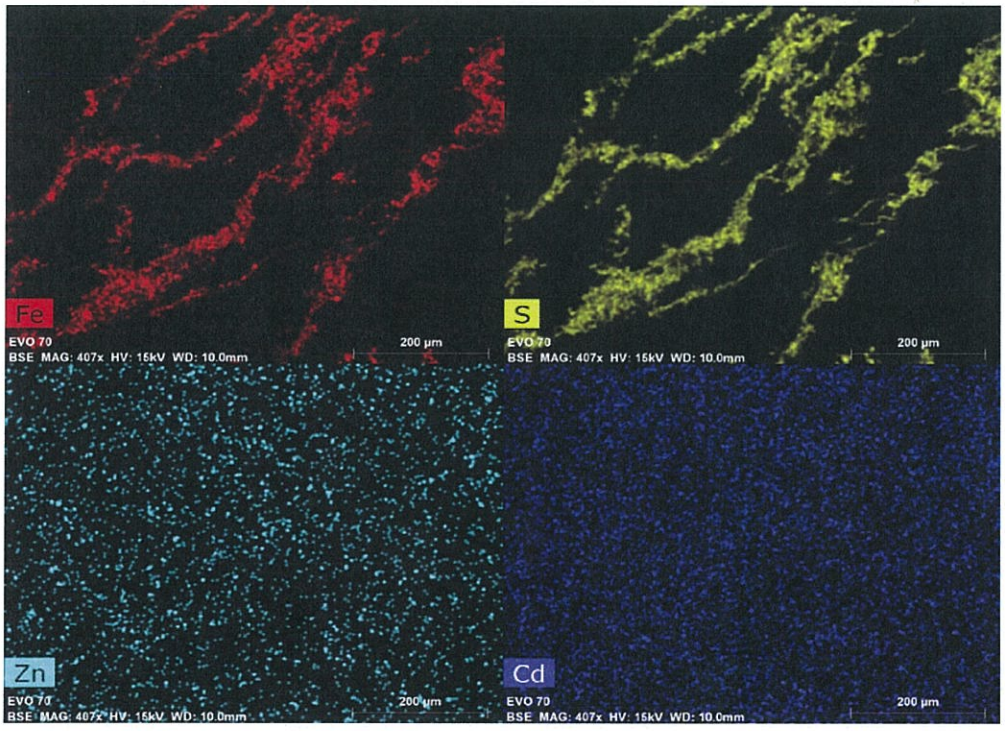


Figure 3-7: Elemental maps for Fe, S, Zn and Cd of area shown in Figure 3-6 (waste rock sample BW-ARD2-10; Type I – PAG).

3.1.2.2 BW-ARD-510 (Type 2 - PAG)

In accordance with geochemical and petrographic results, discrete Zn-phases (generally sphalerite) were found to be relatively rare in sample BW-ARD-510. Where sphalerite was identified, Zn and Cd showed similar distribution patterns and EDX-spectra as observed in sample BW-ARD2-10 (not shown). A major difference between the two PAG samples was, however, that both Zn and Cd partition into pyrite more strongly than in sample BW-ARD2-10 (Type 1 – PAG). This finding is supported by the BSE images and elemental maps shown in Figure 3-8 through Figure 3-11. The pyrite grain shown in Figure 8 is embedded in calcite which is known to be able to incorporate Cd into its crystal lattice, a behaviour that is being explored for remedial purposes in mining environments (Tesoriero *et al.*, 1996). The Cd map of this area (Figure 3-9) suggests, however, that Cd is more abundant in pyrite in the Type 2 sample (with Cd in calcite at background signal levels), making calcite an unlikely source of Cd during water-rock interaction.

3.1.2.3 BW-ARD-648 (Type 3 - NAG)

Sample BW-ARD-648 was classified as NAG based on ABA results; however, this sample still hosts relatively high Zn content (1180 ppm) and thus metal leaching may be an issue in this waste rock sub-group. The first area of interest represents a sphalerite(1)-pyrrhotite(2)-cluster embedded in a chlorite (3) matrix (Figure 3-12). Chalcopyrite occurs as oriented exsolution blebs within the larger sphalerite agglomerate ("chalcopyrite disease"). Grain boundaries at the contact between sulfide and silicate minerals are straight to sutured. Elemental maps illustrate that, like in other samples, Zn is sharply confined to sphalerite. Due to the low signal intensity of Cd, its map appears much less clear. However, comparison between the different elemental maps (Figure 3-13) suggests that Cd is contained in sphalerite and potentially pyrrhotite.

In order to better resolve the chemistry of this sphalerite grain as well as to shed light on the elemental distribution between sphalerite and pyrrhotite, EDX spot and line scans were produced. The chemical composition of the sphalerite was found to be qualitatively homogenous with a typical EDX-spectrum provided in Figure 3-14. Note that, besides the considerable Fe-content in sphalerite already observed in other samples, Mn also shows a clearly distinguishable peak. Although minor, EDX analysis also generally returned above-background peaks for cadmium. The results for selected elements measured in a cross-mineral EDX line-scan are presented in Figure 3-15. The line was positioned to traverse from the large sphalerite grain into the adjacent pyrrhotite. The elemental counts indicate a relatively sharp transition between the two minerals with a small gap between the individual grains. Note the spike in the Zn-signal after the grain boundary was

crossed from sphalerite into pyrrhotite. This phenomenon may be indicative of Zn-diffusion from sphalerite into pyrrhotite. Cadmium is consistently low in both grains, with no clear drop-off in concentration being recognizable for either grain.

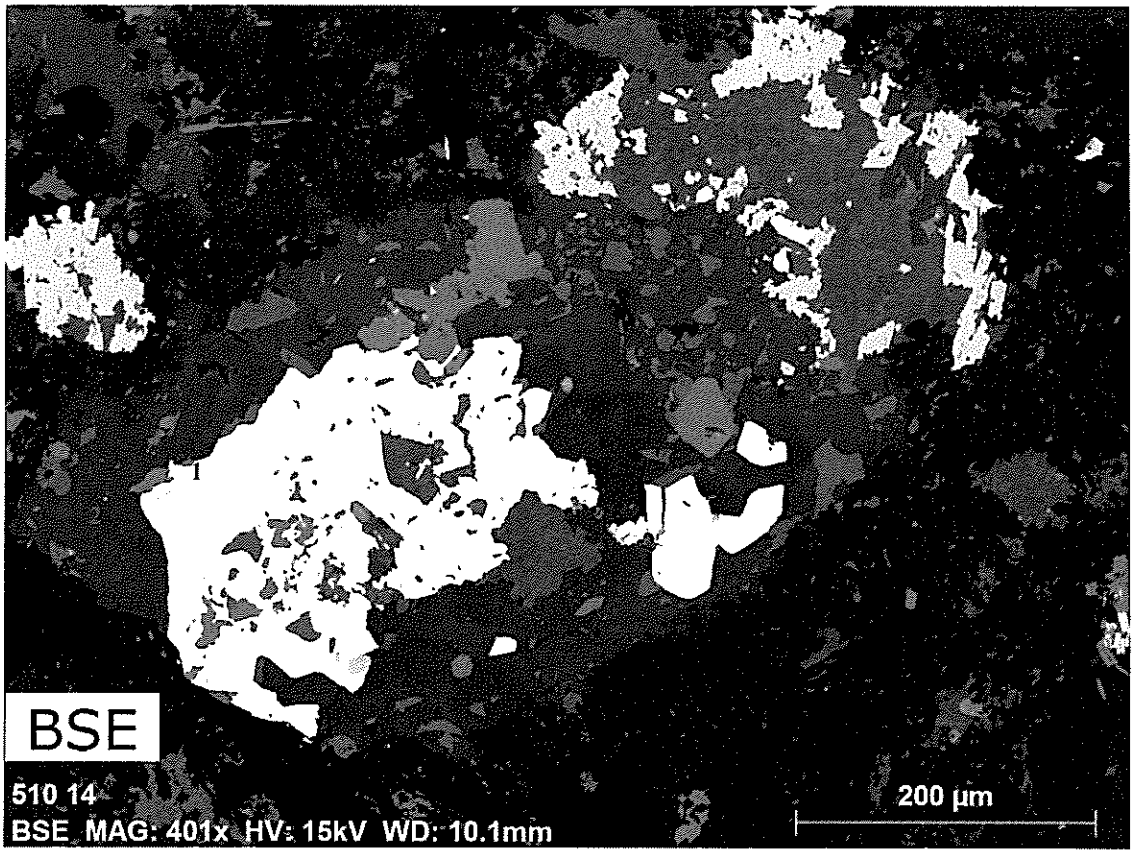


Figure 3-8: BSE-image of pyrite (1) grains embedded in calcite (2) in waste rock sample BW-ARD-510 (Type 2 – PAG).

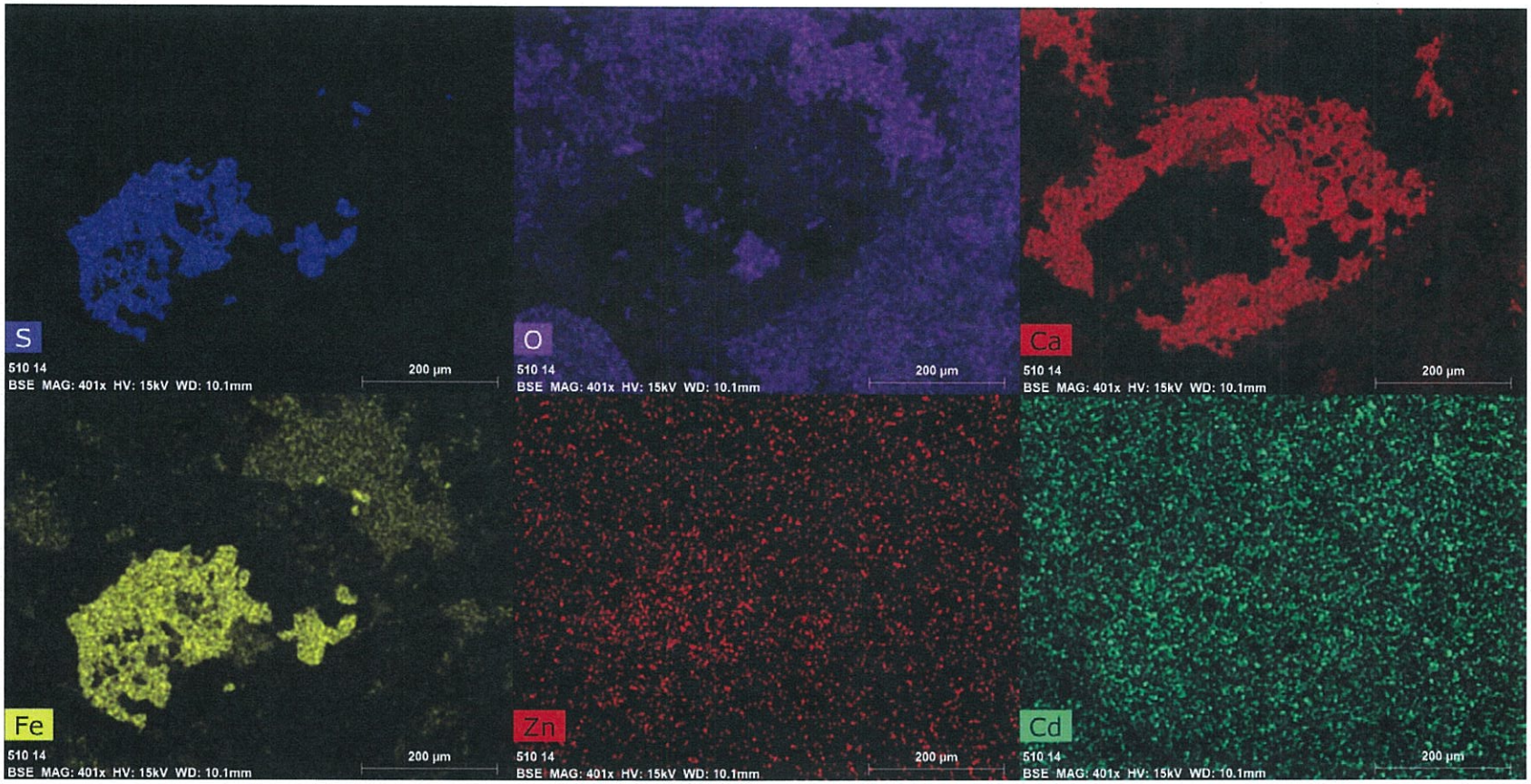


Figure 3-9: Elemental maps for S, O, Ca, Fe, Zn and Cd of area shown in Figure 3-8 (waste rock sample BW-ARD-510; Type 2 – PAG).

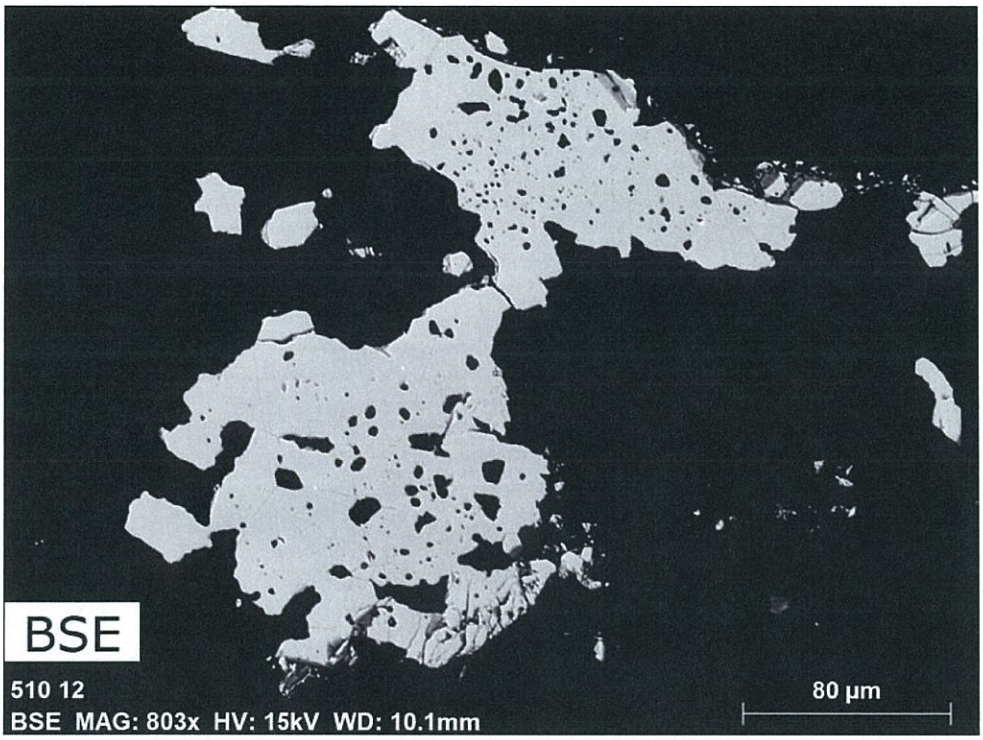


Figure 3-10: Anhedral pyrite aggegragte in waste rock sample BW-ARD-510 (Type 2 – PAG).

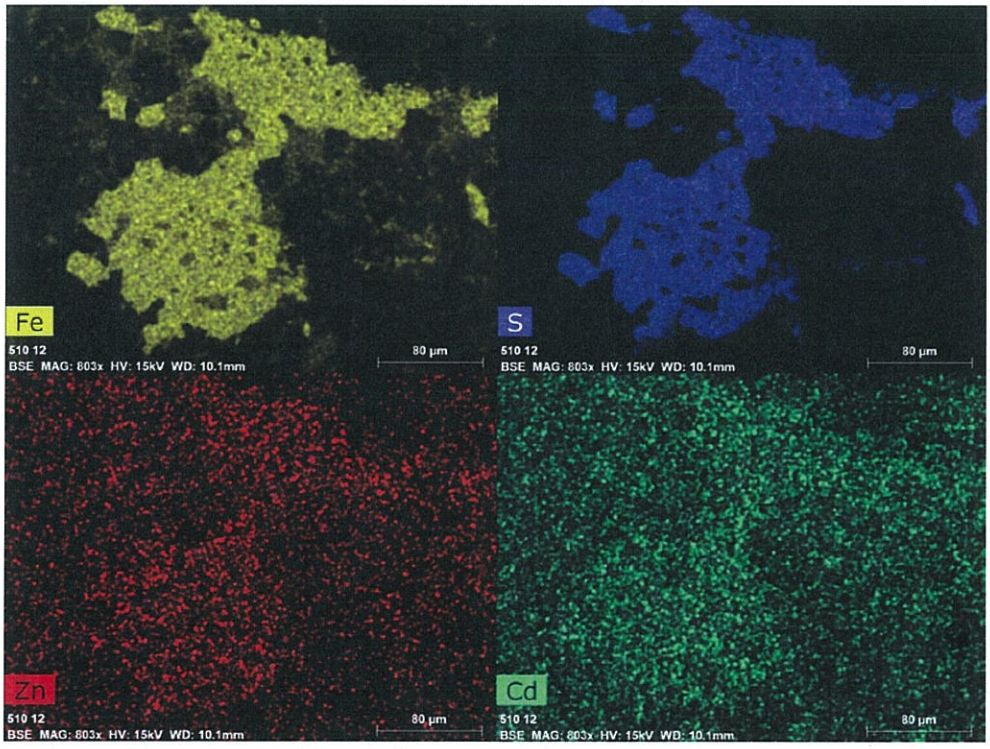


Figure 3-11: Selected elemental maps of area shown in Figure 3-10 (waste rock sample BW-ARD-510; Type 2 – PAG).

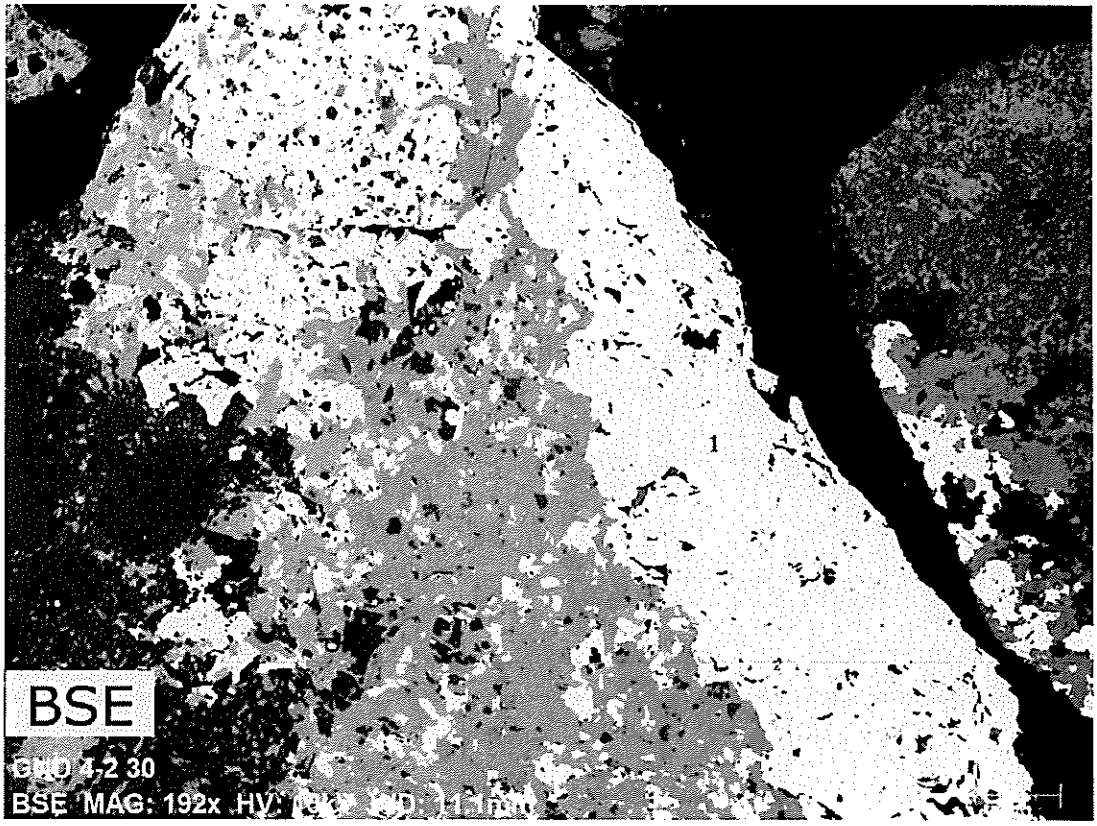


Figure 3-12: BSE image showing sphalerite (1)-pyrrhotite (2) assemblage embedded in chlorite (3) matrix in waste rock sample BW-ARD-648 (Type 3 – NAG).

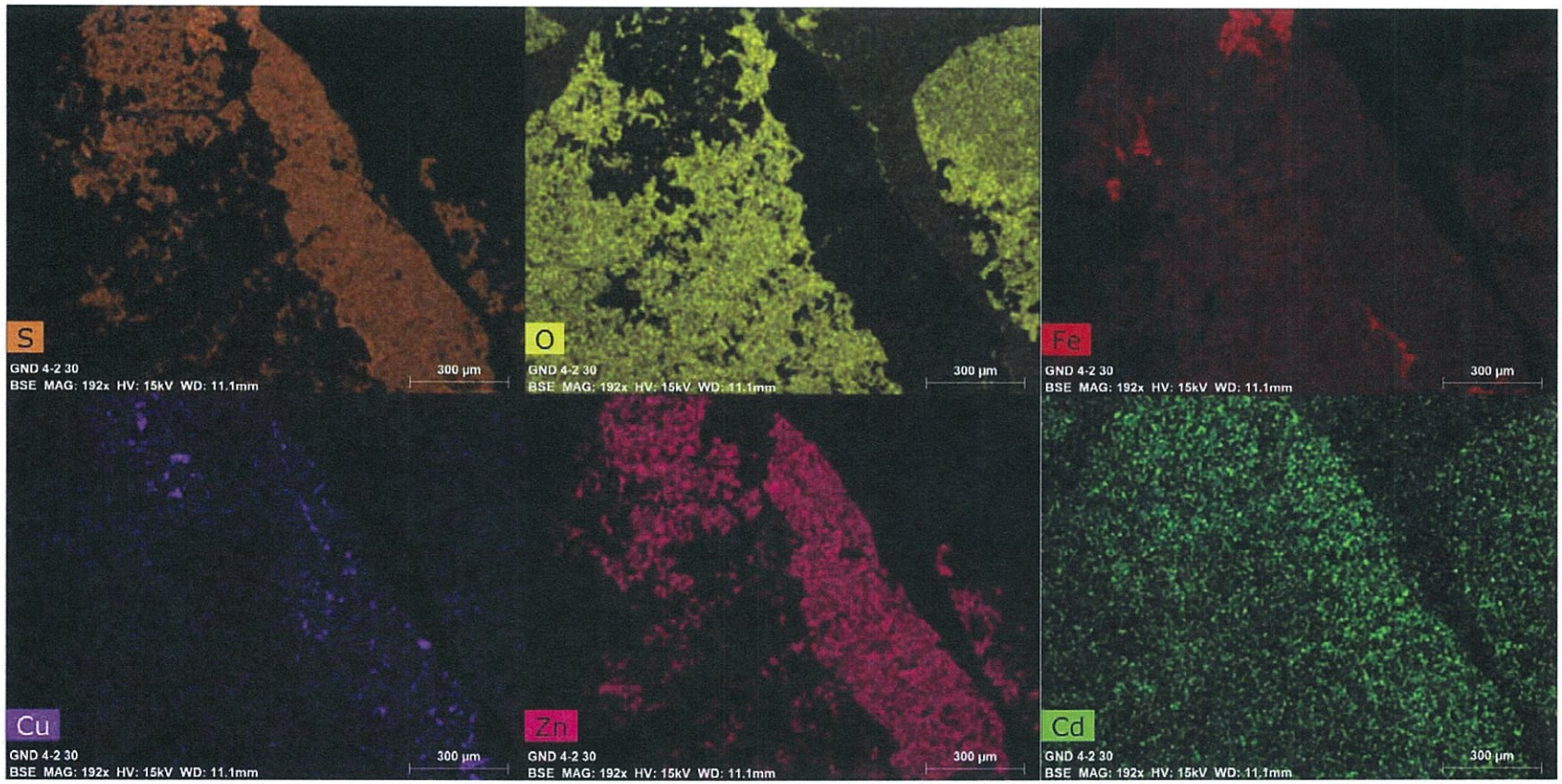


Figure 3-13: Elemental maps for S, O, Fe, Cu, Zn and Cd of area shown in Figure 3-12 (waste rock sample BW-ARD-648; Type 3 – NAG).

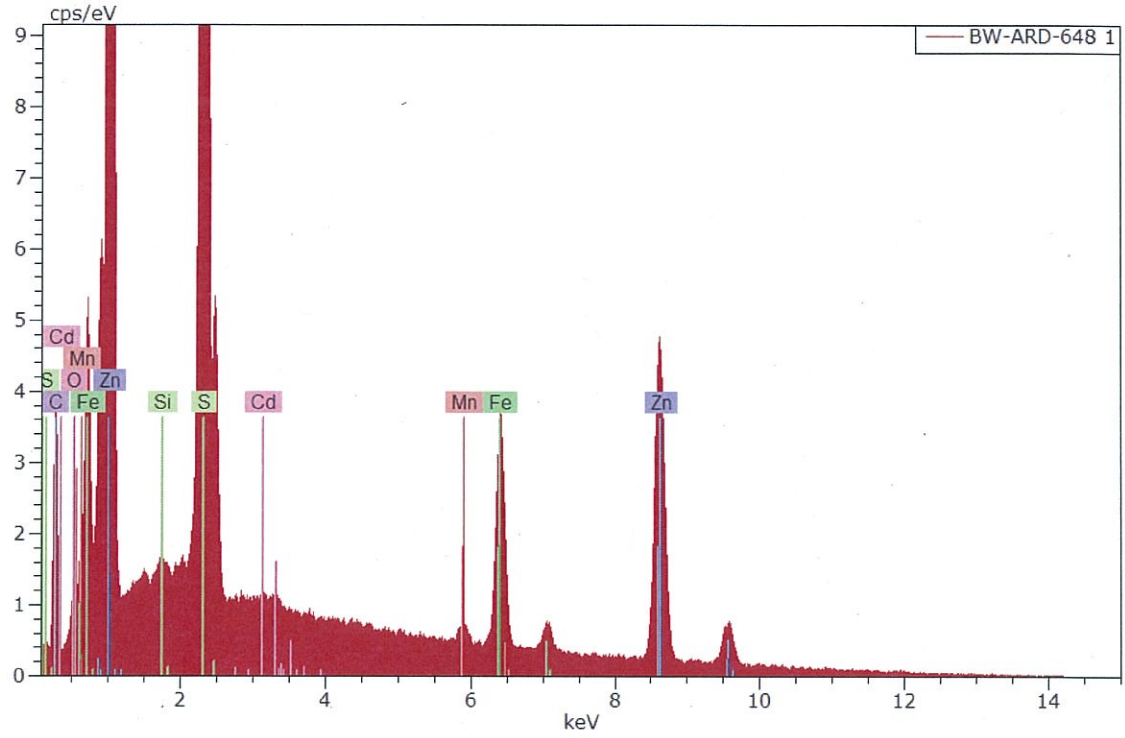


Figure 3-14: EDX-spectrum of sphalerite grain in waste rock sample BW-ARD-648 (Type 3 – NAG) showing presence of Cd, Mn and Fe.

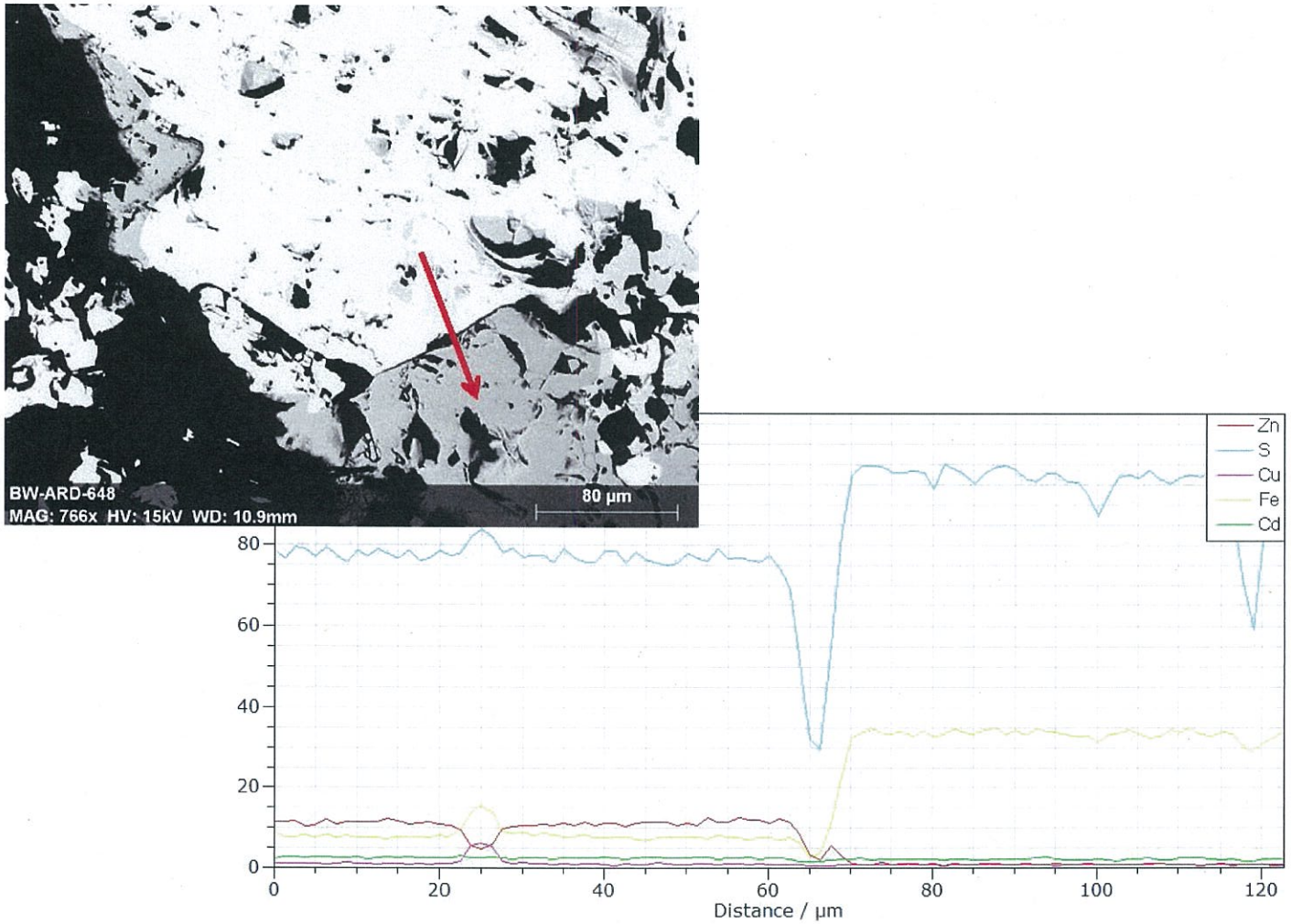


Figure 3-15: BSE-image and counts-vs-disctance plot showing the location and relative elemental abundances (Zn, S, Cu, Fe and Cd) in an EDX line-scan running from sphalerite into pyrrothite in waste rock sample BW-ARD-648 (Type 3 – NAG).

3.1.2.4 BW-ARD-468 (Type 4 - NAG)

The Type 4 (NAG) sample is relatively poor in discrete Zn-phases with pyrite being by far the most common sulfide mineral. A massive pyrite grain with a calcite-chlorite rim was studied and BSE image and elemental maps are shown in Figure 3-16 and Figure 3-17, respectively. Zn is notably enriched in the pyrite grain while Cd, like in other examined aggregates, shows a more diffuse pattern, possibly due to the its low concentration. Nevertheless, it can be concluded that Cd, too, is partitioned into pyrite. The incorporation of these metals into pyrite (also found in other pyrite grains not shown) in a sample with relatively low sphalerite abundance is a feature already observed in sample BW-ARD-510 (Type 2 – PAG). The EDX-spectrum of one of the few larger sphalerite grains is presented in Figure 3-18 and shows that, like in sample BW-ARD-648 (Type 3 – PAG), sphalerite is capable of taking up detectable amounts of Fe, Mn, and Cd into its structure.

3.1.2.5 BW-ARD-473 (Type 3 - NAG)

As discussed in Section 2, sample BW-ARD-473 was initially classified as Type 5 material (NAG; Zn < 600 ppm); however, an error discovered in the selection of the core interval led to the re-classification of this sample to Type 3 (NAG) due to a Zn content of 3790 ppm. Along with sphalerite, several non-sulfide Zn and Cd-bearing phases were discovered during EDX analysis. For example, Figure 3-19 and 3-20 show the BSE image and elemental maps of a Mn-Fe-(±Ca)-carbonate (likely rhodochrosite solid solution) (1) containing considerable Zn and minor Cd in a chlorite(2)-quartz(3)-sericite(4)-groundmass. The associated EDX-spectrum for this phase is given in Figure 3-21. Mineral aggregates of similar composition were also found elsewhere in this sample.

In another area of this sample, multiple grains of a rare polymetallic sulfide (1) containing Zn, Cd, As, Sb and Cu were found to be enclosed by a rhodochrosite assemblage (2) (Figure 3-22). Interestingly, Fe is relatively depleted in the sulfide-aggregate. The chemical heterogeneity of this precipitate is illustrated by an EDX-spectrum recorded within the largest grain (Figure 3-23), showing a Zn-poor aureole with distinct peaks of Sr and Al in addition to Cd, Sb and As. One of the smaller grains in the periphery of this sulfide/Fe-oxide assemblage shows a distinctly strong Cd-response (mineral 3 in Figure 3-24). The EDX-spectrum of this grain confirms the qualitative chemistry given by the elemental map and identifies this grain as a relatively pure CdS-mineral (*e.g.*, Greenockite) with minor Fe- and Mn-contamination.

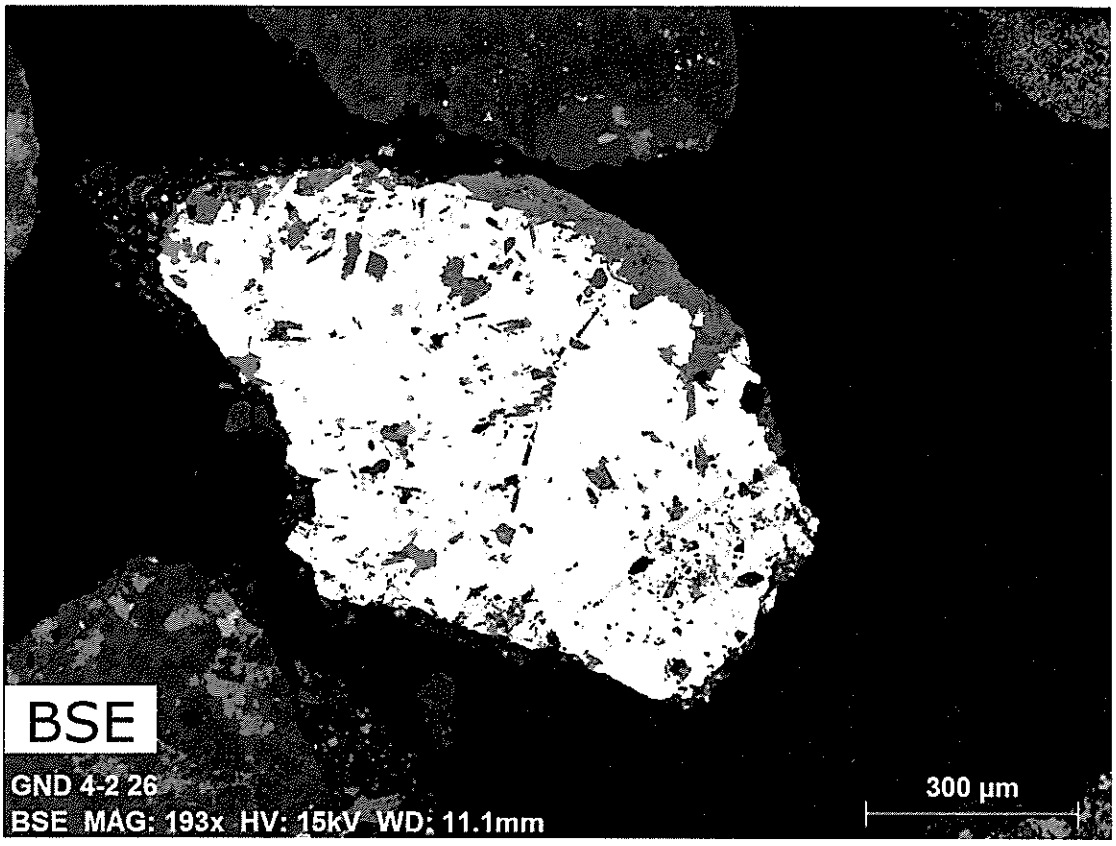


Figure 3-16: BSE-image of a massive pyrite grain in waste rock sample BW-ARD-468 (Type 4 – NAG).

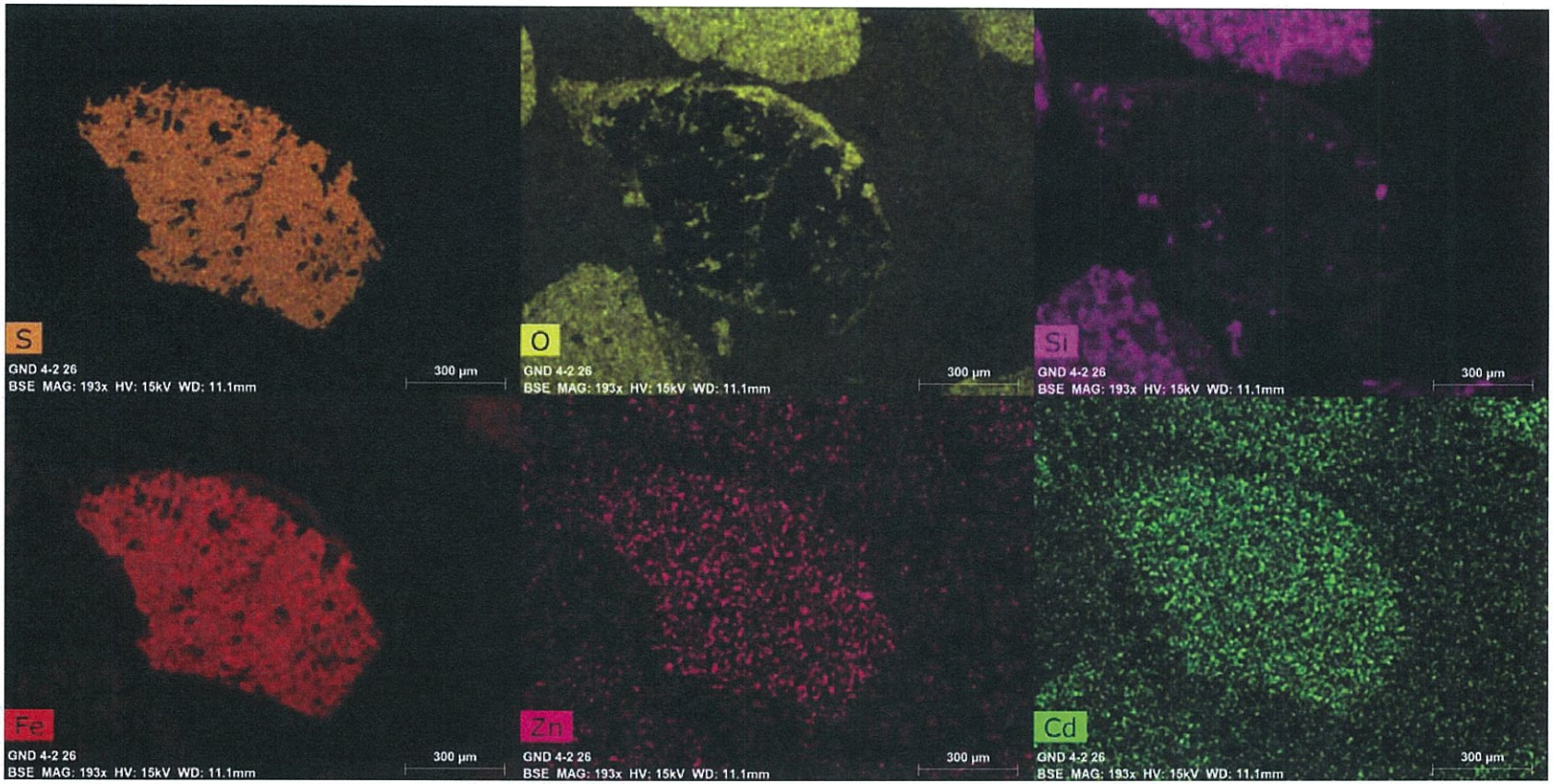


Figure 3-17: Selected elemental for S, O, Si, Fe, Zn and Cd of area shown in Figure 3-16 (waste rock sample BW-ARD-468; Type 4 – NAG).

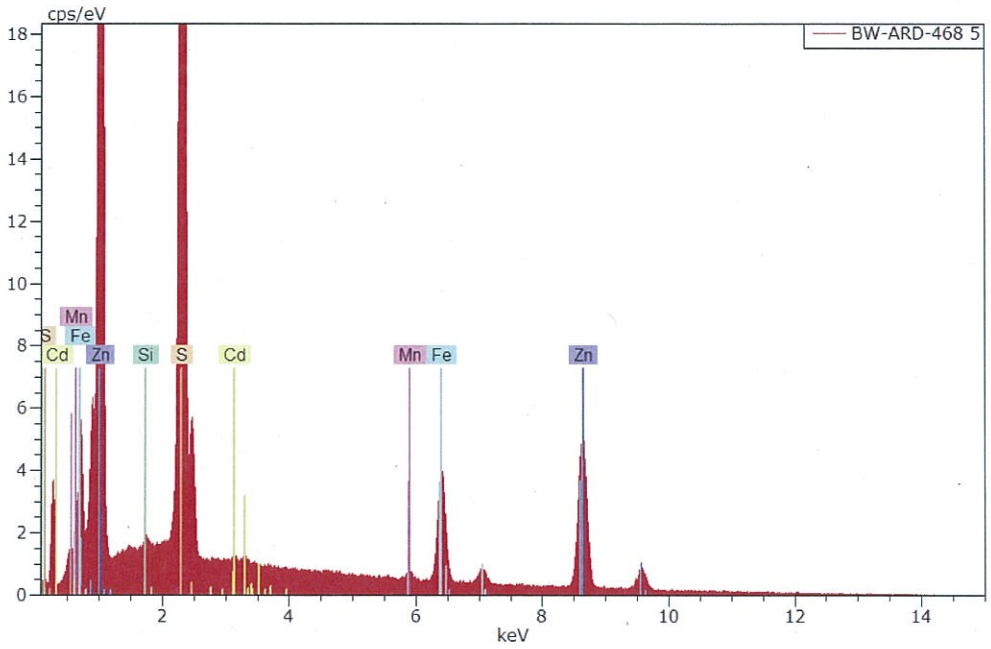


Figure 3-18: EDX-spectrum of a representative sphalerite grain in waste rock sample BW-ARD-468 (Type 4 – NAG) highlighting the partitioning of Cd, Mn, and Fe into the crystal lattice.

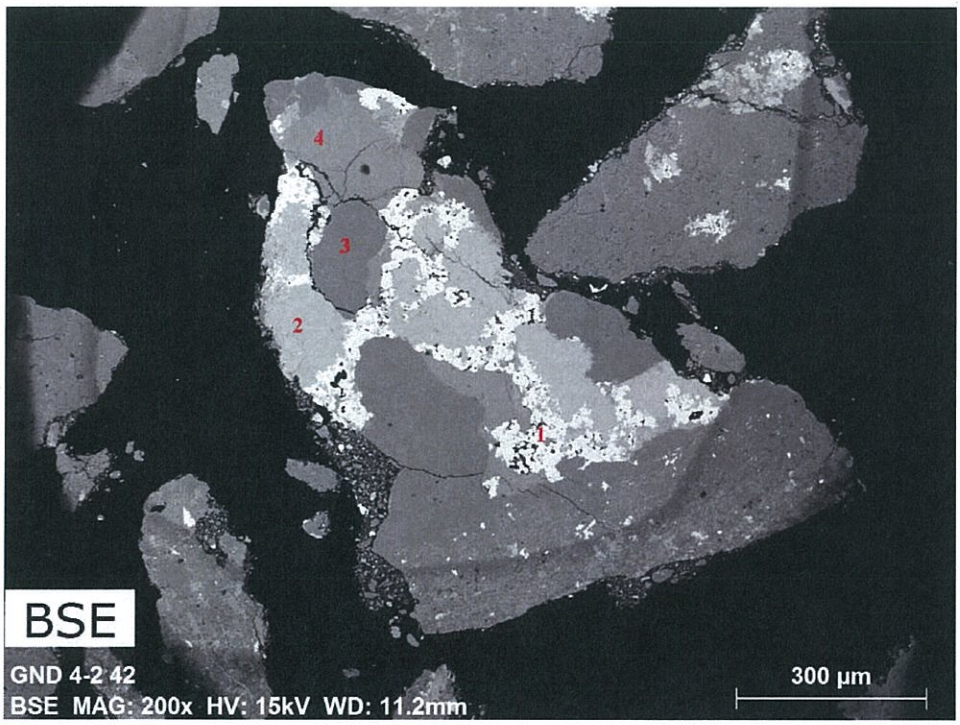


Figure 3-19: BSE-image of fragment containing likely Mn-Fe-Ca carbonate (1; rhodochrosite) in waste rock sample BW-ARD-473 (Type 3 – NAG). Other minerals are (2) chlorite, (3) quartz, and (4) sericite.

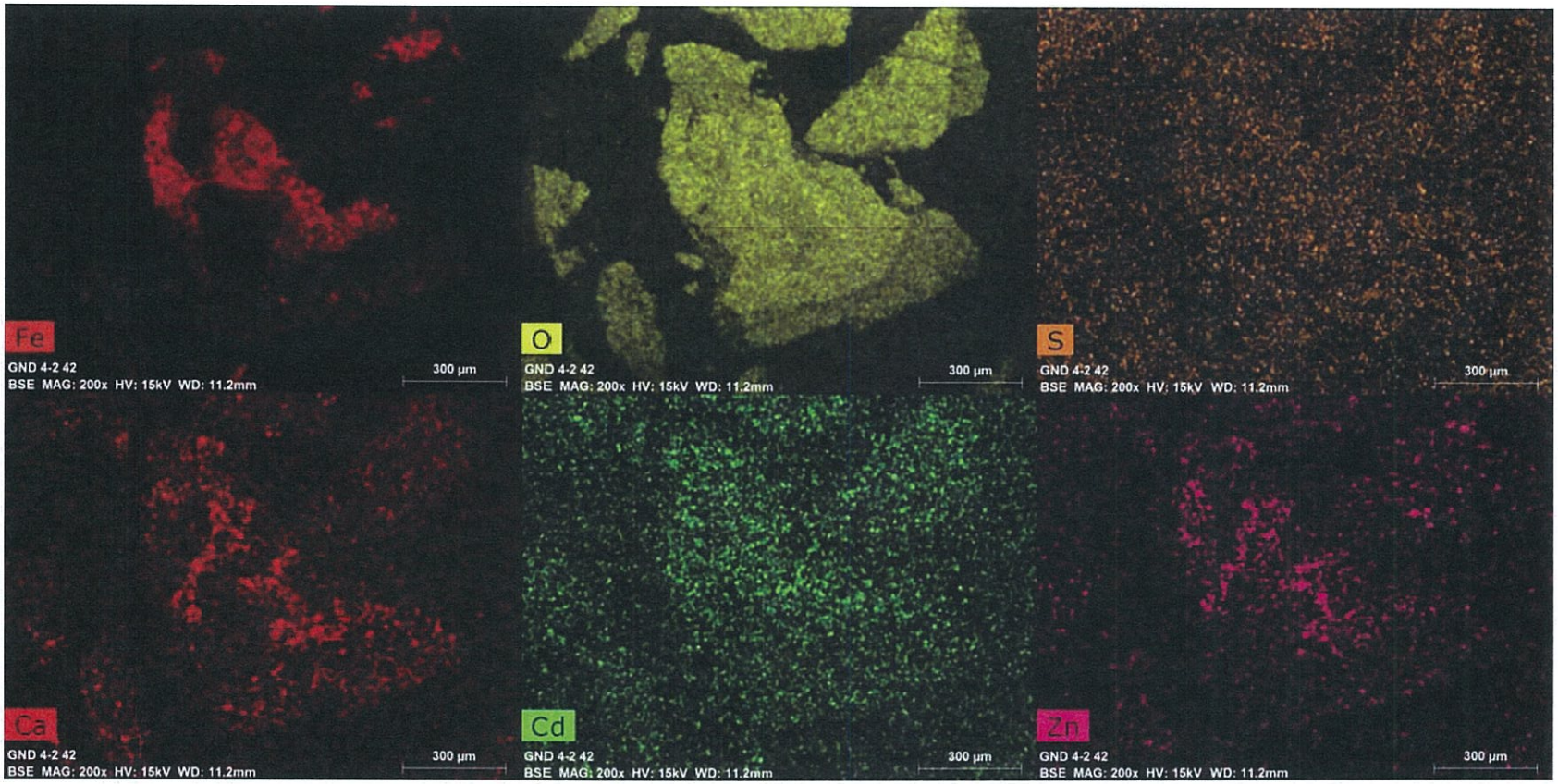


Figure 3-20: Selected elemental maps for Fe, O, S, Ca, Cd and Zn of area shown in Figure 3-18 (waste rock sample BW-ARD-473; Type 3 – NAG).

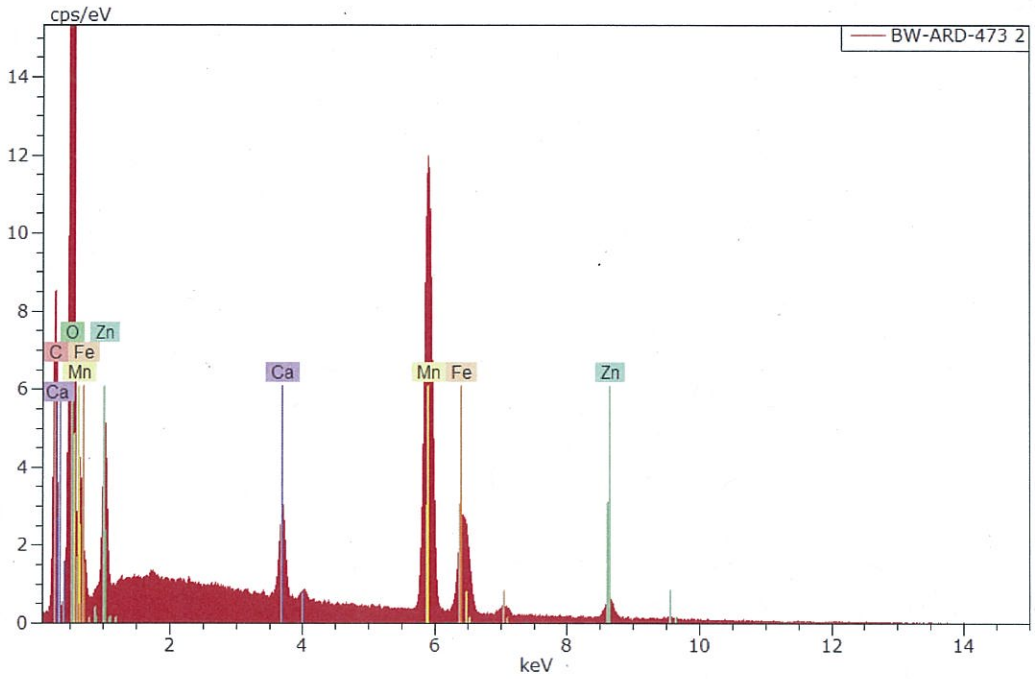


Figure 3-21: EDX-spectrum of mineral 1 in Figure 3-19, suggesting a Mn-Fe-Ca-carbonate with considerable Zn content in waste rock sample BW-ARD-473 (Type 3 – NAG).

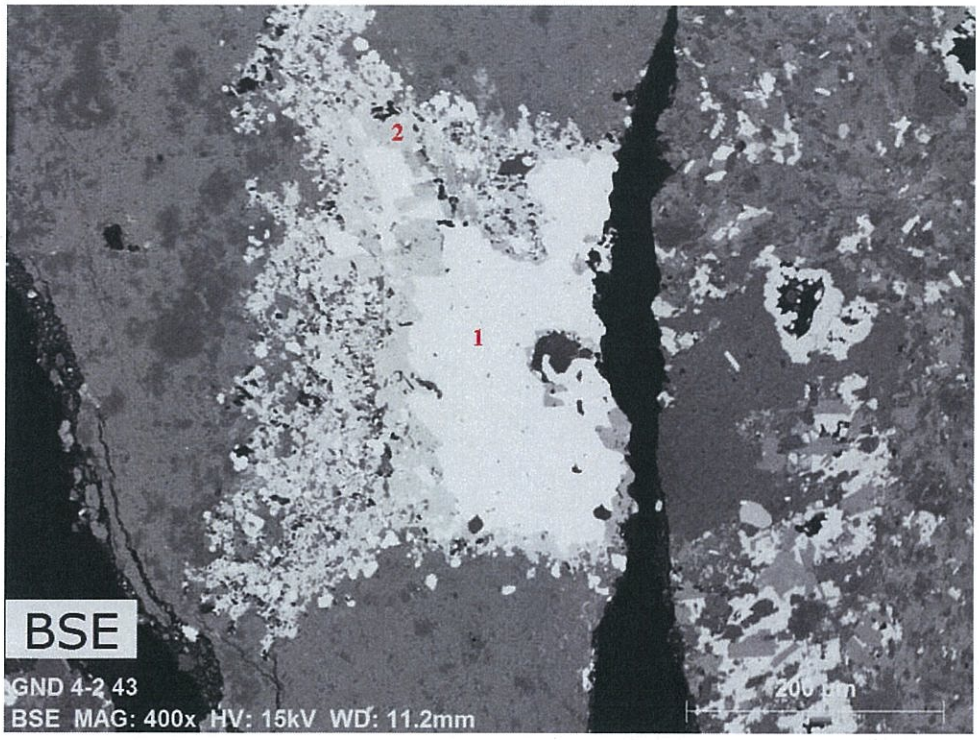


Figure 3-22: BSE-image of polymetallic sulfide cluster (1) enclosed by rhodochrosite (2) in sample BW-ARD-473 (Type 3 – NAG).

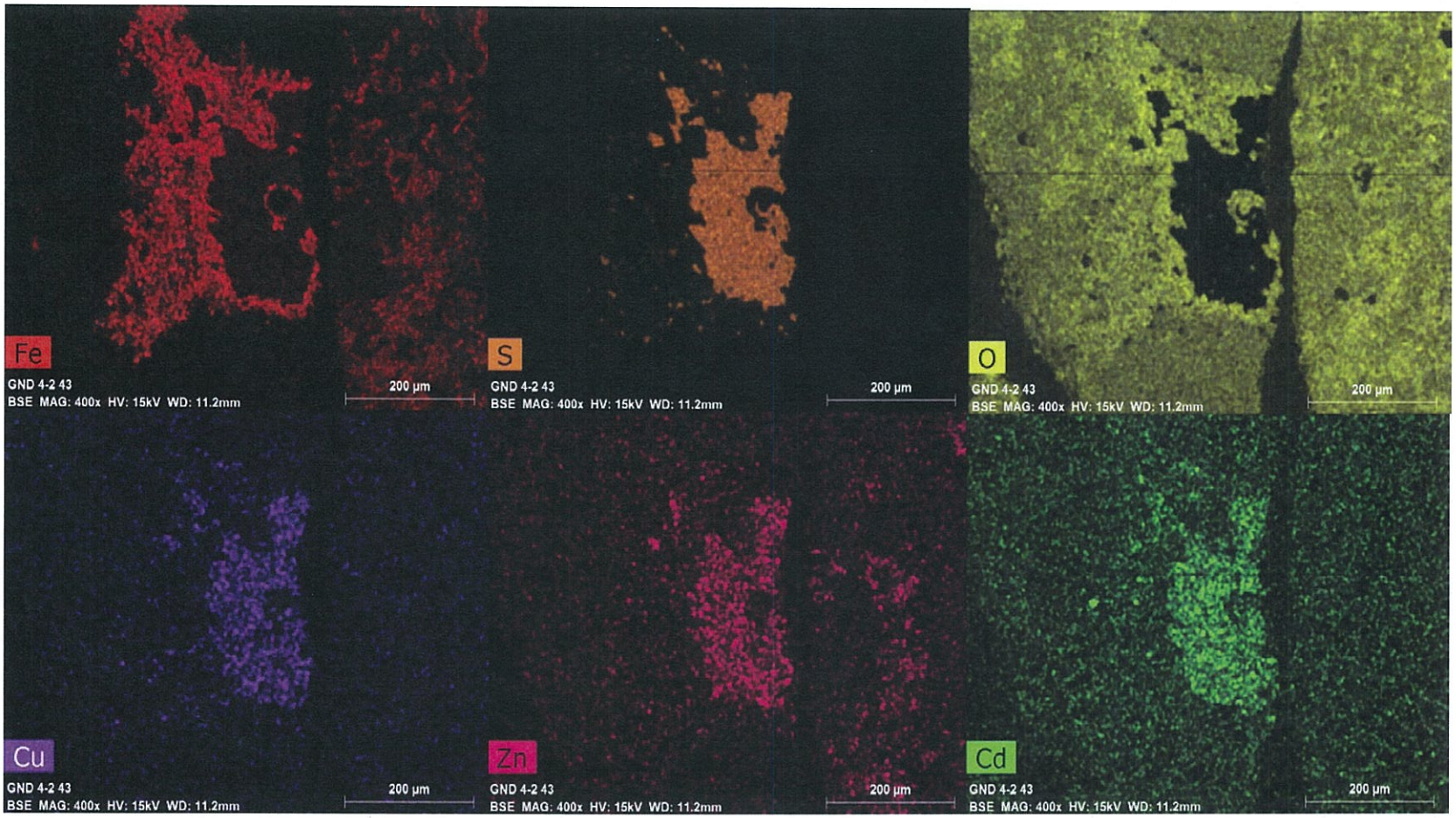


Figure 3-23: Elemental maps for Fe, S, O, Cu, Zn and Cd of area shown in Figure 3-22 (waste rock sample BW-ARD-473; Type 5 – NAG).

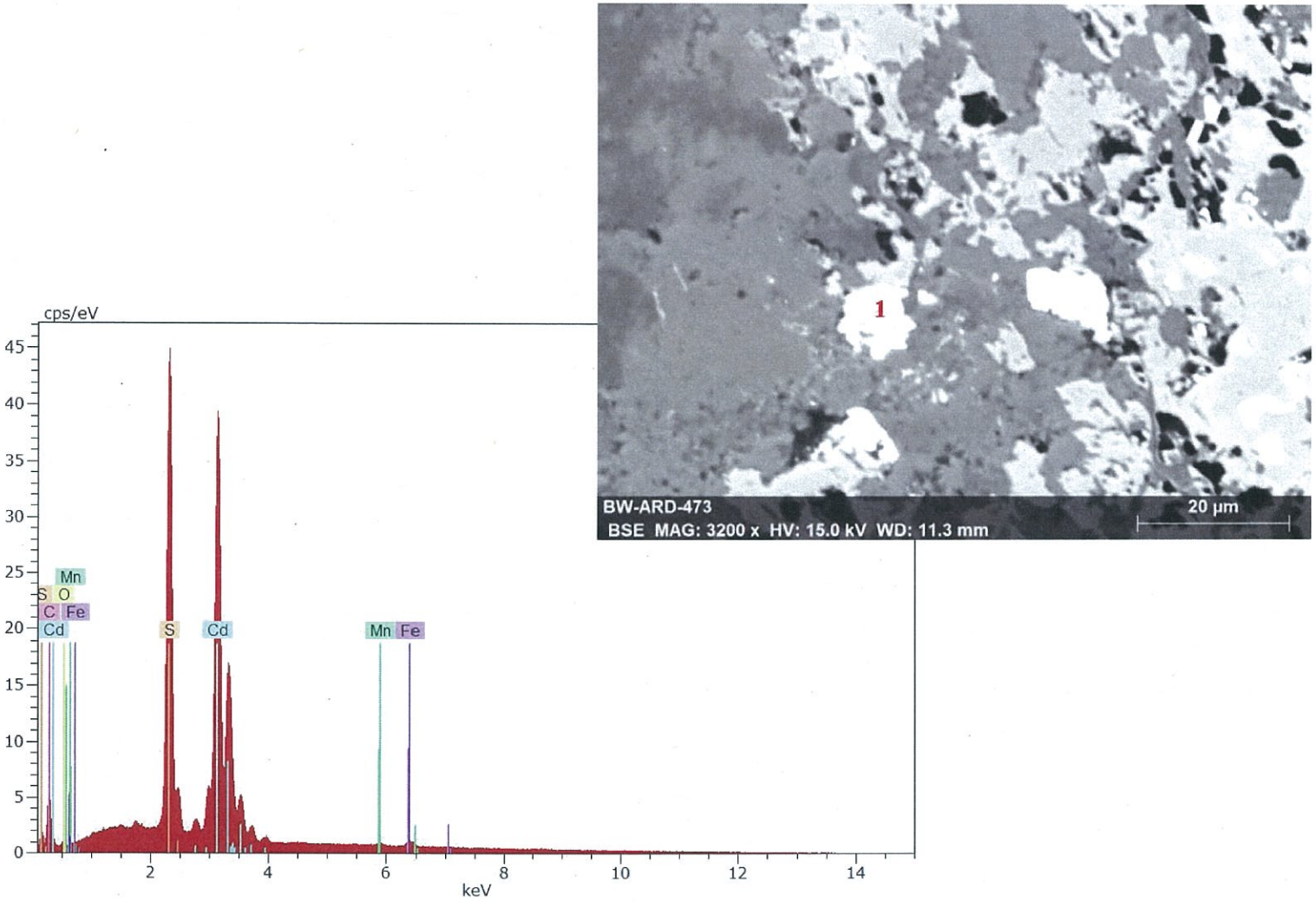


Figure 3-24: BSE- image and EDX spectrum showing location and qualitative chemistry of a Cd-sulfide phase (1) in waste rock sample BW-ARD 473 (BW-ARD-473; Type 3 – NAG).

The BSE image in Figure 3-25 shows a quartz-biotite fragment with a rim of Fe-oxide (or hydroxide) (1). The elemental maps taken of this area (Figure 3-26) suggest that both Zn and Cd were incorporated into this Fe-phase. Interestingly, sulfur was detected as well potentially indicating that this phase may represent an oxidized sulfide mineral. A line scan was conducted from this Fe-rich rim into biotite and then quartz (Figure 3-27) and recorded a relatively gradual drop in concentration across the grain boundaries for Cd but not Zn. This suggests that either Cd is taken up into biotite more readily or that Cd diffusion from the Fe-precipitate into adjacent minerals is faster. Both of these hypotheses would explain the generally more diffuse pattern of Cd distribution observed elsewhere.

3.2 Tailings Samples

3.2.1 Petrographic Overview

As for waste rock samples from the Blackwater Gold Project, mineralogical characterization on tailings was conducted using both optical as well as SEM/EDX methods. Mineralogically and texturally, the two tailings samples are relatively similar and are primarily composed of angular, polymineralic fragments and fragment assemblages. Grain sizes of these fragments show a wide range, with the lower end of the spectrum falling below 1 μm in diameter, while the largest fragments measure around 250 μm. Silicates are the dominant mineral group, making up ~90% of the overall assemblage. Among the silicate phases identified by microscopy are (sorted by estimated modal abundance): quartz, feldspar (both K-feldspar and plagioclase), biotite, and sericite.

Naturally, tailings silicate mineralogy is relatively similar to that observed in waste rock samples and is indicative of strong hydrothermal alteration associated with epithermal ore formation where primary textures are overprinted pervasively.

Opaque and semi-opaque minerals can be subdivided into two major mineral classes, namely sulfides and Fe-oxides/hydroxides. These phases constitute around 10% of the tailings samples (with secondary Fe-oxides having an abundance of <5%); however, due to the affinity of trace elements for these phases, and their chemical instability in saturated settings, such materials can play a dominant role in neutral-pH metal leaching (Tessier and Campbell 1988; Martin and Pedersen, 2002). Optically it appears that sulfide minerals sample CND 1-5 (transition zone) are somewhat more weathered than in sample CND 2-4 with orange-brown coatings (likely Fe-hydroxides) being more prevalent in the transition zone sample. Sulfur primarily resides in sulfide minerals, including pyrite, pyrrhotite and sphalerite with minor chalcopyrite and galena. Sulfides occur as

disseminated, equant and anhedral grains rarely exceeding a diameter of 20 µm. Less commonly, secondary sulfate minerals (Mg- and Fe-bearing) were identified as irregular patches or schlieren.

Fe-bearing oxides (*e.g.*, magnetite and ilmenite) and hydroxides (*e.g.*, goethite) are moderately common among the (semi)-opaque mineral phases. Due to the similarity of magnetite and sphalerite in reflected light, particularly given the small grain sizes, it was difficult to assess the modal abundance of magnetite. However, where EDX-data were available, it was found that magnetite occurs as fine, euhedral grains while sphalerite is generally anhedral. Fe-hydroxides were detected as weathering rims and as amorphous, interstitial masses in most studied areas. In transmitted light, these phases commonly appear as semi-opaque patches with a translucent, dark orange-brown periphery.

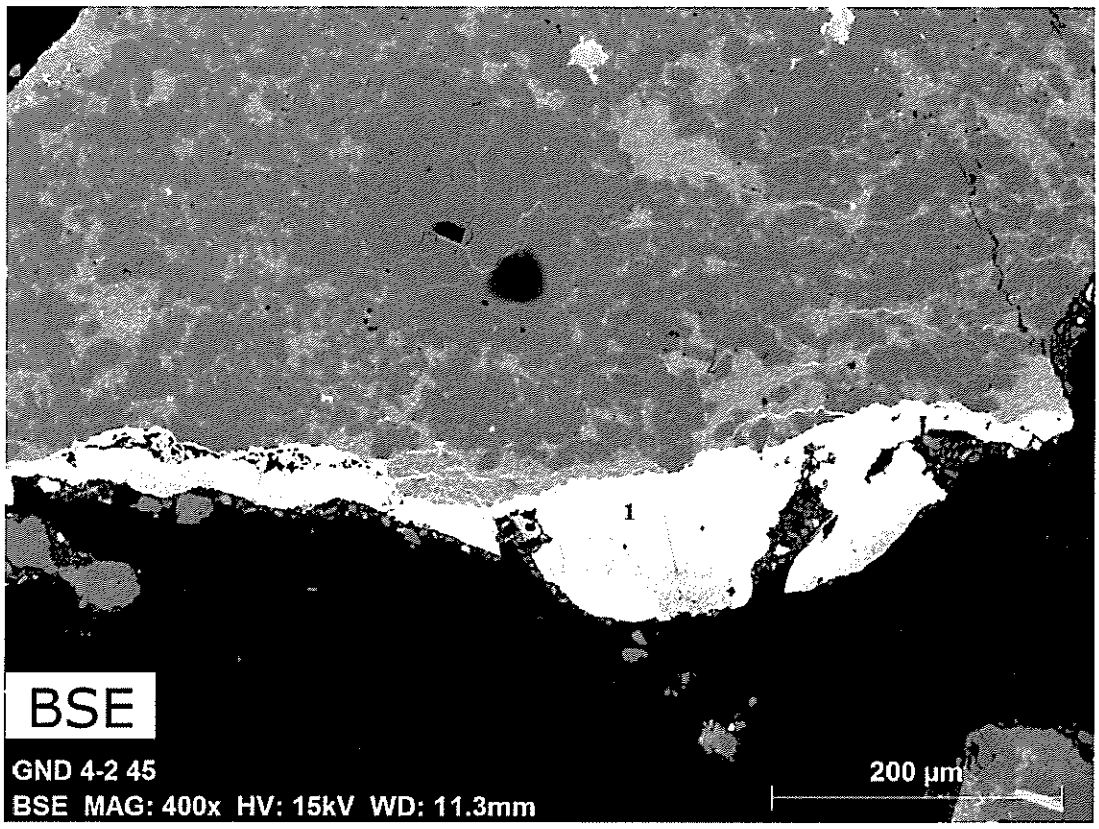


Figure 3-25: BSE-image showing Fe-hydroxide rim (1) adjacent to quartz-biotite (2) matrix in waste rock sample BW-ARD-473 (Type 3 – NAG).

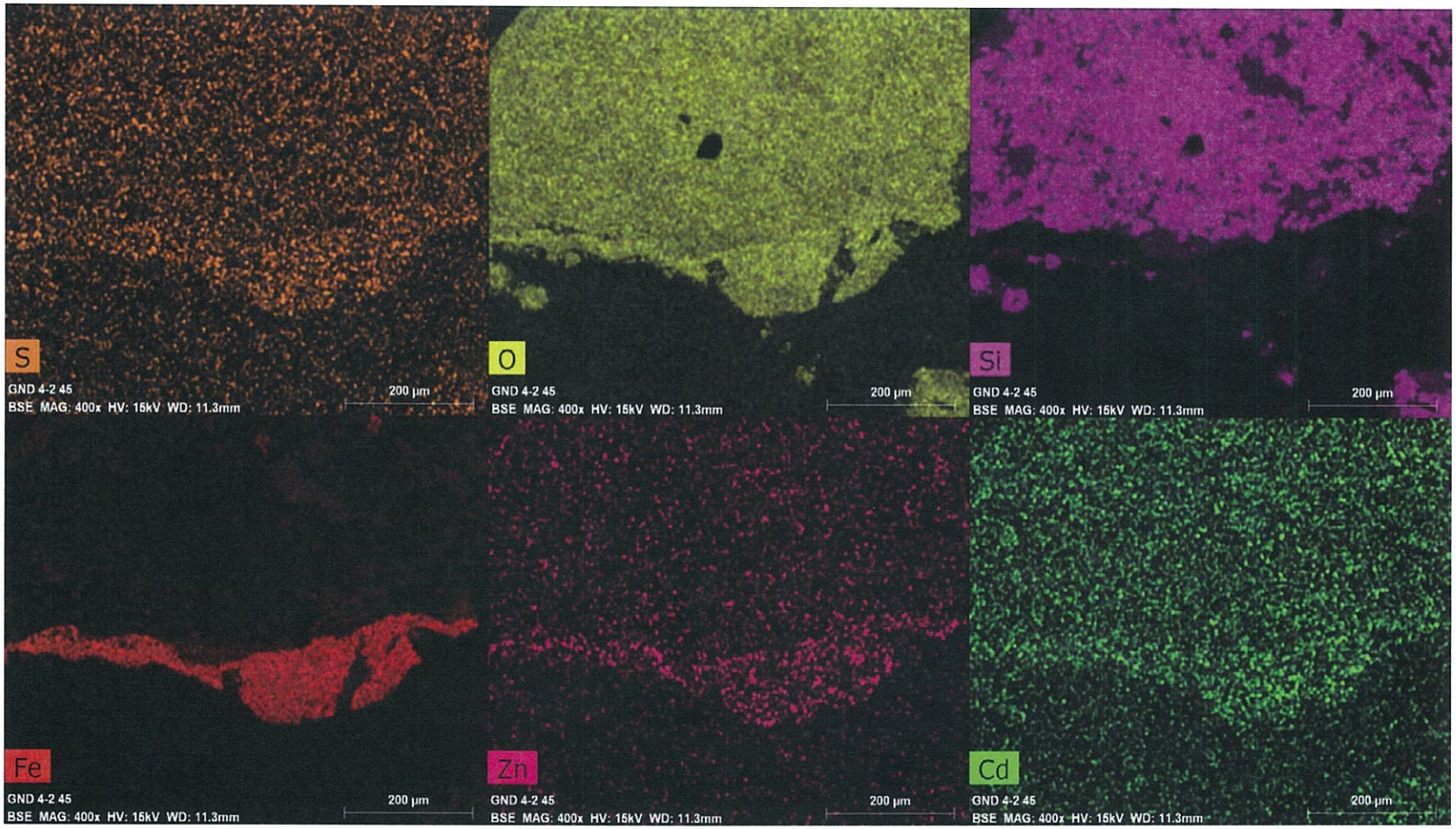


Figure 3-26: Elemental maps S, O, Si, Fe, Zn and Cd of area shown in Figure 3-25 (waste rock sample BW-ARD-473; Type 3 – NAG).

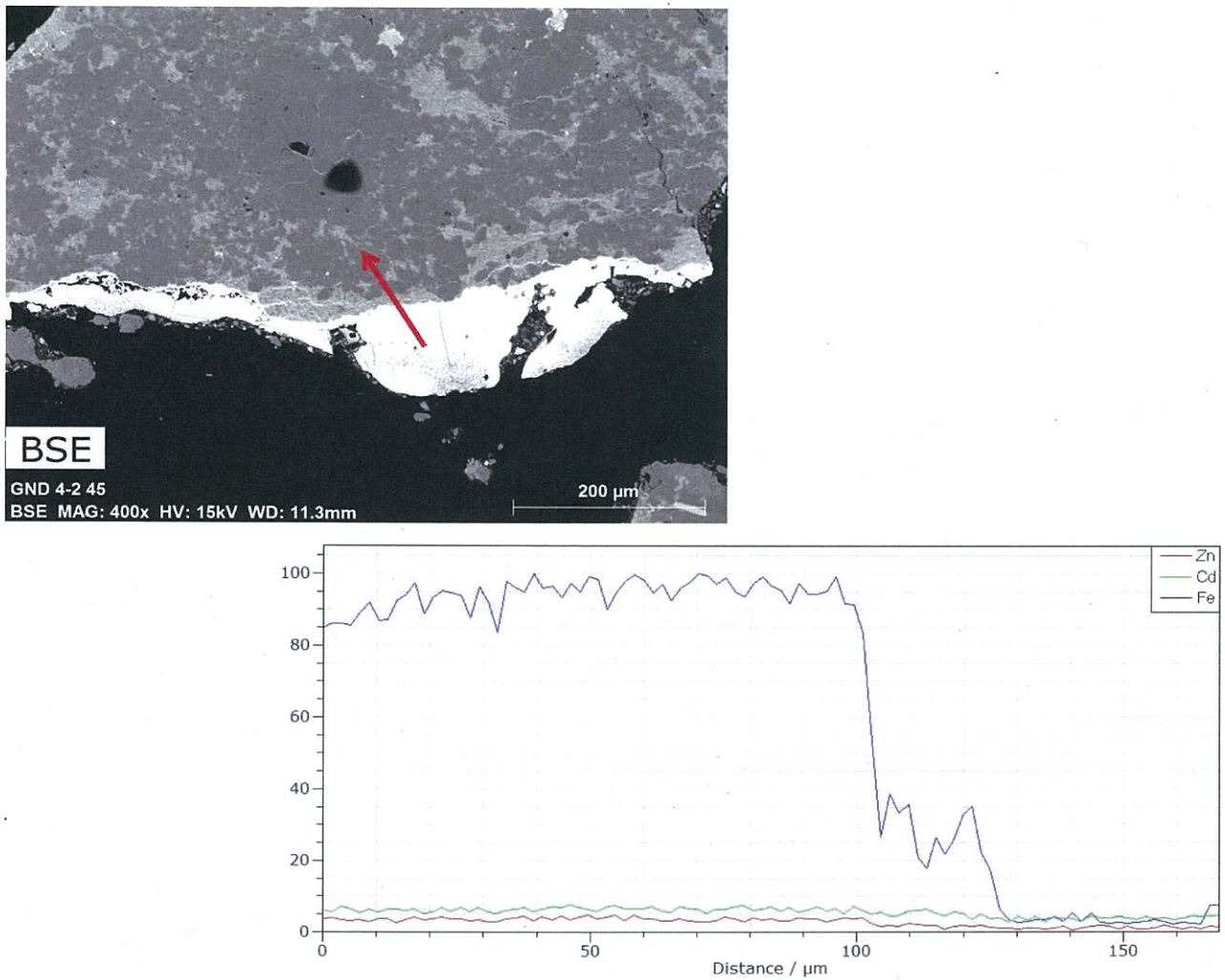


Figure 3-27: BSE-image and counts-vs-disctance plot showing the location and relative elemental abundances in an EDX line-scan running from a secondary Fe-hydroxide into the adjacent quartz-biotite-matrix in waste rock sample BW-ARD-473 (Type 3 – NAG).

3.2.2 SEM Results

3.2.2.1 CND 2-4 (Sulfide Tailings)

Figure 3-28 shows a BSE image of a fragment assemblage typical of the sulfide tailings sample. Elemental mapping of this area (Figure 3-29) gives useful qualitative information about the chemical composition of the various minerals and, in some cases, allows the determination of rare minerals that cannot be identified by petrography alone due to their small grain sizes. For example, EDX-analysis showed that mineral 1 in Figure 3-28 is possibly a Fe-bearing As-sulfate that has above-background Cd content. Note that despite the fact that As was not mapped, the high apparent Mg content is an indicator of As incorporation into the crystal lattice since the As and Mg peaks interfere. Given the relatively bright appearance of this mineral in reflected light and back-scattered imaging, the mapped elements are more likely to be As than Mg. Therefore, this phase was inferred to represent an altered arsenopyrite grain. Another example in the same area shows two sphalerite grains (2) in the center of the image that appear relatively fresh and incorporate appreciable amounts of Fe as well as minor Cd (Figure 3-29). Mineral grain 3 represents a typical morphology of poorly crystalline Fe-hydroxide. Zn does not have an EDX-detectable concentration in this grain. On closer inspection, however, it appears that minor Cd is partitioned into the upper rim of this phase.

A BSE image of another area within tailings sample CND 4-2 is shown in Figure 3-30. Phases of interest in this assemblage include sphalerite (1), arsenopyrite (2), pyrite (3), and a poorly crystalline mixture of Fe-hydroxide surrounding Fe-Al-silicate (4). The elemental map in Figure 3-31 indicates that Cd is enriched in sphalerite and arsenopyrite. An EDX-spectrum of the latter is provided in Figure 3-32 and highlights the interference of As and Mg addressed above. Secondary peaks of As and detectable Sb make clear that Mg is misidentified in the elemental map. In contrast to Cd, Zn is restricted to associations with sphalerite.

A nice example of co-precipitated pyrite (1) and sphalerite (2) showing irregular, almost skeletal grain boundaries is illustrated in Figure 3-33. The surrounding silicate matrix is composed primarily of biotite (3) and muscovite (4). The according elemental distribution depicted in Figure 3-34 shows that Zn is almost exclusively partitioned into sphalerite in detectable amounts. As already observed in other studied areas, the distribution of Cd is less straightforward with the signal being only slightly above background and, in this case, without discernible mineral association.

3.2.2.2 CND 1-5 (Transition Tailings)

Figure 3-35 shows a relatively low-magnification overview of one of the marked areas within tailings sample CND 1-5 (transition tailings). This BSE-image gives a good idea of the typical grain size range as well as the distribution and abundance of sulfide and oxide minerals (brightest shades). The elemental maps illustrated in Figure 3-36 show that Zn is irregularly dispersed and appears to primarily reside in relatively small sphalerite grains (<20 µm). However, the resolution is too low to exclude other mineral associations. The Si-map in combination with other major elements confirms findings from petrographic analysis that silicate minerals such as quartz, feldspar, biotite and muscovite are by far the dominant mineral class. Diffuse iron enrichments circled in the Fe-map of Figure 3-36 are patches of Fe-hydroxide, likely a weathering product of pyrite. High Ca-counts are represented by calcite grains that rarely exceed a grain size of 30 µm. Cadmium signals are at or only slightly above background such that, at this magnification, no ULFCd-host is discernible.

A biotite assemblage that was penetrated by a hydrothermal fluid along grain boundaries and cleavage planes is shown in Figure 3-37. The precipitate from this fluid fills void space and microfractures and appears to act as cementing material for loose fragments. The distribution of selected elements within this cluster is illustrated in Figure 3-38 and indicates that the bright, fluid-derived alteration rims in the BSE-image contain sulfur and iron with minor zinc and copper. Oxygen was detected throughout the assemblage (not shown) suggesting that the precipitated phase is at least partly made up of a sulfate phase. Cadmium does not show a distinct enrichment but appears to show above-background signals in a diffuse pattern. One area that shows clear Fe- and Zn-enrichment (top of Figure 3-37) is devoid of sulfur, giving rise to the conclusion that this precipitate represents a non-sphalerite Zn-phase.

A fragment containing secondary Fe-hydroxide (dark orange-brown in optical microscopy) was investigated and the BSE image of this grain is provided in Figure 3-39. The Fe-map shown in Figure 3-40 illustrates the irregular shape of this Fe-hydroxide aggregate. EDX analysis also revealed an enrichment in Zn in this phase (Figure 3-40), while Cd distribution was found to be inconclusive and generally more random.

Overall the above findings suggest that Zn (and possibly Cd) in transition zone tailings are fractionated into a wider variety of phases with detectable metal contents not restricted to sulfide minerals but also observable in secondary Fe-phases.

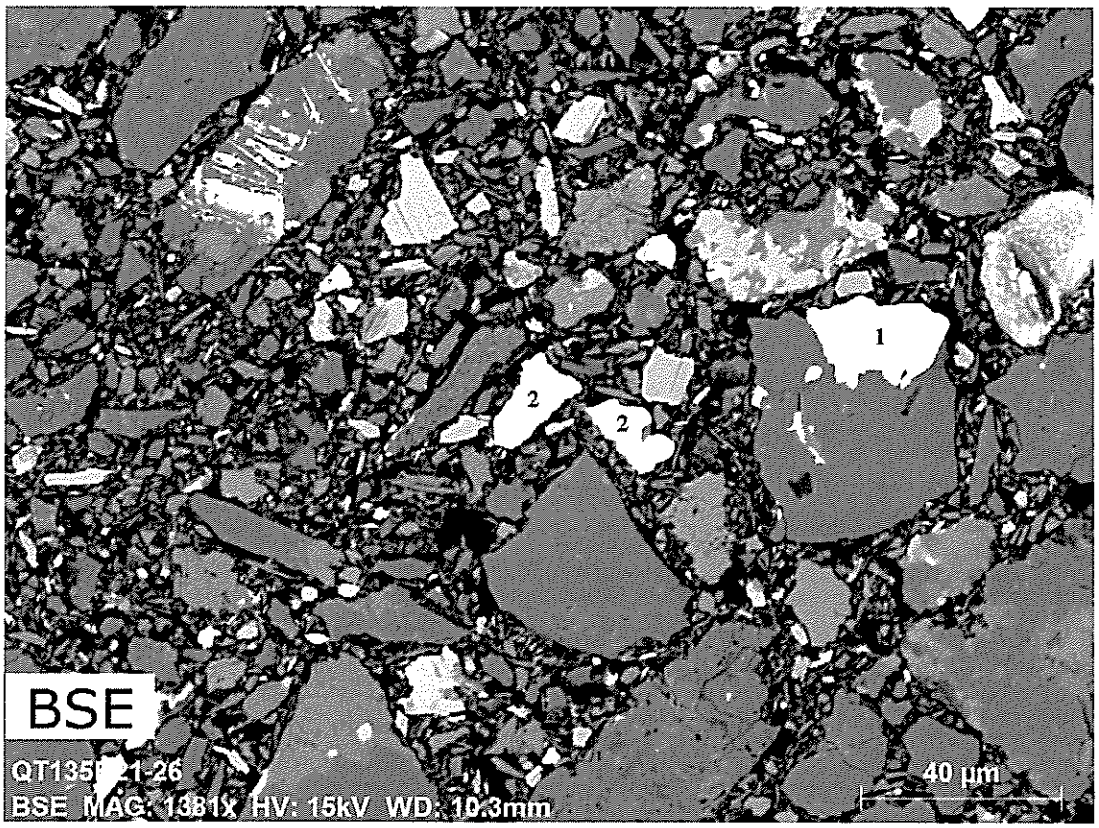


Figure 3-28: BSE-image of a typical fragment assemblage seen in tailings sample CND 2-4 showing (1) altered arsenopyrite (?) and (2) sphalerite.

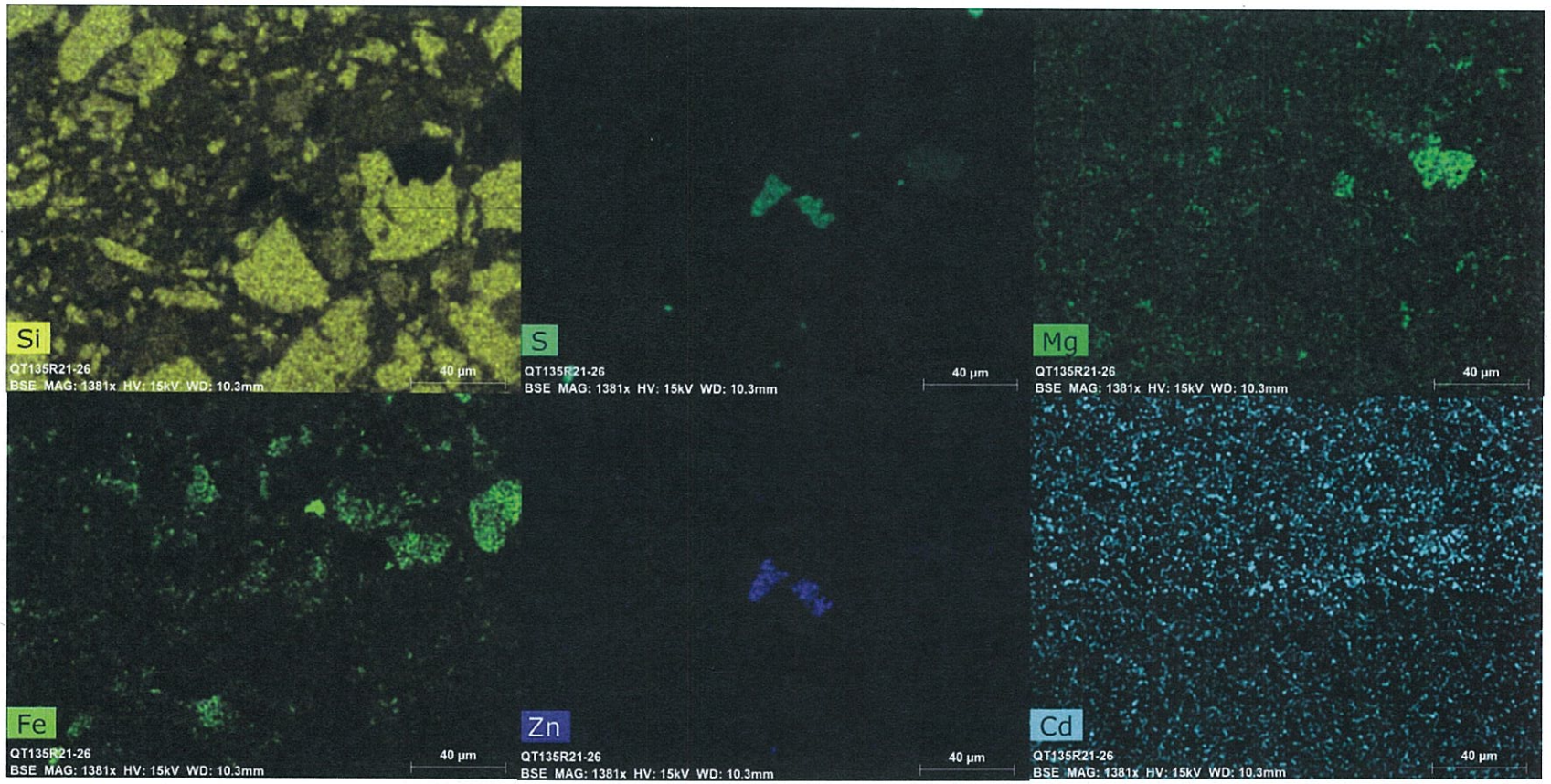


Figure 3-29: Eelemental maps for Si, S, Mg, Fe, Zn and Cd of area shown in Figure 3-28 (tailings sample CND 2-4).

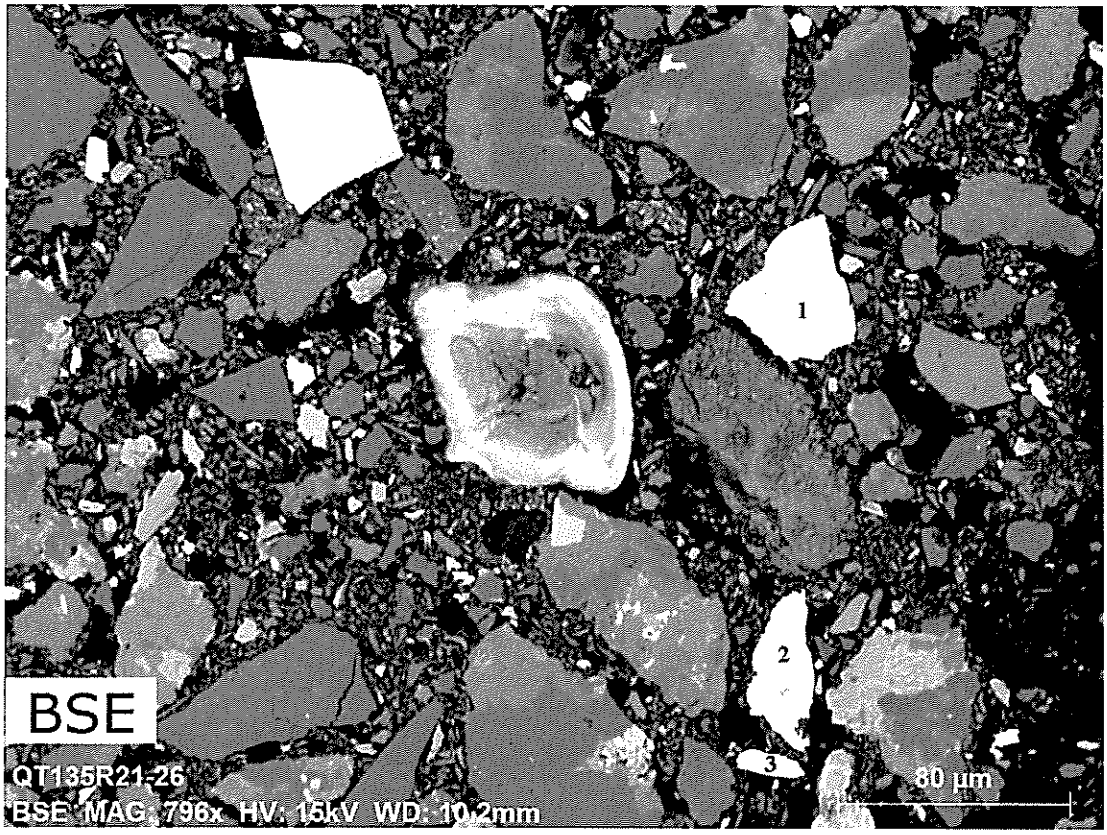


Figure 3-30: BSE-image of fragment assemblage in tailings sample CND 2-4 showing (1) sphalerite, (2) arsenopyrite, (3) pyrite and (4) aluminosilicate with Fe-hydroxide rim.

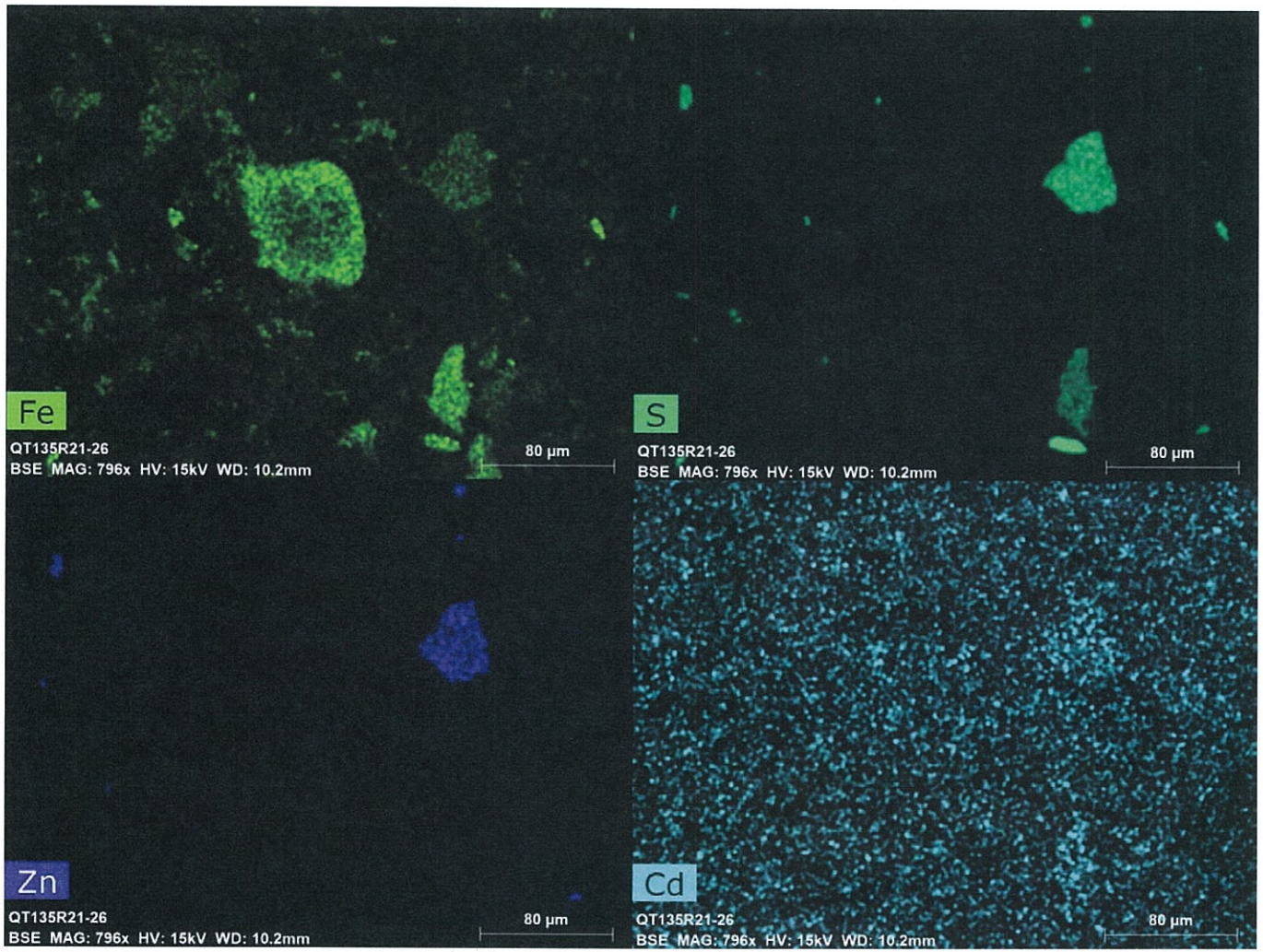


Figure 3-31: Eelemental maps for Si, S, Mg, Fe, Zn and Cd of area shown in Figure 3-30 (tailings sample CND 2-4).

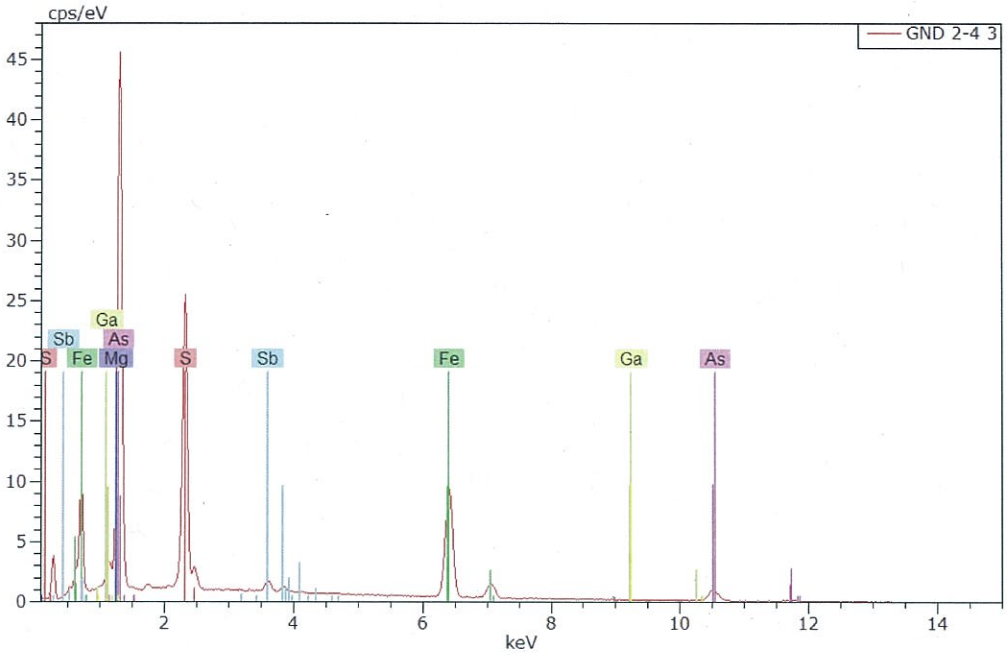


Figure 3-32: EDX-spectrum of arsenopyrite grain in tailings sample CND 2-4 showing detectable Fe, As, Sb, and S.

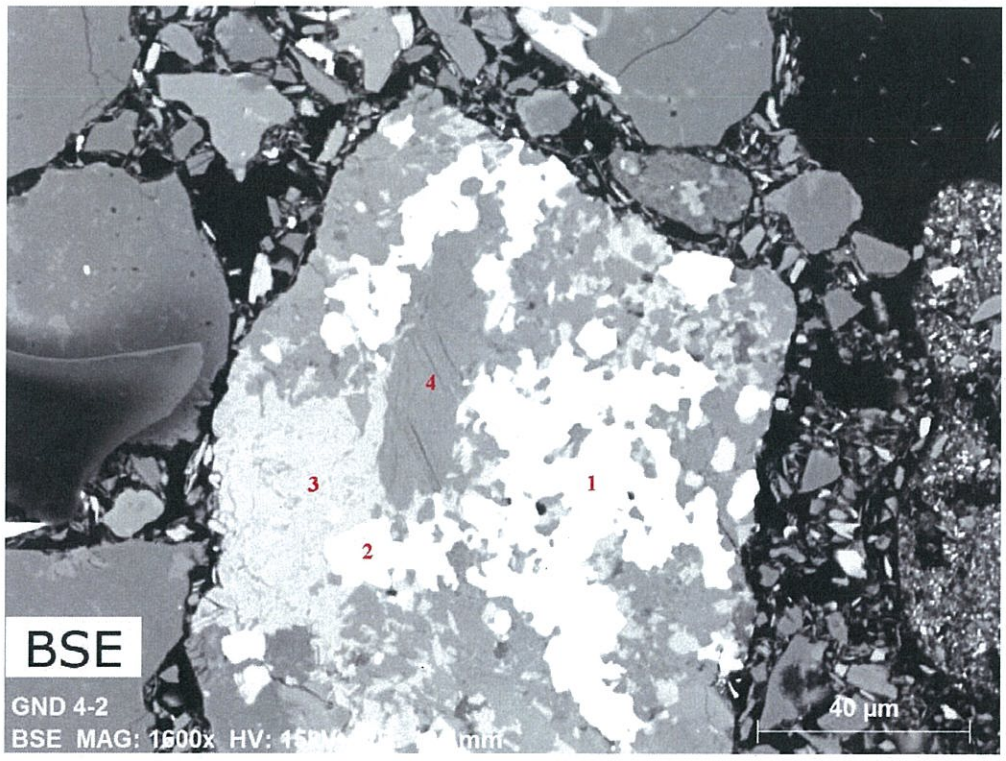


Figure 3-33: BSE-image of tailings sample CND 2-4 showing co-precipiatetd pyrite (1) and sphalerite (2). Gangue minerals are biotite (3) and muscovite (4).

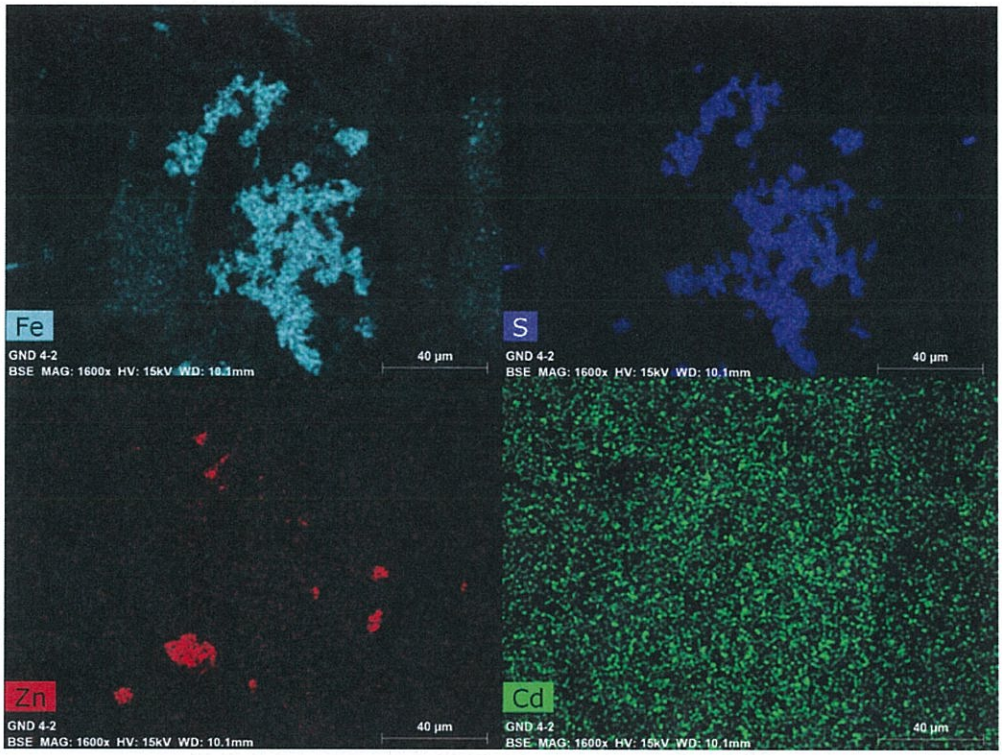


Figure 3-34: Elemental maps for Fe, S, Zn and Cd of area shown in Figure 3-33 (tailings sample CND 2-4).

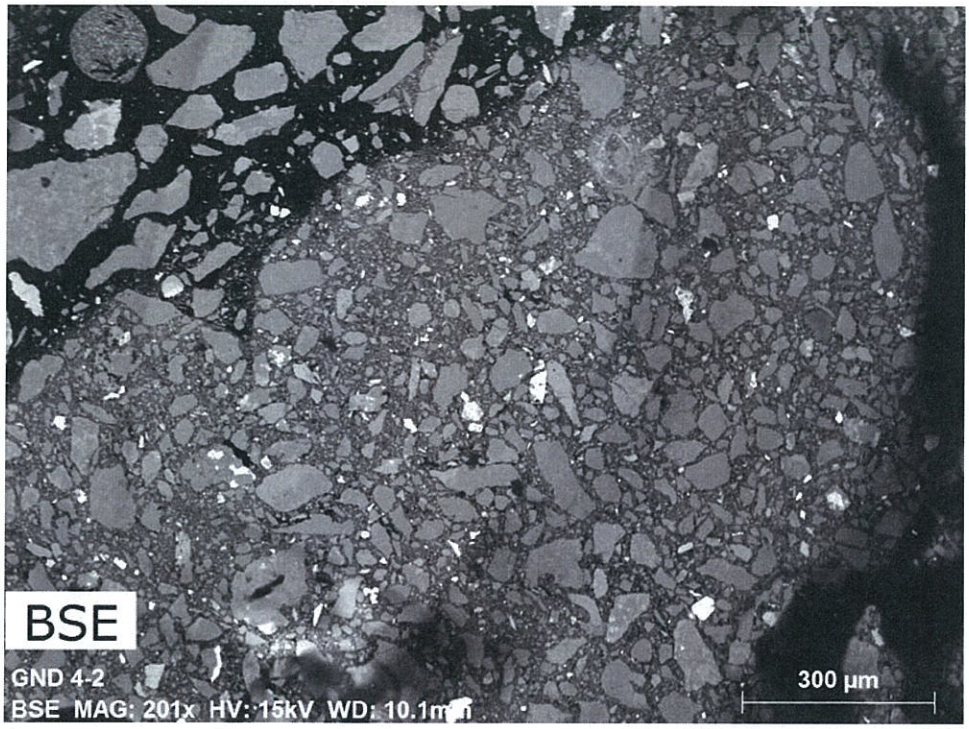


Figure 3-35: BSE-image of tailings sample CND 1-5 showing a relataively low-magnification overview of a fragment assemblage.

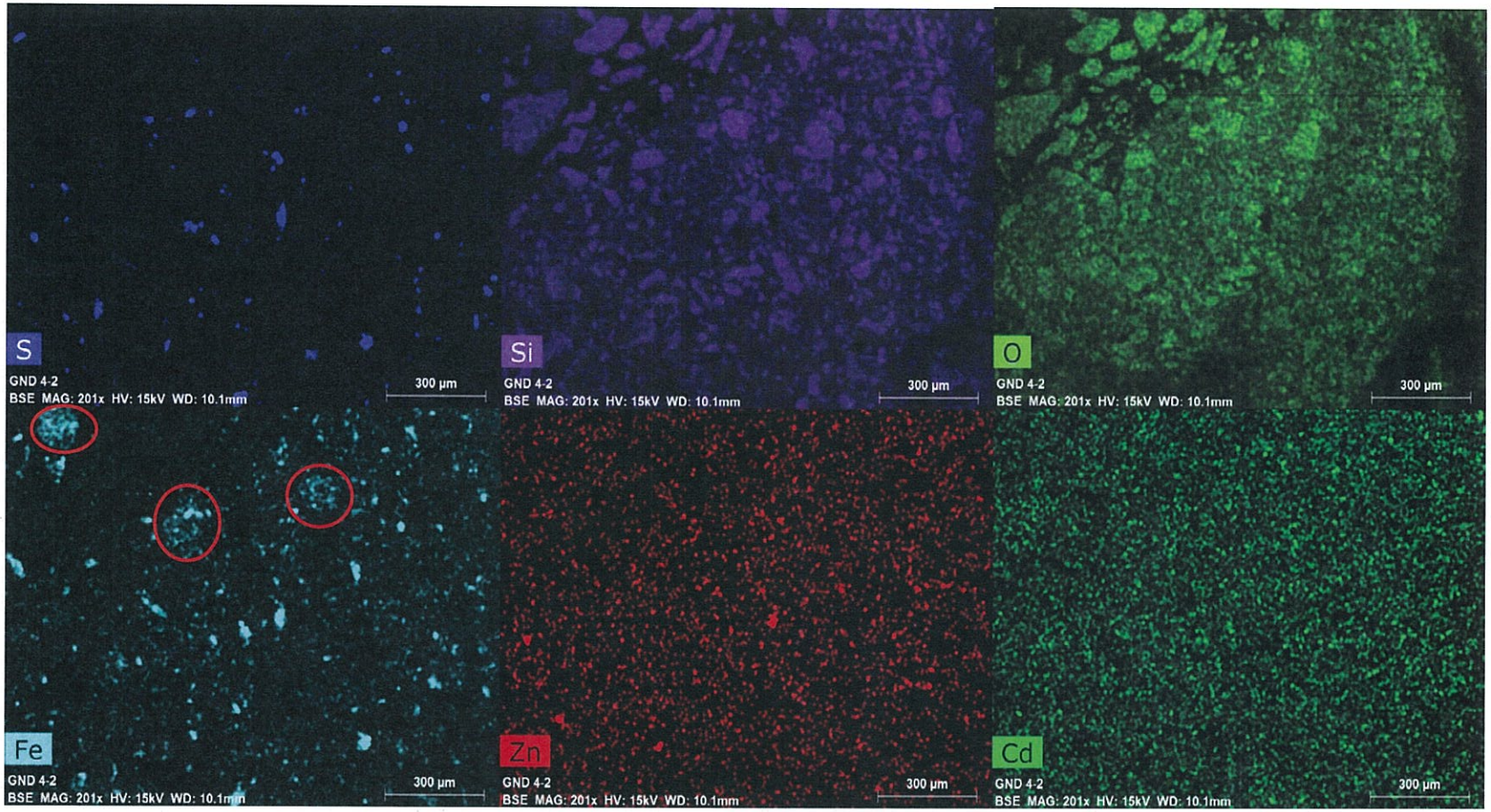


Figure 3-36: Elemental maps for S, Si, O, Fe, Zn and Cd of area shown in Figure 3-35 (tailings sample CND 1-5).

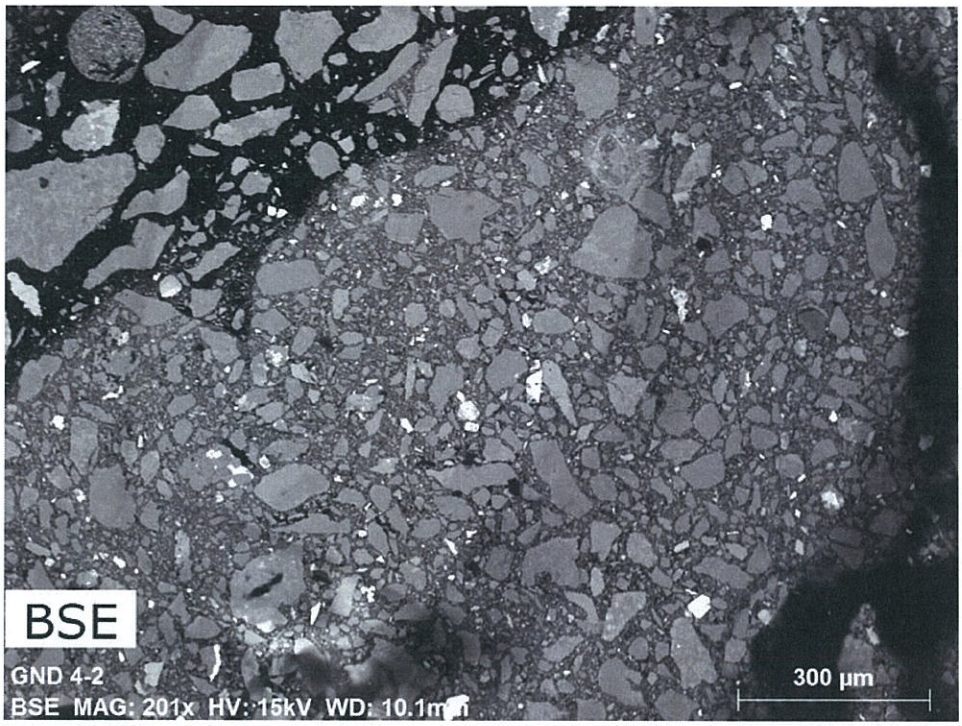


Figure 3-37: BSE-image of tailings sample 1-5 showing biotite cluster with secondary precipitates along grain boundaries.

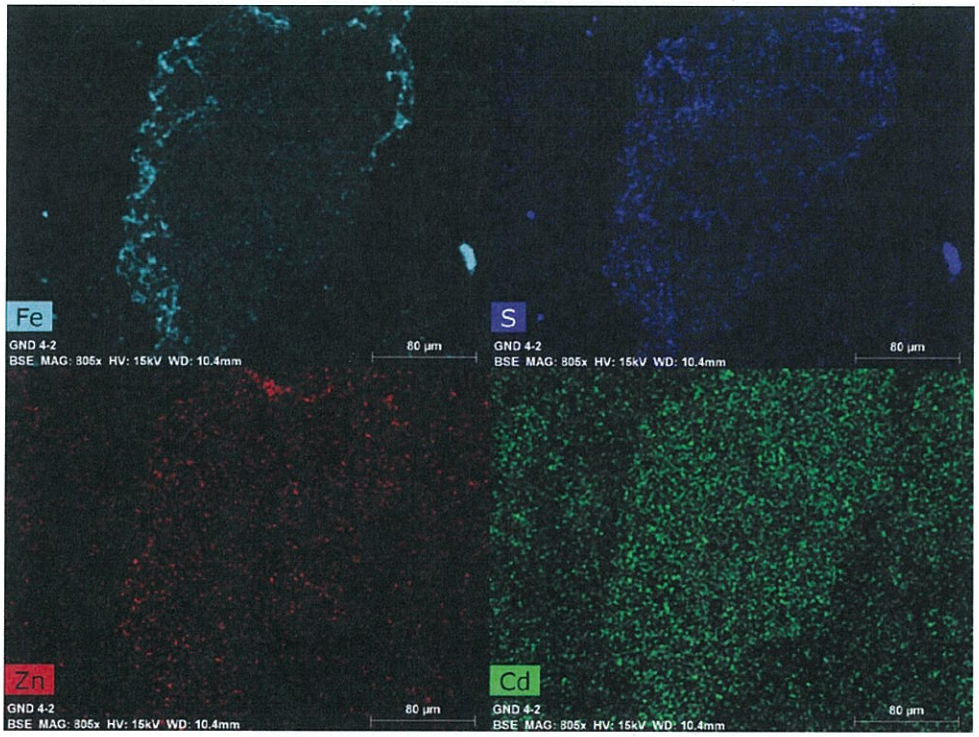


Figure 3-38: Elemental maps of area shown in Figure 3-37 (Tailings sample CND 1-5).

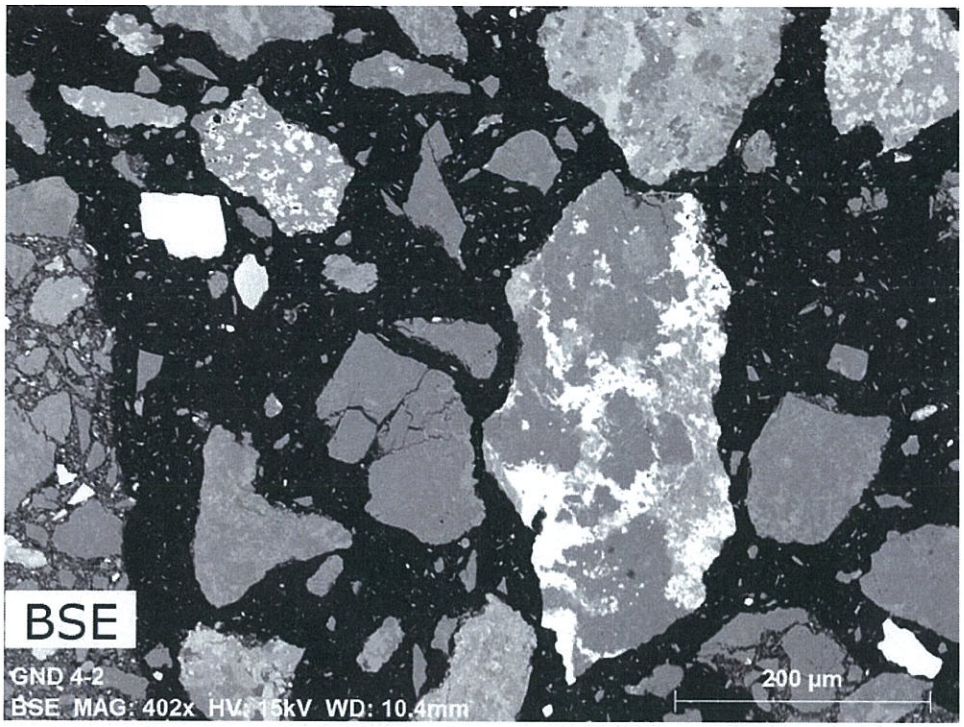


Figure 3-39: BSE-image of tailings sample 1-5 showing network of replacive Fe-hydroxide in polymineralic fragment (Tailings sample CND 1-5)

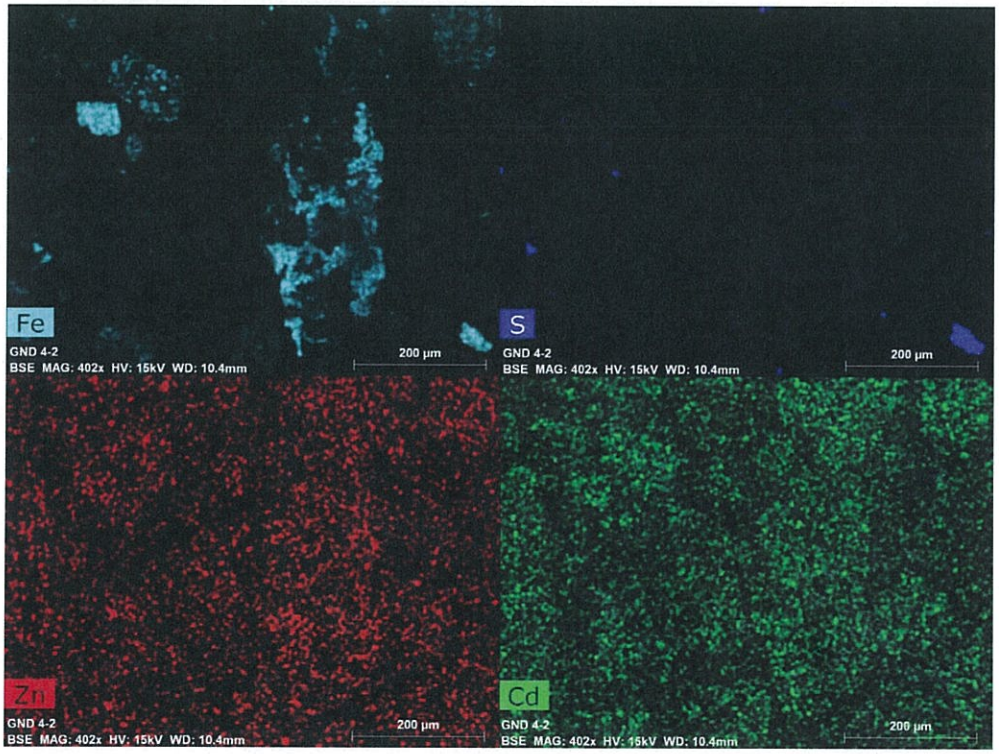


Figure 3-40: Elemental maps of area shown in Figure 3-39 (Tailings sample CND 1-5).

4. Conclusions

newgold™

4. Conclusions

A mineralogical examination of five waste rock and two tailings samples from the Blackwater Gold project was conducted using XRD, petrographic and SEM-analysis in order to gain a better understanding of the general mineralogy as well as the major host minerals for cadmium and zinc. The key findings can be summarizes as follows:

Waste rock

- Waste rock from the Blackwater deposit is composed of varitextured, felsic volcanic and sub-volcanic rock in which igneous textures are largely overprinted by strong hydrothermal alteration that led to partial or full recrystallization of a quartz-feldpar matrix as well as replacement by dominantly sericite-biotite assemblages;
- Samples with high solid-phase Zn content (waste rock Type 1 and Type 3 samples) were found to have the highest sphalerite abundance. This mineral is the dominant host for both zinc and cadmium in these samples;
- While sphalerite still appears to be the main repository for Zn and Cd in all Blackwater waste rock classifications, both elements were additionally identified as minor components in pyrite, polymetallic sulfide as well as in several non-sulphide phases such as Fe-Mn-carbonate and Fe-hydroxide in sample BW-ARD-473 (Type 3). One discrete Cd-mineral (CdS) was also identifed in the latter sample;
- In general, Cd shows a more diffuse distribution pattern than Zn which may be attributed to Cd residing in wider varity of phases, faster diffusion or lack of resolution owing to the low abundance of Cd (*i.e.,* Cd concentrations near the limits of analytical detection of the SEM).

Tailings

- Tailings show generally the same gangue mineralogy as waste rock units; however, grain-sizes are too small to accurately quantify mineral abundances petrographically;
- Cd and Zn distribution patterns are comparabable to those seen in waste rock with Cd apparently residing in a wider variety of non-sphalerite phases (*e.g.*, sulfates and arsenopyrite), while Zn is largely restricted to sphalerite. Generally, the analysis revealed only minor amounts of oxide/hydroxide phases that may be

prone to reductive dissolution in the permanently saturated setting of the TSF. Slightly higher abundances of Fe oxide phases observed in the transition tailings sample imply redox-related dissolution processes will have more relevance to these materials.

References

newgold™

References

Barton, Jr, P. B.; Bethke, P. M. (1987): Chalcopyrite disease in sphalerite: pathology and epidemiology. *American Mineralogist, 72*, 451 – 467.

Craig, J. R., Vokes, F. M., & Solberg, T. N. (1998). Pyrite: physical and chemical textures. *Mineralium Deposita, 34(1)*, 82-101.

Martin A.J., Pedersen T.F. (2002) Seasonal and interannual mobility of arsenic in a lake impacted by metal-mining. *Env. Sci. Tech., 36*, 1516-1523.

Raudsepp. M. and Pani, E. (2003): Application of Rietveld analysis to environmental mineralogy. *Mineralogical Association of Canada, Short Course 31*, Chapter 8, 165-180.

Tessier A., Campbell P.G.C. (1988) Partioning of Trace Metals in Sediments., in: J. R. Kramer and E. A. Herbert (Eds.), Metal Speciation: Theory, Analysis, and Application., Lewis Publishers. pp. 183-200.

Tesoriero, A. J., & Pankow, J. F. (1996). Solid solution partitioning of Sr^{2+}, Ba^{2+}, and Cd^{2+} to calcite. *Geochimica et Cosmochimica Acta, 60*(6), 1053-1063.

ANNEX 2
Elemental Content Analysis Results

Table A2-1: Elemental Content Analytical Results - Overburden Results

Sample ID	Type	Hole ID	From (m)	To (m)	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
					ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Average Crustal Abundance*					0.075	8.23	1.8	4	10	425	3	0.085	4.15	0.15	66.5	25	102		60	5.6	19	1.5	3	0.085	0.25	2.1	39	20	2.33	950	1.2	2.355	20	84	0.015	14	90	0.0007	0.03	0.2	22	0.05	2.3	370	2		9.6	0.565	0.85	2.7	120	1.25	33	70	165
KP-8	overburden	GT12-08	4.42	4.58	0.02	1.97	4.3	0.2	10.0	70.0	1.16	0.06	3.42	0.07	47	19	39	20.4	7.4	4.18	8.25	0.13	0.23	0.01	0.033	0.23	22	18.9	2.47	738	0.58	0.06	0.1	27	1630	6	10.9	0.001	0.01	1.12	6.9	0.4	0.7	158.5	0.01	0.01	3.2	0.09	0.04	1.25	64	0.05	8.94	91	9
KP-7	overburden	GT12-08	2.6	2.8	0.03	0.99	5.9	0.2	10.0	70.0	0.7	0.06	3.13	0.15	41.4	12.8	32	10.55	5.2	3.34	4.38	0.11	0.24	0.02	0.032	0.23	18.5	4.8	0.65	686	0.43	0.06	0.13	18.7	1300	5.3	11.1	0.001	0.01	1.09	4.9	0.3	0.7	115.5	0.01	0.01	2.8	0.075	0.05	0.97	44	0.33	7.27	71	8.3
KP-9	overburden	GT12-08	6.24	6.35	0.04	1.45	6.4	0.2	10.0	90.0	1.15	0.06	5.4	0.15	46.1	17.7	32	10.1	25.7	3.67	5.24	0.12	0.14	0.01	0.023	0.27	22.7	10	1.25	950	0.74	0.05	0.12	27.2	1540	8	13.1	0.001	0.01	1.68	5.2	0.3	0.5	203	0.01	0.01	3.2	0.059	0.06	1.4	54	0.12	8.12	75	6
BW-ARD-316	overburden	BW0086	0	5	0.05	1.03	5.2	0.2	10.0	50.0	0.33	0.21	0.42	0.17	22.4	5.40	13.0	2.47	7.80	1.66	4.96	0.06	0.59	0.01	0.02	0.25	11.7	17.3	0.42	401	0.86	0.06	0.40	8.60	580	4.90	21.6	0.001	0.02	0.45	2.90	0.20	0.30	26.7	0.01	0.01	7.00	0.05	0.20	1.96	27	0.22	7.75	53	19.5
KP-5	overburden	GT12-46	64.35	64.6	0.27	2.66	17.3	0.2	10.0	270.0	0.88	0.17	0.99	0.19	37.5	14.3	37	40.6	18	3.5	7.6	0.13	0.05	0.01	0.023	0.92	18.1	28.6	0.47	1620	1.39	0.03	0.15	19.4	1770	6.3	74.8	0.001	0.01	4.58	4.5	0.4	0.6	226	0.01	0.01	3.3	0.133	1.99	0.54	68	0.72	7.14	63	1.9
KP-6	overburden	GT12-46	26.8	27	0.1	1.57	9.9	0.2	10.0	110.0	0.67	0.2	0.51	0.2	29	9.7	30	3.16	19.1	2.65	6.65	0.11	0.69	0.01	0.028	0.3	13.6	11.6	0.49	632	2.45	0.07	0.36	18.2	750	10.3	28.4	0.001	0.01	0.74	5.6	0.5	0.7	54	0.01	0.02	5.1	0.196	0.25	1.55	57	0.34	11.05	68	24.7
KP-2	overburden	GT12-45	37	37.25	0.08	1.6	4.8	0.2	10.0	130.0	0.63	0.18	0.67	0.21	32.6	11.9	23	1.33	17.3	3.32	6.62	0.13	0.35	0.01	0.036	0.19	15.3	8	0.58	723	1.91	0.08	0.39	16.2	1020	6.9	16.3	0.001	0.01	0.34	6.2	0.6	0.8	97.9	0.01	0.02	4.3	0.243	0.14	1.16	64	0.24	14.75	78	15.8
BW-ARD-300	overburden	BW0072	0	5	0.11	1.32	5.5	0.2	10.0	80.0	0.75	0.31	0.63	0.26	38.2	10.6	21.0	2.61	18.7	2.45	4.26	0.09	0.62	0.05	0.02	0.35	19.2	7.60	0.74	688	0.79	0.19	0.74	16.70	880	10.5	28.5	0.001	0.01	0.64	3.00	0.40	0.40	67.6	0.02	0.01	5.90	0.17	0.18	1.44	49	0.21	9.85	71	21.1
BW-ARD-306	overburden	BW0103	15	25	0.58	1.21	12.4	0.2	10.0	90.0	0.66	0.26	0.22	0.35	29.8	5.60	15.0	4.49	12.3	2.04	5.33	0.07	0.70	0.01	0.03	0.34	16.5	11.5	0.29	709	0.91	0.04	0.33	10.30	440	32.0	27.6	0.001	0.01	1.33	3.30	0.30	0.50	23.2	0.01	0.01	8.00	0.11	0.35	1.98	32	1.71	10.4	130	19.9
BW-ARD-304	overburden	BW0103	0	5	0.33	0.99	26.8	0.2	10.0	150.0	0.75	0.20	0.24	0.50	28.2	6.40	11.0	2.08	11.3	2.15	4.43	0.07	0.70	0.01	0.02	0.16	14.5	8.60	0.35	1360	0.87	0.02	0.22	9.90	470	25.2	13.6	0.001	0.01	1.18	3.40	0.30	0.30	18.6	0.01	0.01	6.80	0.09	0.28	2.65	28	0.23	9.27	105	19.1
BW-ARD-311	overburden	BW0112	20	52	0.27	1.24	9.4	0.2	10.0	80.0	0.55	0.31	0.36	0.72	28.6	5.40	13.0	3.49	14.9	2.36	4.68	0.06	0.54	0.04	0.27	0.27	13.8	11.4	0.37	771	0.65	0.05	0.21	8.80	610	12.0	20.2	0.001	0.02	0.83	3.60	0.40	0.40	29.1	0.01	0.01	4.70	0.10	0.28	1.39	40	0.24	8.89	124	16.8
KP-1	overburden	GT12-45	6.75	6.95	0.53	2.05	17.2	0.2	10.0	120.0	0.68	0.36	0.44	0.78	29.3	8.3	21	4.59	18.9	2.51	6.08	0.09	0.26	0.02	0.075	0.31	14.1	11.9	0.47	709	1.14	0.06	0.41	13.2	690	34.3	21.8	0.001	0.01	1.12	4.3	0.4	0.5	37.6	0.01	0.03	4.7	0.149	0.38	1.31	54	0.18	8.19	180	12.8
BW-ARD-301	overburden	BW0072	12	15	0.85	1.46	53.3	0.5	10.0	70.0	0.68	1.38	0.23	0.86	34.0	8.10	23.0	3.34	31.1	2.89	5.07	0.08	0.67	0.03	0.95	0.26	16.1	11.3	0.29	600	1.24	0.03	0.28	11.50	550	121	18.0	0.001	0.01	4.11	3.90	0.30	0.50	30.9	0.01	0.02	5.20	0.13	0.31	1.86	53	0.15	7.95	184	23.4
KP-4	overburden	GT12-46	5.6	5.8	0.25	1.37	20.8	0.2	10.0	90.0	0.64	0.24	0.37	0.9	28.4	7.2	16	4.77	13	1.98	5.18	0.09	0.54	0.01	0.05	0.32	14	11.2	0.32	670	1.65	0.06	0.27	11.1	630	37.1	23.5	0.001	0.01	1.4	3.7	0.3	0.4	35.6	0.01	0.01	5.2	0.109	0.33	1.29	41	0.22	8.29	145	17.4
BW-ARD-308	overburden	BW0073	0	10	0.23	1.05	14.4	0.2	10.0	70.0	0.57	0.74	0.36	0.91	27.8	4.50	19.0	2.85	18.3	1.80	4.49	0.05	0.61	0.01	0.04	0.31	12.6	16.2	0.35	676	1.50	0.07	0.44	13.80	360	28.3	21.2	0.001	0.01	1.32	3.20	0.40	0.60	24.9	0.01	0.02	7.60	0.04	0.22	1.95	22	0.29	8.51	85	16.9
BW-ARD-318	overburden	BW0074	0	15	0.26	0.93	18.2	0.2	10.0	50.0	0.60	0.38	0.31	0.91	25.4	5.40	15.0	3.35	17.0	1.71	5.84	0.05	0.75	0.01	0.20	0.24	11.6	18.3	0.34	587	1.28	0.07	0.65	10.20	480	30.5	25.7	0.001	0.01	1.21	3.80	0.40	0.70	22.4	0.01	0.01	7.80	0.09	0.24	2.56	31	0.43	9.05	89	23.6
BW-ARD-313	overburden	BW0115	0	30	0.16	1.23	5.5	0.2	10.0	90.0	0.49	0.33	0.49	1.07	30.1	7.00	15.0	3.61	13.7	1.86	5.93	0.13	0.53	0.02	0.02	0.33	12.5	12.5	0.38	609	0.77	0.10	0.33	10.80	560	9.90	27.2	0.001	0.02	0.51	4.30	0.20	0.60	40.2	0.01	0.03	5.70	0.11	0.19	1.57	44	0.21	8.85	96	17.7
BW-ARD-312	overburden	BW0112	52	60	0.39	1.84	16.3	0.2	10.0	120.0	0.63	0.57	0.61	1.25	34.4	14.3	30.0	3.48	32.4	3.70	6.46	0.09	0.28	0.05	0.06	0.18	15.7	9.20	0.58	1000	0.92	0.05	0.16	23.80	980	70.9	12.3	0.001	0.02	3.13	6.60	0.50	0.50	78.8	0.01	0.02	3.30	0.19	0.17	0.94	72	0.13	11.3	172	11.2
BW-ARD-305	overburden	BW0103	5	15	0.41	2.03	38.3	0.2	10.0	120.0	0.83	0.49	0.34	1.45	28.6	8.50	29.0	8.20	18.9	2.79	7.31	0.08	0.56	0.01	0.25	0.47	14.1	19.7	0.39	1020	0.82	0.04	0.23	14.60	770	46.9	35.9	0.001	0.01	2.42	4.30	0.30	0.50	44.9	0.01	0.02	5.50	0.16	0.76	1.46	62	0.33	8.11	336	20.2
BW-ARD-309	overburden	BW0073	10	20	0.11	1.33	12.8	0.2	10.0	100.0	0.85	0.24	0.21	1.47	36.5	8.10	16.0	3.75	13.3	1.93	5.08	0.05	0.66	0.02	0.03	0.19	17.6	9.90	0.22	872	1.04	0.03	0.24	11.40	350	15.3	20.4	0.001	0.01	0.95	4.40	0.40	0.60	25.8	0.01	0.01	6.00	0.08	0.26	2.20	36	0.17	11.0	103	22.5
BW-ARD-303	overburden	BW0072	15	20	0.71	1.32	30.4	0.2	10.0	140.0	0.87	0.41	0.29	1.64	40.2	8.90	17.0	3.88	17.7	2.61	4.59	0.08	0.59	0.06	0.14	0.23	19.3	8.70	0.25	1300	1.11	0.03	0.19	14.00	590	65.7	18.4	0.001	0.01	2.10	4.50	0.40	0.60	37.3	0.01	0.04	5.60	0.12	0.48	1.72	44	0.13	11.3	201	20.3
BW-ARD-310	overburden	BW0112	0	20	1.91	1.12	30.2	0.2	10.0	100.0	0.43	3.32	0.34	1.82	24.1	9.80	23.0	1.95	101	2.27	4.23	0.13	0.47	0.03	0.25	0.25	10.5	8.70	0.56	548	1.36	0.06	0.26	21.60	600	24.1	14.6	0.001	0.13	1.41	3.00	0.30	0.40	52.5	0.01	0.05	5.00	0.11	0.12	1.58	36	0.27	7.71	162	15.7
BW-ARD-303	overburden	BW0072	20	25	0.31	2.00	110.5	0.2	10.0	120.0	1.28	0.42	0.20	1.89	45.5	10.0	20.0	6.49	37.0	3.28	7.16	0.10	0.49	0.06	0.11	0.25	20.8	11.9	0.72	969	1.38	0.02	0.21	11.00	550	18.8	21.8	0.001	0.01	2.56	5.60	0.50	0.80	39.6	0.01	0.03	5.90	0.11	0.69	2.37	52	0.14	17.3	265	17.5
BW-ARD-319	overburden	BW0074	15	23	1.08	1.25	36.5	0.2	10.0	100.0	0.63	1.96	0.19	2.34	33.7	7.20	14.0	3.94	26.5	2.26	5.06	0.05	0.65	0.02	0.51	0.28	14.9	10.5	0.23	871	2.98	0.03	0.35	11.20	440	131	25.1	0.001	0.01	5.72	4.50	0.50	0.70	27.2	0.01	0.01	5.70	0.11	0.30	1.64	39	0.19	9.13	255	22.0
BW-ARD-314	overburden	BW0115	30	38	8.73	1.57	88.0	0.2	10.0	110.0	0.58	1.64	0.33	3.34	36.6	10.4	16.0	5.27	47.4	2.82	5.70	0.15	0.36	0.04	0.36	0.34	16.2	11.3	0.33	1560	1.89	0.03	0.16	15.10	620	420	17.6	0.001	0.01	15.4	4.40	0.30	0.50	42.1	0.01	0.02	5.20	0.11	0.34	1.68	54	0.15	9.93	357	15.0
BW-ARD-315	overburden	BW0116	0	6	0.96	1.35	44.9	0.2	10.0	90.0	0.61	1.34	0.36	5.93	32.3	7.60	16.0	9.06	21.8	2.68	5.72	0.13	0.37	0.02	0.22	0.45	14.6	15.0	0.35	828	1.58	0.09	0.29	13.90	710	131	29.9	0.001	0.02	4.82	3.80	0.30	0.40	38.2	0.01	0.03	5.50	0.11	0.53	1.80	44	0.22	8.08	612	14.0
BW-ARD-307	overburden	BW0062	0	5	2.78	1.57	35.5	0.2	10.0	120.0	0.81	1.39	0.13	6.47	38.2	12.2	21.0	10.7	34.1	3.53	5.13	0.08	0.31	0.03	0.08	0.49	18.3	24.5	0.65	4980	8.04	0.02	0.20	16.40	820	1090	29.2	0.001	0.03	8.72	3.00	0.40	0.40	23.8	0.01	0.01	4.40	0.10	0.93	1.69	38	0.95	5.55	1470	10.9
BW-ARD-317	overburden	BW0086	5	10	3.71	0.50	263.0	0.2	10.0	130.0	0.43	2.11	0.07	10.1	46.3	4.00	7.00	5.01	208	2.99	2.05	0.09	0.22	0.03	0.53	0.20	21.9	2.70	0.07	230	3.32	0.02	0.23	4.40	820	430	9.80	0.001	0.02	24.8	1.30	0.50	0.20	40.1	0.01	0.01	5.70	0.02	0.21	13.8	11	0.30	7.64	423	8.90
KP-3	overburden	GT12-45	91.15	91.3	0.34	5.05	7.6	0.2	10.0	80.0	1	0.55	1.09	21.4	18.95	20	65	18.35	26.9	4.9	16.9	0.18	0.13	0.05	0.428	1.27	8.6	68.6	1.89	1980	3.25	0.16	0.14	28.3	1530	20.7	73.3	0.001	0.01	0.79	9	0.5	1	128	0.01	0.01	2.8	0.267	1.83	0.44	111	29.6	5.3	2320	5.1
KP-30	overburden	GT12-45	79.4	79.65	1.49	2.69	53.5	<0.20	<10.0	220.0	1.22	0.46	0.35	10.75	44.6	19.6	42	17.65	50.4	4.06	9.07	0.14	0.4	0.01	0.104	0.55	18.9	27	0.43	4120	2.21	0.02	0.15	26.5	870	98	48.9	<0.001	0.01	3.63	6.8	0.6	0.8	66.2	0.01	0.02	3.4	0.189	1.37	0.82	92	0.16	9.59	1030	16.6
KP-31	overburden	GT12-45	81	81.2	0.24	2.17	23.9	<0.20	<10.0	120.0	0.84	0.35	0.43	3.72	37.7	134.5	35	6.23	33.1	3.47	7.18	0.14	0.49	0.2	0.073	0.29	17.8	18.7	0.47	1400	2.11	0.04	0.19	22	870	25.4	22.3	0.002	0.01	1.6	6.5	0.6	1.1	53.2	0.01	0.1	4.1	0.159	0.48	0.97	74	131.5	11.2	378	17.4
KP-15	overburden	GT12-45	86	86.2	0.46	5.23	37.5	<0.20	<10.0	190.0	1.66	1.15	0.7	9.7	34.4	14.6	61	18.4	37.7	5.76	16.1	0.24	0.27	0.02	1.28	1.2	18.3	60.3	1.7	1760	0.68	0.03	0.12	34.7	1500	46	72.9	<0.001	0.01	4	0.257	2.13	0.82	123	0.38	9.02	2710	12.5
KP-16	overburden	GT12-45	86.95	87.2	0.98	5.52	13.7	<0.20	<10.0	160.0	1.23	0.62	1.15	48.3	24.6	14.9	66	25.2	29.7	5.46	16	0.23	0.14	0.03	1.11	1.59	11.7	82.1	1.79	1750	4.72	0.18	0.14	34.9	1750	74.8	85.8	0.001	0.09	1.01	11.1	0.8	0.9	140.5	<0.01	0.01	2.3	0.28	2.7	0.39	133	4.56	5.36	3680	5.6
KP-17	overburden	GT12-45	92.2	92.45	0.24	4.97	8.0	<0.20	<10.0	80.0	1.4	0.89	1	31	23.2	18.6	80	26.1	49.1	5.26	15.45	0.21	0.13	0.02	0.911	1.4	11.1	79.5	1.96	2050	4.61	0.07	0.11	34.2	2330	22.9	76.7	0.001	0.01	1.36	10.3	0.8	1	81.7	<0.01	0.01	2.5	0.248	2.15	0.8	129	5.09	5.08	4190	5.1
KP-18	overburden	GT12-45	95.25	95.4	0.27	4.96	5.4	<0.20	<10.0	140.0	1.11	0.63	0.82	16.9	21	17.5	72	29	69.6	5.58	15.7	0.23	0.1	0.01	0.276	1.87	9.5	83.1	1.96	2180	2.69	0.09	0.12	32.4	1650	51.4	88.6	<0.001	0.02	1.09	11.4	0.7	0.8	77.9	<0.01	0.02	2.5	0.278	2.49	0.37	129	2.8	4.73	2720	4.3
KP-16-2	overburden	GT12-46	46.3	46.5	0.23	1.76	8.7	<0.20	<10.0	120.0	0.53	0.2	0.6	0.73	22.5	10.4	31	5.97	43	2.87	5.5	0.12	0.33	0.01	0.035	0.25	11.1	15.1	0.64	892	1.68	0.07	0.15	21.9	840	18.7	16.5	<0.001	0.01	1.99	4.6	0.5	1.2	63.4	<0.01	0.02	2.7	0.132	0.3	0.6	60	0.49	8.38	124	11.8
KP-17-2	overburden	GT12-46	49.25	49.52	0.24	1.9	19.6	<0.20	<10.0	120.0	0.72	0.1	0.55	0.57	43.2	17.7	38	13.15	31.3	3.62	6.08	0.15	0.3	0.02	0.031	0.25	19.7	19.1	0.62	1480	1.81	0.03	0.16	32.7	1300	20.9	18	<0.001	0.01	5.9	5	0.5	0.5	66.3	0.01	<0.01	3.3	0.123	0.51	0.76	66	0.25	10.5	122	12.5
KP-18-2	overburden	GT12-46	52.45	52.7	4.35	1.98	19.2	<0.20	<10.0	140.0	0.64	0.06	0.86	0.18	49.6	15.4	33	17.85	43.8	3.91	5.81	0.13	0.2	<0.01	0.018	0.38	23	26.3	0.78	1400	1.92	0.04	0.06	25.5	1880	7.6	18.7	<0.001	0.01	5.25	3.5	0.4	0.4	91.3	0.01	<0.01	3.2	0.065	0.43	0.72	67	0.41	9.38	92	8.2
KP-19-2	overburden	GT12-46	54.55	54.8	3.47	1.76	22.8	<0.20	<10.0	140.0	0.54	0.05	1.13	0.14	50.8	16.4	17	26.9	183	2.76	4.66	0.13	0.1	<0.01	0.018	0.25	24.1	14.3	0.39	988	1.53	0.02	0.34	20.5	2410	7.5	30.8	<0.001	0.01	10.7	2.3	0.4	0.3	62.7	7.5	<0.01	<0.01	3.5	0.027	0.66	0.75	30	0.15	8.58	58	3.9
KP-20-2	overburden	GT12-46	58.4	58.69	0.7	1.5	8.1	<0.20	<10.0	120.0	1.03	0.06	0.8	0.08	56.3	8.4	30	24.1	68	2.91	3.85	0.14	0.12	<0.01	0.016	0.47	27.4	15	0.47	870	2.14	0.02	0.06	14.8	2060	6.7	24.1	<0.001	0.01	7.22	2.8	0.4	0.4	56.9	0.01	<0.01	4.3	0.056	0.39	0.95	39	0.88	9.19	32	4.3
KP-21-2	overburden	GT12-46	60.7	60.9	0.4	2.63	6.7	<0.20	<10.0	350.0	0.74	0.06	3.29	0.08	43.4	11.8	43	37.4	4.8	4.25	6.48	0.15	0.07	<0.01	0.019	0.88	20.7	26.8	0.69	1440	0.82	0.06	0.16	25.3	1760	5.2	57.8	<0.001	0.01	6.21	5	0.4	0.6	482	<0.01	<0.01	2.8	0.141	1.2	0.92	88	0.18	6.64	79	2.1
KP-22-2	overburden	GT12-46	64.6	64.8	0.25	2.53	14.9	<0.20	<10.0	260.0	0.87	0.18	1.12	0.13	39.1	12.7	39	50.4	20.5	3.69	7.18	0.14	0.06	0.01	0.025	0.93	18.5	36.2	0.52	1290	1.42	0.04	0.15	21.4	1950	6.1	73.5	<0.001	0.01	6.54	4.7	0.4	0.7	221	<0.01	<0.01	3.3	0.131	2.01	0.49	74	1.94	7.18	61	1.8
L016651	OB-rx interface	BW0072	28.85	30	0.68	2.25	138.5	0.2	10.0	110.0	1.16	0.65	0.14	1.74	41.3	8.4	26	10.8	53.4	3.53	8.4	0.09	0.26	0.04	0.544	0.51	19.6	20	0.2	1550	2.26	0.02	0.28	8.8	600	19.9	38.1	0.00	0.01	3.46	6.1	0.7	1.1	40.4	0.01	0.03	5.6	0.121	1.42	2.17	50	0.1	19.2	353	7.9
L016652	OB-rx interface	BW0083	43	45	1.14	2.02	20.0	0.2	10.0	110.0	0.68	0.15	0.05	3.25	35.9	4.9	36	4.86	18.7	3.57	8.65	0.09	0.23	0.01	0.008	0.56	18.9	43	0.81	5590	0.86	0.01	0.29	20.2	350	325	29.9	0.00	0.01	2.49	4.3	0.3	0.6	25	0.01	0.02	3.2	0.216	0.72	0.77	56	0.47	8.84	1340	8.2
L016653	OB-rx interface	BW0089	8	11	5.77	1.66	61.0	0.4	10.0	50.0	0.51	5.52	0.09	11.2	30.8	4.2	27	4.18	21.3	1.58	2.72	0.05	0.49	0.02	0.383	0.2	13.8	5.4	0.13	1020	3	0.01	0.34	5.6	310	326	9.9	0.00	0.01	16.4	1.9	0.4	0.3	20.4	0.01	0.02	5.2	0.048	0.24	1.92	23	0.19	5.82	235	15.4
L016654	OB-rx interface	BW0096	28	31	6.29	0.8	115.5	0.2	10.0	70.0	0.46	1.38	0.1	2.94	27.7	4.3	10	2.2	21.3	1.58	2.72	0.05	0.49	0.02	0.383	0.2	13.8	5.4	0.13	1020	3	0.01	0.34	5.6	310	326	9.9	0.00	0.01	16.4	1.9	0.4	0.3	20.4	0.01	0.02	5.2	0.048	0.24	1.92	23	0.19	5.82	235	15.4
L016655	OB-rx interface	BW0117	30	35	2.65	1.77	128.0	0.2	10.0	140.0	0.73	1.55	0.15	4.27	33.3	7.8	22	7.48	52.2	3.63	6.04	0.07	0.38	0.01	0.523	0.55	16.3	18

Table A2-2: Elemental Content Analytical Results - Waste Rock Results

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
						ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Average Crustal Abundance*						0.075	8.23	1.8	4	10	425	3	0.085	4.15	0.15	66.5	25	102		60	5.6	19	1.5	3	0.085	0.25	2.1	39	20	2.33	950	1.2	2.355	20	84	0.015	14	90	0.0007	0.03	0.2	22	0.05	2.3	370	2		9.6	0.565	0.85	2.7	120	1.25	33	70	165
BW-ARD-119	BW0077	228	238	FT	S	2.3	0.4	107.0	0.2	10.0	10.0	10.0	0.1	4.1	0.01	1.6	21.2	6.9	2.0	0.6	266.0	2.7	1.0	0.1	0.9	0.0	0.2	0.2	9.9	1.5	0.0	41.0	6.3	0.0	0.2	2.8	40.0	11.4	7.2	0.0	3.0	5.4	0.3	0.5	0.2	3.3	0.0	1.0	7.4	0.0	0.3	3.7	1.0	0.1	5.3	1900.0	23.7
BW-ARD2-3	BW0043	123	133	FT	S	1.2	0.3	93.2	0.2	10.0	20.0	0.4	2.8	0.01	38.7	13.9	1.2	1.0	1.2	40.6	1.2	0.7	0.1	0.9	0.2	0.3	0.2	6.0	0.8	0.0	55.0	1.3	0.0	0.5	1.0	20.0	45.9	7.0	0.0	1.4	5.8	0.5	0.5	0.2	2.7	0.0	0.0	10.6	0.0	0.3	4.5	1.0	0.1	6.3	5260.0	22.6
BW-ARD-591	BW0103	119	129	FT	S	5.0	0.6	74.8	0.2	10.0	30.0	0.8	0.9	0.06	10.6	35.9	1.6	82.0	1.4	49.1	3.6	1.7	0.1	0.6	0.0	0.3	0.3	18.9	2.8	0.1	1060.0	3.4	0.0	0.1	5.3	190.0	760.0	8.1	0.0	1.4	8.3	0.5	0.4	0.6	15.0	0.0	0.1	7.5	0.0	1.5	2.5	3.0	0.2	7.0	1550.0	17.4
BW-ARD-357	BW0173	91	101	VC	S	11.8	0.3	290.0	1.1	10.0	30.0	0.2	0.1	0.01	155.5	17.5	2.3	105.0	1.2	38.2	1.0	0.9	0.1	0.8	0.0	0.1	0.3	8.4	1.1	0.0	181.0	5.0	0.0	0.3	3.8	20.0	2670.0	10.6	0.0	1.1	24.1	0.4	0.4	0.3	2.4	0.0	0.0	7.7	0.0	0.5	4.5	1.0	0.1	11.7	4270.0	19.0
L016674	BW0117	36	45		O	1.0	0.4	79.3	0.2	10.0	40.0	0.3	0.7	0.02	8.5	22.6	0.9	12.0	0.7	81.3	1.9	1.2	0.1	0.6	0.0	0.1	0.3	11.3	2.5	0.0	200.0	2.6	0.0	0.2	2.4	100.0	139.0	8.3	0.0	1.0	3.2	0.4	0.2	0.3	9.7	0.0	0.1	5.7	0.0	0.7	2.5	2.0	0.1	4.7	587.0	15.5
BW-ARD-522	BW0191	44	54	VC	T	2.2	3.1	46.0	0.2	10.0	130.0	0.6	10.1	0.16	4.4	29.0	13.9	103.0	18.9	117.5	6.1	8.1	0.1	0.5	0.0	1.8	2.1	13.3	46.5	0.7	3000.0	3.7	0.0	0.3	17.4	770.0	27.9	102.0	0.0	0.4	5.1	3.1	0.5	1.0	17.3	0.0	0.0	6.3	0.2	2.0	1.5	39.0	0.6	7.3	2070.0	19.5
L016670	BW0072	31	40		O	3.9	0.4	656.0	0.3	10.0	30.0	0.2	2.2	0.02	3.5	22.6	0.8	3.0	0.8	78.1	1.7	1.4	0.1	0.6	0.0	0.6	0.3	12.1	1.9	0.0	295.0	2.7	0.0	0.3	1.0	140.0	150.5	8.3	0.0	0.3	10.9	0.4	0.2	0.4	9.1	0.0	0.7	4.1	0.0	0.3	1.1	2.0	0.3	2.8	225.0	14.3
BW-ARD-486	BW0178	164	174	AND	S	0.5	4.5	51.0	0.2	10.0	180.0	0.6	0.8	0.36	1.8	26.4	16.2	116.0	27.2	68.4	8.6	13.6	0.2	0.1	0.0	0.4	3.2	12.7	77.8	1.0	4480.0	5.6	0.0	0.3	32.3	1600.0	8.7	125.0	0.0	0.2	4.2	7.4	0.5	1.6	13.3	0.0	0.0	3.5	0.4	2.4	0.4	96.0	1.4	7.1	969.0	4.2
BW-ARD-415	BW0182	99	109	VC	T	0.3	1.4	8.5	0.2	10.0	90.0	1.5	0.1	0.38	0.2	15.2	4.4	94.0	4.4	19.2	1.6	3.6	0.1	0.3	0.0	0.0	0.3	7.0	23.6	0.3	2650.0	1.6	0.0	0.3	9.1	610.0	9.8	15.2	0.0	0.2	3.4	0.9	0.2	0.3	26.3	0.0	0.0	7.1	0.0	0.2	1.7	10.0	0.4	4.9	253.0	12.2
L016680	BW0173	58	67		O	7.7	0.4	391.0	0.2	10.0	30.0	0.2	1.1	0.01	3.4	16.1	1.5	7.0	2.4	33.0	1.0	1.3	0.1	0.6	0.0	0.2	0.3	9.1	1.7	0.0	124.0	2.8	0.0	0.3	1.1	90.0	1560.0	12.9	0.0	0.1	17.2	0.4	0.2	0.3	2.7	0.0	0.0	6.8	0.0	0.3	1.9	1.0	18.8	3.3	230.0	12.3
L016673	BW0096	32	41		O	1.8	0.4	95.0	0.2	10.0	10.0	0.2	0.1	0.01	0.9	29.0	0.3	1.0	0.6	20.9	0.5	0.9	0.1	0.4	0.0	0.2	0.2	14.3	0.6	0.0	38.0	1.9	0.0	0.9	0.5	70.0	437.0	5.2	0.0	0.0	15.1	0.3	0.2	0.2	2.4	0.0	0.0	8.5	0.0	0.1	3.0	3.0	0.1	3.2	79.0	9.0
L016671	BW0083	46	55		O	9.6	0.3	187.5	1.0	10.0	30.0	0.2	7.4	0.01	5.2	26.6	0.7	2.0	3.0	56.0	1.1	0.8	0.1	0.4	0.0	0.8	0.2	12.1	0.5	0.0	297.0	5.2	0.0	0.6	1.0	620.0	2260.0	9.1	0.0	0.0	13.1	0.3	0.2	0.3	2.7	0.0	0.0	5.3	0.0	0.2	3.4	1.0	0.3	3.6	274.0	7.3
BW-ARD-265	BW0077	150	160	FT	S	1.3	0.5	78.0	0.2	10.0	40.0	0.4	2.5	0.05	12.0	24.8	11.4	1.0	3.7	67.3	1.9	2.1	0.1	0.5	0.0	0.4	0.3	11.2	7.2	0.1	316.0	2.0	0.0	0.7	16.2	240.0	44.1	15.6	0.0	1.8	11.0	1.0	0.7	0.2	17.1	0.0	0.4	5.2	0.0	0.7	1.4	5.0	0.3	7.0	7050.0	17.7
BW-ARD-023	BW0043	123	133	FT	S	1.2	0.3	106.0	0.2	10.0	20.0	0.3	2.1	0.01	42.6	12.5	1.0	1.0	1.0	37.9	1.1	0.9	0.1	0.9	0.2	0.4	0.3	6.1	0.9	0.0	58.0	1.4	0.0	0.4	1.0	30.0	42.1	8.5	0.0	1.3	4.0	0.4	0.8	0.2	3.6	0.0	0.0	8.4	0.0	0.3	3.8	1.0	0.1	5.8	5020.0	22.6
BW-ARD-020	BW0055	95	105	FT	S	1.3	0.3	52.5	0.2	10.0	30.0	0.4	2.0	0.03	24.3	12.0	3.2	2.0	1.3	71.1	1.5	1.0	0.1	0.6	0.2	0.6	0.3	6.1	1.4	0.0	625.0	4.2	0.0	0.1	3.1	100.0	44.6	8.2	0.0	1.2	3.1	0.5	0.5	0.2	6.0	0.0	0.0	6.0	0.0	0.4	2.3	1.0	0.1	3.7	3200.0	16.4
BW-ARD-261	BW0077	192	202	FT	S	1.5	0.4	170.0	0.2	10.0	10.0	0.1	2.7	0.01	3.5	12.6	7.1	1.0	0.9	191.5	2.9	1.3	0.1	0.9	0.0	0.4	0.2	5.9	1.4	0.0	32.0	2.2	0.0	0.6	2.9	40.0	23.8	7.8	0.0	3.2	8.0	0.6	0.6	0.2	3.5	0.0	0.7	6.7	0.0	0.4	3.5	1.0	0.1	3.8	3110.0	22.7
BW-ARD-118	BW0077	150	160	FT	S	1.3	0.8	72.1	0.2	10.0	50.0	0.6	2.2	0.05	12.6	22.6	9.2	6.0	3.4	65.0	2.2	2.3	0.1	0.5	0.0	0.5	0.4	11.7	9.1	0.1	476.0	2.8	0.0	0.5	13.3	260.0	43.4	16.1	0.0	1.9	10.8	1.0	0.6	0.3	15.1	0.0	0.2	5.9	0.1	0.7	1.7	9.0	0.3	6.8	5650.0	16.8
L016678	BW0156	29	38		O	3.2	0.5	116.5	0.6	10.0	10.0	0.5	0.1	0.01	1.1	27.1	0.5	5.0	2.6	39.3	2.7	1.1	0.1	0.4	0.1	0.0	0.3	13.5	1.6	0.0	74.0	2.1	0.0	0.1	1.0	270.0	1165.0	12.1	0.0	0.0	26.0	0.5	0.2	0.2	1.6	0.0	0.0	5.8	0.0	0.2	3.2	1.0	0.2	3.3	561.0	10.0
L016679	BW0163	12	21		O	2.0	0.5	89.2	0.2	10.0	40.0	0.3	0.2	0.04	1.3	21.8	1.2	3.0	1.0	19.0	0.9	1.2	0.1	0.5	0.0	0.0	0.2	10.4	1.9	0.0	297.0	2.1	0.0	0.2	1.9	120.0	617.0	6.6	0.0	0.0	19.0	0.6	0.2	0.2	3.4	0.0	0.0	5.8	0.0	0.2	3.5	185.0	13.0
L016685	BW0224	95	104		O	3.4	0.3	310.0	0.2	10.0	20.0	0.2	0.2	0.01	5.2	30.4	0.6	3.0	1.6	22.9	0.6	0.8	0.1	0.5	0.0	0.0	0.2	15.4	0.6	0.0	122.0	1.5	0.0	0.7	1.0	200.0	1295.0	7.7	0.0	0.0	12.9	0.3	0.2	0.3	3.5	0.0	0.0	7.9	0.0	0.2	3.5	1.0	0.1	6.3	213.0	11.4
BW-ARD-447	BW0172	67	77	FT	S	1.7	0.5	118.0	0.2	10.0	20.0	0.4	4.2	0.03	40.3	21.4	3.8	152.0	1.0	48.4	1.2	1.3	0.1	0.6	0.1	4.6	0.4	11.5	1.8	0.0	626.0	4.8	0.0	0.1	5.2	110.0	91.8	13.3	0.0	1.0	4.3	0.4	0.7	0.4	2.9	0.0	0.0	7.6	0.0	0.7	3.1	1.0	0.1	5.2	7330.0	18.0
BW-ARD-358	BW0173	186	196	FT	S	4.5	0.4	122.5	0.2	10.0	30.0	0.6	0.2	0.03	25.1	22.4	2.4	103.0	1.3	20.4	1.4	1.0	0.1	0.5	0.0	0.0	0.2	11.1	0.8	0.0	338.0	3.8	0.0	0.8	5.3	100.0	1885.0	8.7	0.0	0.9	20.8	0.4	0.3	0.3	3.1	0.0	0.0	7.0	0.0	0.3	3.2	1.0	0.2	6.7	3240.0	12.5
BW-ARD-444	BW0172	25	35	FT	S	1.8	0.4	159.0	0.2	10.0	20.0	0.3	2.5	0.02	24.9	18.0	2.5	105.0	0.9	48.2	1.1	1.1	0.1	0.6	0.0	1.7	0.3	9.6	1.3	0.0	218.0	2.8	0.0	0.1	4.6	70.0	72.7	11.9	0.0	0.9	6.6	0.4	0.5	0.3	2.7	0.0	0.0	6.7	0.0	0.5	2.7	1.0	0.1	5.1	4660.0	17.6
BW-ARD-445	BW0172	36	50	FT	S	2.3	0.5	914.0	0.2	10.0	30.0	0.4	2.3	0.03	12.3	19.6	4.6	131.0	1.4	99.4	1.3	1.3	0.1	0.6	0.0	1.4	0.4	10.5	1.8	0.0	300.0	5.0	0.0	0.1	5.5	100.0	287.0	13.0	0.0	0.9	6.0	0.5	0.5	0.3	5.3	0.0	0.0	7.6	0.0	0.5	3.0	1.0	0.1	5.7	2550.0	19.0
BW-ARD-212	BW0113	220	230	FT	S	6.8	0.3	157.0	0.2	10.0	20.0	0.4	8.6	0.02	39.5	16.7	6.4	1.0	2.0	547.0	1.5	1.2	0.1	0.6	0.2	1.8	0.2	8.0	1.7	0.0	121.0	4.1	0.0	0.2	4.5	70.0	30.6	10.2	0.0	1.6	7.2	0.6	0.8	0.2	10.6	0.0	0.1	7.8	0.0	0.2	3.5	1.0	0.2	4.8	5150.0	16.9
BW-ARD-131	BW0082	286	296	FT	S	2.8	0.4	148.5	0.2	10.0	10.0	0.4	12.5	0.04	1.7	22.7	11.5	2.0	1.6	365.0	3.3	1.4	0.1	0.6	0.0	0.2	0.3	11.2	0.8	0.0	495.0	4.1	0.0	0.2	3.1	190.0	45.6	9.0	0.0	2.0	19.9	0.4	0.4	0.3	2.9	0.0	0.0	6.7	0.0	0.3	3.6	1.0	0.2	4.6	213.0	18.9
L016672	BW0089	8	17		O	4.5	1.7	60.6	0.2	10.0	30.0	0.5	5.9	0.06	49.4	28.8	16.0	27.0	5.9	27.8	3.2	5.9	0.1	0.2	0.0	0.4	0.4	13.4	20.3	0.7	2980.0	3.2	0.0	0.2	30.0	810.0	206.0	18.0	0.0	0.7	6.5	2.4	0.5	0.3	17.1	0.0	0.1	2.4	0.1	0.7	0.7	38.0	0.5	5.8	3990.0	6.4
BW-ARD-368	BW0161	175	185	FT	S	32.3	0.4	114.5	0.2	10.0	10.0	0.4	0.3	0.03	16.5	20.0	0.7	148.0	1.2	31.6	0.7	1.1	0.1	0.5	0.0	0.2	0.3	9.8	1.4	0.0	1640.0	6.1	0.0	0.2	4.0	30.0	118.0	9.7	0.0	0.6	11.6	0.3	0.3	0.2	1.2	0.0	0.0	7.2	0.0	0.2	2.9	1.0	0.1	4.3	5110.0	15.2
BW-ARD-210	BW0113	250	260	FT	S	3.3	0.3	321.0	0.2	10.0	10.0	0.3	8.4	0.02	24.5	19.8	9.7	1.0	1.0	324.0	1.7	1.0	0.1	0.5	0.1	0.8	0.2	8.8	1.0	0.0	521.0	3.9	0.0	0.1	1.4	100.0	32.0	8.2	0.0	1.6	5.0	0.5	0.4	0.2	11.8	0.0	0.1	8.8	0.0	0.2	3.9	1.0	0.1	4.3	2950.0	14.4
BW-ARD-503	BW0185	221	231	FT	S	0.6	0.3	824.0	0.2	10.0	20.0	0.4	0.4	0.03	0.9	29.1	2.3	90.0	0.5	66.0	1.2	1.2	0.1	0.7	0.0	0.0	0.2	13.8	1.2	0.0	1080.0	4.0	0.0	0.1	2.4	80.0	23.3	6.1	0.0	0.6	5.0	0.4	0.4	0.2	2.6	0.0	0.1	8.6	0.0	0.2	3.1	1.0	0.1	5.6	117.0	19.2
BW-ARD-598	BW0113	210	220	FT	S	2.0	0.4	137.5	0.2	10.0	20.0	0.4	6.5	0.02	22.3	18.8	4.3	4.0	1.9	153.5	1.2	1.0	0.1	0.6	0.1	0.7	0.2	9.6	1.0	0.0	150.0	4.3	0.0	0.1	3.4	70.0	23.2	9.3	0.0	1.1	5.5	0.4	0.5	0.2	8.5	0.0	0.0	7.7	0.0	0.2	3.7	1.0	0.1	5.1	3050.0	17.4
BW-ARD-102	BW0115	195	205	FT	S	5.3	0.3	105.0	0.2	10.0	30.0	0.2	0.8	0.01	24.3	24.2	1.6	1.0	0.9	36.8	0.4	0.9	0.1	0.6	0.0	0.2	0.2	11.9	0.5	0.0	48.0	3.7	0.0	0.7	0.9	50.0	913.0	7.2	0.0	0.5	8.8	0.3	0.7	0.2	3.4	0.0	0.0	8.8	0.0	0.4	4.8	1.0	0.1	8.5	4100.0	15.6
BW-ARD-413	BW0182	71	81	FT	T	27.9	0.6	77.0	0.2	10.0	10.0	0.9	1.1	0.05	27.9	25.2	1.6	153.0	3.3	65.2	0.7	1.7	0.1	0.6	0.0	0.1	0.3	11.9	4.8	0.0	2770.0	1.7	0.0	0.3	3.9	40.0	1795.0	18.4	0.0	0.6	31.2	0.4	0.8	0.3	2.8	0.0	0.0	9.4	0.0	0.4	3.1	1.0	0.2	4.9	6310.0	17.2
BW-ARD-531	BW0192	171	181	FT	S	0.6	0.6	23.4	0.2	10.0	40.0	0.5	1.8	0.03	4.0	29.3	1.3	4.0	1.8	50.6	1.3	1.8	0.1	0.6	0.0	0.4	0.3	14.0	2.8	0.0	385.0	2.5	0.0	0.1	0.6	100.0	14.5	13.0	0.0	0.5	4.2	0.6	0.3	0.3	4.5	0.0	0.0	8.0	0.0	0.7	2.9	1.0	0.1	6.1	1180.0	20.4
BW-ARD-369	BW0161	246	256	FT	S	4.6	0.5	278.0	0.2	10.0	10.0	0.4	0.4	0.04	6.1	18.8	1.3	122.0	1.1	78.8	1.6	1.4	0.1	0.5	0.0	0.2	0.3	9.3	1.2	0.0	3220.0	15.8	0.0	0.1	3.9	80.0	71.4	9.7	0.0	1.1	17.8	0.3	0.2	0.2	1.5	0.0	0.4	8.0	0.0	0.3	3.4	1.0	0.2	4.7	911.0	15.4
BW-ARD-346	BW0161	195	205	FT	S	18.1	0.4	707.0	0.2	10.0	20.0	0.4	0.2	0.04	8.5	22.1	0.9	122.0	1.5	26.3	0.8	1.3	0.1	0.6	0.0	0.1	0.3	11.0	0.9	0.0	1840.0	10.2	0.0	0.2	3.9	70.0	66.6	9.0	0.0	0.5	12.8	0.4	0.3	0.2	1.9	0.0	0.0	8.2	0.0	0.2	3.4	1.0	0.2	4.8	1840.0	17.1
BW-ARD-490	BW0178	302	315	FT	S	0.4	0.4	10.1	0.2	10.0	20.0	0.4	0.7	0.03	1.7	29.5	0.6	125.0	0.8	11.7	0.7	1.3	0.1	0.7	0.0	0.0	0.2	14.8	2.5	0.0	307.0	4.8	0.0	0.1	0.4	90.0	26.2	10.2	0.0	0.4	13.1	0.5	0.2	0.2	2.4	0.0	0.0	9.1	0.0	0.2	4.1	1.0	0.1	6.3	2000.0	23.5
BW-ARD-202	BW0116	104	114	VC	S	1.3	1.9	30.7	0.2	10.0	100.0	0.6	2.7	0.03	19.2	35.1	18.3	22.0	17.7	35.0	4.4	5.3	0.1	0.2	0.0	0.4	1.0	16.1	18.4	0.5	2690.0	2.0	0.0	0.3	34.5	140.0	93.8	51.5	0.0	1.9	14.0	2.7	0.9	0.5	18.4	0.0	0.0	4.3	0.3	1.9	0.7	41.0	0.8	6.5	5690.0	5.8
BW-ARD-025	BW0044	150	162	FT	S	2.6	0.3	245.0	0.2	10.0	20.0	0.3	4.9	0.01	25.9	16.0	1.9	1.0	0.9	85.6	1.1	0.9	0.1	0.7	0.1	0.5	0.2	7.8	0.9	0.0	436.0	7.4	0.0	0.8	0.9	40.0	123.5	8.4	0.0	0.9	7.0	0.4	0.5	0.2	4.4	0.0	0.1	8.8	0.0	0.2	4.7	1.0	0.2	6.5	2980.0	18.4
BW-ARD-174	BW0105	250	260	FT	S	1.2	0.4	73.3	0.2	10.0	20.0	0.4	3.0	0.04	20.8	28.7	4.9	3.0	1.0	92.4	1.6	1.3	0.1	0.6	0.0	0.6	0.3	14.8	1.4	0.0	159.0	3.6	0.0	0.2	0.4	80.0	34.3	8.7	0.0	1.2	12.4	0.4	0.3	0.2	3.5	0.0	0.1	7.1	0.0	3.5	3.1	1.0	0.1	4.8	2110.0	17.4
BW-ARD2-4	BW0043	150	160	FT	S	1.5	0.5	148.5	0.2	10.0	30.0	0.5	2.3	0.01	23.5	18.4	1.2	1.0	1.2	30.3	0.8	1.4	0.1	0.9	0.1	0.3	0.4	8.0	1.3	0.0	76.0	1.8	0.0	0.2	1.2	40.0	53.9	12.0	0.0	0.8	13.7	0.7	0.4	0.2	5.6	0.0	0.0	11.1	0.0	0.3	4.7	1.0	0.2	7.1	3180.0	22.5
BW-ARD-448	BW0172	89	99	FT	S	0.5	0.7	57.4	0.2	10.0	30.0	0.6	1.4	0.11	22.9	24.7	4.7	118.0	2.8	29.5	2.3	2.2	0.1	0.5	0.0	0.8	0.4	12.9	7.5	0.1	1340.0	3.8	0.0	0.1	10.0	470.0	9.5	15.6	0.0	1.1	3.9	0.9	0.6	0.3	7.1	0.0	0.0	6.8	0.0	0.6	2.2	6.0	0.1	6.7	3390.0	17.4
BW-ARD-035	BW0049	111	121	VC	S	2.2	0.4	46.7	0.2	10.0	20.0	0.6	0.6	0.02	1.2	14.5	0.3	3.0	0.9	49.8	1.8	0.9	0.1	0.6	0.0	0.2	0.3	7.4	1.1	0.0	824.0	0.6	0.0	0.5	2.1	50.0	216.0	8.8	0.0	1.1	6.1	0.5	0.2	0.2	3.8	0.0	0.0	7.9	0.0	0.2	3.2	1.0	0.1	4.5	703.0	18.2
BW-ARD-036	BW0059	266	277	VC	S	2.3	0.6	89.5	0.2	10.0	20.0	0.5	7.4	0.22	0.3	26.6	15.8	4.0	3.5	508.0	4.8	2.2	0.1	0.3	0.0	0.1	0.3	12.8	3.9	0.1	2170.0	5.8	0.0	0.1	15.8	970.0	33.4	12.9	0.0	3.5	15.9	0.9	0.4	0.2	26.1	0.0	1.9	5.0	0.0	1.1	1.3	9.0	0.3	5.0	91.0	11.5
BW-ARD-152	BW0092	253	263	VC	S	1.0	0.8	138.5	0.2	10.0	40.0	0.4	1.6	0.27	14.1	29.7	11.0	8.0	4.7	81.3	3.3	2.3	0.1	0.5	0.0	0.2	0.5	14.0	8.3	0.1	1780.0	3.1	0.0	0.4	20.0	1270.0	13.0	25.8	0.0	1.8	13.1	1.0	0.6	0.2	18.7	0.0	0.0	6.3	0.

Table A2-2: Elemental Content Analytical Results - Waste Rock Results

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
						ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Average Crustal Abundance*						0.075	8.23	1.8	4	10	425	3	0.085	4.15	0.15	66.5	25	102		60	5.6	19	1.5	3	0.085	0.25	2.1	39	20	2.33	950	1.2	2.355	20	84	0.015	14	90	0.0007	0.03	0.2	22	0.05	2.3	370	2		9.6	0.565	0.85	2.7	120	1.25	33	70	165
BW-ARD-456	BW0174	66	76	VC	S	4.6	0.5	149.5	0.2	10.0	20.0	0.5	0.7	0.04	12.6	17.5	2.0	104.0	2.8	36.9	1.0	1.3	0.1	0.5	0.1	0.2	0.3	8.2	2.4	0.0	1560.0	1.1	0.0	0.1	3.5	140.0	992.0	11.7	0.0	0.5	8.0	0.3	0.3	0.2	2.9	0.0	0.0	6.8	0.0	4.4	2.5	1.0	0.1	3.6	2340.0	13.6
COMPWV00638-W006068	BWWR13	84	96	FT	T	7.6	0.3	123.0	0.2	10.0	20.0	0.3	0.1	0.01	16.9	31.5	0.3	8.0	1.3	1.7	0.8	0.6	0.1	0.8	0.2	0.1	0.2	15.8	1.9	0.0	74.0	3.3	0.0	0.8	1.0	80.0	278.0	7.0	0.0	0.2	13.3	0.4	0.2	0.2	2.0	0.0	0.0	8.1	0.0	1.4	1.0	0.2	7.2	543.0	24.5
BW-ARD 670	GM12-04	132	142	VC	S	20.6	2.8	16.8	0.2	10.0	140.0	0.8	2.1	0.35	40.5	18.6	15.0	27.0	20.6	78.7	5.4	7.1	0.1	0.2	0.0	0.6	1.7	7.7	42.9	0.9	4720.0	1.2	0.0	0.3	22.5	1350.0	2900.0	85.1	0.0	0.4	31.5	3.6	0.2	1.0	17.7	0.0	0.0	4.2	0.2	1.9	0.8	50.0	0.5	6.2	5310.0	7.9
BW-ARD-230	BW0087	250	260	AND	S	1.1	3.0	371.0	0.2	10.0	90.0	0.5	5.4	0.40	66.8	24.2	23.9	42.0	22.0	58.2	7.5	7.9	0.2	0.1	0.0	1.8	2.1	11.8	30.6	1.1	3040.0	2.5	0.0	0.4	31.7	1790.0	13.9	88.1	0.0	2.4	11.1	3.7	1.9	1.1	14.9	0.0	0.1	3.6	0.3	1.8	0.3	69.0	0.3	7.2	8710.0	3.0
BW-ARD-085	BW0066	215	225	AND	S	1.5	4.6	52.4	0.2	10.0	120.0	1.2	1.2	1.09	2.1	22.3	17.3	41.0	36.3	38.5	7.9	10.3	0.2	0.1	0.0	0.1	2.1	10.4	61.7	1.3	3530.0	2.2	0.1	0.4	29.1	1730.0	18.6	115.0	0.0	2.3	6.5	4.4	0.4	0.9	56.2	0.0	0.1	3.8	0.3	2.9	0.3	82.0	0.5	6.2	472.0	2.1
BW-ARD-045	BW0063	15	25	FT	T	1.3	0.4	34.0	0.2	10.0	60.0	0.2	0.8	0.01	165.0	20.7	1.9	1.0	1.3	83.3	0.9	1.1	0.1	0.4	0.0	1.5	0.3	9.5	1.7	0.0	36.0	1.2	0.0	0.2	1.3	40.0	1095.0	11.3	0.0	0.3	4.9	0.3	0.2	0.2	2.4	0.0	0.3	7.8	0.0	0.5	2.5	1.0	0.1	3.2	1380.0	9.4
BW-ARD-343	BW0161	93	100	FT	T	17.8	0.4	253.0	0.2	10.0	20.0	0.7	0.3	0.03	6.2	23.0	0.8	130.0	1.9	25.2	0.6	1.4	0.1	0.6	0.0	0.1	0.3	11.4	1.3	0.0	2820.0	3.8	0.0	0.2	3.2	50.0	443.0	11.6	0.0	0.3	8.7	0.5	0.3	0.2	2.0	0.0	0.1	8.7	0.0	0.2	3.7	1.0	0.2	5.0	1560.0	16.2
BW-ARD-108	BW0065	265	275	AND	S	2.5	3.6	58.0	0.2	10.0	90.0	0.8	8.7	0.47	1.7	15.7	19.1	49.0	14.1	424.0	7.4	11.6	0.2	0.1	0.0	0.4	2.3	7.4	48.0	1.5	1980.0	3.1	0.0	0.2	27.8	1700.0	20.3	89.3	0.0	1.9	6.2	6.0	0.5	1.7	26.1	0.0	0.1	2.1	0.3	1.5	0.2	96.0	0.5	5.5	887.0	2.8
COMPM274731-M274740	BWWR02	105	115	VC	S/O	6.1	8.9	132.4	0.1		810.0	2.0	1.6	0.39	27.3	22.6	79.6			89.4	4.9	20.0					4.5	20.0			0.3	4066.3	3.8	0.1		41.9	1595.0	150.0			1.1	24.3	12.5			44.6			10.0	0.5	6.3	5.6	135.3	12.5		5588.9	
BW-ARD-074	BW0072	246	256	FT	S	0.8	0.3	216.0	0.2	10.0	40.0	0.4	0.5	0.02	9.1	24.3	0.3	3.0	0.4	116.5	0.9	1.0	0.1	0.6	0.0	0.2	0.2	12.2	0.7	0.0	162.0	2.6	0.0	0.2	0.4	60.0	97.3	5.4	0.0	0.4	6.0	0.4	0.2	0.2	3.5	0.0	0.1	8.1	0.0	0.3	3.3	1.0	0.3	5.1	929.0	17.9
BW-ARD-162	BW0097	56	66	AND	T	1.2	1.8	25.8	0.2	10.0	130.0	1.2	2.2	0.36	68.3	45.2	20.2	20.0	24.2	64.0	4.5	5.1	0.1	0.2	0.1	0.8	1.1	21.6	31.3	0.4	1340.0	2.5	0.0	0.2	33.1	1610.0	191.5	59.1	0.0	1.3	7.0	2.4	1.3	0.3	24.8	0.0	0.0	4.5	0.2	3.2	0.9	54.0	0.2	13.3	8050.0	7.7
BW-ARD 618	GM12-01	248	258	AND	S	1.4	2.5	906.0	0.2	10.0	30.0	0.9	1.1	0.82	9.5	29.3	14.3	34.0	28.4	60.1	4.8	7.5	0.1	0.2	0.0	0.1	0.1	12.8	12.8	0.7	1980.0	5.1	0.1	0.2	27.3	1520.0	15.1	106.0	0.0	1.5	22.0	3.9	0.4	0.5	30.6	0.0	0.0	3.4	0.1	1.9	1.0	60.0	0.2	6.5	938.0	3.5
BW-ARD-090	BW0110	57	67	AND	S	1.3	2.2	289.0	0.2	10.0	150.0	0.7	2.6	0.35	47.3	40.5	27.0	30.0	34.1	104.0	4.5	6.3	0.2	0.1	0.0	0.7	1.4	19.3	28.2	0.3	2320.0	2.0	0.0	0.3	50.0	1660.0	134.5	83.3	0.0	1.4	18.7	2.7	1.0	0.4	39.7	0.0	0.0	4.1	0.2	2.5	1.1	48.0	0.9	12.5	10750.0	4.9
BW-ARD-166	BW0099	94	104	FT	T	7.9	0.4	60.8	0.2	10.0	120.0	0.1	0.3	0.01	53.0	17.5	0.6	2.0	0.8	87.0	0.7	0.9	0.1	0.3	0.0	0.1	0.1	8.8	1.0	0.0	22.0	7.3	0.0	0.1	1.0	100.0	2210.0	4.5	0.0	0.2	19.3	0.3	0.2	0.2	2.4	0.0	0.1	7.0	0.0	0.2	4.4	1.0	0.1	2.5	780.0	7.4
BW-ARD-424	BW0187	35	45	VC	T	12.6	0.5	827.0	0.2	10.0	10.0	0.8	0.5	0.02	6.4	28.0	0.6	130.0	2.1	25.6	0.6	1.5	0.1	0.6	0.0	0.0	0.3	13.3	4.0	0.0	1590.0	4.5	0.0	0.2	4.7	60.0	1270.0	16.2	0.0	0.2	11.1	0.3	0.3	0.2	1.5	0.0	0.0	8.6	0.0	0.3	2.9	1.0	0.1	5.4	1120.0	16.8
BW-ARD-096	BW0112	290	300	VC	S	6.8	1.2	462.0	0.2	10.0	30.0	0.8	9.9	0.52	16.4	15.7	13.4	20.0	8.6	161.5	3.8	3.6	0.1	0.2	0.0	0.3	0.5	7.5	15.0	0.3	455.0	2.1	0.0	0.4	22.6	1300.0	318.0	30.8	0.0	1.8	5.2	2.7	0.5	0.3	22.5	0.0	0.0	4.7	0.1	0.7	0.8	34.0	0.4	6.1	1650.0	7.7
BW-ARD-337	BW0100	265	275	SED	S	0.3	1.2	7.7	0.2	10.0	120.0	0.5	0.1	0.34	0.4	11.2	6.9	215.0	1.9	45.7	1.9	3.2	0.1	0.1	0.0	0.0	0.3	6.3	17.5	0.5	123.0	3.4	0.1	0.1	55.0	300.0	3.4	17.3	0.0	0.7	0.7	2.8	1.0	0.4	41.8	0.0	0.1	1.5	0.0	0.2	0.2	28.0	0.1	2.4	44.0	2.1
BW-ARD-501	BW0185	117	127	VC	T	0.7	1.9	636.0	0.2	10.0	40.0	0.6	1.0	0.21	0.8	34.1	9.7	124.0	18.6	20.5	4.6	5.3	0.1	0.3	0.0	0.1	1.1	16.0	20.7	0.2	3670.0	4.7	0.0	0.3	17.4	820.0	12.1	65.0	0.0	0.6	8.8	1.6	0.3	0.8	6.8	0.0	0.0	6.2	0.2	2.1	1.3	25.0	0.6	4.7	537.0	12.2
BW-ARD-032	BW0052	120	130	VC	S	2.1	2.3	98.6	0.2	10.0	280.0	5.0	0.7	0.4	10.1	19.5	7.1	12.0	23.9	20.9	5.8	6.6	0.1	0.5	0.0	0.1	1.4	9.7	42.2	0.3	2860.0	3.1	0.0	0.3	8.7	510.0	74.0	70.7	0.0	0.9	10.7	1.9	0.3	1.1	9.5	0.0	0.1	6.6	0.1	1.6	2.0	22.0	1.0	5.5	458.0	17.9
COMPM261232-M261241	BWWR08	75	84	VC	T	2.2	7.1	23.3	0.0		156.3	1.6	1.5	0.02	4.1		0.6	6.5		1.3	0.9	15.0					3.2	20.0			0.1	1566.9	3.8	0.1		1.1	81.3	179.9			0.3	8.5	2.8			14.6			10.0	0.1	5.0	5.6	1.0	6.3		423.4	
BW-ARD-088	BW0067	215	225	AND	S	1.7	3.8	131.0	0.2	10.0	90.0	1.2	2.4	0.60	6.7	16.4	16.5	46.0	21.4	138.0	8.1	12.5	0.2	0.1	0.0	0.2	2.2	7.5	53.6	1.5	2540.0	2.8	0.1	0.3	28.7	1680.0	19.8	89.6	0.0	2.3	4.4	5.9	0.4	1.0	49.3	0.0	0.4	2.6	0.3	2.0	0.3	93.0	1.1	5.4	1180.0	2.9
BW-ARD-087	BW0067	66	76	AND	S	3.4	2.5	44.2	0.2	10.0	130.0	0.8	7.1	0.42	52.0	24.6	21.7	43.0	18.2	89.1	6.0	6.9	0.2	0.1	0.0	0.0	1.9	11.7	36.2	0.4	2730.0	2.5	0.0	0.3	33.9	1830.0	497.0	65.3	0.0	1.7	6.7	4.2	0.9	0.7	44.0	0.0	0.3	3.5	0.2	1.4	0.6	63.0	1.0	8.1	8150.0	4.7
COMPM261955-M261964	BWWR03	124	133	VC	T	0.5	7.4	322.0	0.1		1120.0	1.8	1.0	0.17	17.5		4.0	25.0		31.0	2.5	20.0					5.3	20.0			0.2	1110.0	2.0	0.2		4.0	580.0	42.0			0.6	17.0	5.0			66.0			10.0	0.2	5.0	5.0	44.0	5.0		1920.0	
BW-ARD-052	BW0070	120	130	VC	T	0.6	2.1	71.6	0.2	20.0	60.0	0.8	1.3	0.32	13.3	38.3	13.4	26.0	29.8	42.5	5.7	6.6	0.1	0.2	0.0	0.2	0.2	13.3	18.7	25.0	3250.0	2.9	0.0	0.3	25.1	1230.0	8.4	69.7	0.0	1.5	7.3	3.0	0.3	0.7	9.5	0.0	0.0	5.0	0.2	2.2	0.9	44.0	0.3	6.0	1680.0	8.5
BW-ARD-284	BW0097	56	66	AND	S	2.7	2.0	31.0	0.2	10.0	130.0	1.1	4.2	0.33	92.3	49.2	25.5	22.0	28.2	88.9	5.2	5.8	0.1	0.2	0.1	0.8	1.3	23.2	34.6	0.4	1580.0	2.7	0.0	0.2	39.0	1560.0	439.0	69.3	0.0	1.8	11.0	2.4	1.1	0.4	25.3	0.0	0.0	4.7	0.2	3.8	0.9	61.0	0.2	17.2	9550.0	8.2
COMPWV006185-W006195	BWWR13	196	206		S	0.7	7.8	1190.0	0.0		1060.0	1.5	1.0	1.20	7.1		14.0	55.0		59.0	5.4	20.0					3.2	20.0			0.2	1930.0	4.0	0.4		44.0	1000.0	19.0			1.4	15.0	21.0			90.0			10.0	0.4	5.0	5.0	150.0	5.0		926.0	
BW-ARD-103	BW0116	262	272	AND	S	0.4	0.3	74.4	0.2	10.0	20.0	0.3	0.5	0.03	0.8	15.2	2.0	3.0	1.2	76.4	0.9	0.9	0.1	0.5	0.0	0.0	0.2	7.6	0.9	0.0	877.0	3.7	0.0	0.1	5.9	120.0	8.8	8.3	0.0	0.4	3.0	0.6	0.2	0.3	15.3	0.0	0.0	6.0	0.0	0.2	2.1	2.0	0.1	3.8	103.0	15.8
BW-ARD-184	BW0109	213	223	FT	T	0.5	1.1	70.4	0.2	10.0	40.0	0.8	3.2	0.07	9.1	35.1	6.4	3.0	3.8	68.7	2.3	3.1	0.1	0.6	0.0	1.0	0.6	18.8	9.0	0.2	603.0	1.7	0.0	0.4	5.7	250.0	12.1	29.6	0.0	0.9	7.8	0.7	0.5	0.3	5.9	0.0	0.1	8.3	0.0	1.0	2.3	5.0	0.1	4.9	2580.0	18.7
COMPM274721-M274730	BWWR02	95	105	VC	S	2.8	8.6	184.9	0.0		692.9	1.9	1.3	0.41	19.2		18.1	62.4		48.7	5.2	20.0					4.3	18.6			0.2	4558.6	2.6	0.1		27.0	1637.1	107.1			1.0	28.7	12.4			39.1			10.0	0.5	5.7	5.0	134.3	8.6		2906.7	
BW-ARD-208	BW0114	52	62	AND	T	4.0	3.5	42.8	0.2	10.0	100.0	0.5	7.6	0.24	159.0	21.9	40.2	43.0	26.3	138.0	6.8	9.2	0.1	0.1	0.0	1.4	2.0	9.8	62.0	1.2	4120.0	1.9	0.0	0.3	40.5	1240.0	120.5	75.5	0.0	1.6	7.7	4.1	0.6	0.8	37.4	0.0	0.1	3.5	0.3	1.7	0.6	68.0	0.7	5.7	5340.0	2.1
BW-ARD-581	BW0066	290	300	FT	S	1.1	0.4	162.5	0.2	10.0	20.0	0.6	0.2	0.07	2.2	23.7	0.4	4.0	0.9	19.2	1.4	1.2	0.1	0.7	0.0	0.0	0.2	12.6	2.5	0.0	248.0	1.4	0.0	0.1	2.4	70.0	56.4	9.4	0.0	0.3	9.3	0.3	0.2	0.2	6.4	0.0	0.0	8.4	0.0	0.2	3.7	0.5	0.1	5.1	324.0	19.1
BW-ARD-474	BW0175	48	58	VC	S	5.5	1.6	366.0	0.2	10.0	110.0	0.9	0.3	0.12	28.2	44.7	12.9	66.0	39.1	99.3	4.5	4.8	0.1	0.1	0.0	0.1	0.9	19.5	17.0	0.1	3290.0	2.5	0.0	0.3	8.1	1590.0	1335.0	71.0	0.0	0.3	18.8	2.5	0.6	0.6	73.7	0.0	0.0	3.7	0.2	3.3	0.7	38.0	0.3	6.6	1790.0	2.7
BW-ARD-366	BW0161	110	120	FT	T	22.3	0.4	161.5	0.2	10.0	10.0	0.6	0.5	0.02	9.0	22.9	0.7	138.0	1.7	18.1	0.5	1.2	0.1	0.6	0.0	0.1	0.3	11.2	0.9	0.0	1310.0	3.8	0.0	0.2	3.6	50.0	287.0	11.2	0.0	0.3	8.2	0.4	0.3	0.2	1.7	0.0	0.0	8.8	0.0	0.2	3.8	1.0	0.1	5.7	2220.0	16.2
COMPQ011351-Q011360	BWWR01	72	82	AND	S	0.4	9.0	35.5	0.0		1148.8	1.5	2.0	0.66	2.5		19.6	63.0		81.9	5.1	20.0					4.6	16.3			0.5	4173.8	0.9	0.3		28.4	1895.0	15.1			1.0	19.9	12.4			77.1			10.0	0.6	6.9	6.3	132.1	5.6		439.1	
BW-ARD-476	BW0175	124	134	FT	S	1.8	4.1	58.0	0.2	10.0	120.0	1.8	0.8	0.98	24.1	26.7	16.3	56.0	29.4	98.3	6.5	13.7	0.2	0.1	0.0	0.5	0.9	11.5	89.0	1.0	2910.0	2.2	0.1	0.3	25.8	1950.0	383.0	54.0	0.0	1.6	9.1	8.9	0.8	0.5	62.0	0.0	0.0	2.7	0.2	1.9	0.4	125.0	0.3	8.6	3350.0	2.7
BW-ARD-077	BW0103	119	129	FT	S	5.1	0.6	67.5	0.2	10.0	40.0	0.6	0.9	0.05	11.4	33.9	1.5	3.0	1.5	54.7	3.0	1.5	0.1	0.6	0.0	0.3	0.3	17.1	2.5	0.1	890.0	3.1	0.0	0.1	3.2	190.0	854.0	8.8	0.0	1.3	7.9	0.6	0.4	0.4	13.3	0.0	0.1	7.3	0.0	1.2	2.7	3.0	0.2	6.3	1630.0	17.0
BW-ARD-059	BW0070	75	85	VC	S	0.8	1.3	230.0	0.2	10.0	70.0	1.2	1.0	0.88	25.9	27.9	20.4	96.0	28.8	89.9	5.0	8.0	0.1	0.1	0.0	0.2	1.3	12.4	31.3	0.5	2180.0	3.1	0.1	0.4	33.0	1760.0	26.1	96.2	0.0	1.2	5.4	4.8	0.6	0.6	64.7	0.0	0.0	4.0	0.3	2.5	0.4	73.0	0.4	8.8	3190.0	2.5
BW-ARD-139	BW0087	34	44	VC	S	2.1	3.1	61.1	0.2	10.0	150.0	0.5	3.9	0.38	35.8	23.5	15.7	45.0	19.7	50.3	5.8	8.1	0.1	0.1	0.0	0.1	1.1	11.2	41.1	1.4	4410.0	1.9	0.0	0.2	3.5	1690.0	137.5	72.2	0.0	1.5	7.1	3.9	1.1	0.7	23.4	0.0	0.0	5.2	0.2	1.5	0.4	72.0	0.3	7.2	8090.0	3.4
BW-ARD-536	BW0198	141	151	VC	S	0.5	1.5	86.6	0.2	10.0	30.0	1.2	1.5	0.40	1.7	38.4	9.5	19.0	10.9	34.8	2.5	5.4	0.1	0.2	0.0	0.1	0.5	19.0	14.4	0.2	1280.0	1.7	0.0	0.1	15.6	980.0	11.0	50.0	0.0	0.4	5.9	4.1	0.4	0.3	15.9	0.0	0.0	6.2	0.0	1.2	1.3	35.0	0.2	7.7	261.0	9.9
BW-ARD-078	BW0068	41	51	VC	O	2.3	1.6	80.5	0.2	10.0	150.0	0.7	2.1	0.04	62.6	28.4	9.1	21.0	10.1	105.0	2.4	4.6	0.1	0.1	0.0	1.6	0.5	14.7	5.0	0.1	448.0	1.5	0.0	0.1	9.3	250.0	202.0	24.4	0.0	0.2	8.9	3.8	0.4	0.7	39.1	0.0	0.0	4.0	0.0	1.3	1.3	46.0	0.1	5.9	1090.0	4.7
BW-ARD 641	GM12-03	118	128	AND	S	8.2	2.6	100.5	0.2	10.0	160.0	0.6	1.5	0.40	13.3	23.3	18.0	31.0	21.1	84.8	4.3	7.2	0.1	0.1	0.1	0.1	1.3	10.7	31.0	0.7	3820.0	3.8	0.0	0.3	43.7	1690.0	691.0	66.7	0.0	0.9	15.8	4.4	0.6	0.7	24.7	0.0	0.0	3.2	0.2	1.7	0.5	47.0	80.0	6.9	3160.0	5.5
BW-ARD-037_Dup		32	24	27.6	0.2	10.0	70.0	0.7	3.6	0.20	26.8	21.3	15.0	29.0	21.3	56.5	4.4	7.1	0.1	0.2	0.0	0.6	1.3	11.0	33.3	0.8	3730.0	3.6	0.0	0.2	30.6	860.0	770.0	55.6	0.0	0.6	7.9	4.1	0.7	0.7	34.2	0.0	0.1	4.2	0.2	1.3	1.0	51.0	0.7	7.3	4690.0	10.5
COMPM274691-M274700	BWWR02	69	78	VC	S	2.0	8.7	84.6	0.0		825.0	1.8	1.6	0.44	11.9		16.9	71.0		42.5	3.9	20.0					4.8	17.5			0.3	3552.5	1.8	0.1		28.6	1797.5	210.5			0.7	18.6	12.3			40.4			10.0	0.6	5.0	5.0	141.1	6.9		1787.8	
COMPM274711-M274720	BWWR02	87	95	VC	S	2.9	8.6	86.6	0.0		1032.9	1.8	1.1	0.43	11.1		21.4	66.7		75.9	4.2	20.0					4.5	20.0			0.3	2771.4	2.1	0.1		30.7	1771.4	183.3			0.7	20.1	12.6			35.0			10.0	0.6	6.4	5.0	137.0	5.0		1476.3	
COMPM261945-M261954	BWWR03	115	124	VC	T	0.3	7.2	35.0	0.2		1190.0	1.5	2.0	0.18	3.8		4.0	28.0		14.0	2.6	20.0					5.4	20.0			0.2	1495.0	1.0	0.2		4.0	530.0	50.0			0.2	12.0	5.0			77.0			10.0	0.2	5.0	5.0	36.0	5.0		671.0	
BW-ARD-236	BW0082	200	210	AND	S	3.4	3.2	76.9	0.2	10.0	120.0	0.6	18.1	0.36	6.7	25.3	23.8	45.0	18.0	577.0	7.8	10.2	0.2	0.1	0.0	0.7	2.4	12.3	36.2	1.3	2280.0	3.1	0.0	0.3	30.5	1620.0	12.9	86.4	0.0	1.5	5.3	5.2	1.6	1.4	17.0	0.0	0.2	2.8	0.3	1.7	0.4	81.0	0.6	6.5	1220.0	3.0
BW-ARD 630	GM12-02	344	354	VC	S	2.8	1.1	104.5	0.2	10.0	30.0	0.4	3.1	0.47	27.7	19.3	8.9	11.0	8.5	66.0	2.7	2.8	0.1	0.3	0.0	0.5	0.6	8.8	10.0	0.2	966.0	3.7	0.0	0.5	20.4	710.0	210.0	42.1	0.0	1.1	8.4

Table A2-2: Elemental Content Analytical Results - Waste Rock Results

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
						ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Average Crustal Abundance*						0.075	8.23	1.8	4	10	425	3	0.085	4.15	0.15	66.5	25	102		60	5.6	19	1.5	3	0.085	0.25	2.1	39	20	2.33	950	1.2	2.355	20	84	0.015	14	90	0.0007	0.03	0.2	22	0.05	2.3	370	2		9.6	0.565	0.85	2.7	120	1.25	33	70	165
BW-ARD-125	BW0080	132	142	AND	S	1.2	5.3	12.6	0.2	10.0	130.0	0.9	2.6	13.4	58.3	1.8	2960.0	2.4	0.3	0.3	25.7	1750.0	22.6	128.0	0.0	1.3	4.1	9.7	0.7	1.5	91.3	0.0	0.1	2.7	0.4	2.3	0.3	139.0	0.5	8.1	2620.0	2.3
BW-ARD-080	BW0075	54	64	VC	S	1.6	2.0	97.8	0.2	10.0	100.0	0.7	2.8	0.20	13.5	17.7	9.9	22.0	11.6	33.3	4.6	5.5	0.1	0.6	0.0	0.4	1.4	8.8	25.4	0.4	2600.0	4.0	0.0	0.3	17.8	850.0	111.5	61.8	0.0	0.9	3.9	3.1	0.7	0.7	16.0	0.0	0.1	5.5	0.2	1.4	1.9	37.0	1.2	6.6	3310.0	20.2
BW-ARD-361	BW0173	218	228	VC	S	5.4	2.2	418.0	0.2	10.0	150.0	0.8	0.1	0.41	16.7	38.8	19.4	82.0	44.5	49.2	5.5	6.0	0.1	0.1	0.0	0.0	1.1	18.4	34.3	0.1	2550.0	3.4	0.0	0.3	33.3	1690.0	1575.0	73.0	0.0	0.8	10.6	3.0	0.5	0.5	15.9	0.0	0.0	3.6	0.2	3.1	0.5	53.0	0.3	7.0	2280.0	3.3
BW-ARD-092	BW0111	290	300	AND	S	3.7	3.8	102.0	0.2	10.0	130.0	0.7	6.0	0.70	61.1	21.4	18.5	43.0	15.9	104.0	6.4	11.2	0.2	0.1	0.0	1.7	2.2	10.2	40.0	1.2	4000.0	1.5	0.1	0.3	32.1	1610.0	61.9	89.3	0.0	1.3	4.5	5.3	0.9	1.1	50.6	0.0	0.1	4.2	0.3	1.8	0.4	78.0	0.3	6.4	6880.0	5.6
BW-ARD-136	BW0085	215	225	VC	S	1.0	5.5	18.6	0.2	10.0	110.0	1.2	4.0	1.46	31.0	25.4	17.9	72.0	25.3	141.5	6.0	16.4	0.2	0.1	0.0	1.7	2.3	12.0	42.8	1.8	2730.0	3.9	0.3	0.3	27.4	1670.0	27.2	103.5	0.0	1.3	4.3	10.0	0.9	1.0	137.5	0.0	0.1	2.4	0.3	1.5	0.4	135.0	0.6	7.5	4140.0	2.8
COMPN274741-M274750	BWWR02	115	125	VC	O	2.5	8.6	199.1	0.0		1340.0	1.8	1.0	0.22	13.9	10.1	39.6		41.1	3.0	20.0						4.8	20.0		0.2	2123.6	2.6	0.1			13.4	1012.9	61.0				0.3	24.9	7.9			56.7			10.0	0.3	8.6	5.7	80.7	7.9		2645.0	
BW-ARD-024	BW0043	180	190	FT/VC	S	0.4	1.7	78.5	0.2	10.0	110.0	0.8	1.0	0.29	15.4	26.7	11.1	16.0	20.6	32.6	3.4	5.0	0.1	0.4	0.0	0.2	1.0	12.8	28.0	0.4	2460.0	2.2	0.0	0.3	14.5	1000.0	10.1	58.8	0.0	0.7	7.0	2.7	0.5	0.4	31.7	0.0	0.0	6.2	0.1	1.8	2.5	38.0	0.4	7.7	1960.0	11.8
COMPW0060047-W006057	BWWR13	74	84		S	5.9	0.3	306.0	0.2	10.0	30.0	0.3	0.1	0.01	39.0	31.7	0.4	7.0	1.2	1.5	0.5	1.0	0.1	0.7	0.2	0.1	0.2	16.0	2.0	0.0	79.0	3.4	0.0	0.6	1.3	50.0	366.0	8.2	9.0	0.0	0.2	15.3	0.4	0.3	0.2	2.5	0.0	0.0	0.6	0.0	0.3	3.6	1.0	0.1	7.1	934.0	21.7
BW-ARD-418	BW0182	167	177	VC	S	10.7	0.5	243.0	0.2	10.0	10.0	0.8	1.0	0.04	7.2	18.2	0.9	107.0	3.0	38.5	0.6	1.3	0.1	0.6	0.0	0.0	0.3	8.6	5.2	0.0	333.0	0.6	0.0	0.4	2.9	90.0	562.0	18.4	0.0	0.2	17.0	0.2	0.4	0.2	3.0	0.0	0.0	8.6	0.0	0.3	3.3	1.0	0.4	5.2	2070.0	19.4
BW-ARD-509	BW0186	103	113	VC	S	0.7	1.0	12.0	0.2	10.0	40.0	0.5	2.5	0.08	0.8	28.1	3.8	88.0	7.7	30.0	2.3	3.4	0.1	0.7	0.0	0.2	0.6	13.2	17.6	0.1	1450.0	2.1	0.0	0.4	7.0	320.0	19.7	45.8	0.0	0.3	2.8	1.1	0.3	0.5	4.0	0.0	0.0	7.9	0.1	1.3	2.5	9.0	0.2	6.9	187.0	22.7
COMPW0066243-W006253	BWWR13	246	256	SED	S	2.9	7.3	134.0	0.0		820.0	1.3	1.0	0.68	7.3		10.0	91.0		52.0	4.2	20.0						3.3	10.0		0.7	2200.0	3.0	0.1			86.0	670.0	206.0				1.0	31.0	18.0			41.0			10.0	0.4	5.0	5.0	154.0	5.0		973.0	
BW-ARD-509_Dup				VC	S	0.6	1.1	23.2	0.2	10.0	50.0	0.6	4.2	0.08	0.8	29.0	3.9	10.0	7.3	27.3	2.3	3.9	0.1	0.7	0.0	0.2	0.7	14.3	19.0	0.1	1360.0	2.0	0.0	0.5	6.1	310.0	19.9	46.9	0.0	0.3	3.5	1.3	0.2	0.5	4.6	0.0	0.0	7.6	0.1	1.2	2.7	8.0	0.3	7.1	178.0	21.9
COMPM274780-M274790	BWWR02	149	161	VC	T	2.4	8.0	56.5	0.1		1306.3	1.7	1.6	0.14	13.5		33.3	27.5		15.6	1.9	20.0						5.2	20.0		0.2	2024.3	3.5	0.1			6.1	496.3	189.1				0.3	21.8	4.5			53.0			10.0	0.2	6.3	10.0	37.9	5.0		2238.0	
BW-ARD-124	BW0080	60	70	AND	S	1.6	3.4	23.7	0.2	10.0	280.0	0.6	3.7	0.29	22.4	25.5	16.4	37.0	21.5	57.2	5.1	8.2	0.1	0.1	0.0	1.8	2.2	11.9	45.3	1.4	2670.0	1.5	0.0	0.2	29.4	1290.0	37.4	76.0	0.0	0.9	6.6	4.3	1.2	1.0	28.2	0.0	0.1	3.4	0.3	1.4	0.8	57.0	0.3	11.0	7960.0	4.3
BW-ARD-454	BW0174	40	50	VC	S	3.1	0.7	37.2	0.2	10.0	20.0	0.6	0.3	0.13	8.4	20.3	4.0	96.0	4.2	32.1	1.5	2.1	0.1	0.5	0.0	0.2	0.3	9.5	6.2	0.1	3300.0	1.6	0.0	0.1	8.8	410.0	460.0	11.2	0.0	0.4	8.8	0.7	0.4	0.2	5.9	0.0	0.0	5.9	0.0	0.2	2.4	6.0	0.1	5.4	2300.0	14.5
BW-ARD-458	BW0174	124	134	AND	S	4.4	2.7	32.4	0.2	10.0	70.0	0.8	1.1	0.41	19.4	40.3	13.9	76.0	18.1	35.4	5.2	8.2	0.1	0.3	0.2	0.6	1.0	18.5	33.9	0.9	5210.0	1.3	0.0	0.3	18.2	1390.0	1265.0	53.6	0.0	0.9	13.6	4.2	0.7	0.8	16.8	0.0	0.0	4.9	0.1	1.4	1.4	53.0	0.4	7.7	3150.0	12.3
BW-ARD-347	BW0173	69	79	VC	O	3.8	0.4	133.0	0.2	10.0	40.0	0.2	0.3	0.02	1.5	24.6	0.5	81.0	1.9	9.5	0.7	1.1	0.1	0.7	0.0	0.0	0.3	12.7	1.5	0.0	51.0	1.5	0.0	0.2	1.9	120.0	1160.0	13.0	0.0	0.1	14.1	0.5	0.2	0.2	2.8	0.0	0.0	6.6	0.0	0.3	1.7	1.0	0.1	4.2	132.0	14.0
L016687	BW0249	69	78	O		8.6	0.3	413.0	0.2	10.0	30.0	0.4	0.2	0.02	2.5	22.2	0.5	2.0	4.0	24.4	2.7	0.9	0.1	0.4	0.1	0.0	0.3	10.1	1.0	0.0	72.0	2.6	0.0	0.1	1.5	390.0	1920.0	12.8	0.0	0.1	41.6	0.2	0.2	0.3	3.0	0.0	0.0	6.7	0.0	0.2	2.3	1.0	0.2	2.6	838.0	8.3
BW-ARD-429	BW0187	231	241	FT	S	0.3	0.4	160.5	0.2	10.0	80.0	0.4	0.2	0.02	2.3	26.6	0.4	112.0	1.3	13.2	0.3	1.0	0.1	0.7	0.0	0.0	0.3	12.8	0.8	0.0	880.0	2.8	0.0	0.2	2.9	40.0	14.8	10.4	0.0	0.1	2.4	0.2	0.2	0.2	1.8	0.0	0.0	8.6	0.0	0.2	3.9	1.0	0.1	4.4	458.0	19.6
COMPM274461-M274469	BWWR03	181	189	AND	T	0.5	7.7	111.7	0.1		615.7	1.6	2.1	0.11	19.1		4.6	19.6		59.4	3.3	18.6						4.0	17.1		0.2	1237.3	2.1	0.1			3.4	340.0	12.6				0.2	16.4	6.0			41.3			10.0	0.2	5.0	5.0	50.0	8.6		3560.0	
BW-ARD-557	BW0199	262	272	AND	S	1.4	3.7	27.6	0.2	10.0	150.0	1.4	1.9	1.17	8.9	23.6	19.3	48.0	26.9	52.5	5.2	10.7	0.2	0.1	0.0	0.1	1.3	10.8	49.8	0.7	2620.0	2.6	0.1	0.3	32.0	1730.0	155.0	77.7	0.0	0.8	3.2	5.8	0.6	0.6	81.4	0.0	0.0	3.8	0.2	2.0	0.4	84.0	0.3	6.1	1160.0	2.2
BW-ARD 603	GM12-01	67	77	VC	S	0.7	3.5	42.2	0.2	10.0	190.0	1.1	4.7	0.34	0.8	23.6	11.5	29.0	41.0	80.6	6.9	9.8	0.2	0.2	0.0	0.3	2.2	10.5	67.1	0.6	4140.0	3.2	0.0	0.4	19.2	1020.0	5.0	120.5	0.0	0.5	1.6	4.5	0.4	1.1	24.6	0.0	0.1	5.1	0.3	2.7	0.9	49.0	0.4	6.5	429.0	10.3
BW-ARD 672	GM12-04	152	162	VC	S	2.3	4.1	59.2	0.2	10.0	110.0	1.5	1.5	0.89	13.0	20.9	16.1	40.0	19.4	98.1	5.6	12.2	0.1	0.1	0.0	0.7	1.7	8.7	49.4	1.2	4900.0	2.5	0.1	0.2	25.9	1480.0	195.5	81.9	0.0	0.8	8.7	7.1	0.2	1.2	45.3	0.0	0.0	3.9	0.2	2.0	0.6	90.0	0.5	5.9	2520.0	4.5
BW-ARD-479	BW0175	200	210	AND	S	7.0	0.6	22.7	0.2	10.0	20.0	0.6	0.1	0.06	11.6	26.1	2.2	107.0	5.0	60.2	0.6	1.6	0.1	0.4	0.1	0.0	0.4	11.8	2.1	0.0	511.0	5.6	0.0	0.2	7.2	170.0	2560.0	16.2	0.0	0.4	9.4	0.4	0.4	0.2	9.6	0.0	0.0	8.5	0.0	0.4	3.0	1.0	0.1	5.8	1920.0	10.8
COMPM274451-M274460	BWWR03	168	181	AND	T	1.4	8.4	105.1	0.0		910.0	1.6	3.1	0.28	6.8		9.5	40.3		60.0	3.6	20.0						4.7	20.0		0.3	4103.8	1.8	0.1			16.6	1042.5	171.4				0.3	17.3	8.4			62.4			10.0	0.4	5.6	5.0	82.4	6.3		2620.0	
BW-ARD 640	GM12-03	103	112	VC	T	3.0	2.1	60.0	0.2	10.0	120.0	0.6	4.8	0.16	2.1	29.6	14.2	22.0	21.9	92.9	3.9	6.6	0.1	0.3	0.0	0.0	1.3	14.0	27.7	0.6	2320.0	1.0	0.0	0.3	21.8	830.0	112.5	72.7	0.0	0.4	11.3	3.6	0.4	0.6	14.3	0.0	0.1	4.6	0.2	1.9	1.0	37.0	1.0	6.3	2190.0	13.4
BW-ARD-071	BW0098	220	230	FT	S	0.8	0.5	304.0	0.2	10.0	20.0	0.5	0.2	0.03	3.0	27.8	0.2	4.0	1.8	15.0	0.8	1.7	0.1	0.7	0.0	0.0	0.3	14.0	1.9	0.0	1340.0	1.3	0.0	0.2	0.2	80.0	158.5	11.1	0.0	0.2	3.6	0.5	0.2	0.3	2.3	0.0	0.0	8.7	0.0	0.4	3.6	1.0	0.1	5.1	511.0	17.5
BW-ARD-057	BW0070	170	180	VC	S	0.8	3.3	30.3	0.2	10.0	90.0	1.2	0.4	0.37	0.1	27.0	13.3	37.0	30.1	21.7	5.6	10.8	0.1	0.2	0.0	0.1	1.7	12.8	64.0	1.0	2560.0	3.0	0.0	0.4	22.9	1110.0	11.6	91.3	0.0	0.7	8.1	5.4	0.2	0.9	15.7	0.0	0.0	5.0	0.2	2.2	0.9	64.0	0.3	6.4	216.0	8.7
BW-ARD-475	BW0175	109	119	VC	S	0.5	3.1	86.4	0.2	10.0	80.0	1.0	0.6	0.60	23.9	39.9	14.3	66.0	13.0	54.2	5.6	12.2	0.1	0.1	0.0	0.4	0.6	17.4	80.0	1.1	4290.0	2.1	0.1	0.2	23.7	1820.0	24.7	36.5	0.0	0.8	6.1	8.7	0.6	0.4	38.8	0.0	0.0	3.7	0.1	1.2	0.5	107.0	0.1	8.7	2580.0	4.8
BW-ARD 664	GM12-04	54	64	AND	S	7.6	2.3	336.0	0.2	10.0	110.0	0.8	4.2	0.35	27.5	20.9	18.8	28.0	19.4	75.6	4.1	6.6	0.1	0.2	0.0	0.5	1.0	9.6	28.5	0.7	3190.0	3.0	0.0	0.3	38.7	1510.0	1445.0	51.9	0.0	0.7	17.0	4.1	1.0	0.4	29.3	0.0	0.0	3.0	0.2	1.1	0.6	43.0	0.7	7.0	5430.0	7.7
BW-ARD-129	BW0082	57	67	AND	S	1.4	3.8	56.4	0.2	10.0	260.0	0.7	2.3	0.15	33.9	24.2	14.2	46.0	19.9	62.6	6.6	9.2	0.2	0.2	0.0	0.3	2.3	12.7	11.6	54.5	1.0	4620.0	2.5	0.1	0.3	25.5	770.0	28.5	89.4	0.0	0.7	4.6	5.0	1.2	1.5	32.8	0.0	0.0	3.8	0.4	1.8	0.7	70.0	0.4	10.6	2000.0	5.4
BW-ARD-164	BW0097	275	285	AND	S	1.1	3.8	51.6	0.2	10.0	140.0	0.6	2.2	1.22	26.7	33.6	17.6	61.0	16.9	97.6	5.2	13.4	0.2	0.1	0.0	1.0	1.8	16.4	41.3	1.6	1900.0	1.6	0.3	0.2	28.2	1610.0	24.5	67.7	0.0	1.4	3.3	8.9	0.7	1.2	114.5	0.0	0.1	3.1	0.3	0.9	0.5	115.0	0.6	8.0	3480.0	4.0
COMPW006254-W006265	BWWR13	256	266		S	5.6	6.8	282.0	0.0		790.0	1.4	1.0	1.13	9.7		12.0	133.0		68.0	4.3	10.0						2.8	10.0		0.7	4590.0	3.0	0.1			102.0	680.0	397.0				1.1	22.0	16.0			67.0			10.0	0.4	5.0	5.0	136.0	5.0		1220.0	
BW-ARD-416	BW0182	117	127	AND	S	0.2	4.4	273.0	0.2	10.0	60.0	1.3	0.2	1.71	0.0	23.1	15.1	79.0	10.3	83.0	5.6	19.2	0.2	0.1	0.0	0.0	0.3	10.3	80.8	1.5	1280.0	1.5	0.4	0.3	22.0	1580.0	15.9	22.0	0.0	1.2	8.0	6.9	0.6	0.2	106.5	0.0	0.0	2.9	0.1	0.6	0.4	115.0	0.2	5.5	72.0	4.6
BW-ARD-231	BW0087	200	210	AND	S	2.1	2.7	196.5	0.2	10.0	140.0	0.5	4.7	0.39	35.0	17.6	17.8	43.0	13.0	150.5	5.7	7.3	0.1	0.1	0.0	1.0	2.0	8.4	24.1	1.1	2840.0	4.2	0.0	0.4	34.1	1710.0	216.0	74.1	0.0	1.2	6.6	4.0	1.4	1.0	20.9	0.0	0.1	3.0	0.3	1.4	0.3	67.0	0.4	6.6	4960.0	2.4
BW-ARD-034	BW0049	35	45	FT/VC	T	3.1	0.6	443.0	0.2	10.0	30.0	0.3	1.0	0.01	6.5	24.0	1.0	2.0	1.3	50.0	0.8	1.8	0.1	0.5	0.0	0.4	0.3	12.1	3.7	0.0	367.0	2.4	0.0	0.2	1.6	60.0	106.5	14.9	0.0	0.1	7.5	0.8	0.2	0.2	1.5	3.2	1.0	0.1	6.0	0.0	1.5	3.2	1.0	0.1	6.0	1120.0	15.5
BW-ARD-167	BW0099	229	239	VC	S	2.1	2.9	60.8	0.2	10.0	240.0	0.6	3.0	0.43	27.7	24.9	15.1	36.0	28.0	42.3	5.9	6.4	0.1	0.1	0.0	0.3	1.8	11.5	43.5	0.8	3950.0	2.2	0.0	0.2	26.8	1900.0	324.0	77.2	0.0	0.9	3.5	5.2	0.2	1.8	105.0	0.0	0.0	4.6	0.2	2.0	0.4	66.0	0.3	6.6	3330.0	4.7
BW-ARD-523	BW0191	68	78	AND	T	5.2	4.3	60.5	0.2	10.0	180.0	0.6	5.0	0.35	32.1	25.3	15.7	108.0	28.1	21.6	7.8	10.6	0.2	0.1	0.0	0.3	3.1	2.9	10.9	78.9	1.1	6500.0	2.4	0.0	0.3	31.8	1600.0	244.0	128.0	0.0	0.8	5.1	5.6	1.1	1.2	16.5	0.0	0.0	3.6	0.4	2.6	0.3	94.0	0.7	6.4	8540.0	2.6
BW-ARD2-6	BW0043	200	210	FT	S	1.7	3.6	23.1	0.2	10.0	160.0	1.3	1.6	0.85	17.3	34.9	17.6	33.0	16.3	82.3	5.9	11.2	0.1	0.1	0.0	0.3	1.1	14.7	58.0	1.1	7690.0	3.6	0.1	0.2	22.6	1610.0	144.0	51.0	0.0	1.4	8.7	6.3	0.5	0.7	64.8	0.0	0.0	4.3	0.2	0.9	0.8	87.0	0.3	7.7	2530.0	3.5
COMPQ0111421-Q011430	BWWR01	136	145	VC	S	0.9	8.0	33.0	0.1		1345.7	1.8	1.0	0.22	4.0		4.9	24.7		13.9	2.3	17.1						5.2	20.0		0.3	2854.3	3.4	0.1			4.9	655.7	213.1				0.3	17.7	4.7			66.7			10.0	0.2	6.4	9.3	40.0	5.0		766.4	
COMPM274770-M274779	BWWR02	141	149	VC	T	1.9	8.0	51.6	0.0		1341.4	1.6	3.0	0.15	13.3		4.9	30.0		10.3	2.4	20.0						5.2	20.0		0.2	1967.4	2.9	0.1			6.7	597.1	141.6				0.3	16.9	5.1			61.1			10.0	0.2	5.7	7.9	41.9	5.0		2237.5	
BW-ARD-142	BW0088	48	58	VC	S	8.0	2.3	152.5	0.2	10.0	80.0	0.7	0.9	0.34	23.3	17.8	13.5	30.0	20.3	43.1	4.2	5.7	0.1	0.2	0.0	0.3	1.0	8.5	28.2	0.8	3170.0	3.3	0.0	0.4	32.8	1450.0	1055.0	53.5	0.0	0.9	17.4	3.0	1.0	0.5	22.2	0.0	0.0	3.0	0.2	1.3	0.7	44.0	0.4	6.5	5120.0	8.9
BW-ARD 650	GM12-03	274	284	AND	S	0.9	3.0	120.0	0.2	10.0	30.0	1.1	2.5	1.49	0.8	24.5	21.7	41.0	14.9	152.0	4.1	10.6	0.1	0.1	0.0	0.1	0.9	11.1	34.2	0.8	871.0	2.3	0.0	0.1	26.4	1650.0	16.8	57.6	0.0	1.3	4.9	7.8	0.4	0.5	79.6	0.0	0.0	1.3	0.4	0.8	0.4	88.0	0.4	7.8	814.0	1.9
BW-ARD-171	BW0104	146	156	AND	S	0.7	2.5	33.6	0.2	10.0	40.0	1.0	0.7	1.42	9.3	27.5	22.5	30.0	18.2	59.7	4.0	7.0	0.1	0.1	0.0	0.1	0.6	12.4	27.6	0.4	1540.0	1.5	0.2	0.3	28.9	1820.0	46.5	41.3	0.0	1.4	11.1	3.5	0.3	0.4	53.7	0.0	0.0	3.2	0.1	1.0	0.3	52.0	0.2	7.8	937.0	1.7
BW-ARD-572	BW0211	277	287	AND	S	2.0	2.5	47.8	0.2	10.0	80.0	1.0	2.2	0.73	11.3	28.1	8.6	8.0	12.9	65.2	3.6	7.6	0.1	0.1	0.0	0.2	0.9	15.9	26.0	0.3	2490.0	1.4	0.1	0.2	4.4	880.0	429.0	42.0	0.0	0.9	10.3	2.8	0.5	0.4	43.8	0.0	0.0	3.9	0.1	1.4	0.6	38.0	0.3	6.8	1540.0	5.5
BW-ARD-214	BW0113	18	28	AND	S/T	1.2	3.5	47.2	0.3	10.0	110.0	0.4	1.6	0.13	59.8	22.7	12.8	50.0	22.2	64.6	6.9	9.9	0.2	0.1	0.0	1.8	1.4	10.2	39.6	1.1	6100.0	1.8	0.0	0.2	37.1	1400.0	33.9	64.1	0.0	0.6	5.9	4.8	0.6	0.6	21.7	0.0	0.0	2.8	0.3	1.6	0.6	77.0	1.1	6.6	3380.0	3.2
BW-ARD-271	BW0078	153	163	VC	S	1.5	1.1	152.0	0.2	10.0	40.0	0.4	2.0	0.24	24.1	24.4	8.7	10.0	11.8	64.1	2.8	3.5	0.1	0.3	0.0	0.4	0.5	10.6	16.9	0.2	1540.

Table A2-2: Elemental Content Analytical Results - Waste Rock Results

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
						ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Average Crustal Abundance*						0.075	8.23	1.8	4	10	425	3	0.085	4.15	0.15	66.5	25	102		60	5.6	19	1.5	3	0.085	0.25	2.1	39	20	2.33	950	1.2	2.355	20	84	0.015	14	90	0.0007	0.03	0.2	22	0.05	2.3	370	2		9.6	0.565	0.85	2.7	120	1.25	33	70	165
BW-ARD-100	BW0114	260	270	AND	S	0.6	3.5	136.5	0.2	10.0	80.0	0.7	1.0	1.49	2.8	33.0	20.5	54.0	15.0	51.9	4.3	12.2	0.1	0.1	0.0	0.2	1.2	15.7	33.7	1.3	1760.0	1.8	0.2	0.3	30.6	1780.0	16.6	60.7	0.0	1.0	2.4	7.6	0.5	0.8	97.5	0.0	0.3	4.8	0.2	0.8	0.6	119.0	0.6	7.6	499.0	4.1
BW-ARD-403	BW0181	14	24	AND	S	0.2	3.9	327.0	0.2	10.0	70.0	0.6	0.7	1.63	0.1	30.5	21.8	92.0	16.1	55.6	5.1	16.3	0.2	0.1	0.0	0.0	0.4	14.1	65.5	1.3	1400.0	2.1	0.4	0.2	21.9	1630.0	10.2	30.0	0.0	0.9	1.9	8.1	0.5	0.3	129.0	0.0	0.1	3.9	0.2	0.7	0.4	122.0	0.2	7.3	138.0	4.4
COMPQ011401-Q011410	BWWR01	117	127	VC	S	1.2	7.9	32.0	0.1		1218.8	1.8	1.9	0.38	7.1		6.6	17.5		18.3	2.6	18.8					4.8	20.0		0.3	2645.6	3.4	0.2		3.0	750.0	362.4			0.4	15.0	4.5			85.6			10.0	0.2	5.0	5.0	40.0	5.0		123.0	
BW-ARD-270	BW0098	26	36	AND	T	0.5	1.1	286.0	0.2	10.0	30.0	0.6	1.8	0.10	9.6	25.0	2.0	8.0	11.3	26.6	2.7	3.8	0.1	0.8	0.0	1.6	0.7	12.4	22.3	0.1	1500.0	15.3	0.0	0.4	5.5	450.0	5.9	51.1	0.0	0.4	2.9	1.3	0.4	0.6	7.1	0.0	0.0	7.7	0.1	1.2	3.2	15.0	0.3	8.7	1930.0	21.4
BW-ARD-026	BW0044	40	51	VC	S	4.4	2.4	31.5	0.2	10.0	20.0	0.7	1.1	0.33	15.2	28.0	17.1	34.0	10.0	51.2	4.9	8.0	0.1	0.2	0.0	0.1	0.5	12.9	37.2	1.1	5480.0	2.2	0.0	0.1	34.5	1430.0	1165.0	25.7	0.0	0.6	6.8	3.9	0.3	0.4	25.2	0.0	0.0	2.6	0.1	0.6	0.7	56.0	0.1	8.4	2870.0	8.0
BW-ARD-467	BW0174	143	153	AND	S	7.6	0.4	136.0	0.2	10.0	20.0	0.5	0.4	0.08	4.7	18.1	2.9	84.0	1.3	43.0	1.0	1.5	0.1	0.5	0.0	0.1	0.3	8.5	1.4	0.0	4710.0	3.3	0.0	0.1	4.1	180.0	380.0	11.5	0.0	0.4	11.5	0.4	0.2	0.2	3.7	0.0	0.0	5.7	0.0	0.3	2.6	1.0	0.1	4.1	899.0	14.5
COMPQ011431-Q011435	BWWR01	145	150	VC	S	0.6	8.2	27.0	0.0		1217.5	1.8	1.0	0.16	1.4		4.0	25.5		6.8	2.5	20.0					5.1	20.0		0.3	2562.5	2.0	0.1		3.8	562.5	172.3			0.2	14.3	5.0			45.3			10.0	0.2	5.0	10.0	39.8	5.0		334.0	
BW-ARD-093	BWWR11	115	125	VC	S	3.2	3.1	35.6	0.2	10.0	180.0	0.5	4.1	0.34	32.6	20.2	12.8	39.0	20.4	65.8	5.2	8.4	0.1	0.2	0.0	0.7	0.2	9.2	43.8	1.2	3650.0	3.1	0.0	0.2	28.8	1450.0	301.0	102.0	0.0	0.7	6.3	4.5	0.9	1.0	20.7	0.0	0.0	3.4	0.3	1.7	0.6	69.0	0.5	6.4	541.0	5.3
BW-ARD 675	GM12-04	184	194	AND	S	11.9	5.3	28.2	0.2	10.0	190.0	1.1	2.7	1.12	27.6	17.8	19.1	65.0	28.6	81.1	6.3	14.4	0.1	0.1	0.0	0.2	2.5	7.1	63.5	1.4	6710.0	1.4	0.1	0.2	34.2	1630.0	2810.0	94.9	0.0	0.5	10.6	8.2	0.2	1.3	88.2	0.0	0.0	2.6	0.3	2.1	0.3	111.0	0.6	4.2	3770.0	1.8
COMPW006024-W006034	BWWR13	53	63	VC	T	0.7	0.5	333.0	0.2	10.0	50.0	0.6	0.2	0.04	4.1	31.2	1.5	7.0	8.4	7.2	1.0	1.4	0.1	0.5	0.0	0.1	0.3	15.7	8.3	0.0	410.0	2.2	0.0	0.2	3.1	180.0	61.6	19.8	0.0	0.0	17.0	0.9	0.3	0.2	12.2	0.0	0.0	7.0	0.0	0.7	3.0	4.0	1.2	9.6	441.0	16.9
BW-ARD-065	BW0071	290	300	VC	S	0.6	3.5	75.5	0.2	10.0	70.0	1.2	0.2	0.71	0.2	17.6	5.4	29.0	19.3	57.0	5.4	10.7	0.1	0.2	0.0	0.1	1.7	8.3	47.3	0.9	2850.0	3.3	0.1	0.3	31.0	4.5	0.0	14.8	0.0	0.7	4.4	4.3	0.3	0.8	26.5	0.0	0.1	4.0	0.2	2.0	0.6	66.0	0.5	6.0	202.0	6.2
BW-ARD-263	BW0077	60	70	AND	S	2.2	4.6	3.3	0.2	10.0	90.0	1.0	5.8	1.43	19.0	12.4	14.5	59.0	25.6	39.8	4.5	13.0	0.1	0.1	0.0	1.8	1.8	5.5	52.2	1.3	2620.0	5.0	0.2	0.3	25.2	1420.0	53.4	78.0	0.0	0.6	6.3	7.5	0.6	1.2	162.5	0.0	0.0	3.2	0.2	1.2	0.4	101.0	0.5	5.1	3580.0	4.8
COMPQ012641-G012650	BWWR11	380	388	AND	S	1.4	7.3	3030.0	0.2		1250.0	1.4	1.0	2.54	16.4		21.0	68.0		220.0	5.8	20.0					4.0	10.0		1.6	2470.0	1.0	1.1		29.0	1670.0	21.0			0.7	20.0	11.0			380.0			10.0	0.5	10.0	5.0	132.0	10.0		1885.0	
BW-ARD-143	BW0088	88	98	VC	S	1.5	3.0	35.4	0.2	10.0	230.0	0.6	1.7	0.35	27.8	20.2	10.4	32.0	20.7	20.0	5.5	6.9	0.1	0.2	0.0	0.5	1.6	9.4	32.3	0.8	3700.0	2.4	0.0	0.3	20.3	1530.0	176.0	75.5	0.0	0.4	9.4	3.3	0.7	0.5	29.8	0.0	0.0	3.5	0.2	1.6	0.7	51.0	0.4	6.6	4930.0	6.2
BW-ARD-070	BW0098	106	116	VC	S	1.0	1.9	39.5	0.2	10.0	70.0	0.8	0.5	0.14	0.4	17.8	4.1	6.0	14.0	18.0	4.0	5.3	0.1	0.3	0.0	0.1	1.2	9.0	29.7	0.3	2340.0	2.2	0.0	0.4	4.1	590.0	20.1	67.2	0.0	0.4	2.9	1.2	0.2	0.9	4.9	0.0	0.0	5.3	0.1	1.3	1.1	15.0	0.3	4.3	193.0	13.4
BW-ARD-039	BW0058	12	22	AND	T	6.0	4.6	14.9	0.2	10.0	260.0	0.9	3.0	0.86	48.2	33.5	19.0	57.0	29.8	114.0	5.2	13.5	0.2	0.1	0.0	1.5	2.1	15.5	68.4	1.6	4400.0	1.5	0.2	0.1	33.7	1580.0	846.0	77.5	0.0	0.6	5.8	8.9	0.3	1.0	118.5	0.0	0.1	3.3	0.3	1.2	0.6	105.0	0.4	8.5	5250.0	4.1
COMPM261935-M261944	BWWR03	107	115	VC	T	0.3	7.6	33.0	0.0		1140.0	1.6	1.0	0.18	2.1		4.0	26.0		32.0	2.3	20.0					5.0	20.0		0.2	1565.0	1.0	0.2		94.0	570.0	33.0			0.2	14.0	5.0			64.0			10.0	0.2	5.0	10.0	40.0	5.0		848.0	
COMPM261975-M261984	BWWR03	142	153	VC/AND	T	0.7	8.0	62.6	0.0		1418.8	1.7	1.8	0.09	4.1		4.4	25.1		9.8	1.4	20.0					5.1	22.5		0.2	759.5	2.4	0.1		5.9	352.5	47.3			0.1	10.5	4.4			88.3			10.0	0.2	5.6	5.0	31.0	5.0		1580.0	
BW-ARD-586	BW0093	111	121	AND	S	0.7	4.8	11.1	0.2	10.0	150.0	0.9	5.6	1.99	10.4	32.8	18.0	91.0	24.3	89.0	4.6	15.4	0.2	0.1	0.0	0.8	1.6	16.0	58.4	1.6	2780.0	1.8	0.6	0.2	28.0	1770.0	10.8	77.0	0.0	0.8	0.9	7.7	0.6	1.3	229.0	0.0	0.0	5.0	0.3	1.4	0.7	120.0	0.5	7.6	1720.0	3.8
BW-ARD-592	BW0112	214	224	AND	S	2.4	5.3	16.4	0.2	10.0	130.0	1.7	3.9	1.48	27.4	26.6	18.3	110.0	26.4	59.5	6.1	16.4	0.2	0.1	0.0	0.5	1.5	12.6	75.3	1.2	5590.0	1.3	0.3	0.2	33.8	1790.0	105.0	78.6	0.0	0.6	2.2	9.5	0.7	0.8	124.0	0.0	0.0	3.2	0.3	1.8	0.4	134.0	0.3	6.6	3390.0	1.9
COMPM261825-M261834	BWWR03	10	19	AND	T	0.3	8.4	28.0	0.0		1200.0	1.9	1.0	2.62	0.3		17.0	80.0		47.0	4.2	20.0					4.0	20.0		0.5	1560.0	2.0	1.8		27.0	2030.0	31.0			0.4	2.5	13.0			344.0			10.0	0.6	5.0	5.0	162.0	5.0		98.0	
BW-ARD-062	BW0095	73	83	VC	T	0.4	2.7	32.5	0.2	10.0	70.0	0.7	1.0	0.14	0.2	23.0	3.7	16.0	22.8	28.1	5.5	6.6	0.1	0.6	0.0	0.1	1.8	11.3	36.7	0.5	2540.0	2.2	0.0	0.3	11.4	700.0	7.3	92.5	0.0	0.4	5.3	2.8	0.5	1.2	7.4	0.0	0.0	6.8	0.2	2.2	2.0	30.0	0.4	7.4	803.0	20.8
BW-ARD-406	BW0181	93	103	AND	S	0.2	3.6	3430.0	0.2	10.0	100.0	0.8	0.4	2.35	0.0	50.6	24.3	85.0	27.8	89.9	5.4	14.3	0.2	0.1	0.3	0.0	0.7	23.9	53.8	1.0	613.0	2.3	0.3	0.1	23.6	1740.0	9.3	54.3	0.0	1.6	10.8	8.3	1.3	0.4	183.5	0.0	0.0	5.0	0.1	1.6	0.5	122.0	0.1	11.1	62.0	4.8
BW-ARD-267	BW0098	220	230	FT	S	0.8	0.4	279.0	0.2	10.0	20.0	0.5	0.3	0.03	3.2	29.5	0.3	2.0	1.4	15.1	0.8	1.4	0.1	0.7	0.0	0.0	0.2	14.6	1.5	0.0	1060.0	1.6	0.0	0.2	0.5	70.0	133.0	10.5	0.0	0.3	4.2	0.4	0.2	0.2	2.1	0.0	0.0	9.8	0.0	0.4	3.5	1.0	0.1	5.3	496.0	17.7
COMPQ012251-G012260	BWWR11	44	52	AND	T	0.3	8.9	20.0	0.0		1290.0	1.5	1.0	2.83	0.3		18.0	58.0		55.0	5.2	20.0					2.8	20.0		0.6	1405.0	1.0	2.5		34.0	1920.0	24.0			0.5	2.5	13.0			466.0			10.0	0.6	5.0	5.0	152.0	5.0		113.0	
BW-ARD 656	GM12-03	356	367	S	S	3.9	2.2	571.0	0.2	10.0	130.0	0.8	2.0	1.56	12.1	15.4	17.1	74.0	15.8	90.6	3.7	6.4	0.1	0.1	0.0	0.2	0.8	7.9	22.0	0.7	1580.0	3.8	0.0	0.2	103.0	610.0	309.0	54.0	0.0	1.4	25.8	5.4	1.6	0.4	34.0	0.0	0.1	2.3	0.1	1.4	0.3	52.0	0.2	5.5	1520.0	3.1
COMPM261252-M261261	BWWR08	93	101	AND/VC	T	2.1	7.8	71.4	0.0		878.6	2.0	1.0	0.95	2.7		5.3	22.9		7.6	2.4	17.1					4.1	21.4		0.4	3215.7	2.4	0.2		9.3	755.7	177.3			0.3	44.1	6.0			90.3			10.0	0.3	5.7	5.0	53.3	6.4		825.9	
BW-ARD-252	BW0074	125	135	VC	S	3.4	2.2	59.6	0.2	10.0	150.0	0.7	3.0	0.30	10.7	17.9	15.1	23.0	19.0	42.0	3.6	5.9	0.1	0.2	0.0	0.2	1.4	8.5	30.6	0.7	1670.0	3.8	0.0	0.3	34.5	1340.0	645.0	71.2	0.0	0.4	14.8	3.0	0.6	0.6	22.9	0.0	0.0	3.3	0.2	1.3	0.6	38.0	0.5	5.9	3200.0	9.8
BW-ARD-031	BW0052	47	57	VC	T	1.3	2.2	153.0	0.2	10.0	50.0	0.8	1.5	0.12	1.4	30.6	7.0	16.0	21.1	17.7	5.0	7.3	0.1	0.6	0.0	0.2	0.2	1.3	15.3	49.7	0.4	2840.0	3.4	0.0	0.3	11.2	650.0	15.2	95.4	0.0	0.3	4.0	3.2	0.3	1.0	11.7	0.0	0.0	6.6	0.1	2.1	2.2	31.0	0.3	7.4	381.0	19.4
BW-ARD-286	BW0078	280	290	AND	S	1.2	3.6	16.9	0.2	10.0	110.0	0.8	2.0	0.81	31.3	23.4	18.7	47.0	22.8	67.1	5.6	9.2	0.2	0.1	0.0	0.6	2.1	11.4	53.5	1.1	3110.0	5.0	0.1	0.3	32.8	1960.0	58.7	91.0	0.0	0.7	4.3	4.6	1.3	0.6	54.1	0.0	0.0	3.0	0.3	1.7	0.3	81.0	0.2	7.6	3710.0	1.9
BW-ARD 633	GM12-02	379	380	SED	S	2.5	2.0	539.0	0.2	10.0	130.0	0.8	1.9	1.14	17.3	13.5	16.3	93.0	19.7	87.3	3.9	5.4	0.1	0.1	0.0	0.4	1.0	6.3	20.5	0.7	1430.0	5.4	0.0	0.2	106.0	750.0	148.0	65.6	0.0	1.1	26.8	3.8	1.6	0.4	17.1	0.0	0.1	2.6	0.1	1.2	0.4	56.0	0.2	7.9	1950.0	3.5
BW-ARD 624	GM12-01	366	376	VC	T	0.6	1.5	52.3	0.2	10.0	30.0	0.6	0.2	0.43	2.9	24.7	6.0	7.0	10.8	8.0	2.6	4.7	0.1	0.3	0.0	0.0	0.6	12.3	30.8	0.3	1460.0	1.6	0.0	0.3	7.0	630.0	50.1	56.8	0.0	0.4	11.0	1.5	0.4	0.2	16.6	0.0	0.0	5.3	0.1	1.4	3.8	21.0	0.1	3.8	500.0	13.0
BW-ARD-453	BW0174	22	32	VC	T	7.1	1.1	109.5	0.2	10.0	30.0	1.0	1.2	0.18	22.8	22.2	7.1	90.0	5.9	22.0	2.4	3.6	0.1	0.4	0.1	0.6	0.3	10.3	11.1	0.2	6630.0	2.4	0.0	0.1	10.8	560.0	1005.0	10.8	0.0	0.4	10.2	1.3	0.6	0.2	7.4	0.0	0.0	5.1	0.0	0.3	1.6	11.0	0.1	5.8	3840.0	14.4
BW-ARD 632	GM12-02	360	370	SED	S	8.5	2.8	551.0	0.2	10.0	90.0	1.0	2.7	1.73	17.5	24.2	19.2	64.0	26.1	76.6	4.5	7.4	0.1	0.1	0.0	0.4	1.2	10.5	29.4	0.7	2390.0	5.0	0.0	0.3	39.4	1620.0	100.5	82.7	0.0	1.4	38.5	5.2	0.6	0.5	40.1	0.0	0.0	2.9	0.2	2.4	0.5	71.0	0.6	8.5	2250.0	3.2
COMPM261448-M261457	BWWR06	46	55	VC	T	2.0	6.1	196.0	0.0		960.0	1.6	1.0	0.15	0.3		4.0	29.0		11.0	1.7	20.0					4.1	10.0		0.2	1040.0	2.0	0.6		4.0	510.0	21.0			0.2	9.0	3.0			71.0			10.0	0.2	5.0	10.0	34.0	10.0		131.0	
BW-ARD-266	BW0098	250	260	FT	S	0.8	0.3	230.0	0.2	10.0	10.0	0.4	0.1	0.03	1.7	28.4	0.3	2.0	0.8	13.4	0.7	1.3	0.1	0.6	0.0	0.0	0.2	13.9	0.7	0.0	2120.0	1.6	0.0	0.2	0.4	60.0	128.5	8.0	0.0	0.3	5.1	0.3	0.2	0.2	1.6	0.0	0.0	8.8	0.0	0.3	3.1	1.0	0.1	4.7	297.0	15.3
BW-ARD-138	BW0086	240	250	AND	S	7.5	4.3	14.0	0.2	10.0	210.0	0.9	1.1	0.65	13.4	18.2	15.8	53.0	35.1	82.2	7.0	11.0	0.2	0.1	0.0	0.8	2.7	8.3	56.9	1.1	5910.0	1.4	0.2	0.2	24.2	1710.0	2520.0	109.0	0.0	0.7	6.9	4.5	0.8	1.1	23.5	0.0	0.0	3.1	0.3	2.6	0.3	91.0	0.5	4.5	4760.0	2.1
BW-ARD-537	BW0198	151	161	VC	S	0.4	2.5	109.5	0.2	10.0	40.0	1.3	0.5	1.05	2.0	31.0	9.7	26.0	16.0	22.4	2.7	8.5	0.1	0.2	0.0	0.1	0.8	15.2	24.3	0.5	1060.0	1.4	0.2	0.2	15.9	920.0	8.7	67.3	0.0	0.4	7.3	5.0	0.4	0.4	41.7	0.0	0.0	5.0	0.1	1.5	1.1	46.0	0.5	7.2	297.0	9.5
BW-ARD-106	BW0064	150	161	AND	S	1.2	3.4	143.0	0.2	10.0	260.0	0.7	3.1	0.41	13.6	16.9	13.0	43.0	16.8	48.8	6.5	8.8	0.1	0.1	0.0	0.4	2.4	8.1	32.5	1.1	4530.0	2.1	0.0	0.3	31.5	1800.0	42.1	88.3	0.0	0.5	3.4	4.8	0.6	0.8	47.0	0.0	0.0	2.2	0.3	1.7	0.3	72.0	1.6	5.7	1930.0	3.4
COMPW006069-W006077	BWWR13	96	103	FT	T	7.3	0.3	722.0	0.2	10.0	30.0	0.3	0.1	0.02	11.6	31.0	0.3	8.0	1.3	1.8	0.4	0.9	0.1	0.9	0.1	0.0	0.2	15.6	2.6	0.0	140.0	2.9	0.0	0.6	1.1	50.0	225.0	7.5	0.0	0.1	16.8	0.4	0.4	0.2	2.6	0.0	0.0	8.4	0.0	0.2	3.8	1.0	0.1	7.6	351.0	26.6
COMPM261282-M261291	BWWR08	119	127	VC	T/S	1.6	7.5	38.3	0.0		1452.9	1.5	1.4	0.10	2.9		2.4	24.7		2.6	1.4	20.0					4.2	20.0		0.1	1836.3	4.0	0.1		2.9	352.9	108.3			0.2	11.3	3.4			47.8			10.0	0.2	5.0	5.7	26.1	6.4		534.8	
COMPW006019-W006230	BWWR13	226	236	S	S	0.7	6.7	273.0	0.0		1190.0	1.3	1.0	1.81	15.4		12.0	93.0		53.0	3.2	10.0					2.8	10.0		0.4	986.0	2.0	0.2		62.0	950.0	22.0			0.0	9.4	11.0			94.0			10.0	0.4	5.0	5.0	128.0	5.0		1410.0	
BW-ARD 116	GM12-01	224	234	AND	S	0.9	5.4	171.5	0.2	10.0	160.0	1.3	1.3	2.51	25.1	23.6	16.5	57.0	41.9	85.5	4.7	13.6	0.2	0.1	0.0	0.3	1.7	12.2	33.0	1.4	2230.0	2.4	0.4	0.2	30.2	1760.0	13.3	132.0	0.0	0.8	4.3	7.5	0.4	0.7	113.5	0.0	0.1	2.8	0.3	2.4	0.5	102.0	1.8	7.5	535.0	1.9
BW-ARD-133	BW0084	96	106	AND	S	2.6	4.0	33.7	0.2	10.0	290.0	0.8	5.5	0.48	48.2	19.1	14.6	58.0	28.5	39.2	6.0	9.3	0.2	0.1	0.0	0.3	2.2	6.8	8.9	64.5	1.5	3440.0	1.5	0.0	0.3	27.8	1810.0	47.2	89.0	0.0	0.7	5.7	4.8	1.2	1.0	42.8	0.0	0.0	3.1	0.3	1.6	0.5	86.0	0.4	7.2	8200.0	2.8
BW-ARD-154	BW0093	111	121	AND	S	0.5	4.8	8.1	0.2	10.0	150.0	0.8	6.6	1.91	10.5	29.9	16.0	48.0	23.6	78.4	4.6	14.7	0.2	0.1	0.0	0.8	1.7	14.2	55.3	1.6	2930.0	1.7	0.5	0.2	23.9	1730.0	10.0	77.4	0.0	0.8	0.9	7.7	0.6	1.0	221.0	0.0	0.0	4.9	0.3	1.4	0.6	124.0	0.4	7.0	1680.0	3.2
BW-ARD-478	BW0175	186	196	AND	S	0.3	2.5	25.4	0.2	10.0	190.0	1.1	0.1	0.60	0.2	36.9	18.0	78.0	36.2	51.0	3.9	6.8	0.1	0.1	0.0	0.0	1.3	16.2	50.7	0.4	3460.0	2.9	0.1	0.3	28.9	1870.0	8.5	81.9	0.0	0.4	6.3	4.9	0.4	0.5	41.9	0.0	0.0	3.9	0.2	2.9	0.6	63.0	0.3	7.3	654.0	4.0
BW-ARD-512	BW0186	190	200	FT	S	1.7	1.1	23.7	0.2	10.0	30.0	1.1	0.8	0.30	1.1	20.8	0.5	118.0	4.5	38.6	1.5	3.2	0.1	0.8	0.0	0.1	0.4	9.6	19.0	0.0	580.0	2.4	0.0	0.5	3.5	70.0	108.0	29.5	0.0	0.2	4.1	0.6	0.2	0.3	17.5	0.0	0.0	8.5	0.0	0.8	3.1	1.0	0.2	5.6	234.0	23.3
COMPW005843-W005852	BWWR12	154	163

Table A2-2: Elemental Content Analytical Results - Waste Rock Results

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
						ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Average Crustal Abundance*						0.075	8.23	1.8	4	10	425	3	0.085	4.15	0.15	66.5	25	102		60	5.6	19	1.5	3	0.085	0.25	2.1	39	20	2.33	950	1.2	2.355	20	84	0.015	14	90	0.0007	0.03	0.2	22	0.05	2.3	370	2		9.6	0.565	0.85	2.7	120	1.25	33	70	165
BW-ARD 652	GM12-03	303	313	AND	S	0.6	5.3	57.7	0.2	10.0	80.0	1.2	2.3	2.76	13.2	35.2	16.8	55.0	23.9	129.5	4.8	18.3	0.2	0.1	0.0	0.4	1.5	16.4	40.8	1.6	1920.0	2.0	0.3	0.2	28.6	1730.0	16.4	89.0	0.0	0.8	1.6	11.8	0.7	1.2	233.0	0.0	0.0	3.4	0.2	1.7	0.4	126.0	0.5	9.8	1380.0	1.8
BW-ARD 658	GM12-03	377	387	SED	S	0.3	5.1	35.7	0.2	10.0	350.0	0.9	0.2	1.50	0.2	13.1	20.8	136.0	21.3	63.3	3.8	13.5	0.2	0.0	0.0	0.0	1.3	6.5	45.2	1.9	369.0	2.8	0.1	0.2	139.5	670.0	16.3	73.8	0.0	0.3	4.1	15.2	1.3	0.6	146.5	0.0	0.1	2.1	0.1	0.8	0.2	117.0	0.2	4.5	158.0	1.3
BW-ARD 644	GM12-03	191	201		S	4.4	3.4	38.9	0.2	10.0	150.0	1.2	0.1	0.58	7.0	21.1	19.2	51.0	37.1	37.0	5.2	11.4	0.1	0.1	0.0	0.1	1.8	9.6	54.7	0.9	5460.0	2.1	0.0	0.3	31.8	1760.0	992.0	100.5	0.0	0.2	6.0	6.8	0.4	0.8	35.4	0.0	0.0	2.9	0.3	1.9	0.3	82.0	0.5	5.5	1140.0	1.9
BW-ARD-067	BW0102	100	110	VC	S	1.1	1.2	190.5	0.2	10.0	50.0	0.9	0.5	0.09	1.6	23.0	1.0	6.0	10.7	7.7	2.6	3.4	0.1	0.6	0.0	0.1	0.7	11.7	17.4	0.1	1400.0	3.0	0.0	0.3	4.2	300.0	21.2	43.7	0.0	0.2	2.5	0.8	0.2	0.5	5.7	0.0	0.0	6.7	0.1	1.1	2.3	7.0	0.2	4.6	336.0	18.5
BW-ARD-107	BW0065	30	40	AND	T	4.5	3.2	57.6	0.2	10.0	160.0	1.1	2.2	0.23	15.0	32.6	13.1	49.0	22.8	40.8	4.8	9.9	0.1	0.2	0.0	0.6	1.5	15.9	60.2	1.3	5090.0	1.5	0.0	0.2	34.2	860.0	1120.0	68.5	0.0	0.2	9.3	6.2	0.5	0.5	44.6	0.0	0.0	4.3	0.3	1.3	0.8	85.0	0.3	8.6	2710.0	7.0
BW-ARD-693	GM12-05	309	319	AND	S	1.1	5.9	30.8	0.2	10.0	110.0	1.0	1.1	2.34	29.2	18.4	17.5	69.0	32.6	48.8	4.9	17.4	0.2	0.1	0.0	0.5	2.0	8.5	56.1	1.7	2000.0	3.0	0.5	0.2	83.5	1620.0	270.0	119.0	0.0	0.5	1.8	8.8	0.7	1.0	223.0	0.0	0.0	2.3	0.5	0.2	124.0	0.2	4.9	2690.0	2.6
BW-ARD-269	BW0098	106	116	VC	S	1.0	1.7	67.4	0.2	10.0	60.0	0.8	0.5	0.14	0.3	18.9	3.8	4.0	14.9	13.1	3.9	5.0	0.1	0.3	0.0	0.1	1.1	9.6	27.2	0.2	2120.0	2.2	0.0	0.3	4.2	610.0	17.7	65.2	0.0	0.3	2.8	1.0	0.2	0.7	4.5	0.0	0.0	5.5	0.1	1.2	1.0	14.0	0.2	4.1	172.0	10.3
BW-ARD-339	BW0104	171	181	AND	S	1.2	3.2	122.5	0.2	10.0	90.0	0.9	0.3	2.32	2.6	30.6	20.4	84.0	19.7	36.1	4.8	11.7	0.1	0.1	0.0	0.1	1.4	14.3	37.3	1.2	2390.0	1.9	0.1	0.2	33.1	1730.0	36.2	69.5	0.0	0.8	18.7	7.0	0.4	0.6	72.0	0.0	0.0	3.6	0.1	1.8	0.4	90.0	0.1	8.4	363.0	2.3
BW-ARD-168	BW0100	28	38	AND	T	0.1	2.4	7.0	0.2	10.0	90.0	0.5	0.5	0.98	0.2	23.3	10.6	3.0	13.7	53.8	3.3	9.2	0.1	0.2	0.0	0.0	0.7	11.4	26.9	0.4	799.0	1.4	0.3	0.4	2.1	1170.0	6.5	54.8	0.0	0.3	0.6	5.3	0.3	0.6	149.0	0.0	0.0	4.1	0.2	0.8	0.9	78.0	0.5	6.9	96.0	8.7
BW-ARD-083	BW0066	156	166	AND	S	4.6	5.9	15.8	0.2	10.0	280.0	1.4	4.6	1.28	7.7	23.5	14.7	52.0	33.9	45.6	7.4	13.6	0.2	0.1	0.0	1.8	2.7	11.5	53.9	1.6	4920.0	2.2	0.1	0.3	26.8	1580.0	649.0	95.1	0.0	0.4	14.3	7.9	0.6	1.3	86.9	0.0	0.3	3.7	0.3	1.6	0.5	106.0	0.6	6.3	1660.0	2.9
COMPW006127-W006137	BWWR13	146	155	CGL	S	0.1	2.4	532.0	0.2	10.0	70.0	1.0	0.2	1.48	8.1	22.9	9.6	12.0	16.4	31.2	2.4	5.7	0.1	0.4	0.0	0.0	0.6	11.1	24.4	0.3	1070.0	3.0	0.1	0.2	4.3	3.5	0.6	0.2	61.9	0.0	0.0	5.0	0.1	1.5	1.5	47.0	0.1	9.7	756.0	11.4
BW-ARD-201	BW0116	150	160	AND	S	8.5	4.4	40.2	0.2	10.0	160.0	1.2	3.2	0.58	24.7	21.3	16.6	49.0	18.5	51.4	6.1	13.1	0.2	0.1	0.0	0.4	2.0	9.3	59.7	1.7	8020.0	3.0	0.0	0.2	29.9	1570.0	2010.0	75.8	0.0	0.4	6.1	7.7	0.6	0.8	37.6	0.0	0.0	3.7	0.3	1.0	0.5	98.0	0.3	6.4	3470.0	3.4
BW-ARD-579	BW0061	20	30	VC	T	0.5	2.2	22.8	0.2	10.0	60.0	0.6	0.8	0.12	0.8	26.6	5.5	93.0	15.4	24.9	4.3	6.5	0.1	0.6	0.0	0.2	1.5	13.8	33.8	0.6	1940.0	2.4	0.0	0.2	12.0	630.0	13.8	82.0	0.0	0.1	4.9	2.1	0.4	1.1	6.5	0.0	0.0	6.1	0.2	1.7	1.6	26.0	0.2	6.7	562.0	20.8
BW-ARD-342	BW0161	55	65	VC	T	6.4	0.4	305.0	0.2	10.0	40.0	0.5	0.2	0.02	4.6	29.0	1.0	115.0	1.3	12.4	0.6	1.9	0.1	0.5	0.0	0.1	0.2	14.7	1.4	0.0	3330.0	5.3	0.0	0.2	2.9	60.0	75.8	9.2	0.0	0.1	10.6	0.5	0.2	0.2	8.6	0.0	0.0	7.2	0.0	0.2	3.3	1.0	0.2	5.5	314.0	16.5
BW-ARD-472	BW0175	16	26	VC	T	0.3	3.2	1065.0	0.2	10.0	50.0	0.8	1.2	2.35	22.8	44.3	23.9	76.0	7.1	70.1	4.4	12.2	0.1	0.1	0.0	0.5	0.3	19.9	67.9	1.1	812.0	3.8	0.1	0.1	21.1	1650.0	17.7	18.2	0.0	1.1	4.7	8.5	0.6	0.2	294.0	0.0	0.0	5.2	0.0	0.5	0.7	110.0	0.1	9.7	2020.0	4.0
COMPW005674-W005684	BWWR14	268	281	VC	S/T	7.3	7.3	508.0	0.0		1260.0	1.6	1.0	1.03	0.3		2.0	19.0		8.0	2.0	20.0					4.0	20.0		0.3	1010.0	3.0	1.1		3.0	490.0	52.0				0.2	28.0	4.0			122.0			10.0	0.2	5.0	5.0	36.0	5.0		114.0	
COMPW006108-W006116	BWWR13	129	137	SED	S	0.1	5.8	490.0	0.2	10.0	50.0	1.1	0.3	3.86	0.1	17.3	11.7	46.0	18.7	32.0	3.3	18.0	0.2	0.1	0.0	0.0	0.5	7.9	37.4	0.6	414.0	1.9	0.2	0.8	22.8	1230.0	17.9	44.9	0.0	0.6	1.1	7.5	0.5	0.2	169.0	0.0	0.0	3.1	0.1	1.3	1.1	98.0	0.2	5.8	52.0	2.6
COMPM261315-M261324	BWWR07	28	37	T		0.3	8.8	74.0	0.0		1430.0	1.7	1.0	0.43	0.6		11.0	46.0		21.0	4.1	20.0					5.9	30.0		0.4	9590.0	0.5	0.2		17.0	1170.0	9.0				0.2	13.0	11.0			70.0			10.0	0.5	10.0	5.0	107.0	5.0		1700.0	
COMPW006078-W006087	BWWR13	103	112	T/S		3.3	0.4	648.0	0.2	10.0	29.0	0.3	0.2	0.04	7.3	26.6	2.0	8.0	4.4	6.8	0.6	1.2	0.1	0.8	0.0	0.0	0.2	13.4	7.3	0.0	291.0	2.3	0.0	0.4	3.7	100.0	130.5	10.5	0.0	0.1	10.5	0.6	0.3	0.2	4.5	0.0	0.0	7.7	0.0	0.5	2.9	2.0	0.2	7.4	365.0	25.4
COMPG012500-G012509	BWWR11	260	269	VC	T	0.3	7.7	45.0	0.0		930.0	1.7	1.0	0.47	0.3		5.0	28.0		22.0	1.7	20.0					4.0	20.0		0.3	603.0	2.0	1.0		6.0	630.0	15.0				0.2	6.0	6.0			111.0			10.0	0.2	5.0	10.0	48.0	5.0		48.0	
BW-ARD-128	BW0081	230	240	VC	S	0.9	6.7	48.3	0.2	10.0	190.0	1.2	3.1	2.85	25.3	21.7	16.7	70.0	29.2	116.5	5.2	17.0	0.2	0.0	0.0	1.0	2.3	10.2	35.0	1.8	2770.0	4.1	0.5	0.3	25.7	1680.0	32.0	92.6	0.0	0.9	2.6	10.2	0.7	1.4	314.0	0.0	0.0	2.7	0.3	1.7	0.3	138.0	0.9	6.3	2900.0	1.4
BW-ARD-391	BW0177	177	187	AND	S	0.9	4.0	33.8	0.2	10.0	200.0	0.6	2.7	2.14	0.5	30.6	16.5	132.0	38.3	63.3	5.3	14.9	0.2	0.1	0.0	0.0	1.5	14.2	58.9	1.5	1240.0	1.8	0.3	0.2	36.8	1670.0	22.0	99.5	0.0	0.8	1.3	10.3	0.4	0.6	142.0	0.0	0.1	3.8	0.3	2.8	0.5	139.0	0.2	7.5	151.0	4.8
BW-ARD-393	BW0177	197	207	AND	S	0.2	3.9	26.3	0.2	10.0	160.0	1.2	0.2	1.95	0.1	28.3	20.8	108.0	30.5	46.3	4.5	11.1	0.1	0.1	0.0	0.0	1.3	13.0	45.5	0.6	925.0	2.7	0.2	0.3	34.8	1770.0	7.3	83.1	0.0	0.5	2.3	6.1	0.3	0.5	151.0	0.0	0.0	3.5	0.2	2.4	0.4	89.0	0.3	7.1	72.0	3.1
COMPW006117-W006126	BWWR13	137	146		S	0.1	4.4	158.5	0.2	10.0	80.0	1.1	0.2	2.88	2.3	17.4	16.4	38.0	17.3	28.3	2.5	12.5	0.1	0.1	0.0	0.0	0.5	8.1	34.8	0.5	590.0	2.3	0.2	0.5	35.9	1180.0	20.2	36.0	0.0	0.5	2.3	5.2	0.5	0.2	150.0	0.0	0.0	3.3	0.1	1.2	1.0	71.0	0.2	6.5	236.0	4.1
BW-ARD-022	BW0042	182	192	VC/AND	S	0.4	4.1	310.0	0.3	10.0	100.0	1.2	1.2	2.39	13.8	24.5	18.5	37.0	23.3	70.5	5.4	12.2	0.1	0.1	0.0	0.2	1.3	11.4	53.0	1.5	917.0	1.3	0.1	0.2	22.9	1680.0	26.1	77.8	0.0	1.1	1.5	7.0	0.6	0.3	274.0	0.0	0.1	3.3	0.1	2.8	0.5	99.0	0.1	6.6	1300.0	3.6
BW-ARD-510_Dup		0.6	3.2	25.3	0.2	10.0	60.0	1.1	0.9	1.35	0.7	28.1	16.2	39.0	25.3	47.7	4.1	10.0	0.1	0.1	0.0	0.4	1.1	13.1	33.1	0.6	2780.0	1.9	0.3	0.3	22.7	1480.0	25.1	72.5	0.0	0.5	5.4	5.6	0.3	0.8	67.6	0.0	0.0	4.0	0.2	2.0	0.7	73.0	0.4	6.6	405.0	5.2
BW-ARD-585	BW0083	256	266	AND	S	0.7	6.5	82.0	0.2	10.0	140.0	1.5	3.0	2.55	7.5	24.9	18.8	109.0	30.0	64.0	5.1	18.1	0.2	0.1	0.0	0.4	2.3	11.8	35.8	1.8	2770.0	1.7	0.5	0.2	31.8	1860.0	40.8	98.0	0.0	0.4	1.7	8.6	0.6	1.3	257.0	0.0	0.0	2.9	0.3	1.7	0.3	136.0	5.7	7.3	1040.0	2.0
BW-ARD-127	BW0081	114	124	VC	S	2.7	3.6	49.7	0.2	10.0	310.0	0.5	3.2	0.31	19.7	16.8	11.3	38.0	28.1	98.2	2.1	6.8	0.2	0.2	0.0	0.2	2.2	7.9	53.6	0.9	5370.0	2.3	0.0	0.3	25.7	1380.0	458.0	109.0	0.0	0.3	5.4	4.0	0.7	0.9	24.2	0.0	0.1	3.7	0.3	2.6	0.7	63.0	0.4	6.2	4060.0	7.8
BW-ARD-505	BW0185	296	306	VC/AND	S	0.3	5.0	3.8	0.2	10.0	150.0	1.1	0.2	1.15	2.9	20.7	7.8	100.0	30.4	9.5	6.3	11.1	0.1	0.1	0.0	0.4	2.4	9.0	73.2	1.1	3430.0	2.6	0.1	0.3	19.0	1270.0	29.0	90.8	0.0	0.3	1.7	5.3	0.3	1.1	92.7	0.0	0.0	4.5	0.3	2.2	0.6	75.0	0.3	5.4	628.0	4.9
BW-ARD-690	GM12-05	252	262	AND	S	2.2	4.4	21.8	0.2	10.0	150.0	1.2	1.5	0.88	11.2	22.3	16.6	68.0	26.7	32.8	5.4	14.7	0.1	0.1	0.0	0.1	1.9	10.2	75.0	1.4	3900.0	2.2	0.1	0.3	32.0	1680.0	351.0	95.8	0.0	0.3	2.5	9.8	0.5	0.7	71.0	0.0	0.0	2.7	0.3	2.2	0.3	118.0	0.3	5.0	1310.0	2.0
L016675	BW0120	46	55	O	O	4.9	0.4	163.0	0.2	10.0	40.0	0.2	5.8	0.03	11.7	19.8	1.0	4.0	5.6	72.5	1.5	1.5	0.1	0.3	0.0	0.0	0.2	10.0	1.0	0.0	87.0	1.6	0.0	0.1	3.8	110.0	368.0	9.6	0.0	0.6	16.7	0.8	0.2	0.3	8.1	0.0	0.0	4.2	0.0	0.5	1.0	6.0	0.1	3.3	317.0	7.8
L016688	BW0253	68	77	O	O	3.3	0.6	278.0	0.2	10.0	30.0	2.8	0.3	0.04	8.7	29.7	1.1	3.0	6.9	29.3	4.1	1.4	0.1	0.2	0.0	0.0	0.3	15.0	1.8	0.0	177.0	4.3	0.0	0.1	3.5	790.0	1475.0	17.3	0.0	0.1	23.7	0.6	0.2	0.3	5.9	0.0	0.0	5.6	0.0	0.5	2.7	3.0	0.2	3.8	1310.0	6.9
BW-ARD-335	BW0069	7	17	FT	T	6.9	0.5	21.9	0.2	10.0	30.0	0.2	0.1	0.02	8.4	26.4	0.8	73.0	1.3	48.0	0.3	1.4	0.1	0.5	0.0	0.0	0.3	11.9	1.7	0.0	997.0	4.9	0.0	0.2	2.2	100.0	827.0	10.2	0.0	0.0	12.7	0.5	0.2	0.2	3.0	0.0	0.0	8.4	0.0	0.2	4.5	1.0	0.1	3.7	102.0	11.8
BW-ARD-159	BW0096	70	80	FT	T	3.3	0.7	88.5	0.2	10.0	30.0	0.3	0.7	0.02	0.8	87.9	4.9	1.0	0.5	58.0	0.9	1.9	0.1	0.4	0.0	0.1	0.1	28.8	0.6	0.0	2320.0	4.5	0.0	0.4	0.3	430.0	4480.0	5.2	0.0	0.0	19.3	0.4	0.5	0.2	4.9	0.0	0.0	10.0	0.0	1.8	34.9	1.0	0.1	11.0	111.0	8.7
COMPW006138-W006147	BWWR13	155	164	CGL	S	0.1	4.8	144.5	0.2	10.0	110.0	0.9	0.3	3.10	0.1	33.3	15.9	11.0	36.5	14.8	5.2	16.2	0.2	0.1	0.0	0.0	1.3	16.2	66.8	1.3	826.0	2.4	0.2	0.2	15.0	2120.0	13.6	111.5	0.0	0.8	1.1	14.4	1.1	0.3	111.5	0.0	0.1	2.6	0.2	3.5	0.3	192.0	0.2	19.1	103.0	1.7
BW-ARD-577	BW0107	65	75	VC	T	1.4	3.7	16.4	0.2	10.0	100.0	1.8	0.4	0.56	3.1	36.6	18.4	90.0	33.1	22.2	5.6	11.6	0.2	0.1	0.0	0.0	1.6	18.1	60.7	0.9	4880.0	1.6	0.0	0.2	44.7	1780.0	417.0	91.0	0.0	0.2	6.7	5.6	0.6	0.7	27.1	0.0	0.0	5.6	0.3	2.1	0.8	98.0	0.3	9.0	1780.0	4.3
COMPW006332-W006330	BWWR13	314	323	CGL	S	1.0	7.3	144.0	0.0		1350.0	1.8	1.0	1.14	0.1		3.0	24.0		19.0	1.6	20.0					4.0	20.0		0.4	1835.0	4.0	0.2		5.0	440.0	60.0				0.3	13.0	6.0			72.0			10.0	0.2	5.0	5.0	33.0	5.0		164.0	
BW-ARD-692 (duplicate)		0.4	1.5	4.2	0.2	10.0	60.0	0.9	0.4	0.51	1.4	15.6	2.9	2.0	7.4	29.0	1.6	3.4	0.1	0.5	0.0	0.6	0.5	8.1	25.4	0.3	968.0	1.4	0.1	0.5	2.3	160.0	17.6	39.4	0.0	0.2	7.8	0.6	0.4	0.3	34.8	0.0	0.0	7.7	0.1	0.6	1.8	4.0	0.2	4.2	392.0	14.8
COMPM261865-M261874	BWWR03	45	54	AND	T	0.3	8.5	22.0	0.0		1280.0	2.1	1.0	2.65	0.3		22.0	71.0		32.0	4.7	20.0					4.0	20.0		0.6	1750.0	1.0	1.2		42.0	1970.0	21.0				0.3	2.5	14.0			298.0			10.0	0.7	5.0	5.0	169.0	10.0		164.0	
BW-ARD-176_Dup		0.6	5.8	19.7	0.2	10.0	190.0	1.4	1.4	2.01	18.2	18.6	19.2	52.0	25.5	44.3	5.2	14.5	0.2	0.0	0.0	0.3	2.6	8.6	49.0	2.0	2010.0	4.6	0.3	0.2	31.1	1800.0	38.8	86.2	0.0	0.5	3.1	8.6	0.5	1.0	166.0	0.0	0.1	2.5	0.3	1.2	0.2	112.0	0.3	5.8	2160.0	2.0
BW-ARD-699	GM12-05	391	400	AND	S	0.2	3.8	12.8	0.2	10.0	160.0	0.5	0.1	1.48	0.5	32.2	19.5	57.0	28.8	51.0	4.5	13.9	0.2	0.1	0.0	0.1	1.7	14.9	47.4	1.5	1440.0	1.6	0.4	0.3	28.2	1770.0	7.6	111.0	0.0	0.5	1.0	7.1	0.6	1.2	160.5	0.0	0.0	4.1	0.3	1.9	0.5	123.0	1.1	8.7	220.0	3.7
BW-ARD-287	BW0078	253	263	AND	S	2.2	4.3	368.0	0.2	10.0	140.0	1.0	1.6	1.57	19.7	27.2	18.8	61.0	30.7	35.8	5.4	12.1	0.2	0.1	0.0	0.3	1.9	13.6	51.6	1.1	3140.0	1.5	0.2	0.3	37.2	1860.0	562.0	110.5	0.0	0.5	5.5	5.4	1.3	0.7	92.1	0.0	0.0	3.0	0.3	2.3	0.4	104.0	0.2	6.3	2680.0	2.0
BW-ARD-565	BW0211	96	106	VC	S	3.5	1.4	72.9	0.2	10.0	50.0	0.6	0.3	0.16	19.4	31.4	10.1	23.0	16.9	29.0	4.5	2.8	0.1	0.3	0.0	0.0	0.2	18.8	0.1	1840.0	1.0	0.1	0.3	5.5	880.0	606.0	55.5	0.0	0.2	0.1	1.8	1.7	0.2	0.5	30.6	0.0	0.0	5.5	0.1	1.8	0.7	10.0	0.2	4.0	1140.0	12.4
BW-ARD 647	GM12-03	239	250	SED	S	2.1	2.8	108.5	0.2	10.0	120.0	0.8	0.1	1.21	6.1	24.2	20.7	37.0	29.6	53.9	4.2	9.0	0.1	0.1	0.0	0.0	0.3	11.0	37.6	0.6	2530.0	2.9	0.1	0.3	32.5	1750.0	550.0	79.2	0.0	0.5	7.3	4.3	0.3	0.6	99.4	0.0	0.0	3.0	0.2	1.4	0.3	67.0	0.3	4.9	1060.0	2.5
BW-ARD-288	BW0086	164	174	AND	S	7.6	5.1	66.6	0.2	10.0	180.0	1.1	3.9	1.17	24.5	21.0	16.6	66.0	22.1	66.4	5.7	14.4	0.2	0.1	0.0	0.0	2.2	10.0	70.1	1.8	3500.0	1.5	0.2	0.2	35.0	1770.0	1220.0	70.7	0.0	0.4	9.7	8.7	2.1	1.5	145.5	0.0	0.0	3.1	0.3	1.1	0.5	91.0	0.4	7.5	4140.0	2.7
BW-ARD-488	BW0178	219	229	AND	S	0.4	2.0	16.7	0.2	10.0	40.0	1.5	0.2	1.35	3.9	17.5	0.9	120.0	2.0	35.5	0.8	5.2	0.1	0.9	0.0	0.1	0.3	8.9	6.1	0.1	218.0	2.3	0.1	0.6	2.8	80.0	25.0	9.5	0.0	0.4	3.1	1.1	0.2	0.2	57.9	0.0	0.0	8.6	0.0	0.1	3.8	1.0	0.2	6.4	542

Table A2-2: Elemental Content Analytical Results - Waste Rock Results

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
						ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Average Crustal Abundance*						0.075	8.23	1.8	4	10	425	3	0.085	4.15	0.15	66.5	25	102		60	5.6	19	1.5	3	0.085	0.25	2.1	39	20	2.33	950	1.2	2.355	20	84	0.015	14	90	0.0007	0.03	0.2	22	0.05	2.3	370	2		9.6	0.565	0.85	2.7	120	1.25	33	70	165
BW-ARD-470	BW0174	223	233.17	AND	S	0.6	3.1	16.2	0.2	10.0	190.0	0.5	0.1	2.58	6.9	41.9	13.5	89.0	12.5	63.5	4.1	13.0	0.1	0.1	0.0	0.2	1.0	19.1	60.4	1.3	1640.0	4.1	0.2	0.2	21.1	1620.0	8.2	60.6	0.0	0.3	2.6	9.6	0.5	0.7	113.5	0.0	0.0	4.2	0.2	1.0	0.5	114.0	0.2	8.9	815.0	4.3
BW-ARD 634	GM12-02	380	390	SED	S	1.1	2.7	149.0	0.2	10.0	170.0	0.8	0.7	0.92	5.4	13.1	14.7	74.0	21.0	59.1	3.4	7.2	0.1	0.2	0.0	0.1	1.1	6.4	35.0	1.0	984.0	5.6	0.0	0.2	89.5	660.0	87.7	79.1	0.0	0.3	9.7	6.1	1.1	0.4	39.7	0.0	0.1	4.0	0.1	1.4	0.9	63.0	0.2	6.1	810.0	4.9
BW-ARD-691	GM12-05	262	273	AND	S	0.3	4.9	16.9	0.2	10.0	150.0	0.9	0.4	1.76	8.1	19.8	17.3	75.0	24.4	51.3	5.2	17.2	0.2	0.1	0.0	0.2	1.8	9.2	67.4	1.7	2160.0	3.2	0.3	0.3	32.2	1680.0	24.0	93.3	0.0	0.4	1.8	11.8	0.5	0.5	158.0	0.0	0.0	2.4	0.3	2.3	0.2	139.0	0.2	5.0	810.0	2.4
BW-ARD-384	BW0177	100	110	AND	T	9.4	2.4	26.9	0.2	10.0	90.0	0.8	0.1	1.30	0.2	35.9	20.0	95.0	25.4	27.7	4.3	6.3	0.1	0.1	0.0	0.0	0.9	16.8	28.9	1.0	7340.0	1.5	0.0	0.3	27.5	1920.0	37.4	68.3	0.0	0.4	10.0	3.7	0.4	0.4	31.5	0.0	0.0	3.3	0.2	1.9	0.5	47.0	18.2	7.2	797.0	5.2
BW-ARD-170	BW0104	88	98	AND	S	0.1	0.9	4.2	0.2	10.0	250.0	0.5	0.1	0.59	0.0	30.6	9.3	5.0	2.2	18.0	1.5	3.3	0.1	0.5	0.0	0.0	0.3	14.3	10.0	0.4	3210.0	1.7	0.1	0.2	12.9	780.0	5.1	14.5	0.0	0.0	1.2	1.9	0.2	0.4	41.7	0.0	0.0	4.1	0.1	0.1	1.5	25.0	0.1	4.4	737.0	19.1
COMPN260901-M260910	BWWR10	188	197	AND	S	0.5	6.8	18.5	0.0		937.5	1.7	3.6	3.90	2.0		20.0	95.0	25.4	27.7	4.3	6.3	0.1				4.5	17.5		0.4	971.6	3.4	0.3		6.1	296.3	9.6				0.0	12.6	3.4				101.8				10.0	0.1	5.6	5.0	20.5	5.0		732.1	
BW-ARD 606 (duplicate)		0.7	3.5	28.7	0.2	10.0	80.0	1.3	0.3	2.01	7.0	33.3	23.3	35.0	32.2	71.4	3.3	9.6	0.1	0.1	0.0	0.1	1.1	15.8	36.3	0.5	1260.0	1.6	0.3	0.2	34.0	1780.0	51.5	76.6	0.0	0.4	9.4	6.1	0.8	0.4	102.0	0.0	0.0	3.3	0.1	1.7	0.4	71.0	0.4	7.6	732.0	2.7
BW-ARD-552	BW0199	84	94	VC	T	2.0	3.0	74.9	0.2	10.0	80.0	0.8	0.7	0.32	6.4	30.6	6.6	53.0	27.8	45.0	5.8	11.9	0.2	0.1	0.0	0.2	1.3	15.1	57.0	0.9	1650.0	1.3	0.0	0.2	27.2	1170.0	30.3	88.4	0.0	0.0	4.4	8.0	0.5	0.8	51.2	0.0	0.0	4.3	0.2	2.8	0.7	100.0	1.8	9.6	710.0	6.3
BW-ARD-338	BW0104	115	125	AND	S	0.6	3.5	23.8	0.2	10.0	80.0	1.4	0.3	2.08	6.3	37.1	21.3	81.0	31.6	67.1	3.3	9.5	0.1	0.1	0.0	0.1	1.0	17.3	35.8	0.5	1310.0	1.6	0.3	0.3	31.5	1810.0	53.7	71.6	0.0	0.4	10.0	5.8	0.4	0.5	98.5	0.0	0.0	3.6	0.2	1.7	0.5	70.0	0.2	8.4	707.0	3.5
BW-ARD-469	BW0174	173	183	AND	S	0.8	2.9	13.2	0.2	10.0	190.0	0.9	0.2	3.31	2.7	38.9	13.7	63.0	21.3	37.4	3.9	7.0	0.1	0.1	0.0	0.1	1.0	17.4	31.7	1.1	5310.0	1.9	0.0	0.2	20.4	1710.0	24.8	55.2	0.0	0.3	5.1	4.4	0.4	0.4	82.5	0.0	0.0	2.4	0.1	1.3	0.4	55.0	0.1	7.7	671.0	4.0
BW-ARD-554	BW0199	181	191	AND	S	0.1	5.2	25.7	0.2	10.0	100.0	1.1	0.8	1.78	5.2	25.4	16.9	74.0	55.4	4.4	5.7	17.7	0.2	0.1	0.0	0.2	2.2	11.8	77.0	1.9	2070.0	2.2	0.3	0.2	32.9	1790.0	11.7	152.5	0.0	0.1	0.9	11.6	0.6	0.8	125.5	0.0	0.0	3.3	0.3	4.0	0.4	135.0	0.1	7.4	640.0	2.6
COMPG012631-G012640	BWWR11	371	380		S	0.3	7.6	354.0	0.1		940.0	1.6	4.0	3.62	4.6		19.0	71.0		61.0	5.5	20.0					3.4	20.0		1.8	2490.0	1.0	1.2		33.0	1730.0	15.0				0.3	7.0	11.0				475.0				10.0	0.6	5.0	5.0	146.0	5.0		639.0	
BW-ARD-432	BW0171	3	16	AND	T	1.2	1.7	26.8	0.2	10.0	60.0	0.6	0.1	0.51	0.8	32.7	12.4	70.0	11.5	44.1	3.4	5.5	0.1	0.3	0.0	0.0	0.4	15.1	18.7	0.7	11700.0	2.5	0.0	0.2	18.5	1750.0	81.5	24.7	0.0	0.2	8.2	3.6	0.3	0.3	15.0	0.0	0.0	3.1	0.1	0.5	0.9	39.0	0.3	7.8	623.0	10.8
BW-ARD-468	BW0174	157	167	AND	S	4.3	0.4	39.7	0.2	10.0	20.0	0.4	0.1	0.07	3.4	16.4	0.8	77.0	2.4	43.8	0.6	1.6	0.1	0.6	0.0	0.0	0.3	7.3	0.8	0.0	7890.0	1.0	0.0	0.2	1.7	50.0	264.0	11.4	0.0	0.2	7.1	0.3	0.2	0.2	4.2	0.0	0.0	7.1	0.0	0.2	2.6	1.0	0.1	4.7	622.0	14.0
BW-ARD-483	BW0178	97	109	AND	T	0.6	1.5	80.3	0.2	10.0	110.0	0.5	0.8	0.03	12.4	38.2	3.2	73.0	14.7	118.0	4.1	5.2	0.1	0.5	0.0	1.2	0.9	19.0	18.1	0.1	794.0	3.7	0.0	0.4	9.8	620.0	4.3	62.4	0.0	0.0	7.0	2.6	0.4	0.7	20.5	0.0	0.1	5.2	0.1	1.7	1.6	30.0	0.2	8.3	621.0	17.3
COMPM260811-M260820	BWWR10	110	119	AND	T	2.2	6.8	18.9	0.0		1001.3	1.2	2.3	3.55	0.3		0.6	33.3		2.5	0.6	12.5					5.0	12.5		0.1	247.6	2.1	0.1		1.6	42.5	33.1				0.0	18.3	2.5				39.4				10.0	0.1	8.1	5.0	2.0	5.6		613.8	
BW-ARD-120	BW0078	31	41	FT	O	10.5	0.7	522.0	0.2	10.0	90.0	0.3	1.8	0.01	6.9	31.2	0.9	19.0	3.7	66.8	1.6	2.0	0.1	0.3	0.0	0.6	0.3	15.1	1.7	0.0	163.0	3.7	0.0	0.2	1.8	480.0	2320.0	9.8	0.0	0.1	25.7	1.2	0.3	0.3	14.7	0.0	0.0	5.8	0.0	0.2	5.8	9.0	0.1	6.4	610.0	8.3
COMPM261335-M261344	BWWR07	45	54	VC	T	3.3	7.7	56.0	0.0		1080.0	1.9	1.0	0.23	3.1		3.0	14.0		15.0	2.1	20.0					5.5	30.0		0.2	5670.0	2.0	0.2		2.0	420.0	7.0				0.1	8.0	4.0				49.0				10.0	0.2	5.0	10.0	28.0	5.0		583.0	
BW-ARD-015	BW0056	10	20	FT	S/T	4.6	1.4	40.8	0.2	10.0	30.0	0.5	0.2	1.65	2.4	27.8	10.0	14.0	12.0	41.3	2.5	3.9	0.1	0.2	0.0	0.0	0.3	13.5	15.9	0.6	3140.0	2.3	0.0	0.1	14.7	990.0	260.0	15.6	0.0	0.3	59.7	0.0	0.0	0.4	24.0	1.1	7.0	582.0	9.2
BW-ARD-527	BW0191	236	246	FT	S	0.1	2.5	17.7	0.2	10.0	70.0	1.5	1.7	1.44	2.9	16.8	1.2	122.0	3.0	12.3	0.8	7.1	0.1	0.6	0.0	0.0	0.2	7.8	10.0	0.1	1310.0	1.3	0.1	0.5	3.8	90.0	29.6	10.5	0.0	0.1	1.2	1.7	0.3	0.2	53.1	0.0	0.0	9.1	0.0	0.1	3.3	1.0	0.2	5.7	577.0	17.8
BW-ARD-061	BW0095	53	63	VC	T	0.4	2.4	19.4	0.2	10.0	60.0	0.6	0.9	0.12	0.6	26.1	5.3	15.0	16.5	26.2	4.5	6.5	0.1	0.5	0.0	0.2	1.6	13.3	32.1	0.6	2060.0	2.2	0.0	0.2	10.7	620.0	13.8	83.8	0.0	0.2	4.6	2.5	0.4	1.0	7.0	0.0	0.0	6.3	0.2	1.7	1.7	27.0	0.3	6.8	576.0	19.9
COMPM261925-M261934	BWWR03	98	107	VC	T	0.3	7.2	19.0	0.0		1300.0	1.4	1.0	0.14	2.1		2.0	23.0		4.0	2.3	20.0					5.4	20.0		0.2	1865.0	0.5	0.2		3.0	500.0	43.0				0.0	9.0	4.0				84.0				10.0	0.2	5.0	5.0	34.0	5.0		576.0	
BW-ARD-550	BW0198	282	292	VC	S	0.2	5.6	19.7	0.2	10.0	60.0	1.5	0.7	3.10	2.4	17.0	13.2	55.0	18.0	26.3	3.5	15.1	0.2	0.1	0.0	0.1	1.4	7.9	49.4	1.1	2380.0	2.0	0.2	0.6	22.3	1380.0	6.0	98.1	0.0	0.2	9.2	0.8	0.5	0.8	127.0	0.0	0.0	4.2	0.3	1.7	0.8	92.0	0.8	5.1	564.0	4.9
COMPM260871-M260880	BWWR10	162	171	AND	S	6.3	7.2	36.8	0.0		977.5	1.8	2.3	4.23	0.5		0.9	19.8		5.1	0.8	16.3					4.9	17.5		0.1	1542.4	5.4	0.2		2.3	72.5	83.9				0.0	22.5	2.9				62.9				10.0	0.1	6.3	8.8	1.5	5.0		557.4	
BW-ARD 646	GM12-03	229	239		S	0.9	3.3	44.1	0.2	10.0	110.0	1.2	0.4	2.31	3.1	25.7	20.1	50.0	27.9	40.4	4.3	10.8	0.1	0.1	0.0	0.0	1.3	11.9	54.9	0.9	3520.0	2.1	0.0	0.3	32.3	1680.0	142.0	80.1	0.0	0.3	5.5	7.6	0.3	0.6	45.9	0.0	0.0	3.3	0.2	1.5	0.5	86.0	0.2	6.5	551.0	1.6
COMPM260921-M260925	BWWR10	205	210	AND	S	0.4	7.5	31.1	0.0		947.1	1.6	1.9	3.62	3.3		3.9	36.1		13.9	1.9	18.6					4.2	18.6		0.5	1241.1	4.6	0.3		8.7	522.9	18.9				0.1	8.1	5.1				86.4				10.0	0.2	5.7	5.0	38.9	5.0		549.6	
COMPM260861-M260870	BWWR10	145	162	AND	S	0.7	7.2	69.4	0.0		920.0	2.1	2.1	3.74	0.8		1.4	17.1		2.3	0.7	18.6					4.9	20.0		0.1	855.1	2.9	0.3		1.5	64.3	44.9				0.0	14.6	3.0				96.7				10.0	0.1	6.4	7.1	1.4	5.0		519.6	
CMPG012611-G012620	BWWR11	354	362	AND	S/T	0.3	7.4	104.0	0.0		830.0	1.4	1.0	4.13	0.3		17.0	59.0		37.0	3.4	10.0					2.8	10.0		1.8	2050.0	1.0	1.2		32.0	1720.0	15.0				0.1	8.0	11.0				587.0				10.0	0.6	5.0	5.0	134.0	5.0		222.0	
BW-ARD-685	GM12-05	173	183	FT	T	3.6	1.3	63.0	0.2	10.0	120.0	0.3	0.2	0.01	2.1	38.5	0.2	2.0	1.1	59.6	1.0	2.1	0.1	0.4	0.0	0.0	0.3	19.3	0.9	0.0	29.0	3.9	0.0	0.4	0.5	530.0	2300.0	12.5	0.0	0.0	8.3	0.5	0.3	0.2	6.4	0.0	0.0	9.2	0.0	0.2	4.1	1.0	0.1	7.8	220.0	9.3
BW-ARD-563	BW0199	221	231	AND	S	0.8	3.8	20.7	0.2	10.0	140.0	1.5	0.2	1.03	0.9	31.8	17.2	52.0	32.5	42.9	4.7	10.1	0.2	0.1	0.0	0.0	1.7	15.4	46.9	0.8	3370.0	1.5	0.2	0.2	29.6	1870.0	36.1	81.1	0.0	0.1	2.4	5.8	0.6	0.8	60.6	0.0	0.0	3.8	0.3	1.6	0.4	84.0	0.1	8.0	216.0	1.9
COMPM261845-M261854	BWWR03	28	36	AND	T	0.3	8.5	8.0	0.0		1000.0	1.8	1.5	1.35	0.3		16.0	70.0		10.0	5.0	20.0					4.0	20.0		0.2	2710.0	0.5	1.0		2.6	2040.0	9.0				0.0	2.5	13.0				160.0				10.0	0.6	5.0	5.0	158.0	5.0		211.0	
COMPW005902-W005913	BWWR12	205	216	VC	S	0.3	1.7	6.9	0.2	10.0	30.0	0.5	0.6	0.77	1.2	21.0	4.9	14.0	12.2	5.8	2.2	7.5	0.1	0.3	0.0	0.0	0.6	10.2	51.2	0.5	673.0	1.5	0.1	0.5	5.2	570.0	10.3	59.5	0.0	0.1	1.9	3.7	0.2	0.4	72.8	0.0	0.0	5.3	0.1	0.8	1.2	34.0	0.3	4.9	208.0	11.5
BW-ARD-158	BW0094	220	230	AND	S	0.1	2.3	13.9	0.2	10.0	120.0	0.2	0.1	0.98	0.8	33.2	14.3	50.0	14.1	14.8	3.2	9.1	0.2	0.2	0.0	0.0	1.1	15.7	53.3	1.1	1540.0	1.6	0.2	0.2	26.5	1710.0	4.3	64.5	0.0	0.1	0.8	2.5	0.4	0.4	101.0	0.0	0.0	5.8	0.3	1.2	0.8	90.0	0.2	6.9	203.0	4.7
COMPM260841-M260850	BWWR10	136	145	AND	S	0.6	6.8	16.0	0.0		940.0	1.0	1.3	3.80	0.3		0.8	13.1		2.3	0.5	10.0					4.6	10.0		0.1	867.5	0.8	0.1		0.9	45.0	21.6				0.0	6.8	2.3				99.8				10.0	0.1	5.0	5.0	1.0	5.0		203.0	
BW-ARD-548	BW0198	262	272	VC	S	0.3	6.9	24.0	0.2	10.0	50.0	1.9	0.7	3.68	0.3	16.3	15.2	63.0	25.8	49.0	4.0	16.1	0.2	0.1	0.0	0.0	1.8	7.7	58.8	1.4	2480.0	1.4	0.2	0.7	25.1	1380.0	7.5	123.5	0.0	0.2	2.1	9.8	0.6	0.8	163.5	0.0	0.0	3.8	0.3	2.1	0.5	108.0	1.1	5.9	202.0	3.3
BW-ARD-401	BW0177	287	297	AND	S	0.2	4.2	21.1	0.2	10.0	220.0	0.6	0.1	3.31	0.6	29.3	18.4	118.0	26.8	43.1	4.6	13.5	0.1	0.1	0.0	0.0	1.7	13.7	55.4	1.6	1440.0	2.6	0.3	0.1	32.5	1650.0	6.6	88.9	0.0	0.4	1.7	10.1	0.5	0.8	414.0	0.0	0.0	3.3	0.2	2.1	0.4	129.0	0.1	9.2	201.0	3.8
BW-ARD-545	BW0198	232	242	VC	S	0.2	5.3	59.9	0.2	10.0	60.0	1.6	1.4	3.00	0.6	16.4	11.9	49.0	20.7	29.0	3.3	15.7	0.2	0.1	0.0	0.1	1.2	7.8	45.5	1.0	1490.0	0.9	0.2	0.6	20.1	1130.0	7.9	94.5	0.0	0.2	2.4	7.5	0.5	0.7	123.5	0.0	0.1	4.1	0.2	1.8	0.7	84.0	1.1	5.1	198.0	4.6
BW-ARD 621	GM12-01	316	326	VC	T	0.4	1.1	84.9	0.2	10.0	50.0	0.8	0.5	0.26	0.4	26.2	4.6	5.0	10.0	16.0	1.6	3.4	0.1	0.5	0.0	0.0	0.5	13.1	26.2	0.3	935.0	1.7	0.0	0.3	4.2	430.0	32.9	47.3	0.0	0.0	6.4	0.9	0.2	0.2	16.0	0.0	0.0	6.6	0.1	1.2	2.0	10.0	0.1	5.4	197.0	17.5
BW-ARD-382	BW0104	134	146	AND	S	0.1	4.2	20.9	0.2	10.0	80.0	1.3	0.1	2.34	1.0	32.4	15.8	90.0	32.7	14.0	3.7	13.5	0.1	0.1	0.0	0.0	1.2	15.5	53.7	0.7	1900.0	1.3	0.4	0.3	24.8	1560.0	13.1	84.5	0.0	0.1	4.5	7.9	0.3	0.7	154.0	0.0	0.0	4.0	0.2	1.7	0.6	98.0	0.2	7.4	193.0	4.7
COMPG012571-G012580	BWWR11	319	328	AND	S	0.3	6.7	2.5	0.0		790.0	1.4	2.0	3.60	0.3		19.0	60.0		34.0	4.7	20.0					2.2	10.0		1.8	1705.0	0.5	1.8		32.0	1670.0	11.0				0.1	5.0	9.0				587.0				10.0	0.5	5.0	5.0	136.0	5.0		189.0	
COMPM261468-M261477	BWWR06	63	72	VC	T	1.7	7.6	84.0	0.0		1340.0	1.6	1.0	0.37	0.3		4.0	26.0		3.0	2.0	20.0					4.9	20.0		0.2	4360.0	2.0	0.8		3.0	510.0	51.0				0.1	2.5	4.0				111.0				10.0	0.2	5.0	10.0	34.0	10.0		186.0	
BW-ARD-697	GM12-05	371	381	AND	S	0.2	4.8	10.0	0.2	10.0	120.0	1.0	0.2	2.27	0.6	31.4	17.6	66.0	33.7	41.4	4.3	15.4	0.2	0.1	0.0	0.0	1.7	14.7	49.0	1.5	1340.0	1.6	0.4	0.2	31.1	1730.0	14.4	108.0	0.0	0.1	0.4	1.0	10.5	0.5	0.7	384.0	0.0	0.0	3.4	0.3	2.1	0.5	125.0	0.2	8.1	185.0	3.0
BW-ARD-481	BW0175	279	289	AND	S	0.1	4.9	21.3	0.2	10.0	150.0	1.5	0.1	3.06	0.9	24.2	13.5	102.0	34.3	26.0	3.9	15.1	0.1	0.1	0.0	0.0	1.4	10.6	66.0	1.2	1540.0	1.0	0.4	0.2	29.6	1700.0	10.9	102.5	0.0	0.3	2.0	11.0	0.4	0.6	131.0	0.0	0.0	3.1	0.2	2.4	0.6	118.0	0.2	6.8	184.0	3.8
COMPG012591-G012600	BWWR11	336	345	AND	S	0.3	7.3	31.0	0.0		1030.0	1.5	3.0	4.09	0.3		18.0	59.0		22.0	4.6	20.0					2.8	10.0		1.7	1850.0	0.5	1.7		32.0	1650.0	10.0				0.1	5.0	10.0				627.0				10.0	0.6	10.0	5.0	137.0	5.0		182.0	
COMPG012581-G012590	BWWR11	328	336	AND	S	0.3	6.9	15.0	0.0		940.0	1.5	1.0	4.48	0.3		18.0	57.0		35.0	4.4	20.0					2.3	10.0		1.6	1765.0	0.5	1.1		32.0	1590.0	9.0				0.1	6.0	10.0				394.0				10.0	0.5	10.0	5.0	132.0	5.0		182.0	
BW-ARD-698	GM12-05	381	391	AND	S	0.1	4.7	6.7	0.2	10.0	220.0	0.7	0.1	1.77	0.2	30.4	19.2	62.0	34.4	46.8	4.6	15.6	0.2	0.1	0.0	0.0	2.0	13.7	53.2	1.7	1630.0	1.3	0.5	0.2	28.6	1760.0	7.2	115.5	0.0	0.3	0.8	9.5	0.6	1.0	243.0	0.0	0.0	3.8	0.3	1.9	0.4	131.0	0.5	8.5	181.0	2.9
COMPG012561-G012570	BWWR11	311	319	AND	S	0.6	7.9	47.0	0.0		890.0	1.6	1.0	4.36	0.3		20.0	65.0		51.0	4.7	20.0					2.4	20.0		1.8	1410.0	0.5	1.5		29.0	1780.0	6.0				0.0	2.5	11.0				570.0				10.0	0.6	5.0	5.0	147.0	5.0		180.0	
COMPW005342-W006350	BWWR13	332	340	CGL	S	1.6	6.3	47.0	0.0		1190.0	2.0	1.0	1.39	1.6		4.0	18.0		8.0	0.7	10.0					4.0	14.0		0.1	503.0	3.0	0.3		2.0	80.0	62.0				0.0	2.5	2.0				143.0				10.0	0.1	5.0	5.0	1.0	5.0		179.0	
BW-ARD 657	GM12-03	367	377	SED	S	0.5	4.9	55.4	0.2	10.0	320.0	0.8	0.2	1.93	0.5	9.6	22.6	168.0	22.7	57.9	3.9	12.3	0.1	0.0	0.0	0.0	1.4	4.7	50.0	2.2	738.0	1.6	0.1	0.2	159.5	650.0	21.4

Table A2-2: Elemental Content Analytical Results - Waste Rock Results

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
Average Crustal Abundance*						0.075	8.23	1.8	4	10	425	3	0.085	4.15	0.15	66.5	25	102		60	5.6	19	1.5	3	0.085	0.25	2.1	39	20	2.33	950	1.2	2.355	20	84	0.015	14	90	0.0007	0.03	0.2	22	0.05	2.3	370	2		9.6	0.565	0.85	2.7	120	1.25	33	70	165
BW-ARD-539	BW0198	172	182	VC	S	0.2	4.1	31.4	0.2	10.0	40.0	1.3	0.2	2.13	0.7	19.0	9.2	37.0	17.1	13.3	2.8	13.0	0.1	0.2	0.0	0.0	0.9	9.2	46.3	0.9	1880.0	0.9	0.4	0.3	15.0	880.0	6.9	76.7	0.0	0.2	2.0	6.0	0.4	0.6	95.5	0.0	0.0	4.7	0.2	1.4	1.0	65.0	0.4	5.9	159.0	8.3
BW-ARD-659	GM12-03	387	397	SED	S	0.4	4.4	43.8	0.2	10.0	310.0	0.9	0.2	1.27	0.5	16.2	19.6	109.0	19.1	66.8	3.6	11.9	0.1	0.1	0.0	0.0	1.2	8.2	43.2	1.7	467.0	4.0	0.1	0.2	4.2	12.1	1.5	0.6	101.5	0.0	0.1	2.8	0.1	0.8	0.3	103.0	0.2	5.3	158.0	2.2
COMPP012930-P1290939	BWWR10	40	48	FLPT	O	0.3	7.6	21.6	0.0		1010.0	1.5	1.4	0.05	5.2		15.8	45.9		5.8	4.4	20.0					2.8	16.3		1.6	2134.4	0.9	2.0		22.1	1748.8	16.5				0.1	12.5	10.3			460.6			10.0	0.5	5.6	8.1	133.0	5.0		155.4	
BW-ARD-388	BW0177	147	157	AND	S	0.2	5.1	19.8	0.2	10.0	230.0	0.9	0.1	1.95	0.2	23.7	16.2	89.0	32.4	15.4	5.1	12.0	0.1	0.1	0.0	0.0	1.6	10.5	62.3	1.6	1940.0	2.4	0.2	0.2	19.4	2060.0	10.6	95.7	0.0	0.1	2.5	6.6	0.4	0.6	139.0	0.0	0.0	2.3	0.2	2.6	0.3	106.0	0.2	7.9	155.0	2.3
BW-ARD 628	GM12-02	28	38	FLPT	T	3.5	0.4	240.0	0.8	10.0	110.0	0.3	3.2	0.01	10.3	24.1	0.3	2.0	2.1	38.7	0.9	1.3	0.1	0.4	0.1	0.7	0.2	11.4	1.3	0.0	37.0	3.9	0.0	0.1	0.6	210.0	396.0	8.2	0.0	0.0	9.1	0.4	0.2	0.2	9.8	0.0	0.0	7.2	0.0	0.2	2.5	1.0	0.1	4.2	154.0	13.2
COMPM261600-M261609	BWWR05	80	88	AND	T	0.5	7.6	15.0	0.0		1190.0	1.4	1.0	4.08	0.3		17.0	61.0		5.0	4.8	20.0					2.3	20.0		1.8	1910.0	0.5	1.8		29.0	1720.0	9.0				0.0	6.0	10.0			594.0			10.0	0.5	5.0	5.0	141.0	5.0		152.0	
COMPM260911-M260920	BWWR10	197	205	AND	S	0.3	7.5	60.1	0.0		901.3	1.4	1.8	3.21	5.2		15.9	40.8		10.4	4.5	20.0					3.7	17.5		1.4	4022.5	3.1	1.1		22.6	1616.3	17.8				0.1	4.6	10.5			405.6			10.0	0.5	5.6	5.0	128.8	5.0		152.0	
BW-ARD-549	BW0198	272	282	VC	S	0.1	5.0	29.4	0.2	10.0	79.0	1.5	0.3	2.73	0.1	18.9	13.4	48.0	21.1	15.6	3.4	13.3	0.2	0.1	0.0	0.0	1.3	9.0	51.5	1.0	2060.0	6.0	0.1	0.7	21.7	1320.0	6.9	102.0	0.0	0.1	3.0	6.7	0.5	0.6	85.4	0.0	0.0	4.2	0.2	1.9	0.8	84.0	0.4	5.6	151.0	6.5
COMPM261621-M261630	BWWR05	98	107	AND	T	0.3	7.5	30.0	0.0		960.0	1.5	1.0	4.26	0.3		19.0	57.0		0.5	4.8	20.0					2.6	20.0		1.6	1900.0	0.5	1.6		29.0	1800.0	5.0				0.0	2.5	10.0			573.0			10.0	0.6	5.0	5.0	145.0	5.0		151.0	
COMPM261570-M261579	BWWR05	54	62	AND	T	0.3	7.2	105.0	0.0		720.0	1.4	1.0	4.30	0.3		26.0	65.0		17.0	5.4	20.0					1.8	20.0		1.7	1835.0	17.0	2.0		36.0	1660.0	11.0				0.2	2.5	10.0			504.0			10.0	0.5	5.0	5.0	136.0	5.0		148.0	
COMPM261488-M261497	BWWR06	81	90	VC	T/S	0.8	7.8	17.0	0.0		1120.0	1.6	1.0	0.32	0.3		4.0	29.0		2.0	1.9	20.0					4.5	20.0		0.2	2230.0	3.0	0.9		5.0	550.0	28.0				0.0	2.5	5.0			106.0			10.0	0.2	5.0	5.0	39.0	10.0		148.0	
COMPP012980-P012989	BWWR10	83	92	FLPT	T	0.3	7.3	21.0	0.0		861.4	1.6	1.0	0.04	0.6		10.0	40.0		3.4	3.5	20.0					3.0	18.6		1.1	1434.3	0.9	1.3		13.3	1138.6	10.7				0.0	2.5	8.4			384.1			10.0	0.4	5.7	5.0	97.7	5.0		147.3	
BW-ARD-568	BW0211	197	207	AND	S	0.1	6.5	36.4	0.2	10.0	210.0	1.4	0.0	2.99	0.2	20.8	21.9	95.0	47.6	4.6	5.1	16.8	0.2	0.1	0.0	0.0	2.2	10.6	68.2	1.4	2940.0	2.6	0.4	0.2	53.0	1800.0	28.4	121.0	0.0	0.0	1.4	12.7	0.5	0.5	168.0	0.0	0.0	2.7	0.3	3.1	0.3	142.0	0.2	6.7	147.0	1.8
COMPM261855-M261864	BWWR03	36	45	AND	T	0.3	8.3	23.0	0.0		950.0	1.7	1.0	2.57	0.3		19.0	69.0		5.0	5.1	20.0					3.0	20.0		1.0	2170.0	1.0	1.6		32.0	1920.0	12.0				0.0	2.5	12.0			297.0			10.0	0.6	5.0	5.0	157.0	5.0		146.0	
COMPW005821-W005831	BWWR12	135	144	VC	S	0.3	7.6	8.0	0.0		1280.0	1.6	1.0	0.44	0.3		4.0	20.0		11.0	1.9	20.0					3.8	20.0		0.2	743.0	4.0	1.6		10.0	620.0	28.0				0.1	13.0	4.0			171.0			10.0	0.2	5.0	5.0	35.0	5.0		146.0	
BW-ARD-676	GM12-05	50	60	FT	O	3.8	0.7	78.5	0.2	10.0	20.0	0.2	0.3	0.07	1.1	34.8	2.7	3.0	1.0	35.0	0.7	1.8	0.1	0.4	0.0	0.1	0.2	15.8	2.7	0.0	1440.0	2.6	0.0	0.3	1.2	160.0	1970.0	7.1	0.0	0.0	14.1	0.9	0.3	0.2	6.7	0.0	0.0	8.9	0.0	1.1	7.3	6.0	0.3	5.5	146.0	11.2
COMPM261590-M261599	BWWR05	71	80	AND	T	0.3	7.3	23.0	0.0		980.0	1.5	1.0	3.71	0.3		20.0	69.0		6.0	4.7	20.0					2.1	20.0		1.7	1470.0	0.5	2.1		29.0	1750.0	10.0				0.0	5.0	10.0			536.0			10.0	0.6	5.0	5.0	145.0	5.0		145.0	
COMPP012940-P1290949	BWWR10	48	57	FLPT	O	0.3	7.7	25.0	0.0		803.8	1.4	1.0	0.05	4.6		17.8	44.1		1.4	4.5	20.0					2.9	18.8		1.8	2783.8	0.9	1.6		22.0	1757.5	18.0				0.0	7.9	10.5			573.9			10.0	0.5	6.3	7.5	130.4	5.0		144.9	
COMPM261478-M261487	BWWR06	72	81	VC	T	1.3	6.5	17.0	0.0		870.0	1.7	2.0	0.25	0.3		5.0	28.0		7.0	2.0	20.0					4.0	10.0		0.2	1780.0	1.0	1.2		4.0	590.0	32.0				0.0	2.5	4.0			103.0			10.0	0.2	5.0	5.0	45.0	5.0		144.0	
COMPM261560-M261569	BWWR05	45	54	AND	T	0.3	7.2	28.0	0.0		770.0	1.6	1.0	3.52	0.3		19.0	58.0		7.0	5.6	20.0					2.4	10.0		2.0	1740.0	2.0	1.7		43.0	1680.0	10.0				0.0	6.0	11.0			465.0			10.0	0.6	10.0	5.0	141.0	5.0		142.0	
COMPP012920-P1290929	BWWR10	30	40	FLPT	O	0.3	7.5	38.0	0.0		1024.3	1.6	2.6	0.06	1.0		16.9	43.1		9.4	4.5	20.0					3.2	20.0		1.5	3114.3	2.7	1.6		22.9	1820.0	9.7				0.1	7.2	10.6			431.3			10.0	0.5	5.0	5.0	132.0	5.0		140.8	
COMPG012531-G012540	BWWR11	285	294		S/T	0.8	8.1	34.0	0.0		970.0	1.6	1.0	4.15	0.3		17.0	65.0		64.0	5.0	20.0					2.6	20.0		1.6	1770.0	0.5	1.6		26.0	1690.0	9.0				0.3	5.0	11.0			511.0			10.0	0.5	5.0	5.0	134.0	5.0		140.0	
BW-ARD-680	GM12-05	99	109	FT	O	5.7	1.2	43.5	0.2	10.0	50.0	0.6	0.4	0.02	3.1	49.0	5.8	1.0	0.9	71.2	0.7	1.8	0.1	0.2	0.0	0.2	0.3	17.2	1.1	0.0	4900.0	4.4	0.0	0.4	0.8	1080.0	7760.0	8.5	0.0	0.0	14.0	0.4	0.2	0.2	4.2	0.0	0.0	8.8	0.0	1.0	11.5	1.0	0.1	5.8	140.0	4.9
BW-ARD-385B	BW0177	117	127	AND	S	0.8	3.0	18.1	0.2	10.0	150.0	0.8	0.1	2.70	0.2	30.1	17.8	78.0	16.7	20.6	4.1	8.4	0.1	0.1	0.0	0.0	0.9	13.5	37.8	1.1	3030.0	2.2	0.1	0.3	24.6	1840.0	47.8	55.9	0.0	0.1	9.5	4.5	0.3	0.5	92.1	0.0	0.0	3.8	0.2	1.3	0.5	67.0	0.3	7.7	139.0	6.1
BW-ARD-544	BW0198	222	232	VC	S	0.2	5.2	36.0	0.2	10.0	60.0	1.6	0.1	2.75	0.1	17.4	11.8	51.0	26.8	17.7	3.3	15.0	0.2	0.1	0.0	0.0	1.5	8.3	51.1	1.1	2100.0	1.2	0.1	0.6	20.7	1160.0	5.7	110.0	0.0	0.1	1.8	8.9	0.5	0.6	90.5	0.0	0.0	3.7	0.2	2.3	0.7	92.0	0.5	5.7	138.0	4.6
BW-ARD-402	BW0177	287	297	AND	S	0.2	4.1	14.3	0.2	10.0	360.0	0.5	0.0	2.98	0.1	22.8	18.4	131.0	23.1	24.6	4.4	15.1	0.1	0.1	0.0	0.0	2.0	10.6	55.5	1.7	1170.0	2.7	0.4	0.2	34.7	1690.0	5.5	93.6	0.0	0.1	0.9	11.1	0.4	0.7	239.0	0.0	0.0	2.9	0.3	1.3	0.3	136.0	0.1	6.8	137.0	3.7
BW-ARD-386	BW0177	127	137	AND	S	0.3	3.6	17.9	0.2	10.0	180.0	1.0	0.1	2.44	0.3	32.7	15.2	68.0	20.3	18.7	3.8	9.6	0.1	0.1	0.0	0.0	1.3	14.9	46.7	1.1	2100.0	1.6	0.1	0.2	21.2	1920.0	14.2	77.6	0.0	0.1	4.4	5.3	0.4	0.6	82.9	0.0	0.0	3.5	0.2	1.8	0.5	79.0	0.2	8.0	134.0	4.4
COMPM261580-M261589	BWWR05	62	71	AND	T	0.3	7.3	33.0	0.0		780.0	1.5	1.0	3.85	0.3		18.0	67.0		5.0	4.9	20.0					2.0	20.0		1.6	1580.0	3.0	2.0		28.0	1720.0	5.0				0.1	5.0	10.0			485.0			10.0	0.6	5.0	5.0	142.0	5.0		134.0	
BW-ARD-534	BW0198	121	131	VC	S	0.1	5.1	28.5	0.2	10.0	50.0	1.5	0.1	2.61	0.2	18.3	9.3	42.0	21.3	7.5	2.9	14.5	0.1	0.2	0.0	0.0	1.1	8.7	43.2	1.0	2210.0	3.2	0.3	0.3	15.4	920.0	8.6	89.9	0.0	0.1	1.0	6.7	0.4	0.6	154.5	0.0	0.0	5.2	0.2	1.7	1.1	70.0	0.3	5.7	133.0	9.3
COMPM261540-M261549	BWWR05	28	36	AND	T	0.3	6.9	17.0	0.0		1240.0	1.4	4.0	3.96	0.3		21.0	56.0		26.0	5.1	20.0					2.2	10.0		1.6	1765.0	0.5	1.9		44.0	1680.0	10.0				0.1	8.0	9.0			546.0			10.0	0.5	20.0	5.0	133.0	5.0		133.0	
COMPM261550-M261559	BWWR05	36	45	AND	T	0.3	6.8	11.0	0.0		1250.0	1.5	1.0	3.65	0.3		19.0	60.0		8.0	4.7	20.0					2.3	10.0		2.0	1530.0	0.5	2.0		3.65	40.0	1660.0	7.0			0.0	2.5	9.0			449.0			10.0	0.6	10.0	5.0	142.0	5.0		133.0	
BW-ARD-682	GM12-05	131	141	FT	O	3.2	1.0	61.9	0.2	10.0	130.0	0.4	0.5	0.01	0.5	31.4	0.8	1.0	1.1	17.7	0.9	1.6	0.1	0.3	0.0	0.1	0.3	15.8	1.2	0.0	303.0	4.1	0.0	0.4	0.5	510.0	1900.0	9.9	0.0	0.0	9.5	0.4	0.2	0.2	3.0	0.0	0.0	8.9	0.0	0.2	4.2	1.0	0.1	5.6	131.0	7.9
COMPP012910-P1290919	BWWR10	20	30	FLPT	O	0.3	7.5	27.6	0.0		831.3	1.4	1.3	0.03	0.5		15.8	40.8		2.9	4.4	20.0					3.1	18.8		1.6	1713.8	3.1	2.2		21.9	1667.5	7.9				0.0	2.5	10.5			521.3			10.0	0.5	5.6	5.0	130.3	5.0		130.6	
BW-ARD-407	BW0181	117	127	AND	S	0.1	2.8	7.1	0.2	10.0	360.0	0.4	0.1	2.14	0.1	38.5	17.0	85.0	23.7	8.3	4.2	11.9	0.2	0.4	0.0	0.0	1.9	17.7	50.8	1.8	806.0	1.9	0.2	0.2	24.4	1710.0	2.8	92.3	0.0	0.0	0.7	7.9	0.5	0.8	178.5	0.0	0.0	3.4	0.3	1.0	0.9	126.0	0.3	10.0	130.0	13.4
BW-ARD-398	BW0177	247	257	AND	S	0.1	5.2	30.9	0.2	10.0	240.0	0.7	0.0	2.32	0.2	22.7	18.3	136.0	31.7	2.8	4.7	16.9	0.2	0.1	0.0	0.0	1.9	10.5	68.0	1.9	1520.0	2.0	0.5	0.1	40.1	1760.0	7.8	112.5	0.0	0.0	2.3	10.3	0.6	0.8	197.5	0.0	0.0	2.3	0.3	2.9	0.2	146.0	0.1	6.0	129.0	2.9
COMPM261498-M261509	BWWR06	90	100	VC	S	0.7	7.6	8.0	0.0		1080.0	1.6	1.0	0.37	0.3		3.0	26.0		2.0	1.9	20.0					4.1	20.0		0.2	1505.0	1.0	1.4		4.0	450.0	34.0				0.0	2.5	4.0			126.0			10.0	0.2	5.0	5.0	36.0	5.0		129.0	
BW-ARD-684	GM12-05	163	173	FT	O	3.9	1.0	49.8	0.2	10.0	190.0	0.3	0.2	0.01	0.4	30.5	0.3	5.0	1.1	11.9	0.5	1.6	0.1	0.4	0.0	0.0	0.3	15.1	0.6	0.0	50.0	1.4	0.0	0.5	0.5	390.0	1600.0	9.6	0.0	0.0	8.2	0.2	0.4	0.2	4.9	0.0	0.0	8.5	0.0	0.2	3.4	1.0	0.1	7.1	129.0	9.2
COMPG012521-G012530	BWWR11	277	285	VC	S/T	0.3	7.9	14.0	0.0		1030.0	2.0	1.0	1.86	0.3		8.0	24.0		18.0	2.8	20.0					3.5	20.0		0.6	1475.0	0.5	1.2		6.0	970.0	17.0				0.0	8.0	7.0			263.0			10.0	0.3	5.0	5.0	71.0	5.0		128.0	
BW-ARD-387	BW0177	137	147	AND	S	0.3	3.2	18.3	0.2	10.0	150.0	0.8	0.1	1.07	0.1	22.1	19.2	77.0	27.4	30.8	4.7	7.8	0.1	0.1	0.0	0.0	1.2	9.8	43.0	1.3	3280.0	2.0	0.0	0.2	21.6	2050.0	6.2	71.3	0.0	0.2	5.3	4.4	0.3	0.5	57.5	0.0	0.0	2.5	0.2	1.7	0.3	68.0	0.2	7.0	127.0	3.1
COMPM261965-M261974	BWWR03	133	142	VC	T	0.3	7.4	139.5	0.0		1285.0	1.5	2.8	0.20	0.6		3.3	15.0		6.0	1.9	16.3					4.9	20.0		0.2	1274.1	2.6	0.2		3.5	400.0	68.8				0.1	14.3	3.9			75.8			10.0	0.2	5.6	6.9	26.8	5.0		125.0	
COMPG012300-G012309	BWWR11	86	95	VC	T	0.3	7.9	146.0	0.0		1080.0	1.5	1.0	0.35	0.3		3.0	16.0		8.0	2.0	20.0					4.2	20.0		0.2	599.0	0.5	1.1		2.0	520.0	25.0				0.0	18.0	4.0			128.0			10.0	0.2	5.0	5.0	37.0	5.0		125.0	
COMPG012280-G012289	BWWR11	69	77	FT	T	1.2	7.7	225.0	0.0		890.0	1.5	1.0	1.19	0.3		6.0	29.0		9.0	3.5	20.0					3.9	20.0		0.6	1745.0	0.5	1.1		11.0	1140.0	27.0				0.0	15.0	7.0			188.0			10.0	0.3	5.0	7.6	70.0	5.0		125.0	
COMPM261875-M261884	BWWR03	54	62	AND	T	0.3	8.4	13.0	0.0		1280.0	1.9	1.0	2.60	0.3		3.6	20.0		16.0	6.8	20.0					3.6	20.0		0.5	1630.0	1.0	1.3		35.0	2390.0	26.0				0.0	2.5	13.0			301.0			10.0	0.7	5.0	5.0	159.0	5.0		124.0	
COMPG012290-G012299	BWWR11	77	86	VC	T	21.5	7.5	184.0	0.0		1130.0	1.5	1.0	0.35	0.3		2.0	19.0		22.0	1.9	20.0					4.4	20.0		0.2	940.0	1.0	1.2		3.0	400.0	126.0				0.0	33.0	3.0			126.0			10.0	0.2	5.0	5.0	27.0	5.0		123.0	
BW-ARD 627	GM12-02	5	15	FLPT	T	7.4	0.5	202.0	0.3	10.0	70.0	0.2	4.5	0.01	3.7	28.2	0.3	2.0	0.9	47.0	1.4	2.1	0.1	0.4	0.1	2.9	0.4	13.5	2.4	0.0	72.0	3.5	0.0	0.2	0.7	180.0	154.0	12.9	0.0	0.0	13.1	0.6	0.2	0.4	7.6	0.0	0.1	6.6	0.0	0.2	2.0	1.0	0.1	2.9	122.0	12.0
BW-ARD-390	BW0177	167	177	AND	S	0.2	3.7	21.6	0.2	10.0	240.0	0.4	0.1	2.39	0.2	31.5	17.0	129.0	34.3	33.7	5.0	13.9	0.2	0.1	0.0	0.0	1.7	14.6	64.3	1.7	1370.0	2.4	0.2	0.2	33.9	1630.0	4.7	104.0	0.0	0.4	3.2	10.8	0.4	0.8	113.5	0.0	0.0	3.7	0.3	2.8	0.6	140.0	0.2	7.5	121.0	5.8
BW-ARD-540	BW0198	182	192	VC	S	0.4	2.9	17.9	0.2	10.0	300.0	0.6	0.1	1.41	0.4	20.6	8.7	35.0	10.9	6.8	2.6	10.7	0.1	0.3	0.0	0.0	0.6	10.1	42.6	0.7	2200.0	1.0	0.3	0.4	14.3	760.0	6.3	53.1	0.0	0.3	2.6	5.0	0.4	0.7	68.5	0.0	0.0	5.0	0.1	0.9	1.2	56.0	0.3	6.1	121.0	11.2
COMPM261530-M261539	BWWR05	19	28	AND	T	0.3	7.5	10.0	0.0		900.0	1.4	1.0	3.88	0.3		17.0	60.0		23.0	4.8	20.0					2.1	10.0		1.5	1340.0	0.5	1.9		33.0	1720.0	13.0				0.1	2.5	11.0			513.0			10.0	0.6	5.0	5.0	137.0	5.0		120.0	
BW-ARD-679	GM12-05	80	90	FT	O	5.9	0.8	156.5	0.2	10.0	20.0	0.8	4.1	0.01	1.5	31.9	1.9	1.0	0.6	72.2	1.0	1.7	0.1	0.1	0.0	0.6	0.3	16.9	0.7	0.0	802.0	4.8	0.0	0.5	0.3	1610.0	9550.0	7.4	0.0	0.0	10.6	0.5	0.5	0.2	2.3	0.0	0.0	9.5	0.0	0.6	19.0	1.0	0.2	10.6	120.0	1.5
BW-ARD-440	BW0171	238	248	AND	S	0.1	4.2	191.5	0.2	10.0	80.0	1.0	0.1	2.49	0.3	27.4	11.3	91.0	13.7	20.7	3.9	13.9	0.1	0.1	0.0	0.0	0.8	12.4	59.8	1.3	811.0	2.2	0.4	0.2	19.7	1790.0	11.5	50.3	0.0	0.3	1.4	8.8	0.4	0.7	161.5	0.0	0.0	3.1	0.2	1.5	0.4	123.0	0.3	6.7	119.0	3.1
COMPG012231-G012240	BWWR11	26	35	AND	T	0.3	8.0	16.0	0.0		720.0	1.5	1.0	2.89	0.3		15.0	58.0		22.0	5.4	20.0					2.4	20.0		0.6	1495.0	0.5	1.7		24.0	1930.0	15.0				0.2	2.5	11.0			319.0			10.0	0.6	5.0	5.0	133.0	5.0		119.0	
COMPG012441-G012450	BWWR11	208	217	VC	S	0.3	7.7	13.0	0.0		1020.0	1.7	1.0	1.28	0.3		4.0	17.0		38.0	1.9	20.0					3.6	20.0		0.4	732.0	2.0	1.3		55.0	560.0	20.0				0.0	2.5	5.0			171.0			10.0	0.2	5.0	5.0	40.0	5.0		119.0	
BW-ARD-582	BW0096	70	80	FT	T

Table A2-2: Elemental Content Analytical Results - Waste Rock Results

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
						ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Average Crustal Abundance*						0.075	8.23	1.8	4	10	425	3	0.085	4.15	0.15	66.5	25	102		60	5.6	19	1.5	3	0.085	0.25	2.1	39	20	2.33	950	1.2	2.355	20	84	0.015	14	90	0.0007	0.03	0.2	22	0.05	2.3	370	2		9.6	0.565	0.85	2.7	120	1.25	33	70	165
COMPG012461-G012470	BWWR11	227	234	VC	S	0.3	8.2	11.0	0.0		1030.0	1.7	1.0	0.56	0.3		3.0	21.0		13.0	2.0	20.0					0.3	910.0	2.0	0.9		11.0	480.0	14.0						0.0	2.5	5.0			110.0			10.0	0.2	5.0	10.0	38.0	5.0		60.0	
COMPW006174-W006184	BWWR13	186	196	CGL	S	0.3	7.3	117.0	0.0		3530.0	1.4	1.0	3.49	0.3		15.0	82.0		19.0	1.3	20.0					0.2	460.0	3.0	1.2		51.0	1130.0	18.0						0.1	7.0	6.0			287.0			10.0	0.5	5.0	122.0	5.0			60.0	
BW-ARD-678	GM12-05	70	80	FT	O	5.9	0.5	91.6	0.2	10.0	10.0	0.3	1.0	0.01	0.6	27.8	0.4	2.0	0.5	38.2	0.7	1.2	0.1	0.3	0.0	0.1	0.2	15.1	0.5	0.0		57.0	3.4	0.0	0.5	0.6	530.0	2170.0	5.9	0.0	0.0	18.1	0.4	0.3	0.2	2.0	0.0	0.0	9.5	0.0	0.2	6.5	1.0	0.3	7.4	60.0	7.0
COMPM261754-M261763	BWWR04	67	76	AND/PPY	T	0.3	7.4	9.5	0.0		1278.8	1.7	1.6	1.67	0.3		4.9	15.1		18.9	1.9	20.0					3.1	20.0		0.5		446.5	5.3	2.3		7.5	805.0	12.5			0.2	4.5	4.1			669.5			10.0	0.3	5.0	50.0	5.0		59.3	
COMPG012451-G012460	BWWR11	217	227	VC	S	0.3	7.9	10.0	0.0		1200.0	1.8	1.0	1.27	0.3		2.0	27.0		4.0	2.0	20.0					3.9	20.0		0.4		781.0	2.0	1.6		5.0	480.0	23.0			0.0	2.5	5.0			216.0			10.0	0.2	5.0	10.0	36.0	5.0		58.0	
COMPG012431-G012440	BWWR11	198	208	VC	S	0.3	8.1	2.5	0.0		1200.0	1.7	1.0	1.14	0.3		4.0	15.0		2.0	1.9	20.0					3.8	20.0		0.3		888.0	1.0	1.6		3.0	1360.0	18.0			0.0	2.5	5.0			227.0			10.0	0.2	5.0	10.0	42.0	5.0		58.0	
COMPG012350-G012359	BWWR11	128	137	VC	T	0.3	7.3	10.0	0.0		1070.0	1.6	1.0	0.78	0.3		4.0	14.0		5.0	1.9	20.0					3.4	20.0		0.3		749.0	0.5	1.6		2.0	610.0	17.0			0.0	2.5	4.0			178.0			10.0	0.2	5.0	5.0	34.0	5.0		56.0	
COMPW005853-W005855	BWWR12	163	166	VC	S	0.3	8.1	19.0	0.0		1370.0	1.5	1.0	0.27	0.3		4.0	20.0		10.0	1.7	20.0					3.9	20.0		0.2		600.0	2.0	1.7		1.0	480.0	31.0			0.1	11.0	4.0			146.0			10.0	0.2	5.0	5.0	31.0	5.0		56.0	
COMPW005730-W005740	BWWR12	55	66	VC	T	0.3	7.7	6.0	0.0		1380.0	1.6	2.0	0.93	0.3		5.0	25.0		2.0	2.1	20.0					3.8	20.0		0.3		784.0	3.0	1.5		2.0	660.0	26.0			0.0	8.0	5.0			225.0			10.0	0.2	5.0	5.0	42.0	5.0		56.0	
COMPG012340-G012349	BWWR11	120	128	VC	T	0.3	7.6	2.5	0.0		1130.0	1.4	1.0	0.52	0.3		3.0	15.0		2.0	1.8	20.0					3.8	20.0		0.2		609.0	0.5	1.4		3.0	490.0	17.0			0.0	2.5	4.0			145.0			10.0	0.2	5.0	5.0	29.0	5.0		55.0	
COMPG012411-G012420	BWWR11	179	187	VC	S	0.3	7.7	11.0	0.0		1020.0	1.6	1.0	1.13	0.3		2.0	14.0		13.0	1.9	20.0					3.1	20.0		0.4		678.0	2.0	1.7		3.0	600.0	18.0			0.0	2.5	4.0			231.0			10.0	0.2	5.0	10.0	35.0	5.0		55.0	
COMPG012371-G012380	BWWR11	145	153	VC	T/S	0.3	8.4	10.0	0.0		1120.0	1.8	1.0	0.72	0.3		5.0	16.0		2.0	2.2	20.0					3.7	20.0		0.4		793.0	1.0	1.8		1.0	650.0	20.0			0.0	2.5	5.0			212.0			10.0	0.2	10.0	5.0	42.0	5.0		55.0	
COMPW005491-W005500	BWWR14	112	121	VC	S/T	0.3	7.4	31.0	0.0		1210.0	1.5	1.0	0.44	0.3		3.0	26.0		4.0	1.6	20.0					4.0	20.0		0.2		683.0	3.0	1.5		2.0	300.0	22.0			0.1	5.0	4.0			116.0			10.0	0.2	5.0	5.0	25.0	10.0		55.0	
COMPM261651-M261659	BWWR05	124	132	VC	T	0.3	7.6	10.0	0.0		1640.0	1.6	1.0	0.62	0.3		4.0	22.0		0.5	1.8	20.0					3.4	20.0		0.3		597.0	1.0	1.7		1.0	350.0	20.0			0.0	7.0	3.0			239.0			10.0	0.2	5.0	5.0	27.0	5.0		54.0	
COMPG012471-G012480	BWWR11	234	243	VC	S/T	0.3	7.9	93.0	0.0		1090.0	1.7	3.0	0.49	0.3		4.0	20.0		3.0	1.7	20.0					4.4	20.0		0.3		981.0	3.0	0.8		3.0	420.0	16.0			0.0	8.0	4.0			121.0			10.0	0.2	5.0	10.0	33.0	5.0		53.0	
COMPG012421-G012430	BWWR11	187	198	VC	S	0.3	8.2	6.0	0.0		1010.0	1.7	1.0	1.00	0.3		3.0	16.0		7.0	1.9	20.0					3.5	20.0		0.3		807.0	1.0	1.9		6.0	740.0	19.0			0.0	2.5	5.0			224.0			10.0	0.3	5.0	5.0	44.0	5.0		53.0	
COMPW005798-W005809	BWWR12	115	125	VC	T/S	0.3	7.8	2.5	0.0		1230.0	1.6	2.0	0.47	0.3		4.0	19.0		8.0	2.0	20.0					3.6	20.0		0.2		687.0	3.0	1.9		0.5	610.0	23.0			0.1	11.0	4.0			166.0			10.0	0.2	5.0	5.0	37.0	5.0		53.0	
COMPG012330-G012339	BWWR11	111	120	VC	T	0.3	7.4	2.5	0.0		1130.0	1.7	1.0	0.69	0.3		2.0	17.0		6.0	1.6	20.0					3.7	20.0		0.2		710.0	0.5	1.7		2.0	440.0	19.0			0.0	2.5	3.0			184.0			10.0	0.2	5.0	5.0	28.0	5.0		52.0	
COMPG012391-G012400	BWWR11	162	171	VC	S	0.3	8.4	6.0	0.0		1100.0	1.8	1.0	1.05	0.3		3.0	18.0		4.0	2.0	20.0					3.4	20.0		0.4		778.0	1.0	1.7		4.0	860.0	17.0			0.0	2.5	5.0			223.0			10.0	0.2	5.0	10.0	41.0	5.0		52.0	
COMPW006003-W006010	BWWR12	293	300	S		0.1	1.6	3.5	0.2	10.0	250.0	0.7	0.1	1.50	0.0	30.9	6.4	13.0	2.5	14.9	1.6	5.8	0.1	0.3	0.0	0.0	0.3	15.3	11.0	0.5		364.0	1.6	0.1	0.1	9.2	870.0	5.8	16.1	0.0	0.0	0.6	2.7	0.3	0.5	128.5	0.0	0.0	4.2	0.1	0.2	1.5	36.0	0.1	4.5	52.0	13.5
COMPW005521-W005530	BWWR14	138	147	VC	T	0.3	7.4	12.0	0.0		1090.0	1.7	1.0	0.91	0.3		4.0	25.0		1.0	1.7	20.0					3.7	20.0		0.3		515.0	2.0	1.5		4.0	530.0	24.0			0.0	2.5	5.0			133.0			10.0	0.2	5.0	5.0	37.0	5.0		52.0	
BW-ARD-165	BW0099	31	41	FT	T	3.0	0.4	44.0	0.2	10.0	10.0	0.1	1.8	0.02	0.4	21.3	0.2	2.0	0.6	40.6	0.7	0.8	0.1	0.2	0.0	0.3	0.1	11.2	0.3	0.0		23.0	4.0	0.0	0.7	0.9	70.0	456.0	3.2	0.0	0.0	20.0	0.3	0.2	0.2	1.6	0.0	0.0	6.3	0.0	0.1	1.7	1.0	0.2	3.7	51.0	5.2
COMPG012491-G012499	BWWR11	252	260	VC	T	0.3	7.8	21.0	0.0		1110.0	1.7	1.0	0.77	0.3		5.0	21.0		7.0	2.0	20.0					3.7	20.0		0.3		978.0	2.0	1.4		3.0	550.0	24.0			0.1	5.0	5.0			174.0			10.0	0.2	5.0	10.0	39.0	5.0		51.0	
COMPW005686-W005696	BWWR14	281	291	VC	S	0.3	7.5	12.0	0.0		1180.0	1.6	1.0	1.50	0.3		2.0	23.0		2.0	2.0	20.0					3.7	20.0		0.5		910.0	1.0	1.5		5.0	510.0	24.0			0.0	5.0	4.0			187.0			10.0	0.2	5.0	5.0	35.0	5.0		51.0	
COMPG012381-G012390	BWWR11	153	162	VC	S	0.3	7.6	10.0	0.0		950.0	1.6	2.0	0.64	0.3		5.0	16.0		9.0	1.9	20.0					4.3	20.0		0.3		810.0	1.0	1.6		9.0	580.0	16.0			0.0	2.5	4.0			172.0			10.0	0.2	5.0	10.0	36.0	5.0		50.0	
COMPW005742-W005752	BWWR12	66	76	VC	T	0.3	7.9	22.0	0.0		1320.0	1.6	1.0	0.48	0.3		5.0	20.0		8.0	1.8	20.0					4.0	20.0		0.2		630.0	4.0	1.4		1.0	680.0	24.0			0.1	21.0	4.0			151.0			10.0	0.2	5.0	5.0	39.0	5.0		50.0	
COMPW005753-W005762	BWWR12	76	85	VC	T	0.3	7.5	2.5	0.0		1460.0	1.4	3.0	0.41	0.3		2.0	19.0		2.0	1.6	20.0					3.6	20.0		0.2		590.0	4.0	1.7		0.5	510.0	28.0			0.0	25.0	4.0			170.0			10.0	0.2	5.0	5.0	31.0	5.0		50.0	
COMPW005541-W005550	BWWR14	155	164	VC	S/T	0.3	7.4	29.0	0.0		1090.0	1.7	1.0	0.93	0.3		3.0	24.0		4.0	1.6	20.0					3.9	20.0		0.3		564.0	2.0	1.6		2.0	450.0	20.0			0.0	2.5	4.0			168.0			10.0	0.2	5.0	5.0	34.0	10.0		50.0	
COMPW005461-W005470	BWWR14	86	95	S		0.3	7.4	41.0	0.0		870.0	1.7	1.0	1.09	0.3		3.0	24.0		3.0	1.6	20.0					3.3	20.0		0.3		595.0	2.0	1.6		3.0	380.0	17.0			0.1	2.5	4.0			320.0			10.0	0.2	5.0	5.0	29.0	10.0		49.0	
COMPG012360-G012370	BWWR11	137	145	T		0.3	7.6	7.0	0.0		1050.0	1.6	1.0	0.76	0.3		3.0	14.0		5.0	2.0	20.0					3.3	20.0		0.3		753.0	1.0	1.6		2.0	550.0	15.0			0.0	2.5	4.0			211.0			10.0	0.2	5.0	5.0	35.0	5.0		48.0	
COMPW005719-W005729	BWWR11	45	55	VC	T	0.3	7.6	2.5	0.0		1250.0	1.7	1.0	1.25	0.3		3.0	24.0		0.5	1.6	20.0					3.1	20.0		0.3		511.0	3.0	2.1		0.5	580.0	20.0			0.0	2.5	4.0			291.0			10.0	0.2	5.0	5.0	36.0	10.0		48.0	
COMPW005652-W005663	BWWR14	252	262	T		0.3	7.6	119.0	0.0		1130.0	1.6	1.0	0.85	0.3		2.0	18.0		6.0	1.8	20.0					4.5	20.0		0.3		595.0	0.5	0.9		3.0	500.0	19.0			0.1	10.0	4.0			107.0			10.0	0.2	5.0	5.0	33.0	5.0		48.0	
COMPW005664-W005570	BWWR14	262	268	VC	T/S	0.3	7.6	117.0	0.0		1180.0	1.7	1.0	0.92	0.3		3.0	14.0		3.0	1.9	20.0					4.3	20.0		0.3		1005.0	2.0	1.0		3.0	520.0	19.0			0.1	11.0	4.0			110.0			10.0	0.2	5.0	5.0	34.0	5.0		48.0	
COMPM261418-M261427	BWWR06	19	28	VC	T	0.3	7.1	36.0	0.0		1090.0	1.7	1.0	1.00	0.3		6.0	38.0		11.0	1.9	20.0					3.4	20.0		0.3		696.0	1.0	2.1		4.0	560.0	19.0			0.0	2.5	4.0			202.0			10.0	0.2	5.0	5.0	36.0	5.0		47.0	
COMPW005481-W005490	BWWR14	103	112	VC	S	0.3	7.7	12.0	0.0		1220.0	1.7	1.0	0.85	0.3		3.0	12.0		2.0	1.5	20.0					3.9	20.0		0.3		618.0	3.0	2.0		3.0	330.0	23.0			0.0	2.5	4.0			156.0			10.0	0.2	5.0	5.0	27.0	10.0		47.0	
COMPW005471-W005480	BWWR14	95	103	S/T		0.3	7.6	9.0	0.0		1220.0	1.7	1.0	0.88	0.3		2.0	28.0		3.0	1.5	20.0					4.0	20.0		0.3		649.0	1.0	1.7		1.0	320.0	29.0			0.0	2.5	4.0			152.0			10.0	0.2	5.0	10.0	24.0	10.0		47.0	
COMPM261744-M261753	BWWR04	58	67	PPY	T	0.3	7.2	5.7	0.0		1181.3	1.6	1.6	1.87	0.3		5.8	15.5		14.9	1.9	20.0					3.0	18.8		0.5		364.1	0.8	2.5		8.4	805.0	9.4			0.0	2.5	4.0			577.5			10.0	0.3	5.0	52.8	5.0		46.5	
COMPM261714-M261723	BWWR04	32	41	PPY	T	0.3	6.6	3.4	0.0		1337.5	1.6	1.6	2.49	0.3		4.8	13.5		14.6	1.7	20.0					2.9	16.3		0.5		271.6	0.7	2.5		7.0	731.3	8.5			0.0	2.5	3.0			800.6			10.0	0.2	5.0	5.0	44.4	5.0		46.3	
COMPW005451-W005460	BWWR14	77	86	VC	S	0.3	7.1	36.0	0.0		1070.0	1.8	1.0	0.91	0.3		3.0	27.0		4.0	1.8	20.0					3.8	10.0		0.3		592.0	2.0	1.6		2.0	400.0	19.0			0.1	2.5	4.0			161.0			10.0	0.2	5.0	5.0	29.0	10.0		46.0	
COMPM261724-M261733	BWWR04	41	50	PPY	T	0.3	6.7	3.4	0.0		1302.5	1.5	1.3	2.49	0.3		5.1	12.3		11.1	1.6	20.0					2.8	17.5		0.5		307.6	0.6	2.5		6.9	723.8	8.0			0.0	2.5	3.1			750.0			10.0	0.2	5.6	5.0	44.1	5.0		45.1	
BW-ARD-160	BW0096	140	150	FT	T	13.0	0.5	29.9	0.2	10.0	180.0	0.2	0.9	0.01	0.4	32.9	0.1	2.0	0.5	14.1	0.4	1.1	0.1	0.5	0.0	0.2	0.2	16.0	0.8	0.0		28.0	3.9	0.0	0.4	0.3	60.0	315.0	6.2	0.0	0.0	8.8	0.4	0.2	0.2	3.3	0.0	0.0	8.5	0.0	0.1	2.8	1.0	0.1	5.5	45.0	12.7
COMPW005421-W005430	BWWR14	51	60	VC	T	0.3	7.5	36.0	0.0		1020.0	1.7	1.0	1.30	0.3		3.0	26.0		5.0	1.6	20.0					3.2	20.0		0.3		408.0	2.0	2.3		3.0	360.0	19.0			0.1	2.5	4.0			225.0			10.0	0.2	5.0	5.0	26.0	10.0		45.0	
COMPW005531-W005540	BWWR14	147	155	VC	T/S	0.3	7.0	15.0	0.0		970.0	1.8	1.0	1.16	0.3		4.0	28.0		4.0	1.8	20.0					3.5	10.0		0.3		572.0	2.0	1.8		3.0	440.0	20.0			0.1	2.5	4.0			164.0			10.0	0.2	5.0	5.0	34.0	5.0		44.0	
COMPW005584-W005594	BWWR14	193	203	VC	T	0.3	7.3	15.0	0.0		1010.0	1.6	1.0	1.14	0.3		2.0	25.0		13.0	1.8	20.0					3.9	20.0		0.3		619.0	1.0	1.5		3.0	480.0	18.0			0.1	7.0	4.0			151.0			10.0	0.2	5.0	5.0	35.0	5.0		43.0	
COMPM261408-M261417	BWWR06	10	19	VC	T	0.3	7.6	39.0	0.0		1130.0	1.8	1.0	0.47	0.3		5.0	21.0		11.0	1.8	20.0					3.4	20.0		0.3		582.0	0.5	1.9		4.0	590.0	16.0			0.0	2.5	4.0			178.0			10.0	0.2	5.0	10.0	39.0	10.0		42.0	
COMPW005707-W005718	BWWR12	35	45	VC	T	0.3	7.7	38.0	0.0		1410.0	1.6	2.0	0.66	0.3		3.0	17.0		4.0	1.8	20.0					3.6	20.0		0.2		736.0	3.0	1.6		0.5	520.0	13.0			0.0	9.0	4.0			234.0			10.0	0.2	5.0	5.0	37.0	10.0		42.0	
COMPG012401-G012410	BWWR11	171	179	VC	S	0.3	8.0	2.5	0.0		990.0	1.6	2.0	0.85	0.3		4.0	17.0		5.0	1.7	20.0					3.2	20.0		0.3		648.0	2.0	1.5		4.0	1080.0	13.0			0.0	2.5	4.0			179.0			10.0	0.2	5.0	10.0	37.0	5.0		40.0	
COMPW005787-W005797	BWWR12	105	115	VC	T	0.3	7.7	13.0	0.0		1260.0	1.5	2.0	0.30	0.3		2.0	25.0		4.0	1.6	20.0					3.8	20.0		0.2		687.0	4.0	1.8		1.0	500.0	19.0			0.0	15.0	4.0			139.0			10.0	0.2	5.0	10.0	32.0	10.0		40.0	
COMPW005641-W005651	BWWR14	242	252	VC	O/T	0.3	7.6	27.0	0.0		1300.0	1.6	1.0	0.83	0.3		1.0	20.0		6.0	1.8	20.0					4.9	20.0		0.3		669.0	1.0	0.5		3.0	440.0	19.0			0.1	12.0	4.0			95.0			10.0	0.2	5.0	5.0	32.0	10.0		40.0	
COMPW005411-W005420	BWWR14	42	51	T		0.6	7.3	19.0	0.0		1060.0	1.8	1.0	1.01	0.3		3.0	27.0		6.0	1.7	20.0					3.6	20.0		0.3		407.0	2.0	2.0		3.0	480.0	18.0			0.1	2.5	5.0			203.0			10.0	0.2	5.0	5.0	34.0	5.0		40.0	
COMPW005573-W005583	BWWR14	183	193	VC	S/T	0.3	7.4	12.0	0.0		990.0	1.7	1.0	0.74	0.3		0.5	24.0		3.0	1.5	20.0					3.9	20.0		0.2		623.0	1.0	1.5		2.0	360.0	15.0			0.0	8.0	4.0			135.0			10.0	0.2	5.0	5.0	28.0	5.0		40.0	
BW-ARD-677	GM12-05	60	70	FT	O	2.9	0.6	17.8	0.2	10.0	20.0	0.2	0.1	0.02	0.3	27.7	0.2	1.0	0.5	16.5	0.4	1.4	0.1	0.4	0.0	0.0	0.2	14.2	0.7	0.0	0.4	44.0	2.0	0.0	0.4	0.4	110.0	472.0	8.0	0.0	0.0	7.6	0.4	0.2	0.2	2.8	0.0	0.0	8.8	0.0	0.2	3.5	1.0	0.5	5.9	40.0	10.6
COMPW005511-W005520	BWWR14	129	138	VC	T	0.3	7.7	17.0	0.0		1170.0	1.7	1.0	0.88	0.3		5.0	28.0		1.0	1.7	20.0					3.9	20.0		0.4		509.0	2.0	1.5		3.0	470.0	17.0			0.0	2.5	5.0			134.0			10.0	0.2	5.0	5.0	38.0	5.0		38.0	
COMPW005441-W005450	BWWR14	69	77	VC	S	0.3	7.6	113.0	0.0		1070.0	1.8	1.0	1.01	0.3		4.0	28.0		4.0	1.8	20.0					3.8	20.0		0.4		502.0	2.0	1.7		3.0	410.0	18.0			0.1	2.5	4.0			164.0			10.0	0.2	5.0	10.0	29.0	10.0		37.0	
COMPW005629-W005638	BWWR14	232	242	S/T/O		0.3	7.6	49.0	0.0		1000.0	1.7	1.0	1.34	0.3		3.0	25.0		20.0	2.0	20.0					4.6	20.0		0.3		538.0	0.5	0.7		5.0	640.0	17.0			0.2	13.0	5.0			130.0			10.0	0.2	5.0	5.0	48.0	5.0		35.0	
COMPW005561-W005572	BWWR14	173	183	S		0.3	7.3	37.0	0.0		1130.0	1.6	1.0	0.88	0.3		2.0	28.0		9.0	1.3	20.0					4.1	20.0		0.2		370.0	3.0	1.5		2.0	340.0	15.0			0.1	5.0	4.0			160.0			10.0	0.2	5.0	5.0	26.0	5.0		30.0	
BW-ARD-169	BW0100	113	123	VC	S	0.1	0.5	3.3	0.2	10.0	20.0	0.4	0.2	0.19	0.2	17.2	0.5	3.0	2.1	2.6	0.4	1.6	0.1	0.4	0.0	0.0	0.1	9.7	4.6	0.1		142.0	0.6	0.0	0.3	0.6	140.0	5.5	8.3	0.0	0.0	0.6	0.4	0.2	0.2	15.6	0.0	0.0	5.0	0.0	0.1	1.5	2.0	0.1

Table A2-3: Elemental Content Analytical Results - Ore Test Results

SampleID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	Ag ppm	Al %	As ppm	Au ppb	B ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Fe %	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	K %	La ppm	Li ppm	Mg %	Mn ppm	Mo ppm	Na %	Nb ppm	Ni ppm	P ppm	Pb ppm	Rb ppm	Re ppm	S %	Sb ppm	Sc ppm	Se ppm	Sn ppm	Sr ppm	Ta ppm	Te ppm	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm	Zr ppm
Average Crustal Abundance*						0.075	8.23	1.8	4	10	425	3	0.085	4.15	0.15	66.5	25	102	60	5.6	19	1.5	3	0.085	0.25	2.1	39	20	2.33	950	1.2	2.355	20	84	0.015	14	90	0.0007	0.035	0.2	22	0.05	2.3	370	2	9.6	0.565	0.85	2.7	120	1.25	33	70	165
BW-ARD2-2	BW0043	79	89	FT		6.41	0.72	48.80	0.90	10.00	30.00	0.59	9.24	0.01	11.10	15.75	2.70	1.00	3.42	134.00	1.77	1.79	0.05	0.88	0.03	0.17	0.47	6.80	4.20	0.01	83.00	10.10	0.01	0.18	1.40	30.00	205.00	18.00	0.001	1.79	4.01	0.80	0.40	0.20	5.40	0.01	0.09	11.10	0.01	0.42	4.76	1.00	10.14	8.69	1540.00	23.20
BW-ARD-010	BW0043	79	89	FT		7.61	0.47	37.40	1.20	10.00	20.00	0.37	8.37	0.01	10.30	13.90	2.70	6.00	2.92	261.00	1.68	0.98	0.05	0.88	0.10	0.50	0.28	6.20	2.00	0.01	82.00	6.88	0.01	0.18	1.60	30.00	157.00	12.00	0.001	1.89	2.80	0.90	0.60	0.20	3.80	0.01	0.10	8.80	0.01	0.29	4.35	1.00	0.09	8.97	3840.00	25.20
BW-ARD-011	BW0043	263	273	FT		4.74	0.46	1130.00	0.60	10.00	30.00	0.45	9.13	0.06	58.40	28.00	5.50	11.00	2.39	187.00	1.78	1.42	0.09	0.41	0.09	0.67	0.31	13.40	1.10	0.02	1060.00	2.10	0.01	0.44	5.60	250.00	281.00	11.40	0.001	1.50	28.20	1.00	0.90	0.20	35.70	0.01	0.03	8.80	0.01	0.53	3.90	2.00	0.09	6.38	6410.00	12.00
BW-ARD2-1	BW0043	47	57	FT		6.71	0.32	37.10	0.20	10.00	20.00	0.21	6.32	0.02	59.40	13.15	4.70	1.00	2.12	121.00	1.09	0.68	0.05	0.81	0.13	1.00	0.23	5.60	1.50	0.01	110.00	1.16	0.01	0.31	2.40	30.00	992.00	9.20	0.001	1.41	5.67	0.50	0.80	0.20	1.60	0.01	0.02	10.10	0.01	0.31	5.67	1.00	0.07	14.25	8540.00	19.90
BW-ARD2-12	BW0044	132	142	FT		2.02	0.37	116.00	0.70	10.00	20.00	0.39	6.65	0.01	23.00	28.90	3.00	1.00	1.48	38.50	1.71	1.11	0.05	0.55	0.02	0.44	0.28	12.00	1.30	0.01	481.00	1.21	0.01	1.16	1.10	50.00	94.40	9.70	0.001	1.44	14.70	0.50	0.50	0.20	4.10	0.01	0.06	11.20	0.01	0.29	4.71	1.00	0.10	7.16	3000.00	13.80
BW-ARD-012	BW0044	69	80	FT		3.28	0.29	170.00	0.50	10.00	20.00	0.27	6.49	0.01	46.90	17.90	3.50	1.00	0.83	107.00	1.22	0.94	0.05	0.65	0.03	0.97	0.23	9.00	0.70	0.01	463.00	2.81	0.01	0.32	1.90	30.00	123.50	8.40	0.001	1.17	8.99	0.70	0.60	0.20	3.00	0.01	0.05	7.00	0.01	0.26	2.77	1.00	0.09	5.12	6150.00	21.20
BW-ARD2-10	BW0044	69	80	FT		4.07	0.32	58.00	0.40	10.00	10.00	0.20	6.00	0.02	51.20	17.50	4.60	2.00	0.82	117.00	1.29	0.96	0.05	0.66	0.02	0.98	0.24	8.15	1.20	0.02	518.00	2.50	0.01	0.28	2.30	40.00	180.50	8.00	0.001	1.14	12.05	0.50	0.70	0.20	3.50	0.01	0.06	8.60	0.01	0.28	2.79	1.00	0.08	5.03	7210.00	18.10
BW-ARD2-11	BW0044	100	110	FT		4.55	0.65	97.00	1.10	10.00	30.00	0.71	8.11	0.03	52.30	34.30	9.30	2.00	3.44	184.00	2.62	1.98	0.07	0.56	0.02	1.74	0.42	15.50	4.50	0.04	1710.00	2.60	0.02	0.13	7.20	120.00	139.00	16.40	0.001	1.87	11.25	0.80	0.70	0.20	13.10	0.01	0.12	8.00	0.01	0.52	5.93	7700.00	16.90
BW-ARD-005	BW0058	241	251	AND/VC		1.67	2.17	14.00	0.20	10.00	70.00	0.67	1.35	0.34	3.19	25.40	19.40	28.00	15.30	462.00	7.39	6.27	0.19	0.17	0.03	0.29	1.39	11.70	22.80	0.68	2870.00	2.54	0.01	0.33	28.00	1560.00	35.80	20.20	0.001	3.71	12.40	3.20	0.60	0.20	11.35	2.70	1.55	0.51	45.00	0.56	7.63	1430.00	8.30	0.60	14.30	2250.00	4.40
BW-ARD-275	BW0062	174	184	FT	S	1.23	0.41	48.90	1.30	10.00	20.00	0.54	8.51	0.03	2.37	14.60	13.20	1.00	1.97	190.50	2.71	1.19	0.05	0.66	0.05	0.19	0.29	7.10	1.00	0.02	2160.00	13.05	0.01	0.14	5.80	190.00	44.90	11.60	0.001	1.91	22.80	0.50	0.40	0.20	22.90	0.01	0.16	7.30	0.01	2.37	3.35	1.00	0.15	4.96	636.00	18.70
BW-ARD-276	BW0062	147	157	FT	S	1.23	0.38	43.30	0.60	10.00	20.00	0.36	9.19	0.01	6.25	14.80	6.50	1.00	2.53	101.00	1.61	1.00	0.05	0.62	0.06	0.33	0.31	7.40	1.90	0.01	343.00	7.36	0.01	0.18	0.90	30.00	37.30	13.50	0.001	1.41	5.82	0.40	0.20	0.20	2.70	0.01	0.31	8.10	0.01	0.24	3.96	1.00	0.06	4.28	973.00	15.20
BW-ARD-013	BW0062	147	157	FT	S	1.95	0.37	40.60	1.60	10.00	20.00	0.32	8.57	0.01	8.43	13.20	7.70	2.00	2.36	72.00	1.56	0.96	0.06	0.57	0.05	0.36	0.29	6.30	1.50	0.01	294.00	8.50	0.01	0.19	1.20	40.00	47.70	12.20	0.001	1.51	4.99	0.80	0.20	0.20	2.60	0.01	0.31	8.20	0.01	0.23	4.09	1.00	0.10	4.39	1260.00	16.60
BW-ARD-002	BW0070	197	207	FT	S	3.49	0.37	638.00	2.50	10.00	20.00	0.32	3.17	0.05	2.58	25.40	7.40	2.00	1.05	233.00	2.32	2.00	0.08	0.64	0.04	0.01	0.10	20.20	12.80	0.90	0.03	6120.00	6.58	0.01	0.15	0.90	70.00	39.00	8.20	0.001	1.33	15.40	0.70	0.20	0.20	2.60	0.01	0.31	1.33	3.58	1.00	0.05	1.49	197.00	19.30
BW-ARD-001	BW0070	19	29	FLPT	T	7.44	1.03	353.00	0.80	10.00	70.00	0.28	0.41	0.04	5.01	27.10	3.10	5.00	6.72	436.00	2.87	4.35	0.11	0.47	0.03	0.74	0.48	11.60	9.40	0.03	3440.00	2.82	0.01	2.50	170.00	19.80	31.20	0.001	0.01	13.10	1.70	0.20	0.60	11.60	0.01	0.11	7.70	0.03	1.30	3.83	10.00	0.09	5.45	274.00	15.60
BW-ARD-007	BW0072	93	103	FT-S	S	4.12	0.53	51.80	0.70	10.00	20.00	0.58	0.71	0.03	1.96	24.50	1.30	3.00	0.67	128.00	2.37	1.92	0.05	0.67	0.01	0.16	0.37	10.70	1.90	0.01	1560.00	2.89	0.01	0.18	0.60	80.00	149.50	10.60	0.001	0.51	9.80	0.01	0.44	3.44	1.00	0.14	5.08	315.00	20.80
BW-ARD-259	BW0072	39	49	FT	T	8.18	0.33	465.00	0.40	10.00	20.00	0.16	1.01	0.01	3.12	22.00	0.80	2.00	0.44	112.00	2.01	1.26	0.05	0.51	0.01	0.04	0.64	23.00	11.40	1.20	0.01	472.00	3.53	0.01	0.20	1.30	150.00	718.00	8.00	0.001	0.64	17.45	0.40	0.20	0.50	17.00	0.01	0.01	7.20	0.01	0.21	1.85	1.00	0.22	2.11	178.00	13.20
BW-ARD-258	BW0072	280	290	FT	S	6.49	0.39	151.50	2.40	10.00	10.00	0.31	4.47	0.02	27.70	20.10	3.10	2.00	2.81	210.00	2.01	1.07	0.05	0.78	0.02	0.29	0.26	10.30	6.60	0.02	243.00	4.18	0.01	0.40	0.40	60.00	1350.00	6.50	0.001	1.42	18.30	0.50	0.40	0.20	1.90	0.01	0.52	7.80	0.01	0.17	3.53	1.00	0.20	4.68	3720.00	23.00
BW-ARD-280	BW0073	100	110	FT	S	2.32	0.30	400.00	2.20	10.00	20.00	0.30	3.45	0.02	0.20	26.60	0.90	2.00	0.53	160.00	1.00	1.36	0.05	0.80	0.01	0.02	0.23	12.00	0.90	0.01	1960.00	4.35	0.01	0.19	0.70	50.00	14.80	7.70	0.001	0.50	9.37	0.70	0.30	0.40	3.00	0.01	0.07	7.90	0.01	0.18	3.26	1.00	0.15	4.68	63.00	22.10
BW-ARD-277	BW0073	212	222	FT	S	4.53	0.38	121.50	1.20	10.00	20.00	0.43	0.59	0.02	12.00	26.40	0.60	2.00	0.97	103.00	1.07	1.20	0.05	0.66	0.01	0.28	0.29	12.10	0.40	0.01	388.00	3.44	0.01	0.21	0.40	60.00	888.00	8.90	0.001	0.60	7.29	0.60	0.40	0.20	2.20	0.01	0.18	7.50	0.01	0.20	3.19	1.00	0.14	4.45	1540.00	19.30
BW-ARD-249	BW0074	175	185	FT	S	44.50	0.38	204.00	4.50	10.00	30.00	0.54	82.10	0.16	81.60	29.90	38.30	3.00	5.19	727.00	4.35	1.70	0.06	0.31	0.07	4.20	0.25	12.40	2.30	0.05	1650.00	1.94	0.01	0.01	2.14	28.60	680.00	726.00	13.00	0.001	4.13	44.20	1.00	1.20	0.50	20.90	0.01	0.50	3.30	0.01	0.54	0.94	6.00	0.10	5.79	1060.00	14.20
BW-ARD-235	BW0082	123	133	AND	S	2.13	0.32	30.20	0.60	10.00	60.00	0.69	2.20	0.35	8.65	30.00	26.80	42.00	14.70	227.00	5.08	0.05	0.19	0.13	0.01	0.51	1.12	14.70	40.10	1.06	2260.00	3.50	0.01	0.24	27.30	1560.00	53.80	12.20	0.001	2.64	2.65	15.85	3.60	1.50	0.80	22.20	0.01	0.31	2.90	0.01	0.33	7.55	73.00	0.51	7.10	3050.00	4.80
BW-ARD-006	BW0082	43	53	FT	S	4.91	0.57	213.00	0.70	10.00	60.00	0.30	6.33	0.01	46.20	21.00	16.30	3.00	2.95	149.00	1.15	1.62	0.07	0.77	0.02	2.75	0.31	10.00	3.60	0.04	202.00	2.91	0.01	0.44	12.30	140.00	144.50	12.00	0.001	1.44	5.13	1.10	1.20	0.30	20.90	0.01	0.11	7.30	0.02	0.77	3.36	5.00	0.17	8.67	9670.00	24.90
BW-ARD-234	BW0082	15	25	FT	T	8.58	0.60	99.60	1.30	10.00	120.00	0.25	7.87	0.01	84.00	29.10	5.60	2.00	1.71	275.00	1.65	1.11	0.06	0.53	0.01	1.89	0.17	9.50	1.80	0.01	44.00	3.07	0.01	0.09	3.50	230.00	131.00	5.70	0.003	0.57	10.40	0.70	1.00	0.40	14.50	0.01	0.01	10.10	0.01	0.60	0.01	0.61	3.80	2.00	0.07	7.84	1760.00	15.70
BW-ARD-007	BW0097	8	18	FT	T	5.16	0.46	447.00	0.40	10.00	120.00	0.26	3.86	0.01	9.67	42.50	0.80	3.00	1.18	54.10	1.81	2.24	0.10	0.26	0.07	2.07	0.28	21.50	1.50	0.01	88.00	3.11	0.01	0.22	1.00	610.00	1030.00	10.00	0.001	0.02	16.10	1.00	0.30	0.40	9.10	0.01	0.03	8.40	0.01	0.12	8.22	1.00	0.17	5.47	2450.00	6.90
BW-ARD-285	BW0097	8	19	FT	T	4.75	0.48	476.00	0.20	10.00	160.00	0.34	5.00	0.02	11.55	60.30	0.80	1.00	1.21	46.00	1.88	2.11	0.09	0.29	0.07	1.83	0.25	29.40	1.50	0.01	88.00	3.36	0.01	0.28	0.90	750.00	1105.00	9.50	0.001	0.03	19.20	0.80	0.40	0.40	18.20	0.01	0.02	9.50	0.01	0.17	10.70	1.00	0.19	6.08	260.00	6.90
BW-ARD-283	BW0097	149	159	VC	S	8.69	0.80	263.00	0.30	10.00	30.00	0.46	14.85	0.25	40.10	30.60	16.50	10.00	5.30	237.00	4.05	2.71	0.08	0.42	0.01	1.90	0.47	14.20	8.80	0.22	1560.00	2.57	0.01	0.30	19.90	1090.00	189.50	27.50	0.001	1.94	11.90	1.20	0.70	0.40	15.80	0.01	0.10	5.90	0.05	0.79	1.25	14.00	0.11	7.89	4700.00	15.00
BW-ARD-248	BW0097	159	169	VC	S	7.77	0.77	329.00	0.20	10.00	40.00	0.34	13.75	0.24	40.90	31.70	17.40	12.00	5.34	222.00	3.19	3.19	0.14	0.49	0.02	2.42	0.45	15.70	9.70	0.22	1500.00	4.35	0.01	0.29	9.70	1.80	0.90	34.70	0.001	2.58	9.70	1.00	0.90	0.40	37.50	0.01	0.01	5.50	0.05	0.78	1.36	13.00	0.17	8.77	4990.00	19.30
BW-ARD-247	BW0103	65	75	FT	T	0.91	0.43	64.40	0.20	10.00	20.00	0.47	0.37	0.02	1.89	20.30	2.00	1.00	0.61	95.40	2.01	1.22	0.05	0.78	0.01	0.04	0.25	9.80	1.80	0.02	1030.00	1.54	0.01	0.15	0.50	60.00	98.60	8.10	0.001	1.19	6.47	0.50	0.20	0.50	5.10	0.01	0.07	8.80	0.01	1.62	3.48	1.00	0.17	7.72	134.00	20.60
BW-ARD-003	BW0103	245	255	S	S	12.65	0.57	1000.00	0.30	10.00	10.00	0.60	27.70	0.01	31.10	16.00	9.90	4.00	1.00	1.27	4.80	2.00	0.08	0.08	0.05	0.22	0.02	1.44	0.50	0.27	0.01	0.50	0.60	2820.00	2.20	0.001	0.50	2.01	26.30	0.60	0.50	0.20	1.25	0.20	0.01	1.25	0.20	0.01	0.01	1.25	0.20	4.00	1.00	0.58	0.27	18.60	0.20
BW-ARD-248	BW0103	181	191	FT	S	14.60	0.40	637.00	1.30	10.00	10.00	0.54	0.30	0.02	31.80	36.10	1.10	1.00	1.77	185.00	2.29	1.61	0.07	0.81	0.01	0.41	0.46	0.27	18.40	1.00	0.02	1040.00	1.96	0.01	0.13	0.40	50.00	4360.00	9.90	0.001	1.56	19.50	0.30	0.50	0.50	2.90	0.01	0.11	9.30	0.01	0.27	3.48	1.00	0.17	6.36	4230.00	20.10
BW-ARD-004	BW0103	147	157	FT	S	7.77	0.40	676.00	1.40	10.00	10.00	0.50	0.96	0.03	38.90	27.40	1.90	2.00	0.77	367.00	2.99	1.63	0.10	0.69	0.01	0.81	0.24	13.90	1.50	0.02	699.00	2.90	0.01	0.14	0.30	60.00	983.00	7.00	0.001	1.93	9.30	0.70	0.70	0.40	4.30	0.01	0.30	7.50	0.01	1.06	3.21	1.00	0.15	5.97	5580.00	22.20
BW-ARD-243	BW0103	2.5	2.35			2.48	0.35	682.00	0.50	10.00	10.00	0.38	0.59	0.02	45.10	17.70	0.60	1.00	0.97	175.00	3.05	0.95	0.06	0.68	0.08	0.54	0.23	8.70	0.70	0.02	784.00	4.34	0.01	0.14	0.60	30.00	339.00	6.40	0.001	2.14	13.40	0.40	0.60	0.30	11.50	0.01	0.19	7.80	0.01	0.37	3.80	1.00	0.15	4.22	5680.00	16.70
BW-ARD-226	BW0107	145	155	FT	S	19.15	0.39	153.00	0.60	10.00	20.00	0.44	10.95	0.09	38.70	21.60	10.00	2.00	2.04	358.00	2.32	1.44	0.06	0.63	0.03	1.58	0.24	10.70	1.30	0.02	760.00	3.90	0.01	0.12	0.50	50.00	550.00	8.80	0.001	1.54	39.60	0.60	0.70	0.50	9.20	0.01	0.05	6.80	0.01	0.19	3.05	2.00	0.10	5.58	4700.00	22.30
BW-ARD-227	BW0107	200	210	VC/AND	S	10.20	0.55	87.80	0.60	10.00	30.00	0.50	17.65	0.27	47.40	25.50	13.40	3.00	3.91	279.00	3.87	1.98	0.09	0.35	0.06	1.38	0.32	11.90	5.10	0.05	696.00	2.99	0.01	0.33	17.00	1090.00	426.00	14.80	0.001	2.51	13.35	1.00	0.90	0.40	16.30	0.01	0.07	5.10	0.04	0.27	1.55	8.00	0.36	7.17	5550.00	12.70
BW-ARD-224	BW0109	125	135	ANT	S	1.93	1.22	1030.00	0.20	10.00	90.00	0.60	7.52	0.31	41.10	28.50	12.20	24.00	16.85	257.00	6.51	10.20	0.17	0.16	0.07	3.07	1.38	10.90	45.60	0.77	3270.00	2.44	0.01	0.33	35.90	1440.00	54.50	57.60	0.001	2.61	14.00	4.20	0.70	0.40	49.70	0.01	0.09	3.60	0.15	0.74	66.00	0.49	4.23	6880.00	8.20
BW-ARD-009	BW0111	218	228	AND	S	1.40	2.71	177.00	0.50	10.00	100.00	0.49	10.15	0.37	74.40	24.50	20.20	41.00	18.95	249.00	7.06	7.67	0.19	0.10	0.04	2.68	1.78	11.30	31.90	1.12	3500.00	1.85	0.01	0.27	2.83	8.33	4.10	1.40	0.80	33.50	0.01	0.10	3.00	0.23	1.64	0.36	60.00	0.69	7.07	4090.00	19.30
BW-ARD-014	BW0112	161	171	AND		23.10	1.18	1390.00	25.00	10.00	40.00	0.72	15.35	0.40	31.50	32.20	32.40	17.00	13.10	296.00	4.87	3.76	0.14	0.13	0.02	0.82	0.66	15.10	8.60	0.11	2350.00	2.38	0.01	0.28	40.00	1690.00	386.00	38.30	0.001	2.89	37.90	2.50	0.70	0.40	27.20	0.01	0.07	3.70	0.06	1.13	0.59	26.00	0.30	7.58	3730.00	5.50
BW-ARD-004	BW0114	100	110	FT	S	3.98	0.33	134.50	0.20	10.00	20.00	0.29	13.90	0.03	8.41	10.50	4.60	1.00	1.27	48.00	2.59	0.82	0.05	0.84	2.00	0.08	0.23	4.70	0.80	0.01	62.00	3.32	0.01	0.18	3.60	90.00	146.00	11.70	0.001	2.72	3.57	0.50	0.40	0.20	11.70	0.01	0.04	9.50	0.01	0.22	4.47	1.00	0.08	5.68	1520.00	27.20
BW-ARD-110a	BW0114	25	35	FT/AND	O/T	5.18	1.06	153.00	1.30	10.00	130.00	0.26	9.24	0.02	1000.00	29.00	9.70	12.00	4.05	2320.00	3.05	4.12	0.12	0.11	0.21	6.87	0.26	12.40	4.30	0.07	1620.00	4.30	0.01	0.70	16.25	2.30	0.70	0.80	20.70	0.01	0.07	4.90	0.01	0.69	1.14	19.00	0.08	3.03	4130.00	12.40
BW-ARD-200	BW0116	200	210	FT		14.75	0.40	397.00	6.40	10.00	20.00	0.27	69.80	0.05	37.20	12.10	30.30	2.00	2.32	1420.00	8.26	1.31	0.14	0.59	0.15	2.34	0.24	5.50	2.10	0.03	1290.00	2.42	0.01	0.32	6.50	160.00	106.50	10.20	0.001	8.81	7.56	0.60	1.40	0.30	7.60	0.01	1.46	6.00	0.01	0.19	1.96	2.00	0.13	3.71	3570.00	18.30
BW-ARD-015	BW0116	65	85			8.04	0.46	72.10	1.00	10.00	20.00	0.16	8.74	0.01	271.00	16.50	1.90	1.00	1.74	113.00	0.68	1.82	0.09	0.40	0.01	0.18	0.36	2.70	2.10	0.01	1.00	0.01	52.00	0.78	0.01	0.82	1.80	60.00	502.00	14.70	0.003	0.31	18.60	0.70	0.20	0.30	3.50	0.01	0.01	8.00	0.01	0.38	1.98	1.00	0.17	3.01	4480.00	16.60
KM# 2885 Blend Comp 1 Whole Ore						6.55	0.89	199.00	0.80	10.00	50.00	0.41	6.96	0.16	40.10	21.40	10.40	28.70	2.68	358.00	3.52	2.37	0.10	0.47	0.06	0.75	0.51	10.40	8.20	0.14	1260.00	7.69	0.01	0.36	15.20	620.00	393.00	23.80	0.001	1.85	13.00	1.30	0.70	0.30	16.40	0.01	0.44	6.70	0.05	0.82	2.36	13.00	0.38	5.30	3070.00	14.50
	W007677	BW1016	12.19	14	O	1.13	2.5	649	0.20	10.00	110	0.46	0.27	0.07	3.46	28.7	2	18	44.2	46.2	5.74	7.82	0.13	0.6	0.02	0.38	1.49	15.2	43.3	0.13	3540	2.71	0.01	0.34	8.3	240	19.4	103.5	0.001	0.03	5.71	2.1	0.2	1.2	28.5	0.01	0.01	6.4	0.142	2.98	1.96	25	2.68	5.9	382	23.8
	W007678	BW1016	14	15	O	0.89	2.54	1030.00	0.20	10.00	80	0.39	0.35	0.07	2.24	23.1	1.8	20	35.9	34.7	3.46	5.17	0.12	0.56	0.02	0.16	1.6	11.5	40.8	0.1	3780	1.77	0.01	0.34	8.9	340	15.5	115	0.001	0.05	6.03	1.9	0.2	1.2	39.3	0.01	0.01	6.5	0.162	3.23	2.28	27	2.54	6.4	238	22.6
	W007705	BW1016	38	39	O	11.6	0.47	3440	3.0	10.00	150	0.29	0.54	0.03	2.4	28.8	0.8	11	1.65	118.5	2.29	2.54	0.05	0.55	0.01	0.45	0.2	13.9	1.1	0.01	1780	3.44	0.01	0.23	1.1	130	59.5	11.9	0.00	0.01	2.92	0.5	0.3	0.6	6.8	0.01	0.23	7.6	0.01	0.54	2.51	1	0.62	3.76	127	14.5
	W007719	BW1016	49	50		4.7	0.41	511	0.20	10.00	110	0.14	0.21	0

Table A2-4: Elemental Content Analysis Results - Metallurgical Tailings Samples

Name	Description	Ag ppm	Al %	As ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Hg ppm	In ppm	K %	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	S %	Sb ppm	Se ppm	Sn ppm	Sr ppm	Th ppm	Ti %	Tl ppm	W ppm	Zn ppm
		ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	%	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
Average Crustal Abundance*		0.075	8.23	1.8	0.085	4.15	0.15	25	102	60	5.6	0.085	0.25	2.1	2.33	950	1.2	2.36	84	0.015	14	0.03	0.2	0.05	2.3	370	9.6	0.57	0.85	1.25	70
KM# 2885 Test 1, 2 Rougher Tailings	Rougher Tails Flotation Cyanidation (-150µm)	2.2	0.76	57	2.2	0.27	8.9	3	9	46	1.9	0.01	0.32	0.41	0.13	1120	3.8	0.01	6.3	640	145	0.19	5.4	0.3	0.4	19	6.3	0.05	0.53	0.35	596
KM# 2885 Test 13,14,15 Cleaner tailings	Cleaner Tails Flotation Cyanidation (-150µm)	5.3	0.93	201	6.7	0.65	23	13.7	26	178	4.2	0.03	0.6	0.46	0.2	1740	26	0.01	44	770	327	1.6	16	0.5	0.7	33	8.6	0.06	1.1	0.4	1480
KM# 2885 Test 8,9 Cyanide Tails	WOL Cyanidation	2.8	0.81	200	6.7	0.25	36	10.9	9	310	3.6	0.06	0.77	0.44	0.13	1210	7.7	0.01	15	610	414	1.8	13	0.7	0.4	18	6.4	0.04	0.79	0.35	2940
KM# 2885 Blend Comp 1 Whole Ore	WOL Cyanidation	7	0.89	199	7	0.16	40.1	11.6	8	268	4	0.06	0.7	0.51	0.14	1260	8	0.01	15	620	393	1.9	13	0.7	0.3	16	6.7	0.05	0.8	0.38	3070
P_{80}-6.3 mm Cyanidation Tail	Coarse grained heap leach	5	6.6	415	3.5	0.31	24	6	15	2	3.3	--	0.8	3.6	0.2	5890	3.1	0.1	8.2	390	462	1.4	31	1	2.5	57	10.8	0.16	2.1	3.1	3080
P_{80}-6.3 mm Cyanidation Tail_Dup	Coarse grained heap leach	5	6.6	415	3.5	0.31	24	6	15	127	3.3	--	0.8	3.6	0.2	5890	0.0003	0.1	0.0008	390	462	1.4	31	1	2.5	57	10.8	0.16	2.1	3.1	3080
P_{80}-150 µm Cyanidation Tail	Fine grained WOL Cyanidation	3.7	6.6	381	3.3	0.31	25	4.8	24	2.1	3.2	--	0.77	3.7	0.2	4740	3.9	0.1	8.3	380	490	1.3	28	1	2.6	57	10.4	0.16	1.8	3.1	3270
P_{80}-150 µm Cyanidation Tail_Dup	Fine grained WOL Cyanidation	3.7	6.6	381	3.3	0.31	25	4.8	24	134.5	3.2	--	0.77	3.7	0.2	4740	3.9	0.1	8.3	380	490	1.3	28	1	2.6	57	10.4	0.16	1.8	3.1	3270
WOL-S comp	Heap Leach (mislabelled as WOL)	5	6.9	393	8.5	0.21	36.8	9.6	21	138	3.9	0.08	1.2	3.8	0.23	2850	4.1	0.09	10.9	600	511	1.8	22.4	1	2.2	52.7	9.5	0.22	2.1	3.6	4280
WOL-S comp_Dup	Heap Leach (mislabelled as WOL)	8.7	9	306	3.2	0.2	26.3	4.7	11	152	2.8	0.02	0.82	3.6	0.15	4040	3.4	0.08	6.7	280	500	1.3	28.2	1	2.6	52.6	11.2	0.13	1.8	2.6	3530
WOL-T comp	Heap Leach (mislabelled as WOL)	7	7.3	270	4.5	0.21	69.4	10.7	28	151	4	0.02	1.2	3.9	0.43	3590	3.7	0.13	16.6	620	370	0.92	21.8	1	2.6	59.3	9.8	0.28	3	4.1	3100
WOL-T comp_Dup	Heap Leach (mislabelled as WOL)	2.2	2.5	477	2.7	0.23	15.9	11.3	50	159	3.7	0.05	0.66	4.2	0.39	2970	3.6	0.07	21.3	960	164	0.49	27.6	1	2.6	53.9	8.3	0.42	2.5	8.4	2360

*Price, 1997

ANNEX 3
Acid Base Accounting and Net Acid Generation Test Results

Table A3-1: Acid Base Accounting and NAG Test Results for Overburden Samples

SampleID	Hole ID	From (m)	To (m)	Type	IZZ RATIN	paste pH	Total S	SO_4(carb	SO_4 (HCl	Sx	MPA	Sx AP	nS adjusted A	TIC	NP	CNP (TIC)	ICP-Ca NP	CO2	NNP	NP:MPA	NP/AP	NAG @ pH 4.5	NAG @ pH 7.0	NAG pH
					Unity	Unity	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	%	kg $CaCO_3$/t	Unity	Unity	kg $H2SO_4$/t	kg $H2SO_4$/t	Unity
KP-8	GT12-08	4.42	4.58	overburden	3	8.8	0.01	0.01	0.01	0.01	0.30	0.31	0.16	0.95	84.0	79.2	85.4	3.5	84.0	280.0	268.8	0.01	0.01	11.0
KP-7	GT12-08	2.6	2.8	overburden	2	8.7	0.04	0.01	0.01	0.03	1.30	0.94	0.82	0.83	72.0	69.2	78.1	3.1	71.0	55.4	76.8	0.01	0.01	11.0
KP-9	GT12-08	6.24	6.35	overburden	3	8.6	0.01	0.01	0.01	0.01	0.30	0.31	0.19	1.54	127.0	128.4	134.8	5.6	127.0	423.3	406.4	0.01	0.01	11.0
BW-ARD-316	BW0086	0	5	overburden	2	7.9	0.02	0.01	0.01	0.02	0.60	0.63	0.54	0.05	9.0	4.2	10.5	0.2	8.0	15.0	14.4	0.01	0.01	7.3
KP-5	GT12-46	64.35	64.6	overburden	1	8.0	0.01	0.01	0.01	0.01	0.30	0.31	0.21	0.10	16.0	8.3	24.7	0.4	16.0	53.3	51.2	0.01	0.01	8.7
KP-6	GT12-46	26.8	27	overburden	1	7.9	0.01	0.01	0.02	0.01	0.30	0.31	0.20	0.05	8.0	4.2	12.7	0.2	8.0	26.7	25.6	0.01	0.01	7.6
KP-2	GT12-45	37	37.25	overburden	1	7.8	0.02	0.01	0.01	0.02	0.60	0.63	0.50	0.05	8.0	4.2	16.7	0.2	7.0	13.3	12.8	0.01	0.01	7.3
BW-ARD-300	BW0072	0	5	overburden	1	8.5	0.01	0.01	0.01	0.01	0.30	0.31	0.20	0.05	18.0	4.2	15.7	0.2	18.0	60.0	57.6	0.01	0.01	8.2
BW-ARD-306	BW0103	15	25	overburden	1	7.9	0.01	0.01	0.01	0.01	0.30	0.31	0.10	0.05	9.0	4.2	5.5	0.2	9.0	30.0	28.8	0.01	0.79	6.8
BW-ARD-304	BW0103	0	5	overburden	1	7.4	0.01	0.01	0.02	0.01	0.30	0.31	0.14	0.05	8.0	4.2	6.0	0.2	8.0	26.7	25.6	0.01	0.01	7.7
BW-ARD-311	BW0112	20	52	overburden	1	7.9	0.01	0.01	0.01	0.01	0.30	0.31	0.11	0.05	6.0	4.2	9.0	0.2	6.0	20.0	19.2	0.01	2.91	6.6
KP-1	GT12-45	6.75	6.95	overburden	1	7.1	0.02	0.01	0.02	0.02	0.60	0.63	0.33	0.05	5.0	4.2	11.0	0.2	4.0	8.3	8.0	0.01	0.01	7.1
BW-ARD-301	BW0072	12	15	overburden	1	7.1	0.01	0.01	0.01	0.01	0.30	0.31	0.01	0.05	6.0	4.2	5.7	0.2	6.0	20.0	19.2	0.01	1.18	6.8
KP-4	GT12-46	5.6	5.8	overburden	1	7.8	0.01	0.01	0.01	0.01	0.30	0.31	0.08	0.05	5.0	4.2	9.2	0.2	5.0	16.7	16.0	0.01	0.01	7.5
BW-ARD-308	BW0073	0	10	overburden	1	8.4	0.01	0.01	0.01	0.01	0.30	0.31	0.17	0.06	10.0	5.0	9.0	0.2	10.0	33.3	32.0	0.01	0.01	8.9
BW-ARD-318	BW0074	0	15	overburden	1	8.4	0.01	0.01	0.01	0.01	0.30	0.31	0.17	0.05	8.0	4.2	7.7	0.2	8.0	26.7	25.6	0.01	2.50	6.8
BW-ARD-313	BW0115	0	30	overburden	1	8.4	0.02	0.02	0.02	0.01	0.60	0.31	0.16	0.05	9.0	4.2	12.2	0.2	8.0	15.0	28.8	0.01	0.01	7.6
BW-ARD-312	BW0112	52	60	overburden	1	7.7	0.02	0.01	0.01	0.01	0.60	0.31	0.03	0.05	9.0	4.2	15.2	0.2	8.0	15.0	28.8	0.01	0.01	8.6
BW-ARD-305	BW0103	5	15	overburden	1	7.3	0.01	0.01	0.02	0.01	0.30	0.31	0.31	0.05	11.0	4.2	8.5	0.2	11.0	36.7	35.2	0.01	0.01	7.1
BW-ARD-309	BW0073	10	20	overburden	1	7.3	0.01	0.01	0.01	0.01	0.30	0.31	0.14	0.05	6.0	4.2	5.2	0.2	6.0	20.0	19.2	0.01	0.01	7.7
BW-ARD-302	BW0072	15	20	overburden	1	7.3	0.01	0.01	0.01	0.01	0.30	0.31	0.31	0.05	8.0	4.2	7.2	0.2	8.0	26.7	25.6	0.01	0.01	7.7
BW-ARD-310	BW0112	0	20	overburden	1	7.9	0.11	0.01	0.02	0.10	3.40	3.13	2.86	0.05	8.0	4.2	8.5	0.2	5.0	2.4	2.6	0.01	2.78	6.1
BW-ARD-303	BW0072	20	25	overburden	1	6.9	0.01	0.02	0.01	0.01	0.30	0.31	0.31	0.05	6.0	4.2	5.0	0.2	6.0	20.0	19.2	0.01	0.01	7.3
BW-ARD-319	BW0074	15	23	overburden	1	7.4	0.02	0.02	0.01	0.01	0.60	0.31	0.31	0.05	6.0	4.2	4.7	0.2	5.0	10.0	19.2	0.01	1.45	6.8
BW-ARD-314	BW0115	30	38	overburden	1	7.2	0.01	0.01	0.01	0.01	0.30	0.31	0.31	0.05	8.0	4.2	8.2	0.2	8.0	26.7	25.6	0.01	0.01	8.4
BW-ARD-315	BW0116	0	6	overburden	1	8.1	0.01	0.01	0.01	0.01	0.30	0.31	0.31	0.05	8.0	4.2	9.0	0.2	8.0	26.7	25.6	0.01	0.01	7.0
BW-ARD-307	BW0062	0	5	overburden	1	7.6	0.04	0.01	0.02	0.03	1.30	0.94	0.94	0.05	9.0	4.2	3.2	0.2	8.0	6.9	9.6	0.01	0.01	7.6
BW-ARD-317	BW0086	5	10	overburden	1	7.2	0.02	0.01	0.01	0.02	0.60	0.63	0.63	0.05	4.0	4.2	1.7	0.2	3.0	6.7	6.4	0.01	0.01	7.1
KP-3	GT12-45	91.15	91.3	overburden	1	7.8	0.03	0.01	0.01	0.03	0.90	0.94	0.94	0.05	14.0	4.2	27.2	0.2	13.0	15.6	14.9	0.01	0.01	7.7
KP-30	GT12-45	79.4	79.65	overburden	1	7.3	0.01	0.01	0.02	0.01	0.30	0.31	0.31	0.05	3.0	4.2	8.7	0.2	3.0	10.0	9.6			
KP-31	GT12-45	81	81.2	overburden	1	7.5	0.01	0.01	0.01	0.01	0.30	0.31	0.31	0.05	6.0	4.2	10.7	0.2	6.0	20.0	19.2			
KP-15	GT12-45	86	86.2	overburden	1	7.4	0.01	0.01	0.01	0.01	0.30	0.31	0.31	0.05	8.0	4.2	17.5	0.2	8.0	26.7	25.6			
KP-16	GT12-45	86.95	87.2	overburden	1	7.3	0.07	0.01	0.01	0.06	2.20	1.88	1.88	0.05	12.0	4.2	28.7	0.2	10.0	5.5	6.4			
KP-17	GT12-45	92.2	92.45	overburden	1	7.7	0.01	0.01	0.01	0.01	0.30	0.31	0.31	0.05	16.0	4.2	25.0	0.2	16.0	53.3	51.2			
KP-18	GT12-45	95.25	95.4	overburden	1	7.8	0.01	0.01	0.02	0.01	0.30	0.31	0.31	0.05	14.0	4.2	20.5	0.2	14.0	46.7	44.8			
KP-16-2	GT12-46	46.3	46.5	overburden	1	7.9	0.01	0.01	0.01	0.01	0.30	0.31	0.11	0.05	8.0	4.2	15.0	0.2	8.0	26.7	25.6			
KP-17-2	GT12-46	49.25	49.52	overburden	1	7.6	0.01	0.01	0.01	0.01	0.30	0.31	0.11	0.05	8.0	4.2	13.7	0.2	8.0	26.7	25.6			
KP-18-2	GT12-46	52.45	52.7	overburden	1	8.1	0.01	0.01	0.01	0.01	0.30	0.31	0.16	0.10	16.0	8.3	21.5	0.4	16.0	53.3	51.2			
KP-19-2	GT12-46	54.55	54.8	overburden	2	8.0	0.01	0.01	0.01	0.01	0.30	0.31	0.22	0.20	25.0	16.7	32.7	0.8	25.0	83.3	80.0			
KP-20-2	GT12-46	58.4	58.69	overburden	1	7.9	0.01	0.01	0.02	0.01	0.30	0.31	0.26	0.06	13.0	5.0	20.0	0.2	13.0	43.3	41.6			
KP-21-2	GT12-46	60.7	60.9	overburden	2	8.2	0.01	0.01	0.01	0.01	0.30	0.31	0.18	0.80	70.0	66.7	82.1	2.9	70.0	233.3	224.0			
KP-22-2	GT12-46	64.6	64.8	overburden	2	8.1	0.01	0.01	0.03	0.01	0.30	0.31	0.21	0.16	20.0	13.3	28.0	0.6	20.0	66.7	64.0			
L016651	BW0072	28.85	30	OB-rx interface	1	6.8	0.01	0.01	0.03	0.01	0.30	0.31	0.31	0.05	2.0	4.2	3.5	0.2	2.0	6.7	6.4			
L016652	BW0083	43	45	OB-rx interface	1	8.4	0.02	0.01	0.02	0.01	0.60	0.31	0.31	0.05	4.0	4.2	1.2	0.2	3.0	6.7	12.8			
L016653	BW0089	8	11	OB-rx interface	1	6.9	0.05	0.01	0.04	0.05	1.60	1.56	1.56	0.05	3.0	4.2	2.2	0.2	1.0	1.9	1.9			
L016654	BW0096	28	31	OB-rx interface	1	7.3	0.01	0.01	0.01	0.01	0.30	0.31	0.31	0.05	2.0	4.2	2.5	0.2	2.0	6.7	6.4			
L016655	BW0117	30	35	OB-rx interface	1	7.4	0.03	0.01	0.02	0.03	0.90	0.94	0.94	0.05	3.0	4.2	3.7	0.2	2.0	3.3	3.2			
L016656	BW0120	38	43	OB-rx interface	1	7.5	0.02	0.01	0.01	0.02	0.60	0.63	0.63	0.05	3.0	4.2	4.2	0.2	2.0	5.0	4.8			
L016657	BW0122	58.35	60	OB-rx interface	1	7.3	0.02	0.01	0.01	0.02	0.60	0.63	0.63	0.05	2.0	4.2	2.7	0.2	1.0	3.3	3.2			
L016658	BW0128	43	48	OB-rx interface	1	7.2	0.02	0.02	0.01	0.01	0.60	0.31	0.31	0.05	3.0	4.2	3.7	0.2	2.0	5.0	9.6			
L016659	BW0156	27	28	OB-rx interface	1	7.7	0.03	0.01	0.01	0.03	0.90	0.94	0.35	0.05	1.0	4.2	0.7	0.2	0.0	1.1	1.1			
L016660	BW0163	11	12	OB-rx interface	1	7.5	0.01	0.01	0.01	0.01	0.30	0.31	0.31	0.05	5.0	4.2	6.0	0.2	5.0	16.7	16.0			
L016661	BW0179	34	35	OB-rx interface	1	6.5	0.03	0.01	0.01	0.03	0.90	0.94	0.37	0.05	2.0	4.2	2.7	0.2	1.0	2.2	2.1			
L016662	BW0200	9	11.4	OB-rx interface	1	7.7	0.01	0.01	0.01	0.01	0.30	0.31	0.31	0.08	7.0	6.7	8.2	0.3	7.0	23.3	22.4			
L016663	BW0206	75	77	OB-rx interface	1	7.4	0.02	0.01	0.01	0.02	0.60	0.63	0.63	0.05	4.0	4.2	9.5	0.2	3.0	6.7	6.4			
L016664	BW0213	13	18	OB-rx interface	1	7.2	0.03	0.01	0.03	0.02	0.90	0.63	0.63	0.05	2.0	4.2	1.7	0.2	1.0	2.2	3.2			
L016665	BW0224	93	94	OB-rx interface	1	7.1	0.02	0.01	0.01	0.02	0.60	0.63	0.63	0.05	3.0	4.2	2.2	0.2	2.0	5.0	4.8			
L016666	BW0241	75	80	OB-rx interface	1	7.0	0.03	0.01	0.01	0.03	0.90	0.94	0.94	0.05	1.0	4.2	1.7	0.2	0.0	1.1	1.1			
L016667	BW0249	63	68	OB-rx interface	1	6.7	0.03	0.01	0.02	0.03	0.90	0.94	0.94	0.05	1.0	4.2	1.7	0.2	-1.0	1.1	1.1			
L016668	BW0253	64	68	OB-rx interface	1	6.9	0.04	0.01	0.02	0.03	1.30	0.94	0.94	0.05	1.0	4.2	1.2	0.2	-1.0	0.8	1.1			
L016669	BW0288	14	20.5	OB-rx interface	1	7.0	0.66	0.01	0.01	0.65	20.60	20.31	12.67	0.09	5.0	7.5	5.5	0.3	-16.0	0.2	0.2			
KP-23	GT13-14	28.75	29.05	Plant Site	1	7.9	0.01	0.01		0.01	0.30	0.31	0.31		8.0	0.0	14.2		8.0	26.7	25.6			
KP-24	GT13-14	30.5	30.7	Plant Site	1	7.7	0.01	0.01		0.01	0.30	0.31	0.31		8.0	0.0	15.5		8.0	26.7	25.6			
KP-25	GT13-14	32.05	32.35	Plant Site	1	7.9	0.01	0.01		0.01	0.30	0.31	0.31		11.0	0.0	15.2		11.0	36.7	35.2			
KP-26	GT13-15	1.07	1.5	Plant Site	1	8.5	0.01	0.01		0.01	0.30	0.31	0.13		17.0	0.0	28.2		17.0	56.7	54.4			
KP-27	GT13-15	3.05	3.45	Plant Site	2	8.7	0.01	0.01		0.01	0.30	0.31	0.10		39.0	0.0	52.4		39.0	130.0	124.8			
KP-28	GT13-15	5	5.4	Plant Site	2	8.7	0.01	0.01		0.01	0.30	0.31	0.04		63.0	0.0	77.9		63.0	210.0	201.6			
KP-29	GT13-16	15.32	15.62	Plant Site	2	8.4	0.01	0.01		0.01	0.30	0.31	0.31		64.0	0.0	77.9		64.0	213.3	204.8			
KP-30	GT13-16	17.3	17.6	Plant Site	2	8.6	0.01	0.01		0.01	0.30	0.31	0.31		58.0	0.0	58.7		58.0	193.3	185.6			
KP-31	GT13-16	19.3	19.6	Plant Site	2	8.7	0.01	0.01		0.01	0.30	0.31	0.31		45.0	0.0	44.7		45.0	150.0	144.0			
KP-32	GT13-17	12.5	12.8	Plant Site	1	8.3	0.01	0.01		0.01	0.30	0.31	0.31		18.0	0.0	22.5		18.0	60.0	57.6			
KP-33	GT13-17	14.5	14.7	Plant Site	1	8.5	0.01	0.01		0.01	0.30	0.31	0.31		18.0	0.0	34.7		18.0	60.0	57.6			
KP-34	GT13-17	16.5	16.7	Plant Site	2	8.4	0.01	0.01		0.01	0.30	0.31	0.31		32.0	0.0	72.4		32.0	106.7	102.4			
KP-35	GT13-18	24.4	24.7	Plant Site	2	8.8	0.01	0.01		0.01	0.30	0.31	0.22		46.0	0.0	52.4		46.0	153.3	147.2			
KP-36	GT13-18	26	26.4	Plant Site	2	8.9	0.01	0.01		0.01	0.30	0.31	0.22		42.0	0.0	48.4		42.0	140.0	134.4			
KP-37	GT13-18	28.5	28.9	Plant Site	2	8.9	0.01	0.01		0.01	0.30	0.31	0.20		59.0	0.0	62.4		59.0	196.7	188.8			
PAR-01				Permitted Access Road	1	7.3	0.02	0.01	0.03	0.02	0.60	0.63	0.55	0.05	7.0	4.2	11.2	0.2	6.0	11.7	11.2			
PAR-02				Permitted Access Road	1	6.7	0.01	0.01	0.01	0.01	0.30	0.31	0.25	0.05	7.0	4.2	11.0	0.2	7.0	23.3	22.4			
PAR-03				Permitted Access Road	1	6.9	0.01	0.01	0.01	0.01	0.30	0.31	0.23	0.05	7.0	4.2	15.2	0.2	7.0	23.3	22.4			
PAR-04				Permitted Access Road	2	8.0	0.04	0.01	0.03	0.04	1.30	1.25	1.18	0.95	79.0	79.2	87.9	3.5	78.0	60.8	63.2			
PAR-05				Permitted Access Road	1	7.4	0.02	0.01	0.02	0.01	0.60	0.31	0.25	0.05	6.0	4.2	15.5	0.2	5.0	10.0	19.2			
PAR-06				Permitted Access Road	1	7.4	0.02	0.01	0.01	0.02	0.60	0.63	0.55	0.05	10.0	4.2	20.0	0.2	9.0	16.7	16.0			
PAR-07				Permitted Access Road	1	7.4	0.01	0.01	0.01	0.01	0.30	0.31	0.26	0.05	4.0	4.2	7.5	0.2	4.0	13.3	12.8			
PAR-08				Permitted Access Road	1	7.2	0.01	0.01	0.01	0.01	0.30	0.31	0.25	0.05	3.0	4.2	5.5	0.2	3.0	10.0	9.6			
PAR-09				Permitted Access Road	1	7.5	0.02	0.01	0.03	0.01	0.60	0.31	0.23	0.05	8.0	4.2	9.7	0.2	7.0	13.3	25.6			
PAR-10				Permitted Access Road	1	7.2	0.01	0.01	0.01	0.01	0.30	0.31	0.25	0.05	3.0	4.2	7.7	0.2	3.0	10.0	9.6			
PAR-11				Permitted Access Road	1	7.1	0.01	0.01	0.01	0.01	0.30	0.31	0.23	0.05	3.0	4.2	6.0	0.2	3.0	10.0	9.6			
PAR-12				Permitted Access Road	1	6.7	0.01	0.01	0.02	0.01	0.30	0.31	0.27	0.05	2.0	4.2	6.2	0.2	2.0	6.7	6.4			
PAR-13				Permitted Access Road	1	7.2	0.01	0.02	0.01	0.01	0.30	0.31	0.24	0.05	3.0	4.2	9.5	0.2	3.0	10.0	9.6			
PAR-14				Permitted Access Road	1	6.3	0.01	0.01	0.01	0.01	0.30	0.31	0.23	0.05	6.0	4.2	9.5	0.2	6.0	20.0	19.2			
PAR-15				Permitted Access Road	1	7.5	0.01	0.01	0.02	0.01	0.30	0.31	0.25	0.05	5.0	4.2	8.0	0.2	5.0	16.7	16.0			
PAR-16				Permitted Access Road	1	6.5	0.02	0.01	0.04	0.02	0.60	0.63	0.52	0.05	5.0	4.2	15.2	0.2	4.0	8.3	8.0			
PAR-17				Permitted Access Road	1	8.1	0.02	0.01	0.01	0.01	0.60	0.31	0.24	0.05	6.0	4.2	10.2	0.2	5.0	10.0	19.2			
BE-01				Permitted Access Road	1	7.1	0.02	0.01	0.02	0.02	0.60	0.63	0.56	0.05	5.0	4.2	10.7	0.2	4.0	8.3	8.0			
BE-02				Permitted Access Road	1	7.0	0.02	0.01	0.01	0.02	0.60	0.63	0.52	0.05	4.0	4.2	10.5	0.2	3.0	6.7	6.4			

Table A3-2: Acid Base Accounting and NAG Test Results for Waste Rock Samples

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	FIZZ RATING Unity	paste pH Unity	Total S %	SO_4 (carb leach) %	SO_4 (HCl leach) %	Sx %	MPA kg $CaCO_3$/t	Sx AP kg $CaCO_3$/t	AP adjust for ZnS kg $CaCO_3$/t	TIC %	NP kg CaCO3/t	CNP (TIC) kg $CaCO_3$/t	ICP-Ca NP kg $CaCO_3$/t	CO_2 %	NNP kg CaCO3/t	NP:MPA Unity	NP/AP Unity	NAG @ pH 4.5 kg H_2SO_4/t	NAG @ pH 7.0 kg H_2SO_4/t	AG pH Unity
BW-ARD-119	BW0077	228	238	FT	S	1	4.7	2.59	0.08	0.02	2.5	80.9	78.4	75.5	0.1	0.01	4.2	0.2	0.2	-82.0	0.0001	0.0001	65.4	75.4	2.6
BW-ARD2-3	BW0043	123	133	FT	S	1	5.1	1.29	0.06	0.01	1.2	40.3	38.4	30.4	0.1	0.01	4.2	0.2	0.2	-40.0	0.0002	0.0003			
BW-ARD-591	BW0103	119	129	FT	S	1	5.2	1.26	0.02	0.01	1.2	39.4	38.8	36.4	0.1	0.01	9.2	1.5	0.4	5.0	0.0003	0.0003	23.5	34.6	2.6
BW-ARD-357	BW0173	91	101	VC	S	1	5.0	1.05	0.08	0.01	1.0	32.8	30.3	23.8	0.1	0.01	4.2	0.2	0.2	-33.0	0.0003	0.0003	16.9	23.2	2.8
L016674	BW0117	36	45		O	1	4.1	0.93	0.09	0.10	0.8	29.1	26.3	25.4	0.1	0.01	4.2	0.5	0.2	-32.0	0.0003	0.0004			
BW-ARD-522	BW0191	44	54	VC	T	1	6.9	0.39	0.01	0.02	0.4	12.2	12.2	9.0	0.1	0.01	4.2	4.0	0.2	-14.0	0.001	0.001	2.3	6.7	3.5
L016670	BW0072	31	40		O	1	4.5	0.28	0.05	0.05	0.2	8.8	7.2	6.8	0.1	0.01	4.2	0.5	0.2	-10.0	0.001	0.001			
BW-ARD-486	BW0178	164	174	AND	S	1	8.3	0.19	0.01	0.06	0.2	5.9	5.6	4.1	0.1	0.01	4.2	9.0	0.2	-6.0	0.002	0.002	0.0	0.7	5.3
BW-ARD-415	BW0182	99	109	VC	T	1	6.9	0.15	0.01	0.04	0.1	4.7	4.4	4.0	0.1	0.01	7.5	9.5	0.3	-4.7	0.002	0.002	0.0	0.1	6.8
L016680	BW0173	58	67		O	1	7.6	0.06	0.04	0.06	0.0	1.9	0.6	0.3	0.1	0.01	4.2	0.2	0.2	-2.0	0.01	0.02			
L016673	BW0096	32	41		O	1	7.7	0.03	0.01	0.01	0.0	0.9	0.9	0.8	0.1	0.01	4.2	0.2	0.2	-1.0	0.01	0.01			
L016671	BW0083	46	55		O	1	7.7	0.02	0.01	0.01	0.0	0.6	0.3	0.3	0.1	0.01	4.2	0.2	0.2	-1.0	0.02	0.03			
BW-ARD-265	BW0077	150	160	FT	S	1	4.4	1.79	0.08	0.06	1.7	55.9	53.4	42.6	0.1	1.00	4.2	1.2	0.2	-55.0	0.02	0.02	35.2	48.9	2.8
BW-ARD-023	BW0043	123	133	FT	S	1	5.6	1.22	0.01	0.02	1.2	38.1	38.1	30.4	0.1	1.00	4.2	0.2	0.2	-37.0	0.03	0.03	19.3	10.6	2.7
BW-ARD-020	BW0055	95	105	FT	S	1	4.8	1.09	0.01	0.04	1.1	34.1	34.1	29.2	0.1	1.00	4.2	0.7	0.2	-33.0	0.03	0.03	18.8	8.5	2.8
BW-ARD-261	BW0077	192	202	FT	S	1	5.6	3.20	0.04	0.01	3.2	100.0	98.8	94.0	0.1	3.00	4.2	0.2	0.2	-97.0	0.03	0.03	78.0	91.4	2.5
BW-ARD-118	BW0077	150	160	FT	S	1	5.0	1.93	0.02	0.03	1.9	60.3	59.7	51.0	0.1	2.00	4.2	1.2	0.2	-58.0	0.03	0.03	33.7	48.2	2.6
L016678	BW0156	29	38		O	1	7.4	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	0.01	4.2	0.2	0.2	0.0	0.03	0.03			
L016679	BW0163	12	21		O	1	7.4	0.01	0.01	0.01	0.0	0.3	0.3	0.0	0.1	0.01	4.2	1.0	0.2	0.0	0.03	0.03			
L016685	BW0224	95	104		O	1	8.0	0.01	0.01	0.03	0.0	0.3	0.3	0.3	0.1	0.01	4.2	0.2	0.2	0.0	0.03	0.03			
BW-ARD-447	BW0172	67	77	FT	S	1	5.7	0.95	0.05	0.01	0.9	29.7	28.1	16.9	0.1	1.00	6.7	0.7	0.3	-29.0	0.03	0.04	8.8	18.3	3.0
BW-ARD-358	BW0173	186	196	FT	S	1	5.5	0.93	0.05	0.03	0.9	29.1	27.5	22.5	0.1	1.00	4.2	0.7	0.2	-28.0	0.03	0.04	12.5	20.8	2.9
BW-ARD-444	BW0172	25	35	FT	S	1	5.6	0.84	0.05	0.01	0.8	26.3	24.7	17.5	0.1	1.00	4.2	0.5	0.2	-25.0	0.04	0.04	10.3	18.6	2.9
BW-ARD-445	BW0172	36	50	FT	S	1	5.9	0.82	0.05	0.01	0.8	25.6	24.1	20.2	0.1	1.00	5.0	0.7	0.2	-25.0	0.04	0.04	10.8	18.8	2.9
BW-ARD-212	BW0113	210	220	FT	S	1	6.8	1.46	0.03	0.01	1.4	45.6	44.7	36.8	0.1	2.00	4.2	0.5	0.2	-44.0	0.04	0.04	27.2	40.8	2.9
BW-ARD-131	BW0082	286	296	FT	S	1	5.0	1.93	0.01	0.03	1.9	60.3	60.0	59.7	0.1	3.00	10.0	1.0	0.4	-57.0	0.05	0.05	43.2	50.7	2.7
L016672	BW0089	8	17		O	1	4.2	0.64	0.09	0.11	0.6	20.0	17.2	11.1	0.1	1.00	4.2	1.5	0.2	-19.0	0.05	0.06			
BW-ARD-368	BW0161	175	185	FT	S	1	6.6	0.59	0.01	0.02	0.6	18.4	18.4	10.6	0.2	1.00	12.5	0.7	0.6	-17.0	0.05	0.05	4.4	10.2	3.2
BW-ARD-210	BW0113	250	260	FT	S	1	7.0	1.56	0.02	0.01	1.5	48.8	48.1	43.6	0.1	3.00	4.2	0.5	0.2	-46.0	0.06	0.06	31.8	42.7	2.9
BW-ARD-503	BW0185	221	231	FT	S	1	7.0	0.51	0.01	0.01	0.5	15.9	15.9	15.8	0.1	1.00	5.0	0.7	0.2	-15.0	0.06	0.06	9.4	13.6	2.8
BW-ARD-098	BW0113	210	220	FT	S	1	6.1	1.00	0.01	0.01	1.0	31.3	31.3	26.6	0.1	2.00	4.2	0.5	0.2	-29.0	0.06	0.06	16.9	24.8	2.6
BW-ARD-102	BW0115	195	205	FT	S	1	6.6	0.50	0.02	0.01	0.5	15.6	15.0	8.7	0.1	1.00	4.2	0.2	0.2	-15.0	0.06	0.07	4.3	9.8	2.9
BW-ARD-413	BW0182	71	81	FT	T	1	6.8	0.50	0.01	0.04	0.5	15.6	15.6	6.0	0.1	1.00	4.2	1.2	0.2	-15.0	0.06	0.06	1.0	4.4	3.7
BW-ARD-531	BW0192	171	181	FT	S	1	7.2	0.49	0.01	0.01	0.5	15.3	15.0	13.2	0.1	1.00	4.2	0.7	0.2	-14.0	0.07	0.07	4.1	9.8	3.4
BW-ARD-369	BW0161	246	256	FT	S	1	6.2	0.97	0.01	0.01	1.0	30.3	30.3	28.9	0.1	2.00	6.7	1.0	0.3	-28.0	0.07	0.07	15.9	23.5	2.8
BW-ARD-346	BW0161	195	205	FT	S	1	6.5	0.46	0.01	0.01	0.5	14.4	14.4	11.6	0.3	1.00	23.4	1.0	1.0	-13.0	0.07	0.07	4.1	9.0	3.3
BW-ARD-490	BW0178	302	315	FT	S	2	7.2	0.42	0.03	0.01	0.4	13.1	12.2	9.1	0.1	1.00	5.0	0.7	0.2	-12.0	0.08	0.08	3.6	7.5	3.3
BW-ARD-202	BW0116	104	114	VC	S	1	5.4	1.67	0.02	0.02	1.7	52.2	51.6	42.8	0.1	4.00	4.2	0.7	0.2	-48.0	0.08	0.08	28.9	42.9	2.8
BW-ARD-025	BW0044	150	162	FT	S	1	6.3	0.80	0.01	0.02	0.8	25.0	24.7	20.1	0.1	2.00	4.2	0.2	0.2	-23.0	0.08	0.08	11.4	7.5	2.8
BW-ARD-174	BW0105	250	260	FT	S	1	5.1	1.18	0.05	0.03	1.1	36.9	35.3	32.1	0.1	3.00	4.2	1.0	0.2	-34.0	0.08	0.08	20.7	28.4	2.5
BW-ARD2-4	BW0043	150	160	FT	S	1	6.3	0.71	0.05	0.01	0.7	22.2	20.6	15.8	0.1	2.00	4.2	0.2	0.2	-20.0	0.09	0.10			
BW-ARD-448	BW0172	89	99	FT	S	1	5.9	1.05	0.03	0.01	1.0	32.8	31.9	26.7	0.1	3.00	10.8	2.7	0.5	-30.0	0.09	0.09	11.6	20.7	2.9
BW-ARD-035	BW0049	111	121	VC	S	1	5.2	1.04	0.02	0.01	1.0	32.5	31.9	30.8	0.1	3.00	8.3	0.5	0.4	-30.0	0.09	0.09	16.7	14.4	3.0
BW-ARD-036	BW0059	266	277	VC	S	1	5.0	3.03	0.03	0.04	3.0	94.7	93.8	93.6	0.1	9.00	11.7	5.5	0.5	-86.0	0.10	0.10	67.0	79.2	2.6
BW-ARD-104	BW0116	219	229	VC/AND	S	1	5.9	1.68	0.01	0.01	1.7	52.5	52.2	48.5	0.1	5.00	5.0	4.5	0.2	-48.0	0.10	0.10	26.6	37.2	2.9
BW-ARD-590	BW0086	47	57	VC	S/T	1	5.2	1.66	0.02	0.01	1.6	51.9	51.3	35.9	0.1	5.00	4.2	3.0	0.2	5.0	0.10	0.10	22.1	41.8	2.6
BW-ARD-161	BW0096	225	235	FT	S	1	6.3	0.33	0.01	0.02	0.3	10.3	10.0	4.7	0.1	1.00	4.2	0.2	0.2	-9.0	0.10	0.10	0.2	8.4	4.2
BW-ARD-451	BW0172	188	198	FT	S	1	7.0	0.99	0.02	0.01	1.0	30.9	30.3	22.9	0.1	3.00	5.8	0.5	0.2	-28.0	0.10	0.10	12.3	21.4	2.9
BW-ARD-430	BW0187	269	279	FT	S	1	7.7	0.32	0.01	0.01	0.3	10.0	10.0	5.5	0.1	1.00	4.2	0.5	0.2	-9.0	0.10	0.10	0.3	2.5	4.2
BW-ARD-137	BW0086	47	57	VC	S/T	1	5.3	1.57	0.07	0.05	1.5	49.1	46.9	30.7	0.1	5.00	4.2	3.0	0.2	-44.0	0.10	0.11	17.7	33.2	3.0
BW-ARD-221	BW0109	161	171	FT	S	1	6.5	0.59	0.05	0.02	0.5	18.4	16.9	15.1	0.1	2.00	4.2	0.5	0.2	-16.0	0.11	0.12	9.2	15.3	3.1
BW-ARD-431	BW0187	292	302	FT	S	1	7.6	0.29	0.01	0.01	0.3	9.1	9.1	5.1	0.1	1.00	4.2	0.5	0.2	-8.0	0.11	0.11	0.6	2.6	3.9
BW-ARD-279	BW0073	37	47	FT	T	1	5.1	0.58	0.03	0.01	0.6	18.1	17.2	17.1	0.1	2.00	8.3	0.7	0.4	-16.0	0.11	0.12	9.5	14.3	3.1
BW-ARD-251	BW0074	70	80	VC	T	1	5.6	0.58	0.06	0.01	0.5	18.1	16.3	12.9	0.1	2.00	4.2	0.7	0.2	-16.0	0.11	0.12	9.1	14.2	3.1
COMPW006197-W006207	BWWR13	206	216	SED	S	1	8.9	2.01	0.03	0.03	2.0	62.8	61.9	60.4	0.1	7.00	4.2	22.2	0.2	-56.0	0.11	0.11			
BW-ARD-175	BW0106	210	220	FT	S	1	7.2	0.85	0.02	0.01	0.8	26.6	25.9	20.0	0.1	3.00	11.7	0.5	0.5	-24.0	0.11	0.12	11.2	19.7	2.4
BW-ARD-274	BW0062	64	74	VC	S/T	1	6.1	1.40	0.02	0.02	1.4	43.8	43.1	32.6	0.1	5.00	4.2	0.5	0.2	-39.0	0.11	0.12	22.1	36.1	2.9
BW-ARD 661	GM12-04	19	29	AND	T	1	5.7	0.56	0.06	0.01	0.5	17.5	15.6	7.4	0.1	2.00	4.2	1.5	0.2	-16.0	0.11	0.13	0.5	8.2	4.0
BW-ARD-559	BW0199	103	113	AND	T	1	5.0	1.35	0.09	0.03	1.3	42.2	39.4	32.1	0.1	5.00	10.8	10.7	0.5	-37.0	0.12	0.13	19.2	31.6	2.7
BW-ARD-376	BW0069	20	30	FT	T	1	6.8	0.27	0.02	0.01	0.3	8.4	7.8	3.4	0.1	1.00	4.2	0.5	0.2	-7.0	0.12	0.13	0.2	3.1	4.1
BW-ARD-045	BW0063	15	25	FT	T	1	5.5	0.29	0.04	0.04	0.3	9.1	7.8	5.7	0.1	2.00	4.2	0.2	0.2	-7.0	0.22	0.26	0.9	3.7	3.9
BW-ARD-076	BW0103	289	300	FT	S	1	6.4	0.79	0.01	0.01	0.8	24.7	24.7	22.1	0.1	3.00	4.2	0.7	0.2	-22.0	0.12	0.12	12.6	18.3	2.9
BW-ARD-687	GM12-05	201	211	FT	S	1	6.9	0.79	0.01	0.01	0.8	24.7	24.7	20.4	0.1	3.00	4.2	0.2	0.2	-22.0	0.12	0.12	12.2	18.5	2.7
BW-ARD-232	BW0087	277	287	VC	S	1	6.1	3.15	0.02	0.01	3.1	98.4	97.8	94.9	0.1	12.00	4.2	9.2	0.2	-86.0	0.12	0.12	70.7	82.2	2.6
BW-ARD-082	BW0075	270	280	FT	S	1	6.5	0.52	0.01	0.01	0.5	16.3	16.3	14.7	0.1	2.00	4.2	0.5	0.2	-14.0	0.12	0.12	7.0	11.7	3.1
BW ARD 663	GM12-04	44	54	AND	S	1	5.6	1.56	0.03	0.01	1.5	48.8	47.8	37.9	0.1	6.00	4.2	6.5	0.2	-43.0	0.12	0.13	20.2	35.9	2.7
COMPW261202-M261210	BWWR08	49	58	VC	T	1	5.7	0.26	0.02	0.01	0.2	8.1	7.5	6.7	0.1	1.00	4.2	3.3	0.2	-7.0	0.12	0.13			
BW-ARD-116	BW0076	286	296	FT	S	1	7.2	0.75	0.01	0.01	0.7	23.4	23.1	17.9	0.1	3.00	4.2	0.2	0.2	-20.0	0.13	0.13	8.9	18.0	2.9
BW-ARD-425	BW0187	64	74	VC	T	1	7.4	0.25	0.01	0.02	0.2	7.8	7.5	4.1	0.1	1.00	4.2	0.7	0.2	-7.0	0.13	0.13	0.1	2.1	4.2
BW-ARD-141	BW0087	277	287	VC	S	1	5.9	2.95	0.01	0.01	3.0	92.2	92.2	88.1	0.1	12.00	4.2	9.7	0.2	-80.0	0.13	0.13	61.8	75.2	2.6
BW-ARD-434	BW0171	45	55	VC	S	1	5.4	0.49	0.01	0.01	0.5	15.3	15.3	13.0	0.1	2.00	4.2	2.0	0.2	-13.0	0.13	0.13	4.4	8.4	3.2
BW-ARD 660	GM12-04	9	19	AND	T	1	4.9	0.49	0.09	0.01	0.4	15.3	12.5	8.3	0.1	2.00	4.2	0.2	0.2	-13.0	0.13	0.16	1.7	7.1	3.6
BW-ARD-150	BW0091	261	271	AND	S	1	6.2	2.69	0.01	0.01	2.7	84.1	84.1	80.7	0.1	11.00	4.2	11.2	0.2	-73.0	0.13	0.13	51.0	65.5	2.5
COMPM261985-M261994	BWWR03	153	162	AND	T	1	6.3	0.73	0.01	0.01	0.7	22.8	22.5	20.5	0.1	3.00	4.2	3.7	0.2	-20.0	0.13	0.13			
BW-ARD-047	BW0062	64	74	VC	S/T	1	5.2	1.19	0.08	0.01	1.1	37.2	34.7	25.4	0.1	5.00	4.2	0.7	0.2	-32.0	0.13	0.14	19.4	31.2	2.7
BW-ARD-233	BW0087	175	185	AND	S	1	6.6	3.06	0.02	0.01	3.0	95.6	95.0	84.6	0.1	13.00	4.2	8.7	0.2	-83.0	0.14	0.14	52.7	73.6	2.6
BW-ARD-044	BW0101	82	92	VC	S	1	5.6	0.47	0.01	0.01	0.5	14.7	14.4	12.8	0.1	2.00	4.2	0.5	0.2	-13.0	0.14	0.14	5.3	9.0	3.3
BW-ARD 668	GM12-04	111	121	VC	S	1	7.2	0.94	0.01	0.01	0.9	29.4	29.1	21.3	0.1	4.00	4.2	2.2	0.2	-25.0	0.14	0.14	10.9	22.5	3.0
BW-ARD2-9	BW0044	15	25	VC	T	1	5.1	2.11	0.14	0.09	2.0	65.9	61.6	57.0	0.2	9.00	15.0	3.7	0.7	-57.0	0.14	0.15			
BW-ARD-566	BW0211	136	146	FT	S	1	6.2	0.70	0.01	0.02	0.7	21.9	21.6	18.6	0.1	3.00	7.5	1.0	0.3	-19.0	0.14	0.14	7.4	16.4	3.1
BW-ARD-155	BW0093	200	210	VC	S	1	5.5	1.39	0.05	0.04	1.3	43.4	41.9	39.4	0.1	6.00	5.0	2.7	0.2	-37.0	0.14	0.14	25.9	35.2	3.1
COMPM261182-M261191	BWWR08	32	41	VC	O/T	1	5.6	0.23	0.03	0.01	0.2	7.2	6.3	5.7	0.1	1.00	4.2	1.3	0.2	-6.0	0.14	0.16			
BW-ARD-367	BW0161	137	147	FT	S	1	6.6	0.23	0.03	0.02	0.2	7.2	6.3	4.9	0.1	1.00	4.2	0.7	0.2	-6.0	0.14	0.16	1.8	3.4	3.7
BW-ARD-360	BW0173	206	216	VC	S	1	5.8	1.11	0.05	0.02	1.1	34.7	33.1	29.8	0.1	5.00	6.7	5.5	0.3	-30.0	0.14	0.15	14.1	23.5	2.9
BW-ARD-528	BW0191	259	269	FT	S	1	7.1	0.22	0.01	0.02	0.2	6.9	6.6	5.3	0.1	1.00	4.2	0.7	0.2	-6.0	0.14	0.15	1.0	3.3	3.6
BW-ARD-219	BW0111	246	256	FT	S	1	7.0	0.85	0.02	0.01	0.8	26.6	25.9	22.9	0.1	4.00	6.7	2.0	0.3	-23.0	0.15	0.15	14.2	22.1	2.9
BW-ARD-428	BW0187	144	154	VC	S	1	7.6	0.21	0.01	0.02	0.2	6.6	6.3	5.1	0.1	1.00	4.2	0.7	0.2	-6.0	0.15	0.16	0.8	2.8	3.8
BW-ARD-555	BW0199	212	222	AND	S	1	6.7	1.47	0.03	0.02	1.4	45.9	45.0	43.9	0.1	7.00	4.2	13.5	0.2	-39.0	0.15	0.16	26.8	35.8	2.5
BW-ARD-345	BW0161	160	170	VC	S	1	6.5	0.41	0.03	0.03	0.4	12.8	11.9	8.9	0.1	2.00	4.2	1.2	0.2	-11.0	0.16	0.17	3.8	8.1	3.3
BW-ARD-477	BW0175	161	171	AND	S	1	6.5	1.43	0.01	0.01	1.4	44.7	44.7	41.4	0.1	7.00	9.2	10.5	0.4	-38.0	0.16	0.16	22.0	33.2	2.7
BW-ARD-126	BW0080	231	241	AND	S	1	6.2	1.62	0.02	0.02	1.6	50.6	50.0	45.1	0.1	8.00	5.8	2.5	0.3	-43.0	0.16	0.16	27.8	39.2	2.9
BW-ARD-135	BW0085	74	84	VC	S	1	7.3	2.63	0.01	0.02	2.6	82.2	81.9	70.8	0.1	13.00	6.7	8.7	0.3	-69.0	0.16	0.16	40.9	58.8	2.7
COMPM261192-M261201	BWWR08	41	49	VC	T	1	6.7	0.20	0.01	0.01	0.2	6.3	5.9	5.1	0.1	1.00	4.2	1.3	0.2	-5.0	0.16	0.17			
BW-ARD-207	BW0115	195	205	FT	S	1	7.5	0.40	0.02	0.01	0.4	12.5	11.9	7.9	0.1	2.00	4.2	0.2	0.2	-11.0	0.16	0.17	2.1	7.1	3.5
BW-ARD-511	BW0188	162	172	VC	S	1	7.0	0.40	0.01	0.01	0.4	12.5	12.5	12.2	0.1	2.00	5.0	2.0	0.2	-11.0	0.16	0.16	4.9	9.3	3.2
BW-ARD-145	BW0089	146	156	AND	S	1	6.8	1.98	0.03	0.01	2.0	61.9	60.9	37.9	0.1	10.00	4.2	9.7	0.2	-52.0	0.16	0.16	20.5	46.2	2.9
BW-ARD 604	GM12-01	80	90	VC	S	1	7.5	1.18	0.01	0.01	1.2	36.9	36.9	35.8	0.1	6.00	4.2	10.7	0.2	-31.0	0.16	0.16	18.8	28.2	2.7
BW-ARD-257	BW0072	246	256	FT	S	1	7.8	0.39	0.02	0.01	0.4	12.2	11.6	9.4	0.1	2.00	4.2	0.2	0.2	-10.0	0.16	0.17	4.7	10.2	3.3
COMPM274671-M274680	BWWR02	52	61	VC	S	1	6.1	1.34	0.01	0.01	1.3	41.9	41.6	34.9	0.1	7.00	4	9.5	0.2	-35.0	0.17	0.17			
BW-ARD-514	BW0186	252	262	FT	S	1	8.0	0.19	0.01	0.01	0.2	5.9	5.9	4.5	0.1	1.00	4.2	0.5	0.2	-5.0	0.17	0.17	0.6	2.8	3.9
COMPM274651-M274660	BWWR02	35	43	VC	T	1	6.5	0.92	0.01	0.01	0.9	28.8	28.4	18.1	0.1	5.00	4	6.5	0.7	-24.0	0.17	0.18			
BW-ARD-586	GM12-05	191	201	FT	S	1	7.0	0.36	0.02	0.01	0.3	11.3	10.6	8.4	0.1	2.00	4.2	0.2	0.2	-9.0	0.18	0.19	3.0	6.2	3.2
BW-ARD-130	BW0082	165	175	AND	S	1	6.2	2.53	0.01	0.03	2.5	79.1	78.8	78.3	0.1	14.00	4.2	10.0	0.2	-65.0	0.18	0.18	50.1	63.1	2.7
COMPM261325-M261334	BWWR07	37	45	VC	T	2	5.6	0.54	0.01	0.01	0.5	16.9	16.6	13.5	0.1	3.00	4.2	5.7	0.2	-14.0	0.18	0.18			
BW-ARD-152	BW0092	253	263	VC	S	1	5.3	1.61	0.02	0.01	1.6	50.3	49.7	47.1	0.1	9.00	6.7	6.7	0.3	-41.0	0.18	0.18	28.8	38.3	2.6
COMPM261394-M261397	BWWR07	97	100	VC	T	2	6.3	0.53	0.01	0.01	0.5	16.6	16.3	14.5	0.1	3.00	4.2	3.7	0.2	-14.0	0.18	0.18			
BW-ARD-359	BW0173	197	206	VC	S	1	6

Table A3-2: Acid Base Accounting and NAG Test Results for Waste Rock Samples

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	FIZZ RATING Unity	paste pH Unity	Total S %	SO_4 (carb leach) %	SO_4 (HCl leach) %	Sx %	MPA kg $CaCO_3$/t	Sx AP kg $CaCO_3$/t	AP adjust for ZnS kg $CaCO_3$/t	TIC %	NP kg $CaCO_3$/t	CNP (TIC) kg $CaCO_3$/t	ICP-Ca NP kg $CaCO_3$/t	CO2 %	NNP kg $CaCO_3$/t	NP:MPA Unity	NP/AP Unity	NAG @ pH 4.5 kg H_2SO_4/t	NAG @ pH 7.0 kg H_2SO_4/t	AG pH Unity
BW-ARD-108	BW0065	265	275	AND	S	1	6.6	1.72	0.01	0.02	1.7	53.8	53.4	52.1	0.1	12.00	4.2	11.7	0.2	-42.0	0.22	0.22	28.8	40.9	2.7
COMPMZ74731-M274740	BWWR02	105	115	VC	S/O	1	7.8	1.00	0.01	0.01	1.0	31.3	31.3	22.7	0.1	7.00	4.2	9.7	0.2	-24.0	0.22	0.22			
BW-ARD-074	BW0072	246	256	FT	S	1	7.8	0.43	0.01	0.02	0.4	13.4	13.4	12.0	0.1	3.00	4.2	0.5	0.2	-10.0	0.22	0.22	5.2	9.0	3.2
BW-ARD-162	BW0097	56	66	AND	T	1	5.0	1.14	0.05	0.05	1.1	35.6	34.1	21.7	0.1	8.00	4.2	9.0	0.2	-28.0	0.22	0.23	13.3	26.3	2.9
BW-ARD 618	GM12-01	248	258	AND	S	1	7.5	1.42	0.01	0.01	1.4	44.4	44.4	42.9	0.1	10.00	5.0	20.5	0.2	-34.0	0.23	0.23	20.9	33.7	2.8
BW-ARD-090	BW0110	57	67	AND	S	1	5.3	1.27	0.05	0.05	1.2	39.7	38.1	21.7	0.1	9.00	4.2	8.7	0.2	-31.0	0.23	0.24	9.5	24.7	2.9
BW-ARD-166	BW0099	94	104	FT	T	1	5.2	0.28	0.03	0.02	0.3	8.8	7.8	6.6	0.1	2.00	4.2	0.2	0.2	-7.0	0.23	0.26	1.8	3.7	3.1
BW-ARD-424	BW0187	35	45	VC	T	1	7.2	0.14	0.01	0.03	0.1	4.4	4.4	2.7	0.1	1.00	4.2	0.5	0.2	-3.0	0.23	0.23	0.0	0.4	5.7
BW-ARD-096	BW0112	290	300	VC	S	1	8.1	1.66	0.01	0.01	1.7	51.9	51.6	49.0	0.1	12.00	5.0	13.0	0.2	-40.0	0.23	0.23	24.7	35.3	3.0
BW-ARD-337	BW0100	265	275	SED	S	2	5.8	0.69	0.05	0.01	0.6	21.6	20.0	19.9	0.1	5.00	4.2	8.5	0.2	-17.0	0.23	0.25	8.7	13.9	3.0
BW-ARD-501	BW0185	117	127	VC	T	1	7.1	0.54	0.01	0.01	0.5	16.9	16.6	15.7	0.1	4.00	5.0	5.2	0.2	-13.0	0.24	0.24	7.7	12.8	2.8
BW-ARD-032	BW0052	120	130	VC	S	1	5.4	0.81	0.05	0.03	0.8	25.3	23.8	23.0	0.1	6.00	4.2	2.5	0.2	-19.0	0.24	0.25	13.2	6.1	2.8
COMPM261232-M261241	BWWR08	75	84	VC	T	1	7.7	0.27	0.01	0.01	0.3	8.4	8.1	7.5	0.1	2.00	4.2	0.5	0.2	-6.0	0.24	0.25			
BW-ARD-088	BW0067	215	225	AND	S	1	7.1	2.28	0.04	0.01	2.2	71.3	70.0	68.2	0.1	17.00	4.2	15.0	0.2	-54.0	0.24	0.24	33.2	47.9	2.6
BW-ARD-087	BW0067	66	76	AND	S	1	6.1	1.61	0.05	0.01	1.6	50.3	48.8	36.3	0.1	12.00	4.2	10.5	0.2	-38.0	0.24	0.25	17.7	34.8	2.7
COMPM261955-M261964	BWWR03	124	133	VC	T	1	6.8	0.53	0.01	0.01	0.5	16.6	16.3	13.3	0.1	4.00	4.2	4.2	0.1	-13.0	0.24	0.25			
BW-ARD-052	BW0070	120	130	VC	T	1	6.7	1.43	0.03	0.02	1.4	44.7	43.8	41.2	0.2	11.00	18.3	8.0	0.8	-34.0	0.25	0.25	20.8	30.3	2.7
BW-ARD-284	BW0097	56	66	AND	T	1	4.5	1.43	0.09	0.03	1.3	44.7	41.9	27.2	0.1	11.00	4.2	8.2	0.2	-34.0	0.25	0.26	20.8	35.2	2.7
COMPW006185-W006195	BWWR13	196	206		S	1	8.9	1.65	0.02	0.01	1.6	51.6	50.9	49.5	0.1	13.00	8.3	30.0	0.4	-39.0	0.25	0.26			
BW-ARD-103	BW0116	262	272	AND	S	1	7.2	0.38	0.01	0.01	0.4	11.9	11.9	11.7	0.1	3.00	5.0	0.7	0.2	-9.0	0.25	0.25	4.4	7.2	2.7
BW-ARD-184	BW0109	213	223	FT	S	1	7.0	0.88	0.03	0.01	0.9	27.5	26.6	22.6	0.1	7.00	4.2	1.7	0.2	-21.0	0.25	0.26	12.9	21.3	2.8
COMPM274721-M274730	BWWR02	95	105	VC	S	1	6.9	1.00	0.01	0.01	1.0	31.3	30.9	26.5	0.1	8.00	8.3	10.3	0.4	-23.0	0.26	0.26			
BW-ARD-208	BW0114	52	62	AND	T	1	6.7	1.50	0.03	0.02	1.5	46.9	45.9	37.8	0.1	12.00	4.2	6.0	0.2	-35.0	0.26	0.26	24.3	38.8	2.7
BW-ARD-581	BW0066	290	300	FT	S	1	6.6	0.25	0.01	0.01	0.2	7.8	7.5	7.0	0.1	2.00	4.2	1.7	0.2	5.0	0.26	0.27	3.0	5.7	3.3
BW-ARD-474	BW0175	48	58	VC	S	1	6.0	0.25	0.03	0.08	0.2	7.8	6.9	4.1	0.2	2.00	20.0	3.0	0.9	-6.0	0.26	0.29	0.0	0.5	5.7
BW-ARD-366	BW0161	110	120	FT	T	1	6.9	0.25	0.01	0.01	0.3	7.8	7.8	4.4	0.1	2.00	4.2	0.5	0.2	-6.0	0.26	0.26	0.6	2.3	4.0
COMPQ011351-Q011360	BWWR01	72	82	AND	S	1	7.7	0.87	0.01	0.01	0.9	27.2	27.2	26.5	0.1	7.00	5.0	16.4	0.2	-20.0	0.26	0.26			
BW-ARD-476	BW0175	124	134	FT	S	1	6.5	1.49	0.03	0.05	1.5	46.6	45.6	40.5	0.2	12.00	12.5	24.5	0.5	-35.0	0.26	0.26	14.4	27.7	3.0
BW-ARD-077	BW0103	119	129	FT	S	1	5.5	1.24	0.01	0.01	1.2	38.8	38.4	35.9	0.1	10.00	8.3	1.2	0.4	-29.0	0.26	0.26	20.7	30.7	2.9
BW-ARD-059	BW0070	75	85	VC	T	1	5.9	0.99	0.04	0.01	1.0	30.9	29.7	28.2	0.2	8.00	13.3	3.2	0.6	-23.0	0.26	0.27	13.6	19.8	
BW-ARD-054	BW0070	140	150	FT	S	1	6.4	1.11	0.02	0.01	1.1	34.7	34.1	32.8	0.2	9.00	15.8	4.5	0.7	-26.0	0.26	0.26	16.4	26.4	2.8
BW-ARD-173	BW0105	84	94	AND	S	1	6.8	1.35	0.02	0.01	1.3	42.2	41.6	35.8	0.1	11.00	4.2	8.7	0.2	-31.0	0.26	0.26	18.6	28.8	2.8
BW-ARD-046	BW0062	286	296	VC	S	1	5.9	0.98	0.04	0.02	0.9	30.6	29.4	29.0	0.1	8.00	7.5	7.2	0.3	-23.0	0.26	0.27	12.2	18.8	2.9
BW-ARD-333	BW0069	215	225	VC	S	1	6.1	0.98	0.03	0.03	1.0	30.6	29.7	19.3	0.1	8.00	4.2	9.7	0.2	-23.0	0.26	0.27	8.8	18.8	3.0
BW-ARD-435	BW0171	57	68	VC	S	1	6.8	0.12	0.01	0.01	0.1	3.8	3.4	3.0	0.1	1.00	4.2	0.7	0.2	-3.0	0.26	0.29	0.0	0.4	5.3
BW-ARD-513	BW0186	203	213	FT	S	1	7.6	0.24	0.01	0.03	0.2	7.5	7.2	7.0	0.1	2.00	4.2	0.5	0.2	-6.0	0.27	0.28	2.9	6.1	3.5
BW-ARD-414	BW0182	88	98	VC	T	1	6.9	0.24	0.01	0.02	0.2	7.5	7.5	5.7	0.1	2.00	4.2	2.0	0.2	-6.0	0.27	0.27	1.0	3.4	3.8
BW-ARD-438	BW0171	103	113	AND	S	1	6.7	0.95	0.01	0.01	0.9	29.7	29.4	20.8	0.1	8.00	7.5	8.7	0.3	-22.0	0.27	0.27	6.3	14.5	3.1
BW-ARD-237	BW0082	250	260	AND	S	1	6.8	2.02	0.01	0.02	2.0	63.1	62.8	61.5	0.1	17.00	4.2	9.7	0.2	-46.0	0.27	0.27	34.5	48.4	2.8
BW-ARD-530	BW0192	118	128	VC	S	1	7.6	0.83	0.04	0.02	0.8	25.9	24.7	22.2	0.1	7.00	4.2	5.7	0.2	-19.0	0.27	0.28	7.3	16.0	3.2
BW-ARD 608	GM12-01	126	136	VC	S	1	8.6	0.71	0.01	0.01	0.7	22.2	22.2	19.0	0.1	6.00	4.2	7.0	0.2	-16.0	0.27	0.27	7.1	15.7	3.1
BW-ARD 654	GM12-03	325	335	VC	S	1	7.3	0.71	0.01	0.01	0.7	22.2	21.9	20.1	0.1	6.00	7.5	6.0	0.3	-16.0	0.27	0.27	6.4	15.3	3.3
BW-ARD 667	GM12-04	84	94	AND	S	1	7.7	1.05	0.01	0.01	1.0	32.8	32.5	23.1	0.1	9.00	4.2	9.5	0.2	-24.0	0.27	0.28	9.9	23.7	3.0
BW-ARD-502	BW0185	186	196	FT	S	1	6.9	0.35	0.01	0.01	0.4	10.9	10.9	10.7	0.1	3.00	10.8	1.0	0.5	-8.0	0.28	0.27	2.4	5.3	3.3
COMPM261384-M261393	BWWR07	89	97	VC	T	2	7.1	0.35	0.01	0.01	0.3	10.9	10.6	8.1	0.1	3.00	4.2	4.2	0.2	-8.0	0.28	0.28			
BW-ARD-218	BW0111	191	201	AND	S	1	8.4	1.50	0.01	0.03	1.5	46.9	46.6	29.5	0.1	13.00	4.2	9.2	0.2	-34.0	0.28	0.28	12.8	31.4	2.8
BW-ARD-086	BW0066	290	300	FT	S	1	6.9	0.23	0.02	0.01	0.2	7.2	6.6	6.0	0.1	2.00	4.2	1.7	0.2	-5.0	0.28	0.30	1.5	6.1	3.0
COMPM261211-M261221	BWWR08	58	67	VC	T	1	6.4	0.23	0.03	0.01	0.2	7.2	6.3	5.4	0.1	2.00	4.2	3.3	0.2	-5.0	0.28	0.32			
BW-ARD-068	BW0102	149	159	FT	S	1	7.5	0.34	0.02	0.01	0.3	10.6	10.0	9.8	0.1	3.00	5.8	0.7	0.3	-8.0	0.28	0.30	2.5	3.5	3.2
COMPQ011361-Q011370	BWWR01	82	90	AND	S	1	7.5	0.79	0.01	0.01	0.8	24.7	24.7	24.4	0.1	7.00	4.2	16.1	0.2	-18.0	0.28	0.28			
COMPM274681-M274690	BWWR02	61	69	VC	S	1	7.5	0.79	0.01	0.01	0.8	24.7	24.7	19.3	0.1	7.00	4.2	10.4	0.2	-18.0	0.28	0.28			
BW-ARD-520	BW0190	224	234	FT	S	1	6.9	0.45	0.01	0.03	0.4	14.1	13.8	12.4	0.1	4.00	4.2	8.0	0.2	-10.0	0.28	0.29	4.2	9.5	3.4
BW-ARD 662	GM12-04	29	39	AND	T	1	5.4	0.44	0.04	0.01	0.4	13.8	12.5	6.5	0.1	4.00	4.2	1.5	0.2	-10.0	0.29	0.32	0.8	6.6	3.9
BW-ARD-041	BW0047	68	78	AND	S	1	6.3	1.32	0.01	0.02	1.3	41.3	40.9	30.6	0.1	12.00	4.2	6.0	0.2	-29.0	0.29	0.29	12.1	27.9	3.0
BW-ARD-244	BW0062	286	296	VC	S	1	6.9	0.98	0.02	0.01	1.0	30.6	30.0	29.7	0.1	9.00	7.5	6.2	0.3	-22.0	0.29	0.30	13.1	20.6	3.0
BW-ARD-449	BW0172	119	129	VC	S	1	6.3	0.65	0.07	0.01	0.6	20.3	18.1	10.8	0.1	6.00	4.2	7.0	0.2	-14.0	0.30	0.33	3.2	10.8	3.4
BW-ARD-049	BW0061	102	112	VC	T	1	5.3	0.75	0.11	0.06	0.6	23.4	20.0	12.3	0.1	7.00	4.2	3.7	0.2	-16.0	0.30	0.35	9.0	17.7	2.9
BW-ARD-362	BW0173	232	242	AND	S	1	7.0	1.07	0.04	0.02	1.0	33.4	32.2	31.8	0.1	10.00	4.2	19.2	0.2	-23.0	0.30	0.31	14.9	23.4	2.8
BW-ARD 669	GM12-04	121	132		S	1	8.0	0.96	0.01	0.01	1.0	30.0	29.7	19.5	0.1	9.00	4.2	8.2	0.2	-21.0	0.30	0.30	6.9	20.8	3.1
BW-ARD-532	BW0192	226	236	VC	S	1	6.9	0.63	0.03	0.06	0.6	19.7	18.8	14.3	0.1	6.00	4.2	0.7	0.2	-14.0	0.30	0.32	5.7	13.2	3.3
BW-ARD-525	BW0191	151	161	VC	S	1	7.1	0.42	0.01	0.01	0.4	13.1	12.8	11.9	0.1	4.00	4.2	1.7	0.2	-9.0	0.31	0.31	5.2	9.1	3.2
BW-ARD-504	BW0185	285	295	VC	S	1	7.3	0.52	0.01	0.09	0.5	16.3	16.3	15.6	0.1	5.00	4.2	4.0	0.2	-11.0	0.31	0.31	7.6	12.6	3.0
COMPM274761-M274769	BWWR02	133	141	VC	T	1	7.6	0.52	0.01	0.01	0.5	16.3	16.3	11.2	0.1	5.00	4.2	5.4	0.2	-11.0	0.31	0.31			
BW-ARD 601	GM12-01	41	51	VC	T	1	7.3	0.52	0.06	0.01	0.5	16.3	14.4	11.9	0.1	5.00	4.2	6.2	0.2	-11.0	0.31	0.35	5.2	12.0	3.2
BW-ARD-058	BW0070	65	75	VC	T	1	6.1	1.25	0.02	0.02	1.2	39.1	38.4	37.5	0.7	12.00	54.2	5.0	2.4	-27.0	0.31	0.31	11.3	17.9	2.7
BW-ARD-576	BW0070	65	75	VC	T	1	6.1	1.25	0.02	0.02	1.2	39.1	38.4	37.5	0.7	12.00	54.2	5.0	2.4	5.0	0.31	0.31	11.3	17.9	2.7
BW-ARD-542	BW0198	202	212	VC	S	1	7.6	1.04	0.01	0.02	1.0	32.5	32.2	18.6	0.2	10.00	15.0	20.5	0.7	-23.0	0.31	0.31	1.8	18.8	3.7
BW-ARD-217	BW0111	29	39	AND	T	1	5.5	1.04	0.05	0.02	1.0	32.5	30.9	17.0	0.1	10.00	4.2	4.0	0.2	-23.0	0.31	0.32	7.1	22.2	3.2
COMPM261374-M261383	BWWR07	80	89	VC	T	2	6.8	0.31	0.01	0.01	0.3	9.7	9.4	8.1	0.1	3.00	4.2	4.2	0.2	-7.0	0.31	0.32			
BW-ARD-239	BW0087	34	44	VC	S	1	7.5	1.65	0.01	0.03	1.7	51.6	51.6	40.6	0.1	16.00	4.2	10.0	0.2	-36.0	0.31	0.31	21.7	37.8	2.7
BW-ARD-056	BW0070	160	170	FT/AND/VC	S	1	6.6	1.44	0.05	0.01	1.4	45.0	43.4	41.4	0.1	14.00	11.7	14.0	0.5	-31.0	0.31	0.32	17.9	29.1	2.8
BW-ARD-064	BW0095	251	261	VC	S	1	6.2	1.63	0.03	0.01	1.6	50.9	50.0	49.3	0.1	16.00	10.8	9.0	0.5	-35.0	0.31	0.32	23.9	13.2	2.9
BW-ARD 605	GM12-01	94	104	AND	S	1	8.7	0.71	0.01	0.01	0.7	22.2	22.2	21.7	0.1	7.00	4.2	16.0	0.2	-15.0	0.32	0.32	8.2	14.8	3.1
BW-ARD-213	BW0113	115	125	AND	S	1	7.3	1.31	0.03	0.03	1.3	40.9	40.0	27.5	0.1	13.00	4.2	8.2	0.2	-28.0	0.32	0.33	39.3	55.9	3.1
BW-ARD-508	BW0186	54	64	VC	T	1	7.0	0.60	0.01	0.04	0.6	18.8	18.4	18.1	0.1	6.00	4.2	5.7	0.2	-13.0	0.32	0.33	9.3	15.5	3.0
COMPM274751-M274760	BWWR02	123	133	VC	T	1	7.6	0.60	0.02	0.01	0.6	18.8	18.1	12.3	0.1	6.00	4.2	8.3	0.2	-13.0	0.32	0.33			
BW-ARD-134	BW0084	216	226	AND	S	1	8.5	1.40	0.01	0.03	1.4	43.8	43.4	39.6	0.1	14.00	4.2	9.2	0.2	-30.0	0.32	0.32	19.8	30.7	3.0
BW-ARD-344	BW0161	125	135	FT	S	1	6.8	0.10	0.01	0.02	0.1	3.1	2.8	2.6	0.1	1.00	4.2	0.7	0.2	-2.0	0.32	0.36	0.0	0.6	5.1
BW-ARD-571	BW0211	253	263	VC	S	1	7.8	0.79	0.01	0.03	0.8	24.7	24.7	22.1	0.1	8.00	6.7	5.7	0.3	-17.0	0.32	0.32	5.1	14.9	3.4
BW-ARD-051	BW0060	176	186	VC	S	1	7.2	1.18	0.04	0.01	1.1	36.9	35.6	28.5	0.1	12.00	5.8	7.5	0.3	-25.0	0.33	0.34	14.9	26.8	2.8
BW-ARD-073	BW0073	185	195	FT	S	1	6.6	0.59	0.01	0.02	0.6	18.4	18.1	17.0	0.1	6.00	5.8	0.5	0.2	-12.0	0.33	0.33	9.1	14.0	3.0
BW-ARD-587	BW0111	290	300	AND	S	1	7.5	1.27	0.01	0.02	1.3	39.7	39.4	27.7	0.1	13.00	4.2	18.2	0.2	5.0	0.33	0.33	11.8	29.6	2.9
BW-ARD-043	BW0101	15	25	VC	T	1	7.2	0.39	0.01	0.01	0.4	12.2	11.9	7.1	0.1	4.00	4.2	0.5	0.2	-8.0	0.33	0.34	0.0	2.5	4.5
BW-ARD-050	BW0060	271	281	VC	S	1	7.9	1.16	0.03	0.01	1.1	36.3	35.3	28.2	0.1	12.00	4.2	7.7	0.2	-24.0	0.33	0.34	17.2	28.0	2.8
BW-ARD-334	BW0069	245	255	AND	S	1	6.7	1.15	0.04	0.01	1.1	35.9	34.7	29.8	0.1	12.00	10.8	22.0	0.5	-24.0	0.33	0.35	12.6	21.6	2.9
BW-ARD-139	BW0087	34	44	VC	S	1	6.9	1.43	0.01	0.03	1.4	44.7	44.4	32.0	0.1	15.00	5.8	9.5	0.3	-30.0	0.34	0.34	13.2	26.1	3.1
BW-ARD-536	BW0198	141	151	VC	S	1	7.0	0.38	0.01	0.03	0.4	11.9	11.6	11.2	0.1	4.00	4.2	10.0	0.2	-8.0	0.34	0.35	1.7	6.0	3.7
BW-ARD-078	BW0068	41	51	VC	O	1	6.1	0.19	0.01	0.03	0.2	5.9	5.6	4.0	0.1	2.00	4.2	1.0	0.2	-4.0	0.34	0.36	0.5	14.2	4.1
BW-ARD 641	GM12-03	118	128	AND	S	1	7.7	0.84	0.01	0.01	0.8	26.3	25.9	21.1	0.1	9.00	4.2	10.0	0.2	-17.0	0.34	0.35	8.8	18.3	3.0
BW-ARD-037_Dup				VC	S	1	7.5	0.56	0.01	0.01	0.6	17.5	17.2	10.0	0.1	6.00	4.2	5.0	0.2	-12.0	0.34	0.35			
COMPM274691-M274700	BWWR02	69	78	VC	S	1	7.7	0.65	0.06	0.01	0.6	20.3	18.4	15.7	0.1	7.00	4.2	10.9	0.2	-13.0	0.34	0.38			
COMPM274711-M274720	BWWR02	87	95	VC	S	1	7.3	0.65	0.09	0.01	0.6	20.3	17.5	15.2	0.1	7.00	4.2	10.7	0.2	-13.0	0.34	0.40			
COMPM261945-M261954	BWWR03	115	124	VC	T	1	7.3	0.37	0.02	0.02	0.4	11.6	10.9	9.9	0.1	4.00	4.2	4.5	0.1	-8.0	0.34	0.37			
BW-ARD-236	BW0082	200	210	AND	S	1	7.9	1.47	0.02	0.04	1.5	45.9	45.3	43.4	0.1	16.00	4.2	9.0	0.2	-30.0	0.35	0.35	24.6	34.5	2.6
BW-ARD 630	GM12-02	344	354	VC	S	2	8.8	1.08	0.01	0.01	1.1	33.8	33.8	28.3	0.1	12.00	10.0	11.7	0.4	-22.0	0.36	0.36	10.2	21.5	3.0
BW-ARD-066	BW0102	68	78	VC	S	1	7.5	0.89	0.01	0.01	0.9	27.8	27.5	26.1	0.1	10.00	4.2	8.0	0.2	-18.0	0.36	0.36	12.8	7.5	2.9
BW-ARD-069	BW0098	26	36	AND	T	1	6.2	0.44	0.02	0.01	0.4	13.8	13.1	9.6	0.1	5.00	4.2	1.2	0.2	-9.0	0.36	0.38	2.7	5.5	3.2
COMPW006208-W006218	BWWR13	216	226		S	1	8.9	0.97	0.02	0.01	1.0	30.3	29.7	29.4	0.1	11.00	4.2	53.7	0.2	-19.0	0.36	0.37			
BW-ARD-524	BW0191	107	117	VC	T	1	7.2	0.35	0.01	0.02	0.4	10.9	10.9	4.7	0.1	4.00	5.8	2.0	0.3	-7.0	0.37	0.37	0.3	2.8	4.2
BW-ARD 613	GM12-01	184	194	AND	S	1	9.0	0.43	0.01	0.01	0.4	13.4	13.4	11.1	0.1	5.00	5.0	65.7	0.2	-8.0	0.37	0.37	0.0	2.6	4.7
COMPM261242-M261251	BWWR08	84	93	VC	T	1	6.9	0.17	0.01	0.01	0.2	5.3	5.0	3.8	0.1	2.00	4.2	3.3	0.2	-3.0	0.38	0.40			
BW-ARD-060	BW0095	63	73	VC	T	1	5.4	0.67	0.14	0.07	0.5	20.9	16.6	13.1	0.1	8.00	4.2	6.5	0.2	-13.0	0.38	0.48	5.3	11.1	3.0
BW-ARD-151	BW0092	85	95	AND	T	1	6.5	1.00	0.04	0.01	1.0	31.3	30.0	17.6	0.1	12.00	4.2	8.5	0.2	-19.0	0.38	0.40	3.9	16.9	3.0
COMPM261222-M261231	BWWR08	67	75	VC	T	1	6.8	0.25	0.02	0.01	0.2	7.8	7.2	6.1	0.1	3.00	4.2	4.6	0.2	-5.0	0.38	0.42			
BW-ARD-215	BW0111	100	110	AND	S	1	8.2	1.16	0.03	0.07	1.1	36.3	35.3	28.8	0.1	14.00	4.2	10.7	0.2	-22.0	0.39	0.40	14.9	26.9	2.9
BW-ARD 671	GM12-04	142	152	VC	S	1	7.7	0.81	0.05	0.01	0.8	25.3	23.8	18.8	0.1	10.00

Table A3-2: Acid Base Accounting and NAG Test Results for Waste Rock Samples

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	FIZZ RATING Unity	paste pH Unity	Total S %	SO_4 (carb leach) %	SO_4 (HCl leach) %	Sx %	MPA kg $CaCO_3$/t	Sx AP kg $CaCO_3$/t	AP adjust for ZnS kg $CaCO_3$/t	TIC %	NP kg CaCO3/t	CNP (TIC) kg $CaCO_3$/t	ICP-Ca NP kg $CaCO_3$/t	CO_2 %	NNP kg CaCO3/t	NP:MPA Unity	NP/AP Unity	NAG @ pH 4.5 kg H_2SO_4/t	NAG @ pH 7.0 kg H_2SO_4/t	AG pH Unity
BW-ARD-454	BW0174	40	50	VC	S	1	6.5	0.36	0.02	0.01	0.3	11.3	10.6	7.1	0.1	5.00	10.0	3.2	0.4	-6.0	0.44	0.47	0.0	1.2	5.1
BW-ARD-458	BW0174	124	134	AND	S	1	6.7	0.79	0.04	0.02	0.8	24.7	23.4	18.6	0.1	11.00	8.3	10.2	0.4	-14.0	0.45	0.47	3.8	10.9	3.3
BW-ARD-347	BW0173	69	79	VC	O	1	7.4	0.07	0.07	0.02	0.0	2.2	0.3	0.1	0.1	1.00	4.2	0.5	0.2	-1.0	0.45	3.20	0.0	0.6	6.9
L016687	BW0249	69	78		O	1	7.3	0.07	0.07	0.02	0.0	2.2	0.3	0.3	0.1	1.00	4.2	0.5	0.2	-1.0	0.45	3.20			
BW-ARD-429	BW0187	231	241	FT	S	1	7.7	0.07	0.01	0.01	0.1	2.2	1.9	1.2	0.1	1.00	4.2	0.5	0.2	-1.0	0.45	0.53	0.0	0.0	7.3
COMPM274461-M274469	BWWR03	181	189	AND	T	1	7.0	0.14	0.02	0.02	0.1	4.4	3.8	3.8	0.1	2.00	4.2	2.7	0.2	-2.0	0.45	0.53			
BW-ARD-557	BW0199	262	272	AND	S	1	7.8	0.70	0.01	0.01	0.7	21.9	21.6	19.8	0.1	10.00	11.7	29.2	0.5	-12.0	0.46	0.46	4.6	12.1	3.3
BW-ARD 603	GM12-01	67	77	VC	S	1	8.3	0.49	0.03	0.01	0.5	15.3	14.4	13.7	0.1	7.00	4.2	8.5	0.2	-8.0	0.46	0.49	4.6	9.4	3.2
BW-ARD 672	GM12-04	152	162	VC	S	1	7.4	0.69	0.02	0.02	0.7	21.6	20.9	17.1	0.1	10.00	7.5	22.2	0.4	-12.0	0.46	0.48	3.8	13.4	3.5
BW-ARD-479	BW0175	200	210	AND	S	1	6.6	0.41	0.04	0.01	0.4	12.8	11.6	8.6	0.1	6.00	4.2	1.5	0.2	-7.0	0.47	0.52	2.7	7.0	3.5
COMPM274451-M274460	BWWR03	168	181	AND	T	1	7.7	0.41	0.01	0.01	0.4	12.8	12.5	8.5	0.1	6.00	4.2	6.9	0.2	-7.0	0.47	0.48			
BW-ARD 640	GM12-03	103	112	VC	T	1	7.4	0.41	0.01	0.01	0.4	12.8	12.5	9.1	0.1	6.00	4.2	4.0	0.2	-7.0	0.47	0.48	2.6	7.7	3.5
BW-ARD-071	BW0098	220	230	FT	S	1	7.9	0.20	0.01	0.01	0.2	6.3	6.3	5.5	0.1	3.00	4.2	0.7	0.2	-3.0	0.48	0.48	0.2	2.1	4.0
BW-ARD-057	BW0070	170	180	VC	S	1	6.9	0.67	0.05	0.01	0.6	20.9	19.4	19.0	0.1	10.00	4.2	9.2	0.2	-11.0	0.48	0.52	7.3	12.2	2.9
BW-ARD-475	BW0175	109	119	VC	S	1	6.5	0.67	0.03	0.03	0.6	20.9	20.0	16.0	0.3	10.00	28.4	15.0	1.2	-11.0	0.48	0.50	1.9	8.9	3.7
BW-ARD 664	GM12-04	54	64	AND	S	1	7.9	0.67	0.05	0.01	0.6	20.9	19.4	11.1	0.1	10.00	5.0	8.7	0.2	-11.0	0.48	0.52	2.8	13.1	3.4
BW-ARD-129	BW0082	57	67	AND	S	1	6.9	0.60	0.02	0.02	0.6	18.8	18.1	5.9	0.1	9.00	4.2	3.7	0.2	-10.0	0.48	0.50	1.4	11.8	3.8
BW-ARD-164	BW0097	275	285	AND	S	1	8.6	1.20	0.01	0.02	1.2	37.5	37.5	32.2	0.1	18.00	5.8	30.5	0.3	-20.0	0.48	0.48			
COMPW006254-W006265	BWWR13	256	266		S	1	8.6	1.19	0.02	0.01	1.2	37.2	36.6	34.7	0.1	18.00	11.7	28.2	0.5	-19.0	0.48	0.49			
BW-ARD-416	BW0182	117	127	AND	S	1	7.6	1.12	0.01	0.04	1.1	35.0	35.0	34.9	0.1	17.00	5.8	42.7	0.3	-18.0	0.49	0.49	8.9	16.5	3.1
BW-ARD-231	BW0087	200	210	AND	S	1	8.2	1.05	0.01	0.01	1.0	32.8	32.5	24.9	0.1	16.00	4.2	9.7	0.2	-17.0	0.49	0.49	12.6	21.7	2.9
BW-ARD-034	BW0049	35	45	FT/VC	T	1	6.6	0.13	0.02	0.01	0.1	4.1	3.4	1.7	0.1	2.00	4.2	0.2	0.2	-2.0	0.49	0.58	0.0	6.8	5.2
BW-ARD-167	BW0099	229	239	VC	S	1	6.6	0.85	0.03	0.02	0.8	26.6	25.6	20.5	0.1	13.00	4.2	10.7	0.2	-14.0	0.49	0.51	9.1	16.5	2.7
BW-ARD-523	BW0191	68	78	AND	T	1	7.7	0.72	0.01	0.06	0.7	22.5	22.5	9.4	0.1	11.00	4.2	8.7	0.2	-12.0	0.49	0.49	1.9	8.7	3.5
BW-ARD2-6	BW0043	200	210	FT	S	1	7.1	1.31	0.02	0.01	1.3	40.9	40.3	36.4	0.3	20.00	27.5	21.2	1.2	-21.0	0.49	0.50			
COMPQ011421-Q011430	BWWR01	136	145	VC	S	2	7.7	0.26	0.01	0.01	0.3	8.1	8.1	7.0	0.1	4.00	4.2	5.4	0.2	-4.0	0.49	0.49			
COMPM274770-M274779	BWWR02	141	149	VC	T	1	7.8	0.26	0.01	0.01	0.3	8.1	7.8	4.4	0.1	4.00	4.2	3.7	0.2	-4.0	0.49	0.51			
BW-ARD-142	BW0088	48	58	VC	S	1	6.7	0.71	0.02	0.01	0.7	22.2	21.6	13.7	0.1	11.00	4.2	8.5	0.2	-11.0	0.50	0.51	4.2	12.5	3.2
BW-ARD 650	GM12-03	274	284	AND	S	2	8.2	1.29	0.01	0.01	1.3	40.3	40.0	38.8	0.1	20.00	10.8	37.2	0.5	-20.0	0.50	0.50	10.8	21.7	3.1
BW-ARD-171	BW0104	146	156	AND	S	2	7.8	1.41	0.02	0.01	1.4	44.1	43.4	42.0	0.1	22.00	10.0	35.4	0.5	-22.0	0.50	0.51	14.3	22.9	2.7
BW-ARD-572	BW0211	277	287	AND	S	1	7.8	0.83	0.01	0.02	0.8	25.9	25.9	23.6	0.1	13.00	10.0	18.2	0.4	-13.0	0.50	0.50	3.6	11.9	3.5
BW-ARD-214	BW0113	18	28	AND	S/T	1	5.6	0.51	0.04	0.04	0.5	15.9	14.7	9.5	0.1	8.00	4.2	3.2	0.2	-8.0	0.50	0.54	4.4	11.6	3.3
BW-ARD-271	BW0078	153	163	VC	S	1	7.4	0.57	0.02	0.01	0.6	17.8	17.2	11.8	0.1	9.00	4.2	6.0	0.2	-9.0	0.51	0.52	6.2	12.6	3.3
COMPM274480-M274489	BWWR02	16	25	VC	O/T	1	7.3	0.19	0.01	0.01	0.2	5.9	5.6	1.6	0.1	3.00	4	5.4	0.2	-3.0	0.51	0.53			
BW-ARD-268	BW0098	67	77	VC	S	1	8.0	0.69	0.01	0.02	0.7	21.6	21.3	20.5	0.1	11.00	4.2	3.5	0.2	-11.0	0.51	0.52	10.7	17.2	3.1
BW-ARD-278	BW0073	150	160	FT	S	1	8.0	0.25	0.02	0.01	0.2	7.8	7.2	6.3	0.2	4.00	16.7	0.7	0.7	-4.0	0.51	0.56	1.1	3.4	3.9
COMPM261774-M261783	BWWR04	84	93	VC	T	2	8.4	0.50	0.01	0.01	0.5	15.6	15.3	15.2	0.1	8.00	5.8	10.3	0.3	-8.0	0.51	0.52			
BW-ARD-114	BW0076	60	70	VC	T	1	8.0	0.62	0.01	0.01	0.6	19.4	19.1	9.7	0.1	10.00	4.2	3.5	0.2	-9.0	0.52	0.52	2.8	9.2	3.3
BW-ARD-089	BW0067	250	260	AND	S	1	7.9	0.99	0.02	0.01	1.0	30.9	30.3	28.6	0.1	16.00	4.2	20.5	0.2	-15.0	0.52	0.53	9.6	18.9	2.7
BW-ARD 665	GM12-04	64	74	AND	S	1	8.0	0.49	0.01	0.01	0.5	15.3	15.3	9.1	0.1	8.00	4.2	8.5	0.2	-7.0	0.52	0.52	1.7	9.0	3.7
BW-ARD-122	BW0079	72	82	VC	S	1	7.2	0.85	0.01	0.02	0.9	26.6	26.6	20.0	0.1	14.00	8.3	11.7	0.4	-13.0	0.53	0.53	7.4	16.4	3.1
BW-ARD-580	BW0095	73	83	VC	T	1	6.0	0.36	0.01	0.01	0.4	11.3	10.9	9.7	0.1	6.00	4.2	3.5	0.2	5.0	0.53	0.55	4.4	8.0	3.2
BW-ARD 666	GM12-04	74	84	AND	S	1	8.5	0.60	0.02	0.02	0.6	18.8	18.1	11.2	0.1	10.00	4.2	9.2	0.2	-9.0	0.53	0.55	2.6	11.5	3.5
BW-ARD 688	GM12-05	229	239	AND	S	1	7.8	0.66	0.01	0.04	0.7	20.6	20.6	19.1	0.1	11.00	4.2	11.2	0.2	-10.0	0.53	0.53	5.9	11.4	3.2
BW-ARD-018	BW0054	25	35	FT	S	1	6.2	0.42	0.01	0.02	0.4	13.1	13.1	12.0	0.2	7.00	12.5	3.0	0.5	-6.0	0.53	0.53	0.5	3.1	3.6
BW-ARD-182	BW0109	44	54	AND	S	1	7.4	0.81	0.02	0.03	0.8	25.3	24.7	8.6	0.1	14.00	5.0	8.7	0.2	-11.0	0.55	0.57	0.3	13.4	4.2
BW-ARD-529	BW0191	279	289	VC	S	1	7.8	0.69	0.03	0.02	0.7	21.6	20.6	19.3	0.1	12.00	4.2	34.7	0.2	-10.0	0.56	0.58	2.4	9.7	3.7
BW-ARD-146	BW0089	290	300	VC	S	1	8.5	0.51	0.02	0.01	0.5	15.9	15.3	13.2	0.1	9.00	4.2	6.7	0.2	-7.0	0.57	0.59	5.5	10.2	2.9
COMPM261272-M261281	BWWR08	110	119	VC	T	1	7.8	0.17	0.01	0.01	0.2	5.3	5.0	4.1	0.1	3.00	4.2	3.0	0.2	-2.0	0.57	0.60			
COMPM261365-M261373	BWWR07	71	80	VC	T	2	7.3	0.28	0.01	0.01	0.3	8.8	8.4	7.0	0.1	5.00	4.2	4.0	0.2	-4.0	0.57	0.59			
BW-ARD-140	BW0087	200	210	AND	S	1	8.3	1.07	0.01	0.03	1.1	33.4	33.1	26.7	0.1	19.00	4.2	9.7	0.2	-14.0	0.57	0.57	10.8	21.0	2.9
BW-ARD-588	BW0069	155	165	VC	S	1	7.3	0.39	0.01	0.01	0.4	12.2	12.2	6.5	0.1	7.00	4.2	7.5	0.2	5.0	0.57	0.57	1.9	9.2	3.5
COMPM261292-M261294	BWWR08	127	130	VC	S	1	8.2	0.22	0.01	0.01	0.2	6.9	6.6	5.9	0.1	4.00	4.2	3.5	0.2	-3.0	0.58	0.61			
BW-ARD2-5	BW0043	180	190	FT/VC	S	1	7.1	0.60	0.01	0.01	0.6	18.8	18.4	15.6	0.1	11.00	5.8	9.2	0.3	-8.0	0.59	0.60			
BW-ARD-427	BW0187	119	129	VC	S	1	7.8	0.11	0.01	0.01	0.1	3.4	3.4	2.2	0.1	2.00	4.2	0.7	0.2	-1.0	0.59	0.58	0.0	0.1	6.0
COMPW006035-W006045	BWWR13	63	74		T	1	7.6	0.11	0.01	0.01	0.1	3.4	3.1	1.8	0.1	2.00	4.2	1.2	0.2	-1.0	0.59	0.64			
COMPW006232-W006242	BWWR13	236	246	SED	S	2	8.6	1.08	0.02	0.01	1.1	33.8	33.1	32.2	0.2	20.00	15.8	24.7	0.7	-14.0	0.59	0.60			
BW-ARD-183	BW0109	119	129	AND	S	1	8.2	0.70	0.01	0.03	0.7	21.9	21.9	9.4	0.1	13.00	4.2	9.5	0.2	-9.0	0.59	0.59	0.8	10.3	3.8
BW-ARD-091	BW0110	100	110	AND	S	1	8.1	0.70	0.02	0.02	0.7	21.9	21.3	15.0	0.1	13.00	4.2	10.2	0.2	-9.0	0.59	0.61	4.1	13.3	2.9
BW-ARD-521	BW0191	10.9	20.9	VC	O	1	6.5	0.16	0.01	0.07	0.2	5.0	5.0	3.1	0.1	3.00	4.2	1.2	0.2	-2.0	0.60	0.60	0.0	1.6	4.6
BW-ARD-029	BW0051	98	108	FT	S	1	8.3	0.16	0.01	0.01	0.2	5.0	4.7	3.6	0.1	3.00	4.2	0.5	0.2	-2.0	0.60	0.64	0.0	2.2	4.9
COMPW005892-W005901	BWWR12	196	205	VC	S	1	8.4	0.32	0.01	0.02	0.3	10.0	9.7	9.6	0.1	6.00	4.2	8.0	0.2	-4.0	0.60	0.62	2.8	5.5	3.4
BW-ARD-262	BW0077	34	44	AND	T	1	8.5	0.80	0.01	0.01	0.8	25.0	24.7	16.7	0.1	15.00	4.2	38.7	0.2	-10.0	0.60	0.61	4.3	14.8	3.4
BW-ARD-443	BW0172	7	17	AND	T	1	7.0	0.48	0.02	0.02	0.5	15.0	14.4	6.9	0.1	9.00	4.2	9.0	0.2	-6.0	0.60	0.63	0.7	4.8	3.9
BW-ARD-094	BW0112	129	140	AND	S	1	7.8	0.95	0.01	0.01	0.9	29.7	29.4	18.6	0.1	18.00	4.2	10.5	0.2	-12.0	0.61	0.61	7.4	20.1	2.9
BW-ARD-426	BW0187	90	100	VC	S	1	7.7	0.21	0.01	0.02	0.2	6.6	6.6	3.3	0.1	4.00	4.2	0.7	0.2	-3.0	0.61	0.61	0.0	0.7	5.3
BW-ARD-533	BW0192	270	280	FT	S	1	7.7	0.21	0.01	0.01	0.2	6.6	6.3	5.7	0.1	4.00	4.2	2.7	0.2	-3.0	0.61	0.64	1.5	7.2	3.7
BW-ARD-583	BW0066	118	128	AND	S	1	6.9	0.47	0.01	0.02	0.5	14.7	14.7	13.5	0.1	9.00	4.2	17.0	0.2	5.0	0.61	0.61	3.1	9.3	3.5
BW-ARD-526	BW0191	179	189	VC	S	1	7.5	0.31	0.01	0.01	0.3	9.7	9.4	7.9	0.1	6.00	4.2	19.0	0.2	-4.0	0.62	0.64	0.3	3.1	4.2
BW-ARD-216	BW0111	143	153	AND	S	1	8.6	0.72	0.01	0.04	0.7	22.5	22.2	13.0	0.1	14.00	4.2	9.2	0.2	-9.0	0.62	0.63	4.0	14.2	3.3
BW-ARD-033	BW0053	154	164	FT/VC	S	1	7.4	0.77	0.02	0.01	0.8	24.1	23.4	22.6	0.2	15.00	19.2	9.0	0.8	-9.0	0.62	0.64	5.6	6.7	3.1
BW-ARD 643	GM12-03	152	162	AND	S	1	8.1	0.46	0.01	0.01	0.5	14.4	14.1	6.8	0.1	9.00	4.2	11.0	0.2	-5.0	0.63	0.64	0.0	4.6	4.8
BW-ARD-515	BW0190	48	58	FT	T	1	7.0	0.05	0.01	0.01	0.1	1.6	1.6	1.0	0.1	1.00	4.2	0.5	0.2	-1.0	0.63	0.64	0.0	1.7	6.1
COMPW006012-W006023	BWWR13	43	53	VC	T	1	7.6	0.05	0.01	0.01	0.1	1.6	1.6	1.2	0.1	1.00	4.2	0.5	0.2	-1.0	0.63	0.64			
COMPQ011341-Q011350	BWWR01	63	72	AND	S	1	8.3	0.56	0.01	0.01	0.6	17.5	17.2	16.6	0.1	11.00	6.7	31.8	0.3	-7.0	0.63	0.64			
COMPW005775-W005785	BWWR12	95	105	VC	T	1	8.1	0.20	0.01	0.01	0.2	6.3	5.9	5.7	0.1	4.00	4.2	8.2	0.2	-2.0	0.63	0.67			
BW-ARD-260	BW0079	123	133	VC	S	1	8.1	0.75	0.01	0.01	0.7	23.4	23.1	16.5	0.1	15.00	4.2	9.7	0.2	-8.0	0.64	0.65	7.7	15.2	3.1
COMPW006277-W006288	BWWR13	276	286	CGL	S	1	8.7	0.35	0.01	0.01	0.3	10.9	10.6	10.5	0.1	7.00	4.2	13.5	0.2	-4.0	0.64	0.66			
COMPW006149-W006160	BWWR13	164	176	CGL	S	2	8.7	0.74	0.01	0.03	0.7	23.1	23.1	21.6	0.1	15.00	5.8	43.4	0.3	-8.0	0.65	0.65			
COMPQ011371-Q011380	BWWR01	90	99	AND/VC	S	1	8.1	0.44	0.03	0.01	0.4	13.8	12.8	12.7	0.1	9.00	4.2	49.0	0.2	-5.0	0.65	0.70			
BW-ARD-223	BW0109	15	25	AND	S	1	6.9	0.39	0.03	0.05	0.4	12.2	11.3	2.4	0.1	8.00	4.2	3.0	0.2	-4.0	0.66	0.71	0.0	2.1	5.2
BW-ARD-063	BW0095	145	155	AND	S	1	7.1	0.68	0.02	0.02	0.7	21.3	20.6	19.4	0.1	14.00	4.2	10.0	0.2	-7.0	0.66	0.68	8.2	6.4	2.9
BW-ARD 673	GM12-04	162	172	VC	S	1	8.1	0.53	0.01	0.02	0.5	16.6	16.6	14.3	0.1	11.00	5.0	32.2	0.2	-6.0	0.66	0.66	1.2	7.2	3.9
BW-ARD-689	GM12-05	239	249	AND	S	1	7.7	0.58	0.01	0.03	0.6	18.1	18.1	13.6	0.1	12.00	4.2	21.2	0.2	-6.0	0.66	0.66	1.6	7.6	3.8
BW-ARD-181	BW0108	282	292	AND	S	1	8.3	0.77	0.01	0.03	0.8	24.1	23.8	21.5	0.1	16.00	4.2	24.2	0.2	-8.0	0.66	0.67	7.1	15.0	3.2
BW-ARD-506	BW0186	16	26	VC	T	1	6.8	0.48	0.01	0.09	0.5	15.0	15.0	14.3	0.1	10.00	4.2	32.0	0.2	-5.0	0.67	0.67	4.0	9.3	3.4
BW-ARD-480	BW0175	225	235	AND	S	1	7.2	0.62	0.05	0.01	0.6	19.4	17.8	17.7	0.3	13.00	22.5	26.5	1.0	-6.0	0.67	0.73	2.5	6.0	3.5
BW-ARD-573	BW0077	34	44	AND	T	1	7.7	0.62	0.01	0.01	0.6	19.4	19.1	12.0	0.1	13.00	4.2	40.9	0.2	5.0	0.67	0.68	2.0	11.7	3.6
BW-ARD-264	BW0077	86	96	FT	S	1	7.4	0.57	0.01	0.03	0.6	17.8	17.5	13.7	0.1	12.00	4.2	18.5	0.2	-6.0	0.67	0.69	0.0	16.2	5.9
COMPQ011331-Q011340	BWWR01	53	63	AND	T/S	1	7.6	0.52	0.01	0.01	0.5	16.3	15.9	13.7	0.1	11.00	8.3	42.5	0.4	-5.0	0.67	0.69			
BW-ARD-255	BW0072	152	162	FT	S	1	7.8	0.19	0.02	0.02	0.2	5.9	5.3	4.8	0.1	4.00	5.0	0.2	0.2	-2.0	0.68	0.75	0.7	2.6	3.8
COMPW006332-W006340	BWWR13	323	332	CGL	S	1	8.6	0.28	0.01	0.01	0.3	8.8	8.8	8.0	0.1	6.00	4.2	7.5	0.2	-3.0	0.68	0.69			
BW-ARD-109	BW0069	155	165	VC	S	1	8.5	0.42	0.02	0.01	0.4	13.1	12.5	6.8	0.1	9.00	4.2	7.7	0.2	-4.0	0.69	0.72	1.6	6.8	3.4
BW-ARD 617	GM12-01	234	244	AND	S	2	7.9	1.58	0.01	0.01	1.6	49.4	49.4	49.0	0.5	34.00	39.2	62.7	1.7	-15.0	0.69	0.69	0.0	0.0	10.5
BW-ARD-037	BW0045	131	141	VC	S	1	7.8	0.51	0.01	0.02	0.5	15.9	15.6	8.4	0.1	11.00	4.2	5.2	0.2	-5.0	0.69	0.70	1.6	8.3	3.1
BW-ARD 674	GM12-04	174	184	AND	S	1	7.5	0.51	0.03	0.02	0.5	15.9	15.0	8.6	0.1	11.00	9.2	17.0	0.4	-5.0	0.69	0.73	0.7	10.2	4.1
BW-ARD-253	BW0079	85	95	VC	S	1	8.0	0.69	0.02	0.01	0.7	21.6	20.9	11.8	0.1	15.00	4.2	10.2	0.2	-7.0	0.69	0.72	3.0	12.4	3.6
BW-ARD 619	GM12-01	288	298	AND	S	1	7.6	0.46	0.01	0.01	0.5	14.4	14.4	13.1	0.1	10.00	4.2	16.5	0.2	-4.0	0.69	0.70	3.0	8.4	3.5
BW-ARD-179	BW0108	121	131	VC	S	1	7.7	0.73	0.03	0.02	0.7	22.8	21.9	13.6	0.1	16.00	7.5	10.0	0.3	-7.0	0.70	0.73	3.2	12.1	3.4
BW-ARD-115	BW0076	225	235	AND	S	1	8.9	0.63	0.01	0.02	0.6	19.7	19.4	15.3	0.1	14.00	4.2	17.0	0.2	-6.0	0.71	0.72	5.3	13.1	3.0
BW-ARD-149	BW0091	232	242	AND	S	1	8.4	0.63	0.02	0.01	0.6	19.7	19.1	17.0	0.1	14.00	4.2	29.7	0.2	-6.0	0.71	0.73	5.0	10.4	3.0
BW-ARD-075	BW0072	152	162	FT	S	1	7.7	0.18	0.01	0.02	0.2	5.6	5.6	5.1	0.1	4.00	5.8	0.7	0.3	-2.0	0.71	0.71	0.6	3.1	3.9
BW-ARD-121	BW0078	87	97	VC	S	1	6.5	0.27	0.02	0.02	0.3	8.4	7.8	3.1	0.1	6.00	4.2	1.5	0.2	-2.0	0.71	0.77	0.9	5.0	3.8
BW-ARD-417	BW0182	154	164	VC	S	1	7.8	0.09	0.01	0.02	0.1	2.8	2.8	1.2	0.1	2.00	4.2	0.7	0.2	-1.0	0.71	0.71	0.0	0.1	6.6
BW-ARD-117	BW0077	34	44	AND	T	1	8.8	0.67	0.01	0.01	0.7	20.9	20.6	13.8	0.1	15.00	4.2	39.4	0.2	-6.0	0.72	0.73	0.8	8.4	3.5
BW-ARD-100	BW0114	260	270	AND	S	1	8.3	0.89	0.01	0.02	0.9	27.8	27.5	26.7	0.1	20.00	8.3	37.2	0.4	-8.0	0.72

Table A3-2: Acid Base Accounting and NAG Test Results for Waste Rock Samples

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	FIZZ RATING Unity	paste pH Unity	Total S %	SO_4 (carb leach) %	SO_4 (HCl leach) %	Sx %	MPA kg $CaCO_3$/t	Sx AP kg $CaCO_3$/t	AP adjust for ZnS kg $CaCO_3$/t	TIC %	NP kg CaCO3/t	CNP (TIC) kg $CaCO_3$/t	ICP-Ca NP kg $CaCO_3$/t	CO2 %	NNP kg CaCO3/t	NP:MPA Unity	NP/AP Unity	NAG @ pH 4.5 kg $H2SO_4$/t	NAG @ pH 7.0 kg $H2SO_4$/t	AG pH Unity
BW-ARD-062	BW0095	73	83	VC	T	1	6.7	0.35	0.02	0.01	0.3	10.9	10.3	9.1	0.1	9.00	4.2	3.5	0.2	-2.0	0.83	0.87	2.8	3.9	3.4
BW-ARD-406	BW0181	93	103	AND	S	2	7.1	1.47	0.02	0.04	1.5	45.9	45.3	45.2	0.3	38.00	27.5	58.7	1.2	-8.0	0.83	0.84	4.2	10.5	3.4
BW-ARD-267	BW0098	220	230	FT	S	1	8.1	0.23	0.03	0.04	0.2	7.2	6.3	5.5	0.1	6.00	4.2	0.7	0.2	-1.0	0.83	0.96	1.7	4.6	3.7
COMPG012251-G012260	BWWR11	44	52	AND	T	1	6.7	0.42	0.02	0.01	0.4	13.1	12.5	12.3	0.1	11.00	4.2	70.6	0.2	-2.0	0.84	0.88			
BW-ARD 656	GM12-03	356	367		S	2	8.1	1.28	0.01	0.01	1.3	40.0	40.0	37.7	0.4	34.00	30.0	38.9	1.3	-6.0	0.85	0.85	0.0	0.0	9.3
COMPM261252-M261261	BWWR08	93	101	AND/VC	T	1	6.9	0.30	0.02	0.01	0.3	9.4	8.8	7.5	0.1	8.00	4.2	23.7	0.2	-1.0	0.85	0.91			
BW-ARD-252	BW0074	125	135	VC	S	1	8.0	0.41	0.04	0.01	0.4	12.8	11.6	6.7	0.1	11.00	4.2	7.5	0.2	-2.0	0.86	0.95	2.2	7.9	3.6
BW-ARD-031	BW0052	47	57	VC	T	1	6.6	0.22	0.02	0.01	0.2	6.9	6.3	5.7	0.1	6.00	4.2	3.0	0.2	-1.0	0.87	0.96	0.1	2.6	4.3
BW-ARD-286	BW0078	280	290	AND	S	1	8.3	0.62	0.02	0.01	0.6	19.4	18.8	13.1	0.1	17.00	4.2	20.2	0.2	-2.0	0.88	0.91	4.2	11.9	3.5
BW-ARD 633	GM12-02	370	380	SED	S	2	8.4	1.02	0.01	0.01	1.0	31.9	31.6	28.3	0.3	28.00	24.2	28.5	1.1	-4.0	0.88	0.89	0.0	0.0	9.8
BW-ARD 624	GM12-01	366	376	VC	T	1	8.0	0.29	0.01	0.01	0.3	9.1	9.1	8.3	0.1	8.00	4.2	10.7	0.2	-1.0	0.88	0.88	0.9	2.3	3.9
BW-ARD-453	BW0174	22	32	VC	T	1	6.3	0.40	0.02	0.01	0.4	12.5	11.9	6.0	0.2	11.00	17.5	4.5	0.8	-2.0	0.88	0.93	0.0	0.7	6.6
BW-ARD 632	GM12-02	360	370	SED	S	2	7.9	1.23	0.01	0.01	1.2	38.4	38.4	35.0	0.4	34.00	29.2	43.2	1.3	-4.0	0.89	0.88	0.0	0.0	10.5
COMPM261448-M261457	BWWR06	46	55	VC	T	2	8.2	0.18	0.01	0.01	0.2	5.6	5.6	5.4	0.1	5.00	4.2	3.7	0.2	-1.0	0.89	0.89			
BW-ARD-266	BW0098	250	260	FT	S	1	7.8	0.25	0.01	0.02	0.3	7.8	7.8	7.4	0.1	7.00	5.0	0.7	0.2	-1.0	0.90	0.90	1.1	3.7	3.8
BW-ARD-138	BW0086	240	250	AND	S	1	8.5	0.57	0.01	0.02	0.6	17.8	17.8	10.5	0.1	16.00	5.0	16.2	0.2	-2.0	0.90	0.90	0.2	5.8	4.4
BW-ARD-537	BW0198	151	161	VC	S	1	7.8	0.39	0.05	0.01	0.3	12.2	10.6	10.2	0.1	11.00	7.5	26.2	0.3	-1.0	0.90	1.04	0.0	2.3	4.6
BW-ARD-106	BW0064	150	161	AND	S	1	6.8	0.46	0.01	0.06	0.5	14.4	14.4	11.4	0.1	13.00	4.2	10.2	0.2	-1.0	0.90	0.90	2.0	5.9	3.4
COMPW006069-W006077	BWWR13	96	103	FT	T	1	8.6	0.07	0.01	0.01	0.1	2.2	2.2	1.6	0.1	2.00	4.2	0.5	0.2	0.0	0.91	0.91			
COMPM261282-M261291	BWWR08	119	127	VC	T/S	1	8.1	0.14	0.01	0.01	0.1	4.4	4.4	3.6	0.1	4.00	4.2	2.5	0.2	0.0	0.91	0.91			
COMPW006219-W006230	BWWR13	226	236		S	2	8.4	1.04	0.02	0.01	1.0	32.5	31.9	29.7	0.3	30.00	24.2	45.2	1.1	-3.0	0.92	0.94			
BW-ARD 616	GM12-01	224	234	AND	S	2	8.6	0.76	0.01	0.01	0.8	23.8	23.8	22.8	0.1	22.00	11.7	62.7	0.5	-2.0	0.92	0.93	2.1	7.4	3.7
BW-ARD-133	BW0084	96	106	AND	S	1	8.4	0.55	0.01	0.02	0.6	17.2	17.2	4.6	0.1	16.00	4.2	12.0	0.2	-1.0	0.93	0.93	0.0	29.9	4.6
BW-ARD-154	BW0093	111	121	AND	S	1	9.0	0.72	0.01	0.03	0.7	22.5	22.5	19.9	0.1	21.00	7.5	47.7	0.3	-2.0	0.93	0.93	1.1	6.0	4.0
BW-ARD-478	BW0175	186	196	AND	S	1	7.1	0.34	0.01	0.03	0.3	10.6	10.6	9.6	0.1	10.00	5.0	15.0	0.2	-1.0	0.94	0.94	1.1	4.1	3.9
BW-ARD-512	BW0186	180	190	FT	S	1	8.4	0.17	0.01	0.04	0.2	5.3	5.3	5.0	0.1	5.00	4.2	7.5	0.2	0.0	0.94	0.94	0.3	2.2	4.2
COMPW005843-W005852	BWWR12	154	163	VC	S	1	8.4	0.17	0.01	0.01	0.2	5.3	5.0	4.8	0.1	5.00	4.2	10.7	0.2	0.0	0.94	1.00			
COMPM261438-M261447	BWWR06	36	46	VC	T	1	7.9	0.17	0.01	0.01	0.2	5.3	5.3	5.2	0.1	5.00	4.2	12.2	0.2	0.0	0.94	0.94			
BW-ARD 602	GM12-01	51	61	VC	T	1	8.8	0.17	0.02	0.01	0.2	5.3	4.7	3.8	0.1	5.00	4.2	5.2	0.2	0.0	0.94	1.07	0.0	0.6	5.9
COMPQ011381-Q011390	BWWR01	99	108	VC	S	2	8.0	0.20	0.01	0.01	0.2	6.3	5.9	5.8	0.1	6.00	8.3	16.0	0.4	0.0	0.95	1.01			
BW-ARD 649	GM12-03	264	274	AND	S	2	8.0	1.24	0.01	0.01	1.2	38.8	38.4	37.8	0.3	37.00	25.0	50.9	1.1	-2.0	0.95	0.96	2.2	8.9	3.7
COMPW005983-W005992	BWWR12	275	284	VC	S	1	8.6	0.40	0.01	0.01	0.4	12.5	12.2	10.8	0.1	12.00	6.7	14.2	0.3	-1.0	0.96	0.98	0.7	3.1	3.7
BW-ARD-507	BW0186	34	44	AND	T	1	8.0	0.40	0.01	0.06	0.4	12.5	12.5	11.9	0.1	12.00	4.2	34.7	0.2	-1.0	0.96	0.96	2.0	6.0	3.6
BW-ARD-694	GM12-05	331	341	AND	S	2	8.4	0.90	0.01	0.01	0.9	28.1	28.1	25.7	0.1	27.00	11.7	64.4	0.5	-1.0	0.96	0.96	0.5	4.6	4.1
COMPM261764-M261773	BWWR04	76	84	VC	T	2	8.6	0.23	0.01	0.02	0.2	7.2	6.9	6.7	0.1	7.00	5.8	8.1	0.2	0.0	0.97	1.02			
COMPW006088-W006097	BWWR13	112	121	SED	S	1	8.1	0.49	0.01	0.03	0.5	15.3	15.3	14.3	0.1	15.00	4.2	40.2	0.2	0.0	0.98	0.98			
BW-ARD-450	BW0172	147	157	VC	S	1	6.3	0.29	0.01	0.01	0.3	9.1	9.1	2.4	0.1	9.00	4.2	14.2	0.2	0.0	0.99	0.99	0.0	0.9	5.9
COMPQ011391-Q011400	BWWR01	108	117	VC	S	1	8.2	0.16	0.02	0.01	0.1	5.0	4.4	3.7	0.1	5.00	5.0	13.6	0.2	0.0	1.00	1.14			
BW-ARD-099	BW0114	212	222	AND	S	1	8.6	0.51	0.01	0.02	0.5	15.9	15.9	14.9	0.1	16.00	4.2	23.0	0.2	0.0	1.01	1.00	0.8	4.4	3.7
COMPG012261-G012270	BWWR11	52	60	AND	T	1	6.8	0.35	0.04	0.01	0.3	10.9	9.7	9.5	0.1	11.00	4.2	62.9	0.2	0.0	1.01	1.14			
BW-ARD-123	BW0079	89	99	VC	S	1	8.3	0.41	0.01	0.02	0.4	12.8	12.8	6.1	0.1	13.00	4.2	9.5	0.2	0.0	1.02	1.01	0.3	9.6	4.2
COMPW005960-W005970	BWWR12	255	265	VC	S	2	8.8	0.28	0.01	0.02	0.3	8.8	8.4	8.3	0.1	9.00	5.8	9.0	0.3	0.0	1.02	1.07	0.0	1.8	4.6
BW-ARD-148	BW0090	227	237	AND	S	1	7.9	0.50	0.01	0.01	0.5	15.6	15.6	10.2	0.1	16.00	4.2	11.5	0.2	0.0	1.03	1.02	1.3	8.3	3.4
BW-ARD-016	BW0056	99	109	FT	S	1	6.6	0.34	0.01	0.02	0.3	10.6	10.3	6.9	0.2	11.00	19.2	3.5	0.8	0.0	1.04	1.07	0.0	0.5	6.3
COMPM261305-M261314	BWWR07	19	28	VC	T	1	7.8	0.06	0.03	0.01	0.0	1.9	0.9	0.1	0.1	2.00	4.2	4.2	0.2	0.0	1.05	2.13			
COMPM261262-M261271	BWWR08	101	110	VC	T	1	8.0	0.06	0.01	0.01	0.1	1.9	1.6	1.0	0.1	2.00	4.2	1.0	0.2	0.0	1.05	1.28			
BW-ARD 655	GM12-03	346	356	VC	S	2	8.4	0.45	0.01	0.01	0.4	14.1	13.8	11.8	0.1	15.00	7.5	18.2	0.3	1.0	1.06	1.09	0.0	3.0	4.6
BW-ARD-459	BW0174	143	153	AND	S	2	7.6	0.63	0.01	0.01	0.6	19.7	19.4	13.5	0.2	21.00	20.0	17.0	0.9	1.0	1.07	1.08	0.0	0.0	8.0
BW-ARD-040	BW0058	43	53	AND	S	1	7.3	0.42	0.01	0.02	0.4	13.1	12.8	7.1	0.1	14.00	4.2	15.7	0.2	1.0	1.07	1.09	0.3	4.5	4.2
COMPM261794-M261803	BWWR04	102	110	VC	S	2	9.2	0.18	0.02	0.01	0.2	5.6	5.0	4.9	0.1	6.00	4.2	9.0	0.2	0.0	1.07	1.20			
BW-ARD-566_Dup				FT	S	1	6.9	0.27	0.01	0.01	0.3	8.4	8.4	6.8	0.1	9.00	4.2	20.2	0.2	1.0	1.07	1.07	0.3	2.7	3.6
BW-ARD 629	GM12-02	45	56	FLPT	T	1	7.9	0.09	0.01	0.01	0.1	2.8	2.8	2.1	0.1	3.00	4.2	0.2	0.2	0.0	1.07	1.07	0.0	0.1	6.8
BW-ARD-289	BW0086	200	210	AND	S	1	8.5	0.59	0.01	0.02	0.6	18.4	18.4	15.9	0.1	20.00	4.2	30.0	0.2	2.0	1.09	1.08	3.6	8.2	3.4
BW-ARD-695	GM12-05	345	355	AND	S	2	8.4	0.94	0.01	0.03	0.9	29.4	29.1	27.9	0.2	32.00	15.8	65.4	0.7	3.0	1.09	1.10	0.7	3.9	3.9
BW-ARD 651	GM12-03	293	303	AND	S	2	8.7	0.73	0.01	0.01	0.7	22.8	22.8	20.0	0.1	25.00	10.0	53.7	0.4	2.0	1.10	1.10	0.1	4.8	4.4
BW-ARD-537_Dup				VC	S	1	7.9	0.35	0.02	0.01	0.3	10.9	10.3	9.9	0.1	12.00	8.3	26.2	0.4	1.0	1.10	1.16	0.0	0.9	5.6
L016686	BW0241	81	90		O	1	7.5	0.03	0.03	0.04	0.0	0.9	0.3	0.3	0.1	1.00	4.2	0.7	0.2	0.0	1.11	3.20			
BW-ARD-095	BW0112	214	224	AND	S	1	8.2	0.46	0.01	0.01	0.5	14.4	14.4	9.9	0.1	16.00	8.3	37.2	0.4	2.0	1.11	1.11	0.0	3.4	4.9
BW-ARD-437	BW0171	85	95	VC	S	2	6.9	0.46	0.01	0.01	0.5	14.4	14.4	10.2	0.3	16.00	25.9	9.2	1.2	2.0	1.11	1.11	0.0	0.4	6.6
BW-ARD-567	BW0211	161	171	VC	S	1	8.3	0.26	0.01	0.03	0.3	8.1	8.1	7.7	0.1	9.00	10.0	9.2	0.5	1.0	1.11	1.11	0.0	0.4	6.0
BW-ARD-423	BW0187	17	27	VC	T	1	7.1	0.03	0.03	0.02	0.0	0.9	0.3	0.3	0.1	1.00	4.2	0.5	0.2	0.0	1.11	3.20	0.0	0.2	6.9
COMPG012271-G012279	BWWR11	60	69		T	1	6.9	0.23	0.01	0.01	0.2	7.2	6.9	6.7	0.1	8.00	4.2	46.4	0.2	1.0	1.11	1.16			
BW-ARD-172	BW0104	218	228	AND	S	1	8.9	0.54	0.01	0.01	0.5	16.9	16.9	13.6	0.1	19.00	4.2	57.7	0.2	2.0	1.12	1.13	0.5	4.5	4.1
BW-ARD-019	BW0055	26	36	FT/VC	S	1	7.1	0.48	0.01	0.02	0.5	15.0	15.0	11.0	0.2	17.00	16.7	13.2	0.7	2.0	1.13	1.13	0.0	1.1	6.6
BW-ARD-395	BW0177	217	227	AND	S	1	7.6	0.48	0.02	0.02	0.5	15.0	14.4	14.2	0.1	17.00	9.2	30.7	0.4	2.0	1.13	1.18	0.0	0.6	4.7
BW-ARD-584	BW0069	88	98	AND	S	1	7.2	0.31	0.01	0.01	0.3	9.7	9.7	5.3	0.1	11.00	4.2	12.0	0.2	5.0	1.13	1.14	0.4	5.3	3.9
BW-ARD-110	BW0069	260	270	AND	S	1	9.2	0.56	0.01	0.02	0.6	17.5	17.5	16.4	0.1	20.00	4.2	57.4	0.2	3.0	1.14	1.14	1.5	6.6	3.5
COMPQ011321-Q011330	BWWR01	44	53	AND	T	1	7.5	0.22	0.01	0.01	0.2	6.9	6.9	2.2	0.1	8.00	4.2	15.0	0.2	1.0	1.16	1.16			
BW-ARD-084	BW0066	118	128	AND	S	1	7.3	0.55	0.01	0.02	0.6	17.2	17.2	16.1	0.1	20.00	4.2	16.7	0.2	3.0	1.16	1.16	2.6	8.1	3.3
BW-ARD-464	BW0174	66	76	VC	S	1	7.1	0.11	0.01	0.01	0.1	3.4	3.1	1.1	0.1	4.00	4.2	0.5	0.2	1.0	1.18	1.28	0.0	0.1	6.5
COMPM261641-M261650	BWWR05	117	124	VC	T	2	8.9	0.11	0.01	0.01	0.1	3.4	3.1	3.0	0.1	4.00	4.2	11.7	0.2	1.0	1.18	1.28			
BW-ARD-471	BW0175	6	16	VC	O	2	7.8	0.97	0.01	0.01	1.0	30.3	30.3	24.6	0.3	36.00	27.5	47.2	1.2	6.0	1.19	1.19	0.0	0.0	9.1
BW-ARD-482	BW0178	85	95	AND	O	1	7.5	0.16	0.02	0.02	0.1	5.0	4.4	4.3	0.1	6.00	11.7	6.7	0.5	1.0	1.20	1.37	0.0	0.1	6.9
BW-ARD-180	BW0108	163	173	VC	S	1	8.7	0.40	0.02	0.01	0.4	12.5	11.9	6.3	0.1	15.00	4.2	10.5	0.2	3.0	1.20	1.26	0.0	3.4	5.0
COMPG012241-G012250	BWWR11	35	44	AND	T	1	6.7	0.29	0.03	0.01	0.3	9.1	8.1	8.0	0.1	11.00	4.2	70.4	0.2	2.0	1.21	1.35			
BW-ARD-021	BW0042	243	253	AND	S	2	8.4	0.76	0.01	0.02	0.8	23.8	23.8	23.5	0.1	29.00	11.7	41.4	0.5	5.0	1.22	1.22	1.6	2.6	3.4
BW-ARD-222	BW0109	105	115	AND	S	1	8.1	0.39	0.01	0.05	0.4	12.2	11.9	5.8	0.1	15.00	4.2	14.5	0.2	3.0	1.23	1.26	0.0	2.9	4.8
BW-ARD 611	GM12-01	156	166	VC	S	2	8.7	0.26	0.01	0.01	0.3	8.1	8.1	5.2	0.1	10.00	7.5	12.7	0.3	2.0	1.23	1.23	0.0	0.0	7.1
BW-ARD-394	BW0177	207	217	AND	S	1	7.6	0.38	0.01	0.02	0.4	11.9	11.6	11.3	0.1	15.00	7.5	21.2	0.3	3.0	1.26	1.30	0.0	1.4	4.4
BW-ARD-510	BW0186	125	135	VC	S	1	8.6	0.35	0.01	0.02	0.4	10.9	10.9	10.3	0.1	14.00	7.5	36.7	0.3	3.0	1.28	1.28	0.4	3.2	4.2
COMPM261995-M262000	BWWR03	162	168	AND	T	1	8.1	0.10	0.01	0.02	0.1	3.1	3.1	3.1	0.1	4.00	4.2	3.8	0.2	1.0	1.29	1.28			
BW-ARD-489	BW0178	250	260	AND	S	2	7.3	0.37	0.02	0.01	0.4	11.6	10.9	9.3	0.1	15.00	5.8	20.7	0.3	3.0	1.29	1.37	0.2	2.5	4.0
BW-ARD-228	BW0107	15	25	AND	T	1	5.9	0.32	0.12	0.11	0.2	10.0	6.3	4.1	0.1	13.00	4.2	13.7	0.2	3.0	1.30	2.08	0.0	3.3	4.6
BW-ARD-589	BW0074	110	120	VC	S	1	7.9	0.22	0.01	0.02	0.2	6.9	6.9	2.2	0.1	9.00	4.2	8.2	0.2	5.0	1.30	1.31	0.0	2.7	5.3
COMPW006098-W006107	BWWR13	121	129	SED	S	2	8.9	0.59	0.01	0.02	0.6	18.4	18.4	18.3	0.1	24.00	6.7	77.4	0.3	6.0	1.30	1.30			
BW-ARD 653	GM12-03	313	323	AND	S	2	8.2	0.66	0.01	0.01	0.7	20.6	20.6	19.6	0.3	27.00	20.9	39.7	0.9	6.0	1.31	1.31	0.0	0.0	9.9
BW-ARD-220	BW0109	250	260	AND	S	1	8.2	0.34	0.02	0.05	0.3	10.6	10.0	4.6	0.1	14.00	5.0	13.7	0.2	3.0	1.32	1.40	0.0	3.4	4.8
BW-ARD 612	GM12-01	174	184	AND	S	1	9.2	0.41	0.01	0.01	0.4	12.8	12.8	11.1	0.1	17.00	5.0	53.9	0.2	4.0	1.33	1.33	0.0	2.5	4.8
BW-ARD-340	BW0104	250	260	AND	S	1	8.6	0.48	0.01	0.03	0.5	15.0	14.7	11.5	0.1	20.00	6.7	56.4	0.3	5.0	1.33	1.36	0.2	2.5	4.4
BW-ARD-111	BW0069	88	98	AND	S	1	8.0	0.28	0.01	0.02	0.3	8.8	8.4	4.3	0.1	12.00	4.2	12.0	0.2	3.0	1.36	1.42	0.1	3.8	4.5
BW-ARD-485	BW0178	145	155	AND	S	1	7.2	0.07	0.02	0.01	0.1	2.2	1.6	1.6	0.1	3.00	5.0	0.7	0.2	1.0	1.36	1.92	0.0	0.0	7.1
BW-ARD-105	BW0064	273	283	AND	S	1	8.5	0.44	0.01	0.02	0.4	13.8	13.4	9.5	0.1	19.00	8.3	43.9	0.4	5.0	1.38	1.41	0.0	1.4	5.1
BW-ARD 642	GM12-03	142	152	AND	S	1	8.1	0.25	0.01	0.01	0.2	7.8	7.5	3.7	0.2	11.00	13.3	18.0	0.6	3.0	1.41	1.47	0.0	0.8	6.5
COMPM261784-M261793	BWWR04	93	102	VC	S/T	2	8.9	0.25	0.01	0.01	0.2	7.8	7.5	7.3	0.1	11.00	8.3	14.3	0.4	3.0	1.41	1.47			
BW-ARD-250	BW0074	94	104	VC	S	1	7.9	0.18	0.03	0.02	0.2	5.6	4.7	2.0	0.1	8.00	4.2	3.2	0.2	2.0	1.43	1.71	0.3	4.1	4.1
COMPM261915-M261924	BWWR03	88	98	VC	T	1	8.1	0.09	0.01	0.01	0.1	2.8	2.5	1.1	0.1	4.00	4.2	6.0	0.1	1.0	1.43	1.60			
COMPM261345-M261354	BWWR07	54	63	VC	T	2	7.4	0.09	0.01	0.01	0.1	2.8	2.5	1.2	0.1	4.00	4.2	3.7	0.2	1.0	1.43	1.60			
COMPW005971-W005982	BWWR12	265	275	VC	S	1	9.1	0.11	0.01	0.02	0.1	3.4	3.4	3.3	0.1	5.00	4.2	4.5	0.2	2.0	1.47	1.45	0.0	0.4	6.4
BW-ARD 652	GM12-03	303	313	AND	S	2	8.3	0.74	0.01	0.01	0.7	23.1	23.1	21.0	0.3	34.00	24.2	68.9	1.1	11.0	1.47	1.47	0.0	0.0	9.1
BW-ARD 658	GM12-03	377	387	SED	S	1	8.7	0.28	0.01	0.01	0.3	8.8	8.8	8.5	0.1	13.00	5.0	37.4	0.2	4.0	1.48	1.49	0.0	0.0	7.5
BW-ARD 644	GM12-03	191	201		S	1	7.9	0.21	0.01	0.01	0.2	6.6	6.6	4.8	0.1	10.00	5.0	14.5	0.2	3.0	1.52	1.52	0.0	0.7	6.5
BW-ARD-067	BW0102	100	110	VC	S	1	8.4	0.19	0.01	0.02	0.2	5.9	5.6	5.1	0.1	9.00	5.0	2.2	0.2	3.0	1.53	1.60	0.2	1.9	4.3
BW-ARD-107	BW0065	30	40	AND	T	1	7.7	0.19	0.01	0.02	0.2	5.9	5.6	1.5	0.1	9.00	4.2	5.7	0.2	3.0	1.53	1.60	0.0	5.5	5.1
BW-ARD-693	GM12-05	309	319	AND	S	2	8.7	0.46	0.02	0.04	0.4	14.4	13.8	9.6	0.1	22.00	6.7	58.4	0.3	8.0	1.53	1.60	0.0	0.5	5.6
BW-ARD-269	BW0098	106	116	VC	S	1	8.2	0.25	0.01	0.04	0.2	7.8	7.5	7.2	0.1	12.00	4.2	3.5	0.2	4.0	1.54	1.60	2.8	5.4	3.5
BW-ARD-339	BW0104	171	181	AND	S	2	7.2	0.75	0.02	0.02	0.7	23.4	22.8	22.3	0.4	36.00	35.9	57.9	1.6	13.0	1.54	1.58	0.0	0.0	11.0
BW-ARD-168	BW0100

Table A3-2: Acid Base Accounting and NAG Test Results for Waste Rock Samples

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	FIZZ RATING Unity	paste pH Unity	Total S %	SO_4 (carb leach) %	SO_4 (HCl leach) %	Sx %	MPA kg $CaCO_3$/t	Sx AP kg $CaCO_3$/t	AP adjust for ZnS kg $CaCO_3$/t	TIC %	NP kg CaCO3/t	CNP (TIC) kg $CaCO_3$/t	ICP-Ca NP kg $CaCO_3$/t	CO2 %	NNP kg CaCO3/t	NP:MPA Unity	NP/AP Unity	NAG @ pH 4.5 kg $H2SO_4$/t	NAG @ pH 7.0 kg $H2SO_4$/t	AG pH Unity
BW-ARD-505	BW0185	296	306	VC/AND	S	1	8.5	0.27	0.01	0.06	0.3	8.4	8.4	7.5	0.1	14.00	4.2	28.7	0.2	6.0	1.67	1.66	0.0	2.4	4.5
BW-ARD-690	GM12-05	252	262	AND	S	1	8.1	0.23	0.01	0.03	0.2	7.2	7.2	5.2	0.1	12.00	4.2	22.0	0.2	5.0	1.67	1.67	0.0	0.5	6.1
L016675	BW0120	46	55		O	1	7.6	0.02	0.01	0.01	0.0	0.6	0.6	0.1	0.1	1.00	4.2	0.7	0.2	0.0	1.67	1.60			
L016688	BW0253	68	77		O	1	7.5	0.02	0.01	0.02	0.0	0.6	0.6	0.6	0.1	1.00	4.2	1.0	0.2	0.0	1.67	1.60			
BW-ARD-335	BW0069	7	17	FT	T	1	7.2	0.02	0.01	0.02	0.0	0.6	0.6	0.5	0.1	1.00	4.2	0.5	0.2	0.0	1.67	1.60	0.0	0.0	9.0
BW-ARD-159	BW0096	70	80	FT	T	1	7.4	0.02	0.01	0.03	0.0	0.6	0.6	0.5	0.1	1.00	4.2	0.5	0.2	0.0	1.67	1.60	0.0	0.0	9.6
COMPW006138-W006147	BWWR13	155	164	CGL	S	2	8.5	0.76	0.01	0.01	0.8	23.8	23.8	23.6	0.3	40.00	25.9	77.4	1.1	16.0	1.68	1.68			
BW-ARD-577	BW0107	65	75	VC	T	1	7.0	0.17	0.01	0.01	0.2	5.3	5.3	2.6	0.1	9.00	4.2	14.0	0.2	5.0	1.70	1.69	0.0	1.0	5.5
COMPW006322-W006330	BWWR13	314	323	CGL	S	1	8.6	0.28	0.01	0.01	0.3	8.8	8.4	8.2	0.1	15.00	8.3	28.5	0.4	6.0	1.70	1.78			
BW-ARD-692 (duplicate)				AND	S	1	8.8	0.13	0.01	0.01	0.1	4.1	4.1	3.5	0.1	7.00	5.8	12.7	0.3	3.0	1.71	1.72			
COMPM261865-M261874	BWWR03	45	54	AND	T	1	8.2	0.24	0.01	0.01	0.2	7.5	7.2	6.9	0.1	13.00	5.8	66.2	0.1	6.0	1.73	1.81			
BW-ARD-176_Dup				AND	S	2	8.6	0.44	0.01	0.02	0.4	13.8	13.8	10.4	0.1	24.00	10.8	50.2	0.5	10.0	1.74	1.75			
BW-ARD-699	GM12-05	391	400	AND	S	1	9.2	0.40	0.01	0.03	0.4	12.5	12.5	12.2	0.1	22.00	4.2	36.9	0.2	10.0	1.76	1.76	0.0	0.6	5.6
BW-ARD-287	BW0078	253	263	AND	S	2	8.5	0.45	0.01	0.01	0.4	14.1	13.8	9.6	0.1	25.00	6.7	39.2	0.3	11.0	1.77	1.82	0.0	2.9	5.1
BW-ARD-565	BW0211	96	106	VC	O	1	7.6	0.09	0.03	0.02	0.1	2.8	1.9	1.9	0.1	5.00	4.2	4.0	0.2	2.0	1.79	2.67	0.0	0.0	8.0
BW-ARD 647	GM12-03	239	250		S	2	8.3	0.43	0.01	0.01	0.4	13.4	13.1	11.5	0.2	24.00	13.3	30.2	0.6	11.0	1.79	1.83	0.0	0.0	9.6
BW-ARD-288	BW0086	164	174	AND	S	1	8.4	0.32	0.01	0.02	0.3	10.0	10.0	3.7	0.1	18.00	5.8	29.2	0.3	8.0	1.80	1.80	0.0	3.0	5.1
BW-ARD-488	BW0178	219	229	AND	S	2	7.7	0.32	0.01	0.02	0.3	10.0	9.7	8.9	0.1	18.00	9.2	33.7	0.4	8.0	1.80	1.86	0.0	0.6	5.2
BW-ARD-439	BW0171	175	185	AND	S	1	8.5	0.39	0.01	0.01	0.4	12.2	12.2	10.4	0.2	22.00	12.5	50.2	0.6	10.0	1.80	1.81	0.0	0.0	7.0
BW-ARD 645	GM12-03	208	217		S	1	8.5	0.23	0.01	0.01	0.2	7.2	6.9	6.3	0.1	13.00	5.0	22.2	0.2	6.0	1.81	1.89	0.0	0.1	6.9
BW-ARD-499	BW0185	26	36	VC	O	1	7.3	0.07	0.01	0.01	0.1	2.2	1.9	0.6	0.1	4.00	4.2	2.0	0.2	2.0	1.82	2.13	0.0	0.1	6.9
BW-ARD-380	BW0104	70.8	81	AND	T	1	6.8	0.14	0.09	0.05	0.1	4.4	1.6	1.6	0.1	8.00	5.0	12.2	0.2	4.0	1.82	5.12	0.0	0.0	8.0
BW-ARD-389	BW0177	157	167	AND	S	2	7.8	0.58	0.02	0.01	0.6	18.1	17.5	17.3	0.5	33.00	43.4	45.2	1.9	15.0	1.82	1.89	0.0	0.0	9.7
BW-ARD-466	BW0174	124	134	AND	S	2	7.2	0.42	0.02	0.01	0.4	13.1	12.5	8.2	0.5	24.00	40.0	11.7	1.8	11.0	1.83	1.92	0.0	0.1	6.9
BW-ARD 635	GM12-02	390	400	SED	S	2	8.6	0.38	0.01	0.01	0.4	11.9	11.6	11.3	0.1	22.00	7.5	46.2	0.3	10.0	1.85	1.90	0.0	0.0	7.3
BW-ARD-206	BW0115	243	253	VC	S	1	9.0	0.19	0.01	0.03	0.2	5.9	5.6	2.9	0.1	11.00	4.2	5.0	0.2	5.0	1.86	1.96	0.0	0.9	5.8
BW-ARD-452	BW0174	5	15	VC	T	1	6.9	0.19	0.02	0.02	0.2	5.9	5.3	5.3	0.2	11.00	15.8	8.2	0.7	5.0	1.86	2.07	0.0	0.3	6.6
COMPQ011301-Q011310	BWWR01	27	35	VC/AND	T	1	7.7	0.19	0.01	0.01	0.2	5.9	5.6	2.9	0.1	11.00	4.2	44.0	0.2	5.0	1.86	1.96			
COMPM261355-M261364	BWWR07	63	71	VC	T	1	8.0	0.05	0.01	0.02	0.1	1.6	1.6	0.4	0.1	3.00	4.2	4.7	0.2	1.0	1.88	1.92			
BW-ARD-113	BW0074	110	120	VC	S	1	9.0	0.22	0.01	0.01	0.2	6.9	6.9	2.2	0.1	13.00	4.2	8.5	0.2	6.0	1.88	1.89	0.0	1.5	4.8
COMPW005551-W005560	BWWR14	164	173	VC	T/S	2	8.6	0.22	0.02	0.01	0.2	6.9	6.3	6.1	0.1	13.00	11.7	37.7	0.5	6.0	1.88	2.08			
COMPW005869-W005879	BWWR12	176	186	VC	S	1	8.8	0.10	0.01	0.02	0.1	3.1	3.1	3.0	0.1	6.00	4.2	9.0	0.2	3.0	1.94	1.92	0.0	0.4	6.2
BW-ARD 607	GM12-01	114	125	AND	S	1	8.9	0.13	0.01	0.01	0.1	4.1	4.1	2.3	0.1	8.00	4.2	8.7	0.2	4.0	1.95	1.97	0.0	0.2	6.6
COMPM274470-M274479	BWWR02	7.7	16	VC	O	1	6.8	0.03	0.01	0.01	0.0	0.9	0.9	0.9	0.1	2.00	4	3.0	0.3	1.0	2.22	2.13			
BW-ARD-473 (duplicate)	BW0175	29	39		T	2	7.8	0.08	0.01	0.01	0.1	2.5	2.2	2.2	0.7	27.00	56.7	8.0	2.5	25.0	10.80	12.34			
BW-ARD-465	BW0174	112	122	AND	S	2	7.4	0.06	0.01	0.01	0.1	1.9	1.9	1.9	0.6	31.00	53.4	8.5	2.3	29.0	16.32	16.53	0.0	0.0	8.1
BW-ARD-461	BW0174	22	32	VC	T	3	6.9	0.64	0.03	0.01	0.6	20.0	19.1	14.8	0.7	61.00	59.2	67.4	2.6	41.0	3.05	3.20	0.0	0.0	11.0
BW-ARD-229	BW0107	36	46	AND	S	1	6.8	0.10	0.01	0.04	0.1	3.1	2.8	2.8	0.1	15.00	4.2	11.7	0.2	12.0	4.84	5.33	0.0	0.1	6.8
BW-ARD-028	BW0050	60	70	VC/FT	S	1	7.7	0.16	0.01	0.01	0.2	5.0	5.0	1.2	0.1	11.00	4.2	4.7	0.2	6.0	2.20	2.20	0.0	1.1	6.3
COMPQ011311-Q011320	BWWR01	35	44	AND	T	1	7.6	0.06	0.01	0.01	0.1	1.9	1.9	1.9	0.1	9.00	4.2	23.4	0.2	7.0	4.74	4.80			
BW-ARD-176 (duplicate)				AND	S	2	8.7	0.39	0.01	0.02	0.1	12.2	4.1	0.5	0.2	30.00	18.3	52.4	0.8	18.0	2.46	7.38			
BW-ARD-176	BW0106	276	286	AND	S	2	8.8	0.45	0.02	0.01	0.4	14.1	13.4	9.9	0.1	33.00	11.7	51.2	0.5	19.0	2.34	2.46	0.0	0.0	7.1
BW-ARD-553	BW0199	137	147	AND	S	2	8.1	0.14	0.01	0.02	0.1	4.4	4.4	0.8	0.5	50.00	42.5	62.9	1.9	46.0	11.36	11.43	0.0	0.0	11.0
BW-ARD-081	BW0075	14	24	VC	T	1	7.7	0.07	0.01	0.02	0.1	2.2	2.2	2.2	0.1	11.00	4.2	13.2	0.2	9.0	5.00	5.03	0.0	0.0	8.9
BW-ARD-177	BW0107	36	46	AND	S	1	7.2	0.11	0.03	0.04	0.1	3.4	2.5	2.5	0.1	13.00	5.8	12.0	0.2	10.0	3.82	5.20	0.0	0.3	6.9
BW-ARD-575	BW0075	14	24	VC	T	1	7.0	0.08	0.01	0.02	0.1	2.5	2.2	2.2	0.1	7.00	4.2	13.7	0.2	5.0	2.80	3.20	0.0	0.0	7.4
BW-ARD-225	BW0107	65	75	AND	S	1	7.0	0.21	0.02	0.07	0.2	6.6	5.9	2.8	0.1	15.00	8.3	13.0	0.4	8.0	2.27	2.53	0.0	1.3	5.3
BW-ARD-385A	BW0177	94	98	AND	O	1	7.1	0.13	0.03	0.02	0.1	4.1	3.1	3.1	0.1	11.00	11.7	10.2	0.5	7.0	2.68	3.52	0.0	0.0	7.1
BW-ARD-331	BW0069	115	125	AND	S	1	7.5	0.17	0.01	0.01	0.2	5.3	5.3	2.2	0.1	12.00	7.5	19.2	0.3	7.0	2.26	2.26	0.0	0.3	6.4
BW-ARD-892	GM12-05	282	292	AND	S	2	8.4	0.47	0.01	0.01	0.5	14.7	14.7	11.9	0.4	43.00	29.2	65.9	1.3	28.0	2.93	2.93	0.0	0.0	9.7
BW-ARD-178	BW0107	65	75	AND	S	1	7.6	0.18	0.02	0.03	0.2	5.6	5.0	2.2	0.1	13.00	4.2	14.0	0.2	7.0	2.32	2.60	0.0	0.8	6.0
BW-ARD-561	BW0199	170	180	AND	S	2	8.5	0.19	0.01	0.03	0.2	5.9	5.9	3.2	0.2	26.00	13.3	40.9	0.6	20.0	4.41	4.38	0.0	0.0	9.3
BW-ARD-238	BW0082	100	110	AND	S	1	8.3	0.13	0.01	0.01	0.1	4.1	4.1	1.4	0.1	16.00	5.0	23.0	0.2	12.0	3.90	3.94	0.0	1.0	5.7
BW-ARD-112	BW0074	40	50	VC	T	1	8.7	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	7.00	4.2	0.7	0.2	7.0	23.33	22.40	0.0	0.0	8.2
L016677	BW0128	49	58		O	1	7.9	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	4.00	4.2	1.7	0.2	4.0	13.33	12.80			
BW-ARD-048	BW0061	20	30	VC	T	1	6.6	0.20	0.02	0.04	0.2	6.3	5.6	3.1	0.2	18.00	17.5	14.5	0.8	12.0	2.86	3.20	0.0	0.5	6.1
BW-ARD 610 (duplicate)				VC	S	2	8.6	0.36	0.01	0.01	0.4	11.3	11.3	8.8	0.3	41.00	28.4	60.2	1.3	30.0	3.63	3.64			
BW-ARD-238 (duplicate)					S	1	7.9	0.14	0.01	0.02	0.1	4.4	4.1	1.6	0.1	13.00	5.0	22.5	0.2	9.0	2.95	3.20	0.0	0.3	6.5
BW-ARD-042	BW0057	242	252	VC	S	1	8.4	0.46	0.01	0.01	0.5	14.4	14.4	11.9	0.2	29.00	15.8	49.4	0.7	15.0	2.01	2.02	0.0	0.0	9.8
BW-ARD 606	GM12-01	104	114	AND	S	1	8.8	0.19	0.01	0.01	0.2	5.9	5.9	3.5	0.1	13.00	4.2	49.4	0.2	7.0	2.20	2.19	0.0	0.1	6.7
BW-ARD 648 (duplicate)				AND	S	1	8.9	0.19	0.01	0.01	0.2	5.9	5.9	3.5	0.1	12.00	4.2	47.7	0.2	6.0	2.03	2.02			
BW-ARD 637	GM12-03	56	66	VC	O	1	8.6	0.01	0.02	0.01	0.0	0.3	0.3	0.3	0.1	5.00	4.2	0.5	0.2	5.0	16.67	16.00	0.0	0.0	8.8
BW-ARD-153	BW0093	33	43	AND	T	1	8.5	0.14	0.01	0.02	0.1	4.4	4.4	2.2	0.1	17.00	4.2	23.2	0.2	13.0	3.86	3.89	0.0	0.0	8.1
BW-ARD 638	GM12-03	66	76	VC	O	1	8.6	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	5.00	4.2	0.5	0.2	5.0	16.67	16.00	0.0	0.0	8.9
COMPP012900-P1290909	BWWR10	12	20	FLPT	O	1	7.5	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	3.00	4.2	4.4	0.2	3.0	10.00	9.60			
BW-ARD-273	BW0062	28	38	AND	T	2	8.5	0.16	0.01	0.01	0.2	5.0	5.0	3.0	0.3	42.00	25.0	40.9	1.1	37.0	8.40	8.40	0.0	0.0	10.5
BW-ARD-526_Dup				VC	S	1	7.1	0.08	0.02	0.01	0.1	2.5	1.9	1.9	0.1	5.00	4.2	4.2	0.2	3.0	2.00	2.67	0.0	0.0	7.4
BW-ARD-574	BW0093	33	43	AND	T	1	8.0	0.12	0.01	0.01	0.1	3.8	3.4	1.5	0.1	16.00	4.2	27.0	0.2	5.0	4.21	4.65	0.0	0.0	7.1
BW-ARD-457	BW0174	112	122	AND	S	3	6.1	0.21	0.01	0.01	0.2	6.6	6.3	4.3	0.9	71.00	74.2	67.9	3.3	64.0	10.76	11.36	0.0	0.0	11.0
BW-ARD-400	BW0177	267	277	AND	S	2	7.4	0.41	0.06	0.03	0.4	12.8	10.9	9.0	0.5	41.00	43.4	61.9	1.9	28.0	3.20	3.75	0.0	0.0	10.5
BW-ARD-153 (duplicate)					O	1	8.4	0.13	<0.01	<0.01	0.1	4.1	4.1	2.1	0.1	15.00	5.8	23.5	0.3	11.0	3.66	3.69	<0.01	<0.01	7.3
L016683	BW0206	78	87		O	1	7.1	0.01	0.01	0.02	0.0	0.3	0.3	0.3	0.1	5.00	4.2	14.0	0.2	5.0	16.67	16.00			
BW-ARD-132	BW0083	256	266	AND	S	1	9.3	0.33	0.01	0.03	0.3	10.3	10.3	8.4	0.1	21.00	10.8	62.9	0.5	11.0	2.04	2.04	0.0	1.1	5.6
COMPG012661-G012663	BWWR11	397	400.5		S	2	8.5	0.25	0.01	0.02	0.3	7.8	7.8	6.0	0.2	25.00	14.2	66.4	0.6	17.0	3.21	3.20			
BW-ARD 648	GM12-03	254	264	AND	S	2	8.3	0.45	0.01	0.01	0.5	14.1	14.1	12.3	0.3	37.00	25.0	55.7	1.1	23.0	2.62	2.63	0.0	0.0	11.0
BW-ARD 639	GM12-03	82	91	VC	O	1	8.2	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	5.00	4.2	0.7	0.2	5.0	16.67	16.00	0.0	0.0	8.9
BW-ARD 636	GM12-03	46	56	VC	O	1	7.8	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	4.00	4.2	1.0	0.2	4.0	13.33	12.80	0.0	0.0	8.8
BW-ARD-436	BW0171	70	80	AND	S	2	7.6	0.22	0.02	0.01	0.2	6.9	6.3	4.5	0.3	24.00	24.2	23.5	1.1	17.0	3.48	3.84	0.0	0.0	10.5
BW-ARD-569	BW0211	216	226	AND/VC	S	2	8.4	0.21	0.01	0.02	0.2	6.6	6.6	4.8	0.2	36.00	18.3	61.7	0.8	29.0	5.45	5.49	0.0	0.0	10.5
BW-ARD-338 (duplicate)				AND	S	2	8.2	0.54	0.01	0.01	0.5	16.9	16.9	15.2	0.3	38.00	25.9	55.9	1.1	21.0	2.25	2.25			
COMPG012651-G012660	BWWR11	388	397		S	2	8.3	0.13	0.01	0.02	0.1	4.1	4.1	2.5	0.2	25.00	13.3	55.4	0.6	21.0	6.10	6.15			
BW-ARD-282	BW0097	224	234	AND	S	2	8.5	0.46	0.01	0.01	0.5	14.4	14.4	12.8	0.2	34.00	13.3	40.4	0.6	20.0	2.36	2.37	0.0	0.3	6.5
COMPP012960-P1290969	BWWR10	66	74	FLPT	T	1	8.0	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	3.00	4.2	6.1	0.2	3.0	10.00	9.60			
BW-ARD-017	BW0054	69	79	FT	S	2	8.4	0.27	0.01	0.01	0.3	8.4	8.4	6.9	0.7	63.00	55.0	66.9	2.4	55.0	7.50	7.47	0.0	0.0	10.5
BW-ARD-543	BW0198	212	222	VC	S/T	1	7.8	0.23	0.01	0.02	0.2	7.2	7.2	5.7	0.1	17.00	5.8	50.4	0.3	10.0	2.36	2.37	0.0	0.0	7.0
COMPM260821-M260830	BWWR10	119	127	FLPT/AND	T	2	8.5	0.09	0.01	0.01	0.1	2.8	2.8	1.4	0.1	14.00	7.5	20.8	0.3	11.0	5.00	4.98			
COMPM260891-M260900	BWWR10	179	188	AND	S	2	8.8	0.09	0.01	0.01	0.1	2.8	2.8	1.4	0.3	39.00	28.4	89.7	1.3	36.0	13.93	13.87			
L016684	BW0213	18	27		O	1	7.1	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	2.00	4.2	1.0	0.2	2.0	6.67	6.40			
BW-ARD-484	BW0178	124	134	AND	S	1	7.5	0.04	0.02	0.01	0.0	1.3	0.6	0.6	0.1	5.00	5.8	2.2	0.3	4.0	3.85	8.00	0.0	0.0	8.0
BW-ARD-562	BW0199	193	203	AND	S	2	8.6	0.05	0.01	0.03	0.1	1.6	1.6	0.2	0.2	30.00	17.5	60.2	0.8	28.0	18.75	19.20	0.0	0.0	10.5
BW-ARD-455	BW0174	52	62	AND	S	2	6.3	0.13	0.01	0.01	0.1	4.1	3.8	2.5	0.6	33.00	53.4	23.7	2.4	29.0	8.05	8.80	0.0	0.0	9.6
BW-ARD-470	BW0174	223	233.17	AND	S	3	8.3	0.23	0.02	0.02	0.2	7.2	6.6	5.3	0.7	63.00	54.2	64.4	2.4	56.0	8.75	9.60	0.0	0.0	11.0
BW-ARD 634	GM12-02	380	390	SED	S	2	8.5	0.29	0.01	0.01	0.3	9.1	8.8	7.5	0.2	20.00	12.5	23.0	0.6	11.0	2.20	2.29	0.0	0.0	9.5
BW-ARD-691	GM12-05	262	273	AND	S	2	8.6	0.35	0.01	0.04	0.3	10.9	10.6	9.4	0.1	23.00	8.3	43.9	0.4	12.0	2.11	2.16	0.0	0.0	7.4
BW-ARD-384	BW0177	100	110	AND	T	2	7.3	0.28	0.02	0.03	0.3	8.8	8.1	6.9	0.8	33.00	70.1	32.5	3.1	24.0	3.75	4.06	0.0	0.0	10.5
BW-ARD-170	BW0104	88	98	AND	S	1	8.4	0.02	0.02	0.01	0.0	0.6	0.3	0.3	0.2	13.00	12.5	14.7	0.6	12.0	21.67	41.60	0.0	0.0	9.1
COMPM260901-M260910	BWWR10	188	197	AND	S	2	8.3	0.10	0.01	0.01	0.1	3.1	3.1	2.0	0.6	57.00	50.0	97.3	2.2	54.0	18.39	18.24			
BW-ARD 606 (duplicate)				AND	S	2	8.3	0.35	0.01	0.01	0.4	11.0	10.9	9.8	0.2	25.00	18.3	50.2	0.8	14.0	2.28	2.29			
BW-ARD-552	BW0199	84	94	VC	T	1	7.5	0.02	0.02	0.02	0.0	0.6	0.3	0.3	0.1	6.00	4.2	8.0	0.2	5.0	10.00	19.20	0.0	0.0	8.4
BW-ARD-338	BW0104	115	125	AND	S	2	7.6	0.35	0.01	0.01	0.3	10.9	10.6	9.5	0.2	27.00	19.2	51.9	0.8	16.0	2.48	2.54	0.0	0.0	10.5
BW-ARD-469	BW0174	173	183	AND	S	3	7.1	0.28	0.01	0.01	0.3	8.8	8.4	7.4	0.9	78.00	75.9	82.6	3.4	69.0	8.86	9.24	0.0	0.0	10.5
BW-ARD-554	BW0199	181	191	AND	S	2	8.4	0.07	0.01	0.04	0.1	2.2	2.2	1.2	0.2	21.00	14.2	44.4	0.6	19.0	9.55	9.60	0.0	0.0	10.0
COMPG012631-G012640	BWWR11	371	380		S	2	8.8	0.33	0.02	0.02	0.3	10.3	9.7	8.7	0.1	23.00	9.2	90.4	0.4	13.0	2.23	2.37			
BW-ARD-432	BW0171	3	16	AND	T	2	7.5	0.13	0.01	0.01	0.1	4.1	4.1	3.1	0.4	23.00	29.2	12.7	1.3	19.0	5.61	5.66	0.0	0.0	8.0
BW-ARD-468	BW0174	157	167	AND	S	2	7.4	0.16	0.02	0.01	0.1	5.0	4.4	3.4	0.3	13.00	22.5	1.7	1.0	8.0	2.60	2.97	0.0	0.0	7.0
BW-ARD-483	BW0178	97	109	AND	T	1	7.1	0.03	0.02	0.02	0.0	0.9	0.3	0.3	0.1	2.00	6.7	0.7	0.3	1.0	2.22	6.40	0.0	0.0	8.1
COMPM260811-M260820	BWWR10	110	119	AND	T	2	8.6	0.09	0.01	0.01	0.1	2.8	2.8	1.9	0.4	42.00	30.0	88.6	1.3	39.0	15.00	14.93			
BW-ARD-120	B

Table A3-2: Acid Base Accounting and NAG Test Results for Waste Rock Samples

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	FIZZ RATING Unity	paste pH Unity	Total S %	SO_4 (carb leach) %	SO_4 (HCl leach) %	Sx %	MPA kg $CaCO_3$/t	Sx AP kg $CaCO_3$/t	AP adjust for ZnS kg $CaCO_3$/t	TIC %	NP kg $CaCO_3$/t	CNP (TIC) kg $CaCO_3$/t	ICP-Ca NP kg $CaCO_3$/t	CO_2 %	NNP kg $CaCO_3$/t	NP:MPA Unity	NP/AP Unity	NAG @ pH 4.5 kg H_2SO_4/t	NAG @ pH 7.0 kg H_2SO_4/t	AG pH Unity
BW-ARD-463	BW0174	52	62	AND	S	1	7.3	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	4.00	4.2	0.5	0.2	4.0	13.33	12.80	0.0	0.0	8.5
COMPP012970-P1290979	BWWR10	74	83	FLPT	T	1	8.2	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	3.00	4.2	3.7	0.2	3.0	10.00	9.60			
L016676	BW0122	61	70	O	1	1	7.7	0.03	0.01	0.01	0.0	0.9	0.6	0.6	0.1	2.00	4.2	0.7	0.2	1.0	2.22	3.20			
BW-ARD-535	BW0198	131	141	VC	S	2	7.8	0.15	0.02	0.01	0.1	4.7	4.1	3.4	0.2	19.00	15.0	32.5	0.7	14.0	4.04	4.68	0.0	0.0	10.5
BW-ARD-433	BW0171	22	33	AND	S	2	8.0	0.24	0.01	0.01	0.2	7.5	7.5	6.9	0.6	30.00	47.5	40.9	2.1	23.0	4.00	4.00	0.0	0.0	11.0
BW-ARD-163	BW0097	224	234	AND	S	2	8.6	0.44	0.01	0.04	0.4	13.8	13.8	13.1	0.2	34.00	16.7	40.7	0.7	20.0	2.46	2.47			
COMPW006402-W006412	BWWR13	384	393	CGL	S	2	8.1	0.16	0.01	0.02	0.2	5.0	5.0	4.4	0.5	44.00	42.5	60.7	1.9	39.0	8.80	8.80			
BW-ARD-157	BW0094	143	153	AND	S	2	8.2	0.42	0.01	0.02	0.4	13.1	13.1	12.5	0.2	32.00	16.7	35.2	0.7	19.0	2.44	2.44	0.0	0.0	9.5
BW-ARD 610	GM12-01	146	156	VC	S	1	8.9	0.12	0.01	0.01	0.1	3.8	3.4	2.9	0.1	8.00	5.8	14.2	0.2	4.0	2.11	2.33	0.0	0.0	8.2
BW-ARD-500	BW0185	47	57	VC	O	1	7.3	0.02	0.01	0.01	0.0	0.6	0.6	0.1	0.1	4.00	4.2	1.7	0.2	3.0	6.67	6.40	0.0	0.0	8.4
L016682	BW0200	11.4	21		O	1	7.3	0.04	0.01	0.01	0.0	1.3	1.3	0.7	0.1	5.00	4.2	9.7	0.2	4.0	3.85	4.00			
COMPP012950-P1290959	BWWR10	57	66	FLPT	O/T	1	8.0	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	3.00	4.2	2.6	0.2	3.0	10.00	9.60			
COMPW006352-W006360	BWWR13	340	349	CGL	S	1	8.5	0.08	0.01	0.01	0.1	2.5	2.5	2.0	0.1	19.00	11.7	41.4	0.5	17.0	7.60	7.60			
BW-ARD-027	BW0050	3	13	AND	T	2	8.9	0.02	0.01	0.02	0.0	0.6	0.6	0.1	0.6	63.00	50.9	68.9	2.2	62.0	105.00	100.80	0.0	0.0	11.0
BW-ARD-696	GM12-05	361	371	AND	S	2	8.4	0.48	0.01	0.01	0.5	15.0	15.0	14.5	0.2	32.00	15.8	65.2	0.7	17.0	2.13	2.13	0.0	0.0	9.3
BW-ARD-079	BW0068	16	28	VC	O	1	8.0	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	2.00	4.2	0.2	0.2	2.0	6.67	6.40	0.0	10.1	6.3
BW-ARD-156	BW0094	60	70	AND	S	2	8.4	0.28	0.01	0.03	0.3	8.8	8.4	8.0	0.4	47.00	34.2	60.4	1.5	38.0	5.34	5.57	0.0	0.0	10.0
COMPW006362-W006370	BWWR13	349	358	CGL	S	1	8.7	0.07	0.02	0.01	0.1	2.2	1.6	1.1	0.1	14.00	8.3	40.4	0.4	12.0	6.36	8.96			
BW-ARD 614	GM12-01	194	204	AND	S	1	8.9	0.06	0.01	0.01	0.1	1.9	1.9	1.4	0.1	12.00	5.8	38.4	0.3	10.0	6.32	6.40	0.0	0.0	8.5
COMPW006372-W006380	BWWR13	358	366	CGL	S	1	8.6	0.08	0.01	0.01	0.1	2.5	2.5	2.0	0.1	14.00	9.2	39.9	0.4	12.0	5.60	5.60			
COMPM260801-M260810	BWWR10	101	110	FLPT/AND	T	2	8.9	0.03	0.01	0.01	0.0	0.9	0.9	0.5	0.4	8.00	32.5	17.1	1.4	7.0	8.89	8.53			
BW-ARD-518	BW0190	125	135	FT	S	1	7.7	0.03	0.02	0.02	0.0	0.9	0.3	0.3	0.1	2.00	4.2	0.7	0.2	1.0	2.22	6.40	0.0	0.1	6.8
COMPM261815-M261824	BWWR03	2	10	AND	T	1	8.3	0.03	0.01	0.01	0.0	0.9	0.9	0.5	0.1	10.00	4.2	36.7	0.1	9.0	11.11	10.67			
COMPW005763-W005774	BWWR12	85	95	VC	T	1	8.5	0.03	0.01	0.01	0.0	0.9	0.9	0.5	0.1	5.00	4.2	7.2	0.2	4.0	5.56	5.33			
BW-ARD-399	BW0177	257	267	AND	S	2	7.8	0.07	0.01	0.01	0.1	2.2	2.2	1.7	0.3	42.00	26.7	67.9	1.2	40.0	19.09	19.20	0.0	0.0	10.0
COMPM260831-M260840	BWWR10	127	136	AND	T/S	2	8.5	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.3	35.00	25.0	80.8	1.1	35.0	116.67	112.00			
COMPW006392-W006400	BWWR13	375	384		S	2	8.2	0.06	0.01	0.01	0.1	1.9	1.6	1.1	0.4	31.00	29.2	44.7	1.3	29.0	16.32	19.84			
BW-ARD-147	BW0090	60	70	VC	O	1	7.9	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	2.00	4.2	0.7	0.2	2.0	6.67	6.40	0.0	4.7	6.4
BW-ARD 615	GM12-01	204	214	AND	S	2	8.8	0.15	0.01	0.01	0.2	4.7	4.7	4.3	0.1	22.00	11.7	63.9	0.5	17.0	4.68	4.69	0.0	0.0	9.8
COMPM261610-M261620	BWWR05	88	98	AND	T	2	8.6	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.2	27.00	15.0	104.8	0.7	27.0	90.00	86.40			
BW-ARD 620	GM12-01	306	316	AND	T	1	8.1	0.20	0.01	0.01	0.2	6.3	6.3	5.8	0.1	13.00	4.2	23.2	0.2	7.0	2.06	2.08	0.0	0.0	7.0
BW-ARD-383	BW0069	275	285	AND	S	2	8.3	0.10	0.01	0.01	0.2	3.1	2.8	2.4	0.6	34.00	50.9	77.6	2.3	31.0	10.97	12.09	0.0	0.0	10.5
BW-ARD-681	GM12-05	109	118	FT	O	1	7.3	0.02	0.02	0.02	0.0	0.6	0.3	0.3	0.1	2.00	4.2	0.2	0.2	1.0	3.33	6.40	0.0	0.0	8.5
COMPP012990-P013000	BWWR10	92	101	FLPT	T	1	8.5	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	2.00	4.2	1.7	0.2	2.0	6.67	6.40			
BW-ARD-547	BW0198	252	262	VC	S	1	8.9	0.28	0.01	0.01	0.05	0.3	8.8	8.4	8.0	0.1	20.00	5.0	89.9	0.2	11.0	2.27	2.37	0.0	0.3	6.7
BW-ARD-442	BW0171	286	296.57	AND	S	2	8.5	0.09	0.01	0.01	0.1	2.8	2.8	2.4	0.6	54.00	46.7	63.7	2.0	51.0	19.29	19.20	0.0	0.0	10.5
COMPM261172-M261181	BWWR08	23	32	VC	O	1	8.0	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	2.00	4.2	1.4	0.2	2.0	6.67	6.40			
BW-ARD-556	BW0199	240	250	AND	S	1	8.4	0.10	0.01	0.03	0.1	3.1	2.8	2.4	0.2	21.00	13.3	48.9	0.6	18.0	6.77	7.47	0.0	0.0	9.7
COMPM261631-M261640	BWWR05	107	115		T	2	8.7	0.03	0.01	0.01	0.0	0.9	0.6	0.2	0.1	19.00	11.7	68.4	0.5	18.0	21.11	30.40			
BW-ARD-364	BW0161	42	52	VC	T	1	7.3	0.01	0.01	0.03	0.0	0.3	0.3	0.3	0.1	3.00	4.2	0.5	0.2	3.0	10.00	9.60	0.0	0.0	9.0
BW-ARD-460	BW0174	5	15	VC	T	3	7.9	0.32	0.01	0.01	0.3	10.0	9.7	9.3	1.0	74.00	80.9	75.4	3.5	64.0	7.40	7.64	0.0	0.0	10.5
BW-ARD-538	BW0198	161	171	VC	S	2	8.1	0.10	0.01	0.05	0.1	3.1	3.1	2.8	0.4	35.00	29.2	56.9	1.3	32.0	11.29	11.20	0.0	0.0	11.0
BW-ARD-363	BW0161	31	41	VC	T	1	7.3	0.01	0.01	0.08	0.0	0.3	0.3	0.3	0.1	3.00	4.2	0.2	0.2	3.0	10.00	9.60	0.0	0.0	9.2
COMPM261162-M261171	BWWR08	15	23	VC	O	1	8.0	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	2.00	4.2	1.9	0.2	2.0	6.67	6.40			
BW-ARD-473	BW0175	29	39	VC	T	3	7.6	0.35	0.03	0.01	0.3	10.9	10.0	9.6	0.5	54.00	43.4	69.4	1.9	43.0	4.95	5.40	0.0	0.0	10.5
BW-ARD-551	BW0198	292	302	VC	S	1	9.0	0.06	0.03	0.04	0.0	1.9	0.9	0.6	0.1	23.00	5.8	89.9	0.3	21.0	12.11	24.53	0.0	0.0	8.3
COMPG012601-G012610	BWWR11	345	354	AND	S	2	8.8	0.12	0.01	0.02	0.1	3.8	3.8	3.4	0.1	23.00	10.0	99.1	0.5	19.0	6.05	6.13			
COMPW006382-W006390	BWWR13	366	375	CGL	S	2	8.5	0.05	0.01	0.02	0.0	1.6	1.3	0.9	0.3	25.00	22.5	40.2	1.0	23.0	15.63	20.00			
BW-ARD-546	BW0198	242	252	VC	S	2	8.6	0.10	0.01	0.05	0.1	3.1	3.1	2.8	0.1	28.00	11.7	89.1	0.5	25.0	9.03	8.96	0.0	0.0	9.5
COMPG012621-G012630	BWWR11	362	371	AND	S	2	8.9	0.20	0.02	0.01	0.2	6.3	5.6	5.3	0.1	21.00	9.2	97.6	0.4	15.0	3.33	3.73			
BW-ARD-030	BW0051	50	60	FT	T	1	7.8	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	3.00	4.2	0.5	0.2	3.0	10.00	9.60	0.0	0.0	8.8
BW-ARD-570	BW0211	233	243	VC	S	2	8.3	0.26	0.01	0.02	0.3	8.1	7.8	7.5	0.2	21.00	14.2	25.0	0.6	13.0	2.59	2.69	0.0	0.0	8.9
BW-ARD-517	BW0190	79	89	FT	O	1	7.0	0.01	0.02	0.02	0.0	0.3	0.3	0.3	0.1	1.00	4.2	0.5	0.2	1.0	3.33	3.20	0.0	3.9	6.3
COMPM260851-M260860	BWWR10	145	153	AND	S	2	8.4	0.10	0.03	0.01	0.1	3.1	2.2	1.8	0.3	39.00	28.4	80.9	1.3	36.0	12.58	17.83			
COMPG012611-G012620	BWWR11	354	362	AND	S/T	2	8.6	0.13	0.01	0.01	0.1	4.1	3.8	3.4	0.3	37.00	22.5	103.1	1.0	33.0	9.02	9.87			
BW-ARD-685	GM12-05	173	183	FT	T	1	7.3	0.02	0.01	0.03	0.0	0.6	0.6	0.3	0.1	3.00	4.2	0.2	0.2	2.0	5.00	4.80	0.0	7.1	6.3
BW-ARD-563	BW0199	221	231	AND	S	1	8.0	0.11	0.01	0.03	0.1	3.4	3.4	3.1	0.1	14.00	8.3	25.7	0.4	11.0	4.12	4.07	0.0	0.0	7.9
COMPM261845-M261854	BWWR03	28	36	AND	T	1	8.3	0.02	0.01	0.01	0.0	0.6	0.6	0.3	0.1	11.00	4.2	33.7	0.1	10.0	18.33	17.60			
COMPW005902-W005913	BWWR12	205	216	VC	S	2	9.0	0.07	0.02	0.02	0.1	2.2	1.6	1.2	0.1	14.00	8.3	19.2	0.4	12.0	6.36	8.96	0.0	0.0	9.9
BW-ARD-158	BW0094	220	230	AND	S	1	9.6	0.05	0.01	0.05	0.1	1.6	1.6	1.3	0.1	19.00	4.2	24.5	0.2	17.0	11.88	12.16	0.0	0.0	7.5
COMPM260841-M260850	BWWR10	136	145	AND	S	2	8.9	0.02	0.01	0.01	0.0	0.6	0.6	0.3	0.5	52.00	44.2	94.7	1.9	51.0	86.67	83.20			
BW-ARD-548	BW0198	262	272	VC	S	2	8.7	0.20	0.01	0.07	0.2	6.3	6.3	5.9	0.1	27.00	10.0	91.9	0.4	21.0	4.29	4.32	0.0	0.0	9.1
BW-ARD-401	BW0177	277	287	AND	S	2	7.5	0.34	0.03	0.03	0.3	10.6	9.7	9.4	0.8	64.00	68.4	82.6	3.0	53.0	6.04	6.61	0.0	0.0	10.5
BW-ARD-545	BW0198	232	242	VC	S	2	8.4	0.17	0.01	0.05	0.2	5.3	5.0	4.7	0.2	28.00	13.3	74.9	0.6	23.0	5.28	5.60	0.0	0.0	9.6
BW-ARD 621	GM12-01	316	326	VC	T	1	8.2	0.01	0.01	0.01	0.0	0.3	0.3	0.0	0.1	6.00	4.2	6.5	0.2	6.0	20.00	19.20	0.0	0.0	8.7
BW-ARD-382	BW0104	134	146	AND	S	2	7.2	0.07	0.02	0.06	0.1	2.2	1.6	1.3	0.3	32.00	21.7	58.4	1.0	30.0	14.55	20.48	0.0	0.0	10.5
COMPG012571-G012580	BWWR11	319	328	AND	S	2	8.4	0.06	0.01	0.01	0.1	1.9	1.9	1.6	0.2	30.00	13.3	89.9	0.6	28.0	15.79	16.00			
COMPM261468-M261477	BWWR06	63	72	VC	T	2	8.8	0.04	0.01	0.01	0.0	1.3	1.3	1.0	0.1	6.00	5.8	9.2	0.3	5.0	4.62	4.80			
BW-ARD-697	GM12-05	371	381	AND	S	2	8.6	0.32	0.01	0.01	0.3	10.0	10.0	9.7	0.2	33.00	14.2	56.7	0.6	23.0	3.30	3.30	0.0	0.0	9.5
BW-ARD-481	BW0175	279	289	AND	S	3	7.0	0.21	0.01	0.01	0.2	6.6	6.3	6.0	0.5	50.00	40.0	76.4	1.8	43.0	7.58	8.00	0.0	0.0	11.0
COMPG012591-G012600	BWWR11	336	345	AND	S	2	8.5	0.10	0.01	0.02	0.1	3.1	3.1	2.8	0.2	29.00	15.0	102.1	0.7	26.0	9.35	9.28			
COMPG012581-G012590	BWWR11	328	336	AND	S	2	8.2	0.10	0.01	0.01	0.1	3.1	3.1	2.8	0.5	55.00	42.5	111.8	1.9	52.0	17.74	17.60			
BW-ARD-698	GM12-05	381	391	AND	S	1	9.1	0.27	0.02	0.01	0.3	8.4	7.8	7.5	0.1	23.00	6.7	44.2	0.3	15.0	2.74	2.94	0.0	0.0	7.8
COMPG012561-G012570	BWWR11	311	319	AND	S	2	8.3	0.02	0.01	0.01	0.0	0.6	0.6	0.3	0.2	33.00	17.5	108.8	0.8	32.0	55.00	52.80			
COMPW006342-W006350	BWWR13	332	340	CGL	S	1	8.6	0.11	0.01	0.01	0.1	3.4	3.1	2.9	0.1	15.00	9.2	34.7	0.4	12.0	4.41	4.80			
BW-ARD 657	GM12-03	367	377	SED	S	2	8.5	0.44	0.03	0.01	0.4	13.8	12.8	12.5	0.3	32.00	20.9	48.2	0.9	18.0	2.32	2.50	0.0	0.0	9.3
BW-ARD-516	BW0190	62	72	FT	T	1	7.0	0.01	0.01	0.03	0.0	0.3	0.3	0.0	0.1	2.00	4.2	0.5	0.2	2.0	6.67	6.40	0.0	0.0	7.7
COMPG012551-G012560	BWWR11	303	311	AND	S	2	8.4	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.3	39.00	21.7	104.8	1.0	39.0	130.00	124.80			
BW-ARD-683	GM12-05	149	158	FT	T	1	7.2	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	2.00	4.2	0.2	0.2	2.0	6.67	6.40	0.0	9.0	5.8
BW-ARD-404	BW0181	40	50	AND	S	2	7.5	0.47	0.02	0.05	0.5	14.7	14.1	13.8	0.2	31.00	19.2	53.2	0.8	16.0	2.11	2.20	0.0	0.0	9.9
BW-ARD-396	BW0177	227	237	AND	S	2	8.2	0.26	0.02	0.04	0.2	8.1	7.5	7.2	0.2	30.00	19.2	50.9	0.9	22.0	3.70	4.00	0.0	0.0	10.0
COMPW005810-W005820	BWWR12	125	135	VC	S	1	9.3	0.03	0.01	0.01	0.0	0.9	0.9	0.7	0.1	11.00	6.7	44.4	0.3	10.0	12.22	11.73			
BW-ARD-541	BW0198	192	202	VC	S	1	8.5	0.19	0.01	0.02	0.2	5.9	5.9	5.7	0.1	16.00	11.7	39.9	0.5	10.0	2.71	2.69	0.0	0.0	9.0
COMPG012541-G012550	BWWR11	294	303	AND	S	2	8.5	0.06	0.01	0.01	0.1	1.9	1.9	1.6	0.2	33.00	17.5	95.1	0.8	31.0	17.37	17.60			
BW-ARD-539	BW0198	172	182	VC	S	2	8.6	0.18	0.01	0.04	0.2	5.6	5.6	5.4	0.1	20.00	11.7	53.2	0.5	14.0	3.57	3.56	0.0	0.0	9.4
BW-ARD 659	GM12-03	387	397	SED	S	1	8.7	0.14	0.01	0.02	0.1	4.4	4.4	4.1	0.1	16.00	5.8	31.7	0.3	12.0	3.64	3.66	0.0	0.0	9.1
COMPP012930-P1290939	BWWR10	40	48	FLPT	O	1	8.1	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	3.00	4.2	1.3	0.2	3.0	10.00	9.60			
BW-ARD-388	BW0177	147	157	AND	S	1	7.4	0.07	0.02	0.03	0.1	2.2	1.6	1.3	0.1	24.00	9.2	48.7	0.4	22.0	10.91	15.36	0.0	0.0	9.1
BW-ARD 628	GM12-02	28	38	FLPT	T	1	7.8	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	3.00	4.2	0.2	0.2	3.0	10.00	9.60	0.0	5.3	6.4
COMPM261600-M261609	BWWR05	80	88	AND	T	2	8.6	0.03	0.01	0.01	0.0	0.9	0.9	0.7	0.2	29.00	20.0	101.8	0.9	28.0	32.22	30.93			
COMPM260911-M260920	BWWR10	197	205	AND	S	2	8.6	0.05	0.02	0.01	0.0	1.6	0.9	0.7	0.2	27.00	17.5	80.2	0.8	25.0	16.88	28.80			
BW-ARD-549	BW0198	272	282	VC	S	2	8.7	0.12	0.02	0.05	0.1	3.8	3.1	2.9	0.1	26.00	11.7	68.1	0.5	22.0	6.84	8.32	0.0	0.0	9.6
COMPM261621-M261630	BWWR05	98	107	AND	T	2	8.5	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.3	40.00	26.7	106.3	1.2	40.0	133.33	128.00			
COMPM261570-M261579	BWWR05	54	62	AND	T	1	9.0	0.16	0.03	0.01	0.1	5.0	4.1	3.8	0.1	18.00	7.5	107.3	0.3	13.0	3.60	4.43			
COMPM261488-M261497	BWWR06	81	90	VC	T/S	1	8.9	0.02	0.01	0.01	0.0	0.6	0.6	0.4	0.1	6.00	4.2	8.0	0.2	5.0	10.00	9.60			
COMPP012980-P012989	BWWR10	83	92	FLPT	T	1	8.4	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	2.00	4.2	1.1	0.2	2.0	6.67	6.40			
BW-ARD-568	BW0211	197	207	AND	S	2	8.5	0.03	0.01	0.03	0.0	0.9	0.9	0.7	0.3	39.00	20.9	74.6	0.9	38.0	43.33	41.60	0.0	0.0	10.0
COMPM261855-M261864	BWWR03	36	45	AND	T	2	8.7	0.04	0.01	0.01	0.0	1.3	1.3	1.0	0.1	17.00	9.2	64.2	0.1	16.0	13.08	13.60			
COMPW005821-W005831	BWWR12	135	144	VC	S	1	9.0	0.09	0.01	0.01	0.1	2.8	2.8	2.6	0.1	7.00	4.2	11.0	0.2	4.0	2.50	2.49			
BW-ARD-676	GM12-05	50	60	FT	O	1	7.2	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	3.00	4.2	1.7	0.2	3.0	10.00	9.60	0.0	0.0	8.5
COMPM261590-M261599	BWWR05	71	80	AND	T	2	8.9	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	22.00	9.2	92.6	0.4	22.0	73.33	70.40			
COMPP012940-P1290949	BWWR10	48	57	FLPT	O	1	8.2	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	2.00	4.2	1.2	0.2	2.0	6.67	6.40			
COMPM261478-M261487	BWWR06	72	81	VC	T	2	8.8	0.02	0.01	0.01	0.0	0.6	0.3	0.1	0.1	6.00	5.0	6.2	0.2	5.0	10.00	19.20			
COMPM261560-M261569	BWWR05	45	54	AND	T	1	8.8	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	19.00	8.3	87.9	0.4	19.0	63.33	60.80			
COMPP012920-P1290929	BWWR10	30	40	FLPT	O	1	8.1	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	2.00	5.0	1.6	0.2	2.0	6.67	6.40			
COMPG012531-G012540	BWWR11	285	294		S/T	2	8.4	0.30	0.01	0.01	0.3	9.4	9.4	9.2	0.4	47.00	33.4	103.6	1.5	38.0	5.00	5.01			
BW-ARD-680	GM12-05	99	109	FT	O	1	7.2	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	2.00	4.2	0.5	0.2	2.0	6.67	6.40	0.0	0.0	8.7
BW-ARD-385B	BW0177	117	127	AND	S	2	7.9	0.06	0.01	0.05	0.1	1.9	1.9	1.7	0.6	59.00	53.4	67.4	2.3

Table A3-2: Acid Base Accounting and NAG Test Results for Waste Rock Samples

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	FIZZ RATING Unity	paste pH Unity	Total S %	SO_4 (carb leach) %	SO_4 (HCl leach) %	Sx %	MPA kg $CaCO_3$/t	Sx AP kg $CaCO_3$/t	AP adjust for ZnS kg $CaCO_3$/t	TIC %	NP kg CaCO3/t	CNP (TIC) kg $CaCO_3$/t	ICP-Ca NP kg $CaCO_3$/t	CO2 %	NNP kg $CaCO_3$/t	NP:MPA Unity	NP/AP Unity	NAG @ pH 4.5 kg $H2SO_4$/t	NAG @ pH 7.0 kg $H2SO_4$/t	AG pH Unity
COMPM261875-M261884	BWWR03	54	62	AND	T	1	8.1	0.02	0.01	0.01	0.0	0.6	0.3	0.1	0.1	13.00	5.8	64.9	0.1	12.0	21.67	41.60			
COMPG012290-G012299	BWWR11	77	86	VC	T	1	7.9	0.02	0.02	0.01	0.0	0.6	0.3	0.1	0.1	3.00	4.2	8.7	0.2	2.0	5.00	9.60			
BW-ARD 627	GM12-02	5	15	FLPT	T	1	8.4	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	4.00	4.2	0.2	0.2	4.0	13.33	12.80	0.0	4.5	6.5
BW-ARD-390	BW0177	167	177	AND	S	2	8.2	0.32	0.02	0.01	0.3	10.0	9.4	9.2	0.5	36.00	41.7	59.7	1.8	26.0	3.60	3.84	0.0	0.0	11.0
BW-ARD-540	BW0198	182	192	VC	S	2	8.7	0.22	0.01	0.02	0.2	6.9	6.9	6.7	0.1	17.00	10.8	36.9	0.5	10.0	2.46	2.47	0.0	0.0	9.3
COMPM261530-M261539	BWWR05	19	28	AND	T	2	8.6	0.07	0.01	0.01	0.1	2.2	1.9	1.7	0.2	26.00	16.7	96.9	0.7	24.0	11.82	13.87			
BW-ARD-679	GM12-05	80	90	FT	O	1	7.8	0.02	0.01	0.02	0.0	0.6	0.3	0.1	0.1	3.00	4.2	0.2	0.2	2.0	5.00	9.60	0.0	0.0	8.7
BW-ARD-440	BW0171	238	248	AND	S	2	8.4	0.26	0.01	0.02	0.3	8.1	8.1	7.9	0.3	35.00	25.9	62.2	1.1	27.0	4.32	4.31	0.0	0.0	9.7
COMPG012231-G012240	BWWR11	26	35	AND	T	2	8.0	0.17	0.01	0.01	0.2	5.3	5.0	4.8	0.2	23.00	13.3	72.1	0.6	18.0	4.34	4.60			
COMPG012441-G012450	BWWR11	208	217	VC	S	2	8.2	0.03	0.01	0.01	0.0	0.9	0.6	0.4	0.1	13.00	8.3	32.0	0.4	12.0	14.44	20.80			
BW-ARD-582	BW0096	70	80	FT	T	1	6.5	0.01	0.01	0.01	0.0	0.3	0.3	0.1	0.1	1.00	4.2	0.2	0.2	5.0	3.33	3.20	0.0	0.0	8.3
COMPG012221-G012230	BWWR11	18	26	AND	T	1	8.0	0.01	0.02	0.02	0.0	0.3	0.3	0.1	0.1	11.00	4.2	69.4	0.2	11.0	36.67	35.20			
BW-ARD-144	BW0088	260	270	AND	S	2	8.5	0.32	0.01	0.01	0.3	10.0	9.7	9.5	0.1	25.00	9.2	33.9	0.4	15.0	2.50	2.58	0.0	0.7	6.9
BW-ARD-205	BW0115	90	100	FT	O	1	7.6	0.02	0.02	0.01	0.0	0.6	0.3	0.1	0.1	2.00	4.2	0.2	0.2	1.0	3.33	6.40	0.0	0.0	6.4
BW-ARD-392	BW0177	187	197	AND	S	2	7.3	0.34	0.02	0.01	0.3	10.6	10.0	9.8	0.2	27.00	18.3	58.7	0.8	16.0	2.55	2.70	0.0	0.0	9.3
BW-ARD 609	GM12-01	136	146	VC	S	1	8.9	0.08	0.01	0.01	0.1	2.5	2.5	2.3	0.1	10.00	5.8	20.7	0.2	8.0	4.00	4.00	0.0	0.0	8.6
BW-ARD-410	BW0181	281	291	AND	S	2	7.2	0.04	0.01	0.03	0.0	1.3	1.3	1.1	0.4	49.00	34.2	71.9	1.5	48.0	37.69	39.20	0.0	0.0	10.5
BW-ARD-408	BW0181	170	180	AND	S	2	8.3	0.03	0.01	0.04	0.0	0.9	0.9	0.8	0.2	25.00	12.5	47.7	0.6	24.0	27.78	26.67	0.0	0.0	8.6
COMPM261510-M261519	BWWR05	0	10	AND	O/T	1	8.7	0.09	0.01	0.01	0.1	2.8	2.8	2.6	0.1	14.00	5.0	87.9	0.2	11.0	5.00	4.98			
COMPW005914-W005924	BWWR12	216	225	VC	S	2	8.9	0.06	0.01	0.02	0.1	1.9	1.9	1.7	0.1	17.00	11.7	23.2	0.5	15.0	8.95	9.07	0.0	0.0	9.9
COMPW005925-W005935	BWWR12	225	235	VC	S	2	9.1	0.02	0.01	0.01	0.0	0.6	0.6	0.5	0.1	16.00	8.3	21.0	0.4	15.0	26.67	25.60	0.0	0.0	9.4
BW-ARD-409	BW0181	205	215	AND	S	2	7.9	0.07	0.01	0.03	0.1	2.2	1.9	1.7	0.2	34.00	20.0	54.9	0.9	32.0	15.45	18.13	0.0	0.0	10.0
BW-ARD-421	BW0182	243	253	AND	S	2	7.4	0.24	0.01	0.03	0.2	7.5	7.2	7.0	0.3	39.00	24.2	71.6	1.1	32.0	5.20	5.43	0.0	0.0	11.0
BW-ARD-441	BW0171	252	262	AND	S	1	8.3	0.40	0.01	0.01	0.4	12.5	12.2	12.0	0.2	29.00	20.0	50.9	0.9	17.0	2.32	2.38	0.0	0.0	9.6
COMPM261520-M261529	BWWR05	10	19	AND	T	1	8.7	0.15	0.01	0.01	0.2	4.7	4.7	4.5	0.1	16.00	7.5	80.6	0.3	11.0	3.40	3.41			
BW-ARD-465 (duplicate)	BW0174	163	167	VC	S	2	8.7	0.03	0.01	0.01	0.0	0.9	0.9	0.8	1.1	92.00	95.1	82.4	4.2	91.0	102.22	98.13			
BW-ARD-378	BW0100	40	50	AND	S/T	2	8.2	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	19.00	9.2	38.2	0.4	19.0	63.33	60.80	0.0	0.0	10.0
BW-ARD-397	BW0177	237	247	AND	S	2	7.5	0.16	0.02	0.03	0.1	5.0	4.4	4.2	0.2	29.00	19.2	53.4	0.8	24.0	5.80	6.63	0.0	0.0	9.8
BW-ARD-254	BW0079	10	20	FT	T	1	7.7	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	3.00	4.2	0.2	0.2	3.0	10.00	9.60	4.6	11.5	3.4
COMPW006162-W006173	BWWR13	176	186	CGL	S	1	9.2	0.20	0.02	0.01	0.2	6.3	5.6	5.5	0.1	18.00	5.8	81.6	0.2	12.0	2.86	3.20			
COMPM261835-M261844	BWWR03	19	28	AND	T	1	8.7	0.02	0.01	0.01	0.0	0.6	0.3	0.2	0.1	11.00	4.2	50.2	0.1	10.0	18.33	35.20			
COMPW005937-W005947	BWWR12	235	245	VC	S	2	9.0	0.03	0.01	0.02	0.0	0.9	0.9	0.8	0.2	21.00	15.0	27.7	0.7	20.0	23.33	22.40	0.0	0.0	10.5
COMPM261700-M261703	BWWR05	166	169.5	VC	S	2	8.9	0.04	0.01	0.01	0.0	1.3	0.9	0.8	0.2	17.00	15.8	43.9	0.7	16.0	13.08	18.13			
BW-ARD-420	BW0182	216	226	AND	S	2	7.2	0.13	0.01	0.03	0.1	4.1	3.8	3.6	0.4	46.00	31.7	65.7	1.4	42.0	11.22	12.27	0.0	0.0	11.0
COMPW006300-W006310	BWWR13	296	306		S	1	9.0	0.11	0.03	0.01	0.1	3.4	2.5	2.4	0.1	15.00	10.0	53.9	0.4	12.0	4.41	6.00			
BW-ARD-462	BW0174	40	50	VC	S	3	7.6	0.46	0.01	0.01	0.5	14.4	14.1	13.9	0.4	46.00	35.0	70.4	1.5	32.0	3.19	3.27	0.0	0.0	10.5
BW-ARD-419	BW0182	186	196	AND	S	2	7.4	0.03	0.01	0.04	0.0	0.9	0.9	0.8	0.6	61.00	49.2	77.4	2.2	60.0	67.78	65.07	0.0	0.0	11.5
BW-ARD 623	GM12-01	356	366	VC	T	2	8.4	0.03	0.01	0.01	0.0	0.9	0.9	0.8	0.3	32.00	21.7	53.9	1.0	31.0	35.56	34.13	0.0	0.0	10.0
COMPM261690-M261699	BWWR05	158	166	VC	S	2	8.9	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.2	15.00	15.0	31.7	0.7	15.0	50.00	48.00			
COMPG012481-G012490	BWWR11	243	252	VC	T/S	1	8.1	0.01	0.01	0.02	0.0	0.3	0.3	0.2	0.1	11.00	6.7	26.2	0.3	11.0	36.67	35.20			
BW-ARD-101	BW0115	43	53	FT	O	1	8.0	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	2.00	4.2	0.5	0.2	2.0	6.67	6.40	0.0	0.0	7.4
COMPW005596-W005606	BWWR14	203	213		T	2	9.1	0.06	0.01	0.01	0.1	1.9	1.9	1.7	0.1	12.00	9.2	31.5	0.4	10.0	6.32	6.40			
COMPG012510-G012520	BWWR11	269	277	VC	T/S	1	8.2	0.02	0.01	0.01	0.0	0.6	0.3	0.2	0.1	9.00	4.2	38.7	0.2	8.0	15.00	28.80			
COMPM261458-M261467	BWWR06	55	63	VC	T	2	8.6	0.06	0.01	0.01	0.1	1.9	1.9	1.7	0.3	17.00	25.0	27.2	1.1	15.0	8.95	9.07			
BW-ARD 626	GM12-01	386	396	VC	S	2	9.0	0.10	0.01	0.01	0.1	3.1	3.1	3.0	0.1	23.00	10.0	69.9	0.5	20.0	7.42	7.36	0.0	0.0	9.6
COMPW005880-W005890	BWWR12	186	196	VC	S	2	9.1	0.08	0.02	0.02	0.1	2.5	1.9	1.7	0.1	10.00	5.0	13.5	0.2	8.0	4.00	5.33	0.0	0.0	8.4
BW-ARD-411	BW0182	20	30	FT	T	1	7.3	0.01	0.01	0.02	0.0	0.3	0.3	0.2	0.1	1.00	4.2	0.7	0.2	1.0	3.33	3.20	0.0	0.0	7.2
BW-ARD 625	GM12-01	376	386	VC	S	2	8.9	0.13	0.01	0.01	0.1	4.1	4.1	3.9	0.1	23.00	10.8	57.2	0.5	19.0	5.61	5.66	0.0	0.0	8.8
BW-ARD-422	BW0182	268	278	AND	S	1	7.5	0.02	0.01	0.03	0.0	0.6	0.6	0.5	0.2	28.00	15.0	63.7	0.7	27.0	46.67	44.80	0.0	0.0	10.0
COMPW006312-W006320	BWWR13	306	314	CGL	S	1	8.8	0.25	0.02	0.02	0.2	7.8	7.2	7.1	0.1	16.00	9.2	45.7	0.4	8.0	2.05	2.23			
COMPM261680-M261689	BWWR05	149	158	VC	S	2	9.1	0.07	0.01	0.01	0.1	2.2	1.9	1.8	0.1	9.00	6.7	23.0	0.3	7.0	4.09	4.80			
COMPM261885-M261894	BWWR03	62	71	AND	T	1	8.6	0.02	0.01	0.01	0.0	0.6	0.6	0.5	0.1	14.00	8.3	45.2	0.1	13.0	23.33	22.40			
BW-ARD-204	BW0115	43	53	FT	O	1	7.9	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	2.00	4.2	0.2	0.2	2.0	6.67	6.40	0.0	6.3	6.4
COMPM261398-M261407	BWWR06	2	10		O	1	7.9	0.13	0.01	0.01	0.1	4.1	3.8	3.6	0.1	11.00	4.2	33.4	0.2	7.0	2.68	2.93			
COMPW005832-W005842	BWWR12	144	154	VC	S	1	9.0	0.09	0.01	0.01	0.1	2.8	2.8	2.7	0.1	7.00	4.2	17.2	0.2	4.0	2.50	2.49			
COMPM261895-M261904	BWWR03	71	80		T	1	7.9	0.02	0.01	0.01	0.0	0.6	0.6	0.5	0.1	11.00	5.8	30.7	0.1	10.0	18.33	17.60			
COMPW005607-W005617	BWWR14	213	223	VC	T/S	1	9.0	0.03	0.01	0.01	0.0	0.9	0.9	0.8	0.1	6.00	4.2	14.7	0.2	5.0	6.67	6.40			
BW-ARD-336	BW0100	65	75	AND	S	1	7.2	0.19	0.01	0.02	0.2	5.9	5.6	5.5	0.1	13.00	5.8	34.7	0.3	7.0	2.20	2.31	0.0	0.0	7.1
BW-ARD-405	BW0181	67	77	AND	S	2	7.3	0.43	0.01	0.01	0.4	13.4	13.4	13.3	0.2	29.00	18.3	51.9	0.8	16.0	2.16	2.16	0.0	0.0	9.3
COMPG012320-G012329	BWWR11	102	111	VC	T	1	8.3	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	4.00	4.2	16.5	0.2	4.0	13.33	12.80			
COMPM261428-M261437	BWWR06	28	36	VC	T	2	8.2	0.22	0.01	0.01	0.2	6.9	6.6	6.5	0.3	23.00	21.7	25.2	0.9	16.0	3.33	3.50			
COMPW005618-W005628	BWWR14	223	232		S	2	9.2	0.12	0.01	0.01	0.1	3.8	3.4	3.3	0.1	8.00	4.2	36.9	0.2	4.0	2.11	2.33			
COMPM261804-M261814	BWWR04	110	120	VC	S	2	9.2	0.05	0.01	0.01	0.1	1.6	1.6	1.5	0.1	4.00	4.2	7.5	0.2	2.0	2.50	2.56			
BW-ARD-379	BW0100	80	90	AND	S	1	8.0	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	9.00	4.2	23.2	0.2	9.0	30.00	28.80	0.0	0.0	8.6
COMPM261734-M261743	BWWR04	50	58	PPY	T	2	8.4	0.01	0.01	0.02	0.0	0.3	0.3	0.2	0.2	20.00	16.7	50.7	0.7	20.0	66.67	64.00			
COMPW006289-W006299	BWWR13	286	296	CGL	S	1	8.8	0.12	0.03	0.01	0.1	3.8	2.8	2.7	0.1	15.00	8.3	36.7	0.4	11.0	3.95	5.33			
COMPW005993-W006002	BWWR12	284	293		S	2	8.9	0.03	0.01	0.02	0.0	0.9	0.9	0.8	0.2	24.00	15.0	35.2	0.7	23.0	26.67	25.60	0.0	0.0	9.8
COMPW005948-W005959	BWWR12	245	255	VC	S	2	9.0	0.01	0.01	0.02	0.0	0.3	0.3	0.2	0.2	18.00	12.5	21.0	0.6	18.0	60.00	57.60	0.0	0.0	10.0
COMPW006266-W006276	BWWR13	266	276	CGL	S	2	8.5	0.34	0.02	0.01	0.3	10.6	10.0	9.9	0.3	33.00	22.5	70.9	1.0	22.0	3.11	3.30			
COMPM261670-M261679	BWWR05	140	149	VC	T/S	2	9.1	0.05	0.01	0.01	0.0	1.6	1.3	1.2	0.1	9.00	5.8	15.7	0.3	7.0	5.63	7.20			
COMPG012310-G012319	BWWR11	95	102	VC	T	1	8.2	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	4.00	4.2	10.7	0.2	4.0	13.33	12.80			
COMPW005857-W005868	BWWR12	166	176	VC	S	1	8.7	0.02	0.01	0.02	0.0	0.6	0.6	0.5	0.1	7.00	4.2	13.2	0.2	6.0	11.67	11.20	0.0	0.0	8.5
COMPW005501-W005510	BWWR14	121	129	VC	T	2	9.1	0.14	0.01	0.01	0.1	4.4	4.1	4.0	0.1	9.00	5.8	29.7	0.3	5.0	2.05	2.22			
COMPW005431-W005440	BWWR14	60	69		T/S	2	8.6	0.11	0.04	0.01	0.1	3.4	2.2	2.1	0.1	16.00	10.0	45.4	0.4	13.0	4.71	7.31			
COMPM261905-M261914	BWWR03	80	88	VC	T	1	8.7	0.03	0.01	0.01	0.0	0.9	0.9	0.8	0.1	6.00	4.2	15.0	0.1	5.0	6.67	6.40			
COMPM261704-M261813	BWWR04	24	32	PPY	T	2	8.4	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.3	23.00	20.9	54.8	0.9	23.0	76.67	73.60			
COMPM261660-M261669	BWWR05	132	140	VC	T	2	9.3	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	10.00	8.3	23.2	0.4	10.0	33.33	32.00			
COMPG012461-G012470	BWWR11	227	234	VC	S	1	8.3	0.01	0.01	0.02	0.0	0.3	0.3	0.2	0.1	5.00	4.2	14.0	0.2	5.0	16.67	16.00			
COMPW006174-W006184	BWWR13	186	196	CGL	S	1	9.3	0.15	0.02	0.01	0.1	4.7	4.1	4.0	0.1	18.00	7.5	87.1	0.3	13.0	3.83	4.43			
BW-ARD-678	GM12-05	70	80	FT	O	1	7.8	0.01	0.01	0.02	0.0	0.3	0.3	0.2	0.1	2.00	4.2	0.2	0.2	2.0	6.67	6.40	0.0	10.2	6.1
COMPM261754-M261763	BWWR04	67	76	AND/PPY	T	1	8.3	0.17	0.02	0.01	0.2	5.3	4.7	4.6	0.1	13.00	8.3	41.7	0.4	8.0	2.45	2.77			
COMPG012451-G012460	BWWR11	217	227	VC	S	1	8.5	0.03	0.01	0.01	0.0	0.9	0.6	0.5	0.1	5.00	4.2	31.7	0.2	4.0	5.56	8.00			
COMPG012431-G012440	BWWR11	198	208	VC	S	1	8.1	0.01	0.01	0.03	0.0	0.3	0.3	0.2	0.1	9.00	4.2	28.5	0.2	9.0	30.00	28.80			
COMPG012350-G012359	BWWR11	128	137	VC	T	1	8.3	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	8.00	4.2	19.5	0.2	8.0	26.67	25.60			
COMPW005853-W005855	BWWR12	163	166	VC	S	1	8.7	0.06	0.01	0.01	0.1	1.9	1.6	1.5	0.1	4.00	4.2	6.7	0.2	2.0	2.11	2.56			
COMPW005730-W005740	BWWR12	55	66	VC	T	1	8.6	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	7.00	5.0	23.2	0.2	7.0	23.33	22.40			
COMPG012340-G012349	BWWR11	120	128	VC	T	1	8.3	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	4.00	4.2	13.0	0.2	4.0	13.33	12.80			
COMPG012411-G012420	BWWR11	179	187	VC	S	1	8.1	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	6.00	4.2	28.2	0.2	6.0	20.00	19.20			
COMPG012371-G012380	BWWR11	145	153	VC	T/S	1	8.0	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	6.00	4.2	18.0	0.2	6.0	20.00	19.20			
COMPW005491-W005500	BWWR14	112	121	VC	S/T	2	9.0	0.05	0.03	0.01	0.0	1.6	0.6	0.5	0.1	6.00	4.2	11.0	0.2	4.0	3.75	9.60			
COMPM261651-M261659	BWWR05	124	132	VC	T	2	9.0	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	4.00	4.2	15.5	0.2	4.0	13.33	12.80			
COMPG012471-G012480	BWWR11	234	243	VC	S/T	1	8.1	0.03	0.01	0.01	0.0	0.9	0.6	0.5	0.1	6.00	4.2	12.2	0.2	5.0	6.67	9.60			
COMPG012421-G012430	BWWR11	187	198	VC	S	1	8.4	0.01	0.01	0.02	0.0	0.3	0.3	0.2	0.1	6.00	4.2	25.0	0.2	6.0	20.00	19.20			
COMPW005798-W005809	BWWR12	115	125	VC	T/S	1	8.9	0.05	0.01	0.01	0.0	1.6	1.3	1.2	0.1	5.00	4.2	11.7	0.2	3.0	3.13	4.00			
COMPG012330-G012339	BWWR11	111	120		T	1	8.2	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	4.00	4.2	17.2	0.2	4.0	13.33	12.80			
COMPG012391-G012400	BWWR11	162	171	VC	S	1	8.1	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	6.00	4.2	26.2	0.2	6.0	20.00	19.20			
COMPW006003-W006010	BWWR12	293	300		S	2	8.8	0.02	0.01	0.02	0.0	0.6	0.6	0.5	0.2	25.00	16.7	37.4	0.7	24.0	41.67	40.00	0.0	0.0	11.0
COMPW005521-W005530	BWWR14	138	147	VC	T	2	8.9	0.02	0.01	0.01	0.0	0.6	0.3	0.2	0.1	9.00	5.8	22.7	0.2	8.0	15.00	28.80			
BW-ARD-165	BW0099	31	41	FT	T	1	7.0	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	2.00	4.2	0.5	0.2	2.0	6.67	6.40	0.0	22.6	5.8
COMPG012491-G012499	BWWR11	252	260	VC	T	1	8.0	0.07	0.01	0.01	0.1	2.2	1.9	1.8	0.1	5.00	4.2	19.2	0.2	3.0	2.27	2.67			
COMPW005686-W005696	BWWR14	281	291	VC	S	2	9.2	0.03	0.01	0.01	0.0	0.9	0.9	0.9	0.1	11.00	5.8	37.4	0.3	10.0	12.22	11.73			
COMPG012381-G012390	BWWR11	153	162	VC	S	1	8.3	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	5.00	4.2	16.0	0.2	5.0	16.67	16.00			
COMPW005742-W005752	BWWR12	66	76	VC	T	1	8.5	0.08	0.02	0.01	0.1	2.5	1.9	1.8	0.1	6.00	4.2	12.0	0.2	4.0	2.40	3.20			
COMPW005753-W005762	BWWR12	76	85	VC	T	1	8.5	0.04	0.01	0.01	0.0	1.3	0.9	0.9	0.1	4.00	4.2	10.2	0.2	3.0	3.08	4.27			
COMPW005541-W005550	BWWR14	155	164	VC	S/T	2	9.0	0.04	0.01	0.01	0.0	1.3	0.9	0.9	0.1	7.00	5.8	23.2	0.3	6.0	5.38	7.47			
COMPW005461-W005470	BWWR14	86	95		S	2	8.5	0.06	0.03	0.01	0.0	1.9	0.9	0.9	0.1	12.00	11.7	27.2	0.5	10.0	6.32	12.80			
COMPG012360-G012370	BWWR11	137	145		T	1	8.4	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	7.00	4.2	19.0	0.2	7.0	23.33	22.40			
COMPW005719-W005729	BWWR12	45	55	VC	T	1	8.7	0.01	0.01	0.01	0.0	0.3	0.3	0.2	0.1	8.00	5.0	31.2	0.2	8.0	26.67	25.60			
COMPW005652-W005663	BWWR14	252	262		T	2	8.6	0.12	0.01	0.01	0.1	3.8	3.8	3.7	0.1	11.00	8.3	21.2	0.4	7.0	2.89	2.93			
COMPW005664-W005570	BWWR14	262	268	VC	T/S	2	8.6	0.06	0.01	0.01

Table A3-2: Acid Base Accounting and NAG Test Results for Waste Rock Samples

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	FIZZ RATING	paste pH	Total S	SO_4 (carb leach)	SO_4 (HCl leach)	Sx	MPA	Sx AP	AP adjust for ZnS	TIC	NP	CNP (TIC)	ICP-Ca NP	CO2	NNP	NP:MPA	NP/AP	NAG @ pH 4.5	NAG @ pH 7.0	NAG pH
						Unity	Unity	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	%	kg CaCO3/t	kg $CaCO_3$/t	kg $CaCO_3$/t	%	kg CaCO3/t	Unity	Unity	kg $H2SO_4$/t	kg $H2SO_4$/t	Unity
COMPW005411-W005420	BWWR14	42	51		T	2	8.7	0.05	0.01	0.01	0.1	1.6	1.6	1.5	0.1	8.00	4.2	25.2	0.2	6.0	5.00	5.12			
COMPW005573-W005583	BWWR14	183	193	VC	S/T	1	9.1	0.04	0.02	0.01	0.0	1.3	0.6	0.6	0.1	8.00	7.5	18.5	0.4	7.0	6.15	12.80			
BW-ARD-677	GM12-05	60	70	FT	O	1	7.7	0.01	0.01	0.02	0.0	0.3	0.3	0.3	0.1	3.00	4.2	0.5	0.2	3.0	10.00	9.60	0.0	7.4	6.0
COMPW005511-W005520	BWWR14	129	138	VC	T	2	9.2	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	8.00	4.2	22.0	0.2	8.0	26.67	25.60			
COMPW005441-W005450	BWWR14	69	77	VC	S	2	8.7	0.05	0.07	0.01	0.0	1.6	0.3	0.3	0.1	9.00	5.8	25.2	0.3	7.0	5.63	28.80			
COMPW005629-W005639	BWWR14	232	242		S/T/O	2	8.7	0.20	0.04	0.01	0.2	6.3	5.0	4.9	0.1	13.00	10.0	33.4	0.4	7.0	2.06	2.60			
COMPW005561-W005572	BWWR14	173	183		S	1	9.2	0.10	0.01	0.01	0.1	3.1	3.1	3.1	0.1	8.00	6.7	22.0	0.3	5.0	2.58	2.56			
BW-ARD-169	BW0100	113	123	VC	S	1	8.6	0.01	0.01	0.01	0.0	0.3	0.3	0.3	0.1	6.00	4.2	4.7	0.2	6.0	20.00	19.20	0.0	5.0	6.6

Table A3-3: Acid Base Accounting and NAG Test Results for Ore Samples

Sample ID	Hole ID	From (m)	To (m)	Lithology	Oxidation Facies	FIZZ RATING	paste pH	Total S	SO_4(carb leach)	SO_4 (HCl leach)	Sx	MPA	Sx AP	ZnS adjusted AP	TIC	NP	CNP (TIC)	ICP-Ca NP	CO2	NNP	NP:MPA	NP/AP	NAG @ pH 4.5	NAG @ pH 7.0	NAG pH
						Unity	Unity	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	%	kg $CaCO_3$/t	Unity	Unity	kg $H2SO_4$/t	kg $H2SO_4$/t	Unity
BW-ARD2-2	BW0043	79	89	CR SIL		1.0	6.30	1.66	0.05	0.01	1.61	51.90	50.31	47.95	0.05	2.00	4.17	0.25	0.20	-50.00	0.04	0.04			
BW-ARD-010	BW0043	79	89	CR SIL		1.0	5.50	1.73	0.02	0.04	1.71	54.10	53.44	47.55	0.05	0.00	4.17	0.25	0.20	-54.00	0.00	0.00	35.50	45.60	2.80
BW-ARD-011	BW0043	263	273	SIL 5/CR SIL		1.0	5.90	1.47	0.01	0.01	1.46	45.90	45.63	35.80	0.09	5.00	7.51	1.50	0.30	-41.00	0.11	0.11	20.90	33.40	2.90
BW-ARD2-1	BW0043	47	57	CR SIL		1.0	5.20	1.38	0.06	0.01	1.32	43.10	41.25	28.17	0.05	0.00	4.17	0.50	0.20	-43.00	0.00	0.00			
BW-ARD2-12	BW0044	132	142	CR SIL/ SIL 5		1.0	5.40	1.39	0.05	0.02	1.34	43.40	41.88	37.28	0.06	2.00	5.00	0.25	0.20	-41.00	0.05	0.05			
BW-ARD-012	BW0044	69	80	CR SIL/ SIL 5		1.0	5.10	1.02	0.02	0.02	1.00	31.90	31.25	21.83	0.05	1.00	4.17	0.25	0.20	-31.00	0.03	0.03	16.20	27.50	2.80
BW-ARD2-10	BW0044	69	80	CR SIL/ SIL 5		1.0	5.20	1.10	0.05	0.01	1.05	34.40	32.81	21.77	0.05	4.00	4.17	0.50	0.20	-30.00	0.12	0.12			
BW-ARD2-11	BW0044	100	110	CR CHL/CR SIL		1.0	5.60	1.83	0.06	0.01	1.77	57.20	55.31	43.52	0.14	6.00	11.68	0.75	0.50	-51.00	0.10	0.11			
BW-ARD-005	BW0058	241	251	AND/ L/ATFF		1.0	5.10	3.37	0.07	0.02	3.30	105.30	103.13	100.93	0.10	12.00	8.34	8.49	0.40	-93.00	0.11	0.12	67.10	84.20	2.60
BW-ARD-275	BW0062	174	184	SIL 5/ CR CHL	S	1.0	5.50	1.71	0.01	0.01	1.71	53.40	53.44	52.46	0.17	10.00	14.18	0.75	0.60	-43.00	0.19	0.19	35.40	43.80	2.80
BW-ARD-276	BW0062	147	157	SIL 5	S	1.0	7.40	1.33	0.01	0.01	1.32	41.60	41.25	39.76	0.05	4.00	4.17	0.25	0.20	-38.00	0.10	0.10	28.50	34.60	2.90
BW-ARD-013	BW0062	147	157	SIL 5	S	1.0	5.60	1.46	0.02	0.01	1.44	45.60	45.00	43.07	0.05	1.00	4.17	0.25	0.20	-45.00	0.02	0.02	31.20	38.70	2.80
BW-ARD-002	BW0070	197	207	SIL 5	S	1.0	6.70	1.32	0.01	0.02	1.32	41.30	41.25	40.95	0.22	16.00	18.35	1.25	0.80	-25.00	0.39	0.39	17.10	23.80	3.00
BW-ARD-001	BW0070	19	29	LTFF/ RHY	T	1.0	7.70	0.01	0.01	0.01	0.01	0.30	0.31	0.31	0.05	5.00	4.17	1.00	0.20	5.00	16.00	16.00	0.01	0.01	9.00
BW-ARD2-13	BW0072	93	103	SIL 2	S	1.0	6.60	1.49	0.02	0.01	1.47	46.60	45.94	45.45	0.11	5.00	9.17	0.75	0.40	-42.00	0.11	0.11			
BW-ARD-259	BW0072	39	49	SIL 2	T	1.0	4.60	0.61	0.06	0.03	0.55	19.10	17.19	16.91	0.05	1.00	4.17	0.25	0.20	-18.00	0.05	0.06	10.70	14.50	3.00
BW-ARD-258	BW0072	280	290	SIL 5	S	1.0	6.80	1.38	0.01	0.03	1.38	43.10	43.13	37.43	0.05	3.00	4.17	0.50	0.20	-40.00	0.07	0.07	25.30	37.70	2.90
BW-ARD-280	BW0073	100	110	SIL 2	S	1.0	7.10	0.48	0.01	0.01	0.47	15.00	14.69	14.59	0.06	4.00	5.00	0.50	0.20	-11.00	0.27	0.27	6.95	11.65	3.20
BW-ARD-277	BW0073	212	222	SIL 5	S	1.0	7.90	0.56	0.01	0.02	0.55	17.50	17.19	14.83	0.05	4.00	4.17	0.50	0.20	-14.00	0.23	0.23	6.58	12.90	3.30
BW-ARD-249	BW0074	175	185	SIL 2	S	1.0	4.80	4.55	0.07	0.01	4.48	142.20	140.00	123.76	0.15	6.00	12.51	3.99	0.60	-136.00	0.04	0.04	85.80	106.00	2.60
BW-ARD-235	BW0082	123	133	AND	S	1.0	5.80	2.40	0.04	0.04	2.36	75.00	73.75	69.08	0.05	13.00	4.17	8.74	0.20	-62.00	0.17	0.18	44.10	59.50	2.80
BW-ARD-006	BW0082	43	53	FT	S	1.0	5.40	1.36	0.09	0.01	1.27	42.50	39.69	24.87	0.05	0.00	4.17	0.25	0.20	-43.00	0.00	0.00	17.65	31.80	2.90
BW-ARD-234	BW0082	15	25	FT	T	1.0	4.30	0.51	0.08	0.01	0.43	15.90	13.44	10.74	0.05	2.00	4.17	0.25	0.20	-14.00	0.13	0.15	7.67	12.95	3.10
BW-ARD-007	BW0097	8	19	FT	T	1.0	7.80	0.02	0.01	0.01	0.02	0.60	0.63	0.23	0.05	1.00	4.17	0.25	0.20	0.00	1.60	1.60	0.01	13.45	6.10
BW-ARD-285	BW0097	8	19	FT	T	1.0	7.60	0.03	0.01	0.01	0.03	0.90	0.94	0.54	0.05	4.00	4.17	0.50	0.20	3.00	4.27	4.27	0.01	2.42	6.50
BW-ARD-283	BW0097	149	159	FT	S	1.0	6.90	1.89	0.01	0.01	1.89	59.10	59.06	51.86	0.05	12.00	4.17	6.24	0.20	-47.00	0.20	0.20	32.20	45.30	2.80
BW-ARD-008	BW0097	149	159	FT	S	1.0	7.00	1.99	0.01	0.02	1.99	62.20	62.19	54.54	0.05	17.00	4.17	5.99	0.20	-45.00	0.27	0.27	31.90	46.90	2.80
BW-ARD-247	BW0103	65	75	FT	T	1.0	5.20	1.07	0.01	0.04	1.06	33.40	33.13	32.92	0.10	5.00	8.34	0.50	0.40	-28.00	0.15	0.15	20.50	27.90	3.10
BW-ARD-003	BW0103	245	255	FT	S	1.0	5.40	1.88	0.02	0.01	1.86	58.80	58.13	51.91	0.11	7.00	9.17	1.00	0.40	-52.00	0.12	0.12	34.90	47.50	2.70
BW-ARD-248	BW0103	181	191	AND/VC	S	1.0	5.80	1.39	0.03	0.01	1.36	43.40	42.50	36.02	0.09	9.00	7.51	0.50	0.30	-34.00	0.21	0.21	22.60	34.20	3.10
BW-ARD-004	BW0103	147	157	FT	S	1.0	5.90	1.84	0.01	0.02	1.84	57.50	57.50	48.95	0.11	9.00	9.17	0.75	0.40	-49.00	0.16	0.16	32.40	46.60	2.70
BW-ARD-243	BW0103	225	235	FT	S	1.0	4.60	2.00	0.04	0.01	1.96	62.50	61.25	52.67	0.14	9.00	11.68	0.50	0.50	-54.00	0.14	0.15	38.30	53.00	2.90
BW-ARD-226	BW0107	145	155	FT	S	1.0	6.60	1.43	0.02	0.03	1.41	44.70	44.06	36.86	0.05	4.00	4.17	2.25	0.20	-41.00	0.09	0.09	25.00	38.10	3.00
BW-ARD-227	BW0107	200	210	FT	S	1.0	7.20	2.48	0.03	0.05	2.45	77.50	76.56	68.06	0.05	7.00	4.17	6.74	0.20	-71.00	0.09	0.09	50.60	67.10	2.80
BW-ARD-224	BW0109	125	135	FLPT	S	1.0	7.00	2.38	0.02	0.04	2.36	74.40	73.75	63.52	0.05	12.00	4.17	7.74	0.20	-62.00	0.16	0.16	41.20	62.50	2.90
BW-ARD-009	BW0111	218	228	FT	S	1.0	7.30	2.62	0.01	0.02	2.83	81.90	88.44	75.54	0.07	14.00	5.84	9.24	0.30	-68.00	0.17	0.16	37.10	56.50	2.80
BW-ARD-014	BW0112	161	171	FT	S	1.0	6.00	2.59	0.01	0.03	2.58	80.90	80.63	74.91	0.13	10.00	10.84	9.99	0.50	-71.00	0.12	0.12	49.50	65.00	2.40
BW-ARD-209	BW0114	100	110	FT	S	1.0	6.50	2.52	0.03	0.01	2.49	78.80	77.81	75.48	0.05	2.00	4.17	0.75	0.20	-77.00	0.03	0.03	65.20	74.80	2.70
BW-ARD-110a	BW0114	25	35	FT	O/T	1.0	6.10	0.67	0.03	0.01	0.64	20.90	20.00	13.67	0.05	1.00	4.17	0.50	0.20	-20.00	0.05	0.05	4.85	14.35	3.10
BW-ARD-200	BW0116	200	210	FT	S	1.0	5.40	8.90	0.02	0.01	8.88	278.10	277.50	272.03	0.08	4.00	6.67	1.25	0.30	-274.00	0.01	0.01	111.50	131.50	2.50
BW-ARD-203	BW0116	55	65	FT	T	1.0	6.60	0.31	0.02	0.01	0.29	9.70	9.06	8.07	0.05	2.00	4.17	0.25	0.20	-8.00	0.21	0.22	2.11	5.42	3.50
KM# 2885 Blend Comp 1 Whole Ore				AND		1.0	6.40	1.78	0.02	0.01	1.76	55.60	55.00	50.30	1.15	6.00	95.91	3.99	0.60	-50.00	0.11	0.11	30.70	41.80	2.40
W007677	BW1016	12.1899996	14	FT	O	1.0	7.5	0.03	0.02	0.02	0.01	0.9	0.31	0.31	0.05	2	4.17	1.75	0.2	1	2.13	6.40			
W007678	BW1016	14	15	FT	O	1.0	7.7	0.04	0.02	0.02	0.02	1.3	0.63	0.26	0.06	2	5.00	1.75	0.2	1	1.6	3.20			
W007705	BW1016	38	39	FT	O	1.0	7.3	0.11	0.01	0.01	0.11	3.4	3.44	3.24	0.05	2	4.17	0.75	0.2	-1	0.58	0.58			
W007719	BW1016	49	50	FT	T	1.0	7.6	0.02	0.01	0.02	0.01	0.6	0.31	0.21	0.05	1	4.17	0.50	0.2	0	1.6	3.20			
W007745	BW1016	72	73	VC	T	1.0	5.2	0.61	0.01	0.03	0.6	19.1	18.75	16.36	0.05	0	4.17	0.25	0.2	-19	0	0.00			
K017994	BW1017	297	298	VC	S	1.0	7.3	0.58	0.01	0.01	0.58	18.1	18.13	13.04	0.09	2	7.51	0.75	0.4	-16	0.11	0.11			
W009806	BW1017	562	563	FT	S	1.0	7.6	1.15	0.02	0.02	1.13	35.9	35.31	28.28	0.07	3	5.84	1.50	0.3	-33	0.08	0.08			
W008499	BW1019	57	58	FT	O	1.0	7.5	0.01	0.01	0.01	0.01	0.3	0.31	0.31	0.05	1	4.17	0.50	0.2	1	3.2	3.20			
W008553	BW1019	104	105	FT	T	1.0	5.7	0.61	0.03	0.04	0.58	19.1	18.13	16.67	0.06	0	5.00	0.25	0.2	-19	0	0.00			
CP000258	BW1020	9	10	FT	T	2.0	6.6	0.43	0.02	0.01	0.41	13.4	12.81	8.94	0.5	10	41.70	3.25	1.9	-3	0.74	0.78			
O016769	BW1020	525	526	FT	S	2.0	8.2	0.06	0.01	0.01	0.05	1.9	1.56	1.47	0.31	22	25.85	23.96	1.2	20	11.73	14.08			
O016797	BW1020	550	551	FT	O	1.0	8.2	0.66	0.02	0.02	0.64	20.6	20.00	18.05	0.09	7	7.51	5.99	0.3	-14	0.34	0.35			
O016799	BW1020	551	552	VC/AND	O	1.0	8.2	0.6	0.02	0.03	0.58	18.8	18.13	14.36	0.12	8	10.01	8.24	0.4	-11	0.43	0.44			
O016800	BW1020	552	553	AND/FT	O	1.0	8	0.72	0.03	0.02	0.69	22.5	21.56	18.15	0.1	7	8.34	6.49	0.4	-16	0.31	0.32			
P014960	BW1020	216	217	AND	S	1.0	6.6	1.41	0.02	0.01	1.39	44.1	43.44	35.41	0.05	2	4.17	0.50	0.20	-42	0.05	0.05			
W009075	BW1021	47	48	AND	T	2.0	5.5	1.27	0.02	0.03	1.25	39.7	39.06	38.24	0.29	4	24.19	2.00	1.1	-36	0.1	0.10			
K018200	BW1022	11.4499998	12	FT	O	1.0	8	0.01	0.01	0.01	0.01	0.30	0.31	0.22	0.05	2	4.17	0.50	0.2	2	12.8	6.40			
K018205	BW1022	15	16	FT/AND	O	1.0	7.8	0.05	0.01	0.02	0.04	1.6	1.25	1.09	0.05	1	4.17	0.25	0.20	-1	0.64	0.80			
J020002	BW1023	10	11	FT	O	1.0	7.9	0.06	0.01	0.02	0.06	1.9	1.88	1.34	0.05	1	4.17	0.50	0.2	-1	0.53	0.53			
J020048	BW1023	50	51	FT	T	1.0	6.2	0.42	0.04	0.01	0.38	13.1	11.88	8.96	0.05	1	4.17	0.25	0.2	-12	0.08	0.08			
J020129	BW1023	120	121		S	1.0	5.4	2.3	0.03	0.03	2.27	71.9	70.94	67.26	0.06	0	5.00	0.25	0.2	-72	0	0.00			
J020228	BW1023	206	207		S	1.0	6.3	1.43	0.01	0.02	1.42	44.7	44.38	42.02	0.11	1	9.17	0.50	0.4	-44	0.02	0.02			
J020451	BW1023	409	410		S	1.0	7.6	0.9	0.06	0.01	0.84	28.1	26.25	20.58	0.06	1	5.00	0.25	0.2	-27	0.04	0.04			
W008165	BW1024	7	8		T	1.0	8.1	1.17	0.01	0.01	1.16	36.6	36.25	35.12	0.11	18	9.17	51.92	0.4	-19	0.49	0.50			
K018764	BW1024	6	7		T	1.0	5.1	0.74	0.03	0.02	0.71	23.1	22.19	17.48	0.05	3	4.17	2.00	0.2	-20	0.13	0.14			
K018765	BW1024	7	8		T	1.0	5.7	0.22	0.03	0.01	0.19	6.9	5.94	2.11	0.05	4	4.17	2.00	0.2	-3	0.58	0.67			
K018774	BW1024	14	15		T	1.0	5.6	0.29	0.04	0.02	0.25	9.1	7.81	1.06	0.05	5	4.17	3.49	0.20	-4	0.55	0.64			
K018802	BW1024	42	43		T	1.0	6.6	1.6	0.02	0.03	1.58	50	49.38	34.06	0.05	10	4.17	8.99	0.2	-40	0.2	0.20			
K018824	BW1024	60	61		S	1.0	6.6	1.84	0.01	0.01	1.83	57.5	57.19	45.45	0.05	10	4.17	9.49	0.2	-48	0.17	0.17			
K018837	BW1024	71	72		S	1.0	6.6	2.38	0.02	0.02	2.36	74.4	73.75	58.43	0.08	8	6.67	9.49	0.3	-66	0.11	0.11			

Table A3-4: Acid Base Accounting and NAG Test Results for Metallurgical Tailings Samples

Sample ID	Description	izz Ratin	Paste pH	Total C	Mod. Sobek NP	CNP	P Ca N	NNP	Total S	SO_4(carb l	SO_4 (HCl l	Sulphide S	MPA	AP	NPR	G @ pH	NAG @ pH 7.	NAG pH
				(%)	(kg $CaCO_3$/t)	kg $CaCO_3$/t	CaCO	(kg $CaCO_3$/t)	(%)	(%)	(%)	(%)	(kg $CaCO_3$/t)	kg $CaCO_3$/t)		(kg H_2SO_4	(kg H_2SO_4/t)	
KM# 2885 Test 1, 2 Rougher Tailings	Rougher Tails Flotation Cyanidation (-150µm)	1	8.5	-	7	-	6.7	1	0.18	0.03	0.01	0.15	5.6	4.7	1.2	<0.01	0.21	6.6
KM# 2885 Test 13,14,15 Cleaner Tailings	Cleaner Tails Flotation Cyanidation (-150µm)	2	10		17	-	16.2	-33	1.6	0.04	0.03	1.6	50	49	0.34	20	28	2.6
KM# 2885 Test 8,9 Cyanide Tails	WOL Cyanidation	1	7.7	-	7	-	6.2	-49	1.8	0.02	0.01	1.8	55.6	55	0.13	30	41	2.7
KM# 2885 Blend Comp 1 Whole Ore	WOL Cyanidation	1	6.4	-	6	-	4	-50	1.8	0.02	0.01	1.8	55.6	55	0.11	30.7	41.8	2.4
P_{80}-6.3 mm Cyanidation Tail	Coarse grained heap leach	-	8	-	6.9	-	7.7	-28.4	1.5	0.35	0.88	1.1	35.3	35	0.2			
P_{80}-6.3 mm Cyanidation Tail_Dup	Coarse grained heap leach	-	8	-	6.9	-	7.7	-28.4	1.5	0.35	0.88	1.1	35.3	35	0.2			
P_{80}-150 µm Cyanidation Tail	Fine grained WOL Cyanidation	-	8.4	-	8.9	-	7.7	-25.8	1.3	0.18	0.73	1.1	34.7	35	0.26			
P_{80}-150 µm Cyanidation Tail_Dup	Fine grained WOL Cyanidation	-	8.4	-	8.9	-	7.7	-25.8	1.3	0.18	0.73	1.1	34.7	35	0.26			
WOL-S comp	Heap Leach (mislabelled as WOL)	1	8.2	-	6	-	5.2	-44	1.6	0.01	-	1.6	50.3	49	0.12			
WOL-S comp_Dup	Heap Leach (mislabelled as WOL)	-	-	-	5	-	5	-31.9	1.3	0.01	-	1.2	36.9	37	0.14			
WOL-T comp	Heap Leach (mislabelled as WOL)	1	8.5	-	6	-	5.2	-24	0.95	0.03	-	0.79	30	25	0.2			
WOL-T comp_Dup	Heap Leach (mislabeled as WOL)	-	-	-	10	-	5.7	-3.4	0.49	0.03	-	0.43	13.4	13	0.75			

ANNEX 4
Net Acid Generation Leachate Test Results

Table A4-1: NAG Leachate Results - Overburden Samples

Sample ID	BW-ARD-301 OVB	BW-ARD-309 OVB	BW-ARD-305 OVB	BW-ARD-310 OVB	BW-ARD-315 OVB
ALS Sample ID	L1018920-73	L1018920-74	L1018920-75	L1018920-76	L1018920-77
Physical Tests					
Hardness (as CaCO3)	19.0	9.24	13.7	15.0	9.87
pH	7.20	7.28	8.04	6.53	7.74
Anions and Nutrients					
Sulfate	18.0	1.35	0.68	29.9	3.16
Total Metals					
Aluminum	21.0	17.0	24.5	0.345	2.98
Antimony	0.00303	0.00129	0.00267	0.00152	0.00313
Arsenic	0.0395	0.0250	0.0620	0.00084	0.0149
Barium	0.130	0.134	0.170	0.0507	0.0310
Beryllium	<0.001	<0.001	<0.001	<0.0005	<0.0005
Bismuth	<0.001	<0.001	<0.001	<0.0005	<0.0005
Boron	0.027	0.031	0.026	0.035	0.025
Cadmium	0.00094	0.00108	0.00157	0.00331	0.000584
Calcium	2.60	1.17	1.91	3.58	2.63
Chromium	0.0395	0.0136	0.0336	0.00656	0.0116
Cobalt	0.0106	0.00533	0.00800	0.00670	0.00073
Copper	0.0425	0.0429	0.0280	0.0102	0.0114
Iron	20.8	9.46	17.7	0.146	1.52
Lead	0.0975	0.0130	0.0303	0.00202	0.0161
Lithium	0.014	<0.01	0.018	<0.005	<0.005
Magnesium	3.04	1.54	2.17	1.48	0.80
Manganese	0.493	0.570	0.622	0.941	0.201
Molybdenum	0.00313	0.00397	0.00254	0.00425	0.00639
Nickel	0.0122	0.0072	0.0127	0.00328	0.00143
Phosphorus	0.55	0.42	0.67	<0.3	<0.3
Potassium	6.6	5.1	6.1	4.9	7.8
Selenium	<0.002	<0.002	<0.002	<0.001	<0.001
Silicon	38.3	34.9	39.9	6.74	11.8
Silver	0.000846	0.000183	0.000603	0.00157	0.000301
Sodium	7.5	6.7	6.7	7.6	8.3
Strontium	0.0431	0.0233	0.0429	0.0630	0.0215
Thallium	0.00043	0.00031	0.00049	<0.0001	0.00012
Tin	0.0256	0.0226	0.0340	0.00082	0.00509
Titanium	1.29	0.374	0.947	0.018	0.075
Uranium	0.00305	0.00185	0.00179	0.000313	0.000764
Vanadium	0.132	0.0559	0.127	0.0379	0.0329
Zinc	0.144	0.0820	0.191	0.0544	0.0505

Table A4-2: NAG Leachate Results - Waste Rock Samples

Sample ID	BW-ARD-022	BW-ARD-023	BW-ARD2-5	BW-ARD2-9	BW-ARD-037	BW-ARD-029	BW-ARD-032	BW-ARD-019	BW-ARD-042	BW-ARD-050	BW-ARD-246	BW-ARD-106	BW-ARD-105	BW-ARD-083	BW-ARD-088	BW-ARD-110	BW-ARD-054	BW-ARD-055
ALS Sample ID	L1018920-1	L1018920-2	L1018920-3	L1018920-4	L1018920-5	L1018920-6	L1018920-7	L1018920-8	L1018920-9	L1018920-10	L1018920-11	L1018920-12	L1018920-13	L1018920-14	L1018920-15	L1018920-17	L1018920-21	L1018920-22
Physical Tests																		
Hardness	154	4.42	24.3	34.1	14.8	6.57	13.8	45.2	100	23.0	63.2	20.2	39.0	38.8	93.8	83.9	24.0	22.5
pH	7.40	2.76	3.14	2.57	3.45	4.23	2.89	4.53	8.70	2.82	3.06	3.44	4.43	4.23	2.56	3.68	2.88	3.01
Anions and Nutrients																		
Sulfate	154	301	168	510	136	35.4	209	137	98.8	294	254	122	118	99.8	535	149	273	382
Total Metals																		
Aluminum	0.461	10.6	7.17	23.9	2.47	0.159	11.2	<0.03	0.685	11.1	11.4	1.93	0.054	0.108	26.2	1.14	15.5	13.9
Antimony	0.00482	<0.001	0.00070	<0.001	0.0023	0.00382	0.00053	<0.001	0.00714	<0.001	0.00068	<0.0005	0.00065	0.00222	0.00051	0.00034	0.0029	<0.0005
Arsenic	0.00422	<0.001	0.00085	<0.001	<0.001	0.00266	0.00038	<0.001	0.0159	0.0021	0.00746	0.00166	<0.0005	<0.0002	0.00173	<0.0001	0.0692	0.00166
Barium	0.00582	0.0937	0.155	0.0274	0.0846	0.0448	0.0649	0.0400	0.00715	0.0990	0.0612	0.151	0.0856	0.130	0.138	0.0901	0.109	0.103
Beryllium	<0.0005	<0.005	0.0041	0.0106	<0.005	<0.0005	0.00261	<0.005	<0.0005	<0.005	0.0110	<0.0025	<0.0025	<0.001	0.0053	<0.0005	<0.005	0.0040
Bismuth	<0.0005	<0.005	<0.0025	<0.005	<0.005	<0.0005	<0.0005	<0.005	<0.0005	<0.005	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.0005	<0.005	<0.0025
Boron	0.035	<0.1	<0.05	<0.1	<0.1	0.053	0.067	<0.1	0.031	<0.1	<0.05	0.052	0.054	0.071	0.066	0.047	<0.1	0.077
Cadmium	<0.0001	0.386	0.135	0.245	0.255	0.0427	0.0156	0.122	<0.0001	0.372	0.118	0.139	0.158	0.0690	0.0637	0.0445	0.0424	0.0367
Calcium	61.5	1.13	5.90	2.88	1.51	1.87	1.79	11.5	40.1	3.04	10.6	2.79	8.14	9.61	19.1	25.9	4.15	4.01
Chromium	0.00727	0.0052	0.0043	0.0126	<0.005	0.00239	0.00552	<0.005	0.00935	<0.005	0.0049	0.0034	<0.0025	0.0011	0.0052	0.00337	0.0063	0.0066
Cobalt	<0.0001	0.0092	0.111	0.162	0.114	0.00103	0.0522	0.117	<0.0001	0.124	0.163	0.0765	0.0836	0.0518	0.144	0.117	0.0530	0.0426
Copper	0.00193	0.436	0.390	0.669	0.586	0.0780	0.193	0.0462	0.00262	1.18	1.91	0.418	0.0573	0.107	1.15	0.465	0.255	0.372
Iron	<0.03	1.38	0.371	3.24	<0.06	<0.03	0.678	<0.03	<0.03	1.25	0.461	<0.09	<0.03	<0.03	8.87	<0.03	6.68	2.33
Lead	0.000278	0.140	0.0265	3.47	2.92	0.746	0.160	0.0937	0.000335	0.0460	0.501	0.0451	0.00367	0.396	0.0523	0.0263	0.0633	0.0755
Lithium	0.0171	<0.05	0.029	<0.05	<0.05	0.0120	0.0372	<0.05	0.0232	<0.05	0.070	0.027	0.039	0.036	0.076	0.0328	<0.05	<0.025
Magnesium	0.20	0.39	2.32	6.54	2.68	0.46	2.28	4.01	<0.1	3.75	8.92	3.21	4.52	3.60	11.2	4.65	3.31	3.03
Manganese	0.00135	0.364	8.33	28.6	2.21	0.369	3.32	32.4	0.000945	4.25	6.28	8.64	11.2	8.59	3.56	1.91	28.5	23.0
Molybdenum	0.0123	0.00245	0.0168	0.00076	0.0155	0.0181	0.0209	0.00743	0.0140	0.00056	0.00057	0.0191	0.00728	0.0179	0.00014	0.0235	0.00369	0.00038
Nickel	<0.0005	0.0097	0.0958	0.267	0.181	0.00256	0.0591	0.107	<0.0005	0.154	0.195	0.115	0.112	0.0648	0.249	0.182	0.0779	0.0703
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	11.2	11.1	14.3	15.9	16.8	12.7	17.7	10.2	19.1	18.1	17.3	20.4	23.3	18.8	37.2	26.0	17.1	12.0
Selenium	<0.001	<0.01	<0.005	<0.01	<0.01	<0.001	<0.001	<0.01	<0.001	<0.01	<0.005	<0.005	<0.005	<0.002	<0.002	<0.001	<0.01	<0.005
Silicon	3.85	6.76	9.83	16.1	8.99	6.91	13.1	9.12	5.78	13.8	20.5	10.7	13.3	15.3	38.5	16.9	22.1	22.4
Silver	<0.00001	0.00117	0.00128	0.00241	0.0107	0.0100	0.00421	0.00066	0.000027	0.00095	0.00127	0.00581	0.00263	0.00882	0.000459	0.00154	0.00618	0.00826
Sodium	4.1	3.6	3.9	3.7	3.7	3.7	3.6	4.4	4.4	5.2	5.9	3.6	4.0	3.8	4.9	5.1	3.7	3.8
Strontium	0.245	0.0153	0.0342	0.0385	0.0192	0.00985	0.0163	0.0324	0.0871	0.0296	0.0821	0.0323	0.0617	0.0800	0.143	0.218	0.0174	0.0176
Thallium	0.00023	<0.001	0.00127	<0.001	<0.001	0.00052	0.00163	<0.001	<0.0001	0.0010	0.00234	0.00057	0.00063	0.00039	0.00184	0.00115	0.0040	0.00676
Tin	<0.0001	<0.001	<0.0005	<0.001	<0.001	<0.0001	<0.0001	<0.001	<0.0001	<0.001	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0001	0.0044	<0.0005
Titanium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	0.025	0.163	<0.01
Uranium	0.000021	0.0151	0.00407	0.00599	0.00067	0.000445	0.00407	<0.0001	0.000029	0.00206	0.00343	0.000264	<0.0001	0.000047	0.000934	0.000122	0.00703	0.0101
Vanadium	0.0246	<0.01	0.0202	<0.01	0.027	0.0015	0.0094	0.013	0.0413	<0.01	0.0095	0.0241	0.0321	0.0229	<0.002	0.0695	<0.01	<0.005
Zinc	0.0258	42.7	16.6	27.0	37.8	3.69	3.20	12.7	0.0030	45.9	18.0	16.0	14.8	9.47	9.62	4.98	6.88	4.57

Table A4-2: NAG Leachate Results - Waste Rock Samples

Table A4-2: NAG Leachate Resul

Sample ID	BW-ARD-056	BW-ARD-057	BW-ARD-074	BW-ARD-073	BW-ARD-113	BW-ARD-286	BW-ARD-253	BW-ARD-127	BW-ARD-129	BW-ARD-237	BW-ARD-132	BW-ARD-137	BW-ARD-288	BW-ARD-139	BW-ARD-140	BW-ARD-230	BW-ARD-143	BW-ARD-269
ALS Sample ID	L1018920-23	L1018920-24	L1018920-25	L1018920-26	L1018920-27	L1018920-31	L1018920-32	L1018920-33	L1018920-34	L1018920-35	L1018920-36	L1018920-37	L1018920-38	L1018920-39	L1018920-40	L1018920-41	L1018920-42	L1018920-52
Physical Tests																		
Hardness	56.8	39.3	9.04	5.89	17.6	38.9	21.2	12.7	9.44	47.6	58.7	21.1	25.9	39.6	41.6	35.9	11.3	6.70
pH	3.14	3.06	3.24	2.98	4.57	3.17	3.30	4.90	3.51	2.58	4.75	3.23	4.63	2.83	2.93	2.50	4.04	3.61
Anions and Nutrients																		
Sulfate	345	177	114	166	62.9	183	186	69.5	169	460	100	371	95.2	336	272	538	106	63.5
Total Metals																		
Aluminum	20.1	6.90	6.05	7.18	0.102	4.85	2.53	2.51	1.24	22.5	1.32	11.9	<0.03	10.9	12.2	20.0	0.190	2.93
Antimony	<0.001	0.00031	0.00085	0.00047	0.00644	<0.001	<0.002	0.00283	<0.002	<0.0002	0.00161	<0.002	0.0046	<0.002	<0.001	<0.002	0.0040	0.00028
Arsenic	0.0037	0.00059	0.00299	0.00166	0.00085	<0.001	<0.002	0.00288	<0.002	0.00023	0.00173	<0.002	<0.001	<0.002	0.0011	<0.002	<0.001	0.00048
Barium	0.167	0.151	0.212	0.119	0.110	0.0972	0.0797	0.100	0.101	0.130	0.0422	0.0587	0.123	0.120	0.186	0.164	0.151	0.0542
Beryllium	0.0090	0.00508	0.0033	0.0033	<0.0025	<0.005	<0.01	<0.0025	<0.01	0.0031	<0.0005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.005	0.00288
Bismuth	<0.005	<0.0005	<0.001	<0.001	<0.0025	<0.005	<0.01	<0.0025	<0.01	<0.001	<0.0005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.005	<0.0005
Boron	<0.1	0.062	0.062	0.057	<0.05	<0.1	<0.2	<0.05	<0.2	0.102	0.043	<0.2	<0.1	<0.2	<0.1	<0.2	<0.1	0.045
Cadmium	0.0868	0.00108	0.0864	0.0453	0.143	0.321	0.242	0.176	0.332	0.00591	0.0523	0.438	0.199	0.425	0.270	0.672	0.296	0.00318
Calcium	10.5	8.78	2.98	1.21	3.67	11.3	2.11	1.83	1.08	4.40	15.8	1.42	5.00	4.44	8.67	3.28	1.63	1.44
Chromium	0.0107	0.00469	0.0020	0.0037	0.0040	<0.005	<0.01	0.0072	<0.01	0.0085	0.00518	<0.01	<0.005	<0.01	0.0065	<0.01	<0.005	<0.0025
Cobalt	0.0949	0.0735	0.00237	0.00306	0.0840	0.135	0.140	0.0369	0.0931	0.147	0.0508	0.175	0.0785	0.163	0.153	0.229	0.0617	0.0255
Copper	0.311	0.182	1.12	0.630	0.0351	0.718	0.542	0.0163	0.569	5.25	0.0187	0.569	0.0444	0.633	1.82	0.713	0.153	0.194
Iron	1.29	0.554	0.272	0.382	0.046	0.188	0.091	3.41	<0.09	6.92	1.35	0.886	<0.03	0.873	0.627	2.45	<0.03	<0.09
Lead	0.0210	0.0190	0.431	2.12	1.00	0.119	2.29	0.135	0.0073	0.0821	0.00258	2.39	0.363	0.411	0.0580	0.0360	0.169	0.0272
Lithium	0.074	0.0723	<0.01	<0.01	<0.025	<0.05	<0.1	0.028	<0.1	0.037	0.0245	<0.1	<0.05	<0.1	<0.05	<0.1	<0.05	0.0161
Magnesium	7.45	4.21	0.39	0.70	2.05	2.60	3.87	1.98	1.64	8.89	4.66	4.26	3.27	6.92	4.85	6.73	1.76	0.75
Manganese	30.2	3.18	1.29	9.53	1.05	1.91	2.53	2.61	1.45	3.49	1.28	2.61	4.30	11.2	2.61	4.21	1.36	0.886
Molybdenum	0.00109	0.0182	0.0152	0.0543	0.0372	0.0490	0.0242	0.0259	0.0206	<0.0001	0.0137	0.0028	0.0132	<0.001	0.0164	<0.001	0.0211	0.0201
Nickel	0.129	0.130	0.0038	0.0044	0.0623	0.172	0.269	0.0557	0.147	0.255	0.0588	0.327	0.0771	0.373	0.284	0.302	0.108	0.0260
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	27.1	17.4	12.2	10.0	17.6	15.3	26.2	14.6	15.0	26.2	26.2	22.8	17.5	30.9	29.5	27.9	14.1	9.2
Selenium	<0.01	<0.001	<0.002	<0.002	<0.005	<0.01	<0.02	<0.005	<0.02	<0.002	<0.001	<0.02	<0.01	<0.02	<0.01	<0.02	<0.01	<0.001
Silicon	28.7	18.2	8.16	10.1	10.1	11.1	11.4	11.6	7.37	27.3	15.5	10.7	9.37	16.5	15.0	21.3	6.89	6.38
Silver	0.00150	0.00416	0.00432	0.0122	0.0229	0.00301	0.00914	0.0118	0.00608	0.00160	0.00162	0.00478	0.00950	0.00205	0.00220	0.00079	0.00309	0.00417
Sodium	4.2	3.9	3.8	3.7	3.6	4.0	3.6	3.5	3.3	3.8	4.6	3.7	3.8	3.8	6.9	7.0	6.7	6.9
Strontium	0.0614	0.0442	0.0154	0.0123	0.0182	0.0810	0.0210	0.0138	0.0111	0.0257	0.0954	0.0151	0.0337	0.0264	0.0375	0.0216	0.0190	0.0105
Thallium	0.0040	0.00174	0.00141	0.00386	<0.0005	<0.001	<0.002	0.00060	<0.002	0.00289	0.00032	0.0032	<0.001	<0.002	<0.001	<0.002	<0.001	0.00042
Tin	<0.001	0.00018	<0.0002	<0.0002	<0.0005	<0.001	<0.002	0.00189	<0.002	<0.0002	0.00097	<0.002	<0.001	<0.002	<0.001	<0.002	<0.001	<0.0001
Titanium	<0.01	0.019	<0.01	<0.01	<0.01	<0.01	<0.01	0.152	<0.01	<0.01	0.116	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	0.00202	0.00278	0.0106	0.0141	<0.0001	0.00063	0.00085	0.000111	0.00079	0.00149	0.000032	0.00278	<0.0001	0.00118	0.00076	0.00064	<0.0001	0.000410
Vanadium	<0.01	0.0254	<0.002	<0.002	0.0203	0.022	0.032	0.0186	0.029	<0.002	0.0514	<0.02	0.016	<0.02	0.015	<0.02	0.017	0.0053
Zinc	11.6	1.49	8.21	5.99	15.4	36.2	51.0	22.1	64.4	7.02	3.90	95.6	26.7	79.5	38.4	84.7	42.6	1.38

Table A4-2: NAG Leachate Results - Waste Rock Samples

Table A4-2: NAG Leachate Resul																		
Sample ID	BW-ARD-168	BW-ARD-066	BW-ARD-146	BW-ARD-149	BW-ARD-118	BW-ARD-176	BW-ARD-155	BW-ARD-282	BW-ARD-222	BW-ARD-184	BW-ARD-093	BW-ARD-094	BW-ARD-095	BW-ARD-212	BW-ARD-210	BW-ARD-206	BW-ARD-076	BW-ARD-120
ALS Sample ID	L1018920-54	L1018920-55	L1018920-43	L1018920-44	L1018920-29	L1018920-58	L1018920-47	L1018920-50	L1018920-61	L1018920-62	L1018920-64	L1018920-65	L1018920-66	L1018920-67	L1018920-68	L1018920-70	L1018920-56	L1018920-30
Physical Tests																		
Hardness	42.2	17.7	10.8	30.0	14.5	95.3	13.8	103	25.7	13.9	21.7	17.7	43.3	3.24	5.11	7.81	10.5	2.14
pH	3.85	2.92	3.17	3.32	2.50	6.21	2.54	7.21	4.32	3.05	3.68	3.22	4.72	2.60	2.51	5.69	2.84	6.65
Anions and Nutrients																		
Sulfate	73.7	221	136	166	470	134	337	110	119	232	173	248	130	289	311	47.3	204	0.76
Total Metals																		
Aluminum	0.723	12.9	7.17	6.77	13.5	0.0465	12.3	0.316	0.091	14.8	1.11	8.68	0.071	10.0	9.43	0.0314	9.35	11.9
Antimony	0.00014	0.00042	<0.0005	<0.0005	<0.002	0.00747	<0.0005	0.00392	<0.001	<0.0005	<0.002	<0.002	0.00051	<0.001	<0.001	0.00350	0.00060	0.0144
Arsenic	<0.0001	0.00493	<0.0005	0.0108	<0.002	0.00055	<0.0005	0.00855	<0.001	<0.0005	<0.002	<0.002	<0.0005	<0.001	<0.001	0.00245	<0.0005	0.237
Barium	0.0382	0.0950	0.135	0.168	0.0310	0.0292	0.139	0.00919	0.112	0.114	0.131	0.105	0.143	0.0687	0.0631	0.0440	0.0514	0.0610
Beryllium	<0.0005	0.0029	0.0027	<0.0025	<0.01	<0.0005	0.0060	<0.0005	<0.005	0.0058	<0.01	<0.01	<0.0025	<0.005	<0.005	<0.0005	<0.0025	<0.0005
Bismuth	<0.0005	<0.001	<0.0025	<0.0025	<0.01	<0.0005	<0.0025	<0.0005	<0.005	<0.0025	<0.01	<0.01	<0.0025	<0.005	<0.005	<0.0005	<0.0025	0.00071
Boron	0.056	0.057	<0.05	<0.05	<0.2	0.035	<0.05	0.028	<0.1	0.051	<0.2	<0.2	<0.05	<0.1	<0.1	0.043	0.060	0.045
Cadmium	0.000454	0.0633	0.107	0.0827	0.123	0.00569	0.108	<0.0001	0.171	0.0954	0.402	0.581	0.201	0.388	0.244	0.0505	0.0946	0.00300
Calcium	13.3	3.68	1.60	5.01	2.58	33.1	2.67	40.5	3.94	1.56	1.55	3.78	9.55	0.609	1.11	1.16	2.50	0.347
Chromium	0.00247	0.0073	0.0060	0.0058	<0.01	0.0140	0.0045	0.0102	<0.005	0.0039	<0.01	<0.01	0.0030	<0.005	<0.005	0.00734	0.0037	0.0284
Cobalt	0.0527	0.0662	0.0788	0.180	0.0891	0.00168	0.0344	<0.0001	0.0729	0.0611	0.107	0.154	0.116	0.0482	0.0778	0.0178	0.00176	0.00118
Copper	0.206	0.775	0.486	0.465	0.681	0.00634	0.599	0.00173	0.0979	0.810	0.538	1.32	0.0670	5.57	2.99	0.00591	0.557	0.0447
Iron	0.087	0.822	0.172	0.734	2.97	0.039	2.74	<0.03	0.508	0.590	<0.03	0.439	<0.03	1.84	2.48	<0.03	0.611	5.40
Lead	0.00603	0.0315	0.175	0.135	0.0125	0.000312	1.11	0.000321	0.00262	0.0288	0.691	2.41	0.0424	0.206	0.168	0.00557	5.11	0.804
Lithium	0.0317	0.060	<0.025	0.046	<0.1	0.0337	<0.025	0.0160	<0.05	<0.025	<0.1	<0.1	0.059	<0.05	<0.05	0.0342	<0.025	<0.005
Magnesium	2.20	2.06	1.64	4.25	1.96	3.08	1.73	0.41	3.86	2.42	4.34	2.01	4.73	0.42	0.57	1.19	1.03	0.31
Manganese	0.985	2.66	0.993	2.37	0.848	0.163	5.47	0.00176	3.34	1.13	5.60	6.67	13.0	0.696	4.37	4.52	0.961	0.137
Molybdenum	0.0130	0.00113	0.0227	0.00888	<0.001	0.0444	<0.0003	0.0123	0.0186	0.00451	0.0303	0.0286	0.0123	<0.0005	<0.0005	0.0307	0.00254	0.00680
Nickel	0.00937	0.0893	0.141	0.225	0.119	0.00149	0.0527	<0.0005	0.0710	0.0564	0.209	0.227	0.115	0.0331	0.0109	0.0152	0.0025	0.00221
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	9.0	20.1	14.2	24.7	13.1	24.0	13.9	16.3	21.8	17.7	31.6	19.5	19.1	9.9	9.0	17.2	8.7	11.7
Selenium	<0.001	<0.002	<0.005	<0.005	<0.02	<0.001	<0.005	<0.001	<0.01	<0.005	<0.02	<0.02	<0.005	<0.01	<0.01	<0.001	<0.005	<0.001
Silicon	13.4	18.2	8.30	13.6	13.1	10.3	14.1	5.93	12.7	17.3	13.4	12.6	14.8	7.87	8.12	10.6	12.8	20.3
Silver	0.000486	0.00412	0.00327	0.00202	0.00188	0.000035	0.00129	0.000041	0.00111	0.00237	0.00821	0.00266	0.00358	0.00148	0.00442	0.00206	0.0159	0.0204
Sodium	9.5	6.9	6.5	6.3	3.6	7.0	7.2	7.9	6.8	6.9	7.1	6.9	7.0	6.6	6.5	6.6	7.1	4.5
Strontium	0.251	0.0262	0.0198	0.0590	0.0268	0.131	0.0195	0.0841	0.0386	0.0170	0.0211	0.0264	0.115	0.0179	0.0274	0.0174	0.0166	0.00678
Thallium	0.00039	0.00147	0.00057	0.00084	0.0023	0.00010	0.00094	<0.0001	<0.001	0.00257	<0.002	<0.002	<0.0005	<0.001	<0.001	0.00037	0.00393	0.00058
Tin	<0.0009	<0.0002	<0.0005	<0.0005	<0.002	<0.0001	<0.0005	<0.0001	<0.001	<0.0005	<0.002	<0.002	<0.0005	<0.001	<0.001	<0.0001	<0.0005	0.0105
Titanium	0.048	<0.01	<0.01	0.045	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.016	0.440
Uranium	0.000156	0.00602	0.000864	0.000466	0.00740	<0.	0.00684	0.000013	<0.0001	0.00774	<0.0002	0.00037	<0.0001	0.0171	0.0231	0.000029	0.0140	0.00279
Vanadium	0.0604	0.0054	0.0138	0.0208	<0.02	0.0449	<0.005	0.0416	0.026	<0.005	0.032	0.031	0.0432	<0.01	<0.01	0.0216	<0.005	0.0278
Zinc	0.190	7.15	11.8	9.96	50.3	0.112	15.3	<0.003	27.1	22.3	56.5	72.9	22.0	46.4	26.9	4.05	15.0	0.287

Table A4-2: NAG Leachate Results - Waste Rock Samples

Table A4-2: NAG Leachate Resul

Sample ID	BW-ARD-228	BW-ARD-061	BW-ARD-159	BW-ARD-217	BW-ARD-166	BW-ARD-204	BW-ARD-079	BW-ARD-114	BW-ARD-058	BW-ARD-059	BW-ARD-052	BW-ARD-153	BW-ARD-069	BW-ARD-170	BW-ARD-499	BW-ARD-509	BW-ARD-537	BW-ARD-566
ALS Sample ID	L1018920-59	L1018920-48	L1018920-49	L1018920-63	L1018920-53	L1018920-69	L1018920-16	L1018920-28	L1018920-18	L1018920-19	L1018920-20	L1018920-46	L1018920-51	L1018920-57	L1126720-1	L1126720-2	L1126720-3	L1128048-1
Physical Tests																		
Hardness	18.6	7.81	<0.5	21.1	3.54	<0.5	7.78	18.2	58.1	31.9	49.1	20.4	6.23	14.4	4.26	9.66	74.5	33.9
pH	4.50	5.99	7.63	3.12	3.55	6.31	6.06	3.56	2.88	2.83	2.71	5.83	3.46	7.62				
Anions and Nutrients																		
Sulfate	56.7	34.6	1.33	263	51.5	0.75	1.68	162	280	254	338	35.9	112	25.2	24.5	54.6	97.7	72.5
Total Metals																		
Aluminum	0.107	0.0309	8.21	9.00	1.14	0.629	4.46	1.68	7.20	9.55	11.4	2.25	3.18	7.96	0.0516	0.766	0.0683	1.11
Antimony	0.00322	0.00710	0.0168	<0.002	0.00119	0.00744	0.00370	0.0023	<0.001	<0.0005	<0.0005	0.00094	0.00054	0.00476	0.00299	0.00042	0.00335	0.00032
Arsenic	0.00354	0.00016	0.0889	<0.002	0.00034	0.00979	0.00851	<0.002	<0.001	0.00145	0.00082	0.00297	0.00226	0.00885	0.00389	0.00049	0.00183	0.00057
Barium	0.0128	0.0108	0.0226	0.0434	0.0410	0.00313	0.0238	0.0809	0.0728	0.105	0.119	0.0299	0.0572	0.0536	0.00599	0.0821	0.0215	0.0821
Beryllium	<0.0005	<0.0005	<0.0005	<0.01	<0.001	<0.0005	<0.0005	<0.01	<0.005	0.0045	0.0073	<0.0005	0.0044	<0.0005	<0.0005	0.00151	<0.0005	0.0022
Bismuth	<0.0005	<0.0005	<0.0005	<0.01	<0.001	<0.0005	<0.0005	<0.01	<0.005	<0.0025	<0.0025	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.001
Boron	0.054	0.034	0.039	<0.2	0.049	0.035	0.058	<0.2	<0.1	0.065	0.072	0.023	<0.05	0.030	0.027	0.066	0.057	0.035
Cadmium	0.0647	0.00258	0.000328	2.30	0.489	0.000153	0.000949	0.485	0.0145	0.0540	0.125	0.00292	0.118	0.000276	0.000771	0.00785	0.0107	0.0722
Calcium	4.21	1.30	0.120	1.00	0.779	0.173	2.88	1.54	8.22	5.52	9.94	4.78	1.23	3.83	0.802	1.66	26.1	12.1
Chromium	0.00276	<0.0045	<0.003	0.013	0.0052	0.00486	0.00411	<0.01	0.0072	0.0064	0.0078	0.0129	0.0038	0.00843	0.00360	0.00187	0.00384	0.0012
Cobalt	0.0447	0.00837	0.00121	0.223	0.00500	<0.0001	0.00025	0.122	0.135	0.0458	0.129	0.00199	0.0187	0.00275	0.00047	0.0148	0.0148	0.00494
Copper	0.0756	0.00877	0.0230	0.696	0.774	0.00147	0.0119	0.347	0.0836	0.138	0.384	0.00538	0.369	0.0240	0.00513	0.0477	0.0214	0.0834
Iron	<0.03	<0.03	1.74	0.299	0.034	0.126	1.49	0.056	0.502	1.14	1.90	1.87	<0.06	4.40	0.061	0.034	<0.03	0.033
Lead	0.00291	0.000226	0.546	3.32	8.39	0.0418	0.0492	1.40	0.0122	0.0204	0.0186	0.00146	0.00564	0.00390	0.000083	0.0120	0.000543	0.00510
Lithium	0.0253	0.0145	<0.005	<0.1	<0.01	<0.005	<0.005	<0.1	<0.05	<0.025	0.048	0.0232	<0.025	0.0092	0.0137	0.0185	0.0171	<0.01
Magnesium	1.97	1.11	<0.1	4.53	0.39	<0.1	0.14	3.49	9.12	4.40	5.89	2.05	0.77	1.18	0.55	1.34	2.25	0.87
Manganese	2.71	0.939	0.224	3.74	0.0912	0.0561	0.0738	2.97	37.0	10.7	14.6	0.687	2.75	2.00	0.591	5.16	2.60	3.72
Molybdenum	0.0192	0.0166	0.0167	0.0071	0.0171	0.0113	0.00306	0.0143	0.0225	0.0259	0.00031	0.0209	0.0724	0.0141	0.0194	0.0184	0.0117	0.00971
Nickel	0.0581	0.0114	<0.0005	0.352	0.0069	<0.0005	0.00165	0.310	0.121	0.0713	0.201	0.00253	0.0172	0.00558	<0.0005	0.0312	0.0131	0.0048
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	11.0	14.3	4.6	14.5	2.9	6.6	5.9	19.0	13.8	16.7	21.7	11.1	16.2	3.4	14.8	19.7	15.1	6.4
Selenium	<0.001	<0.001	<0.001	<0.02	<0.002	<0.001	<0.001	<0.02	<0.01	<0.005	<0.005	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	<0.002
Silicon	10.6	6.73	14.9	9.90	2.73	4.77	9.02	12.1	12.3	13.4	21.8	12.7	11.0	25.5	11.1	16.8	17.1	15.6
Silver	0.000152	0.000260	0.000834	0.00378	0.0115	0.000629	0.000616	0.0131	0.00458	0.00483	0.00215	0.000238	0.00346	0.000131	0.000029	0.00309	0.000975	0.000352
Sodium	6.3	6.8	6.1	6.7	6.5	5.2	3.2	3.7	3.8	3.7	3.8	7.8	7.2	7.2	3.3	3.6	3.7	4.3
Strontium	0.0112	0.0108	0.00202	0.0236	0.00553	0.00124	0.00686	0.0220	0.0309	0.0261	0.0275	0.0375	0.0206	0.0270	0.00939	0.0157	0.0520	0.0499
Thallium	0.00045	0.00032	0.00081	0.0055	0.00062	<0.0001	0.00021	0.0022	0.0053	0.00311	0.00365	0.00014	0.00091	<0.0001	0.00091	0.00105	0.00101	<0.0002
Tin	<0.0001	<0.0001	0.0114	<0.002	<0.0008	0.00077	0.00989	<0.002	<0.001	<0.0005	<0.0005	0.00505	<0.0005	0.0242	<0.0001	<0.0001	<0.0001	<0.0002
Titanium	<0.01	<0.01	0.027	<0.01	<0.01	<0.01	0.035	<0.01	<0.01	0.012	<0.01	0.083	<0.01	0.131	<0.01	<0.01	<0.01	<0.01
Uranium	0.000074	0.000044	0.00491	0.00075	0.00165	0.000739	0.000521	0.00057	0.00371	0.00503	0.00357	0.000045	0.00427	0.000286	0.000010	0.00108	0.000063	0.00113
Vanadium	0.0422	0.0106	<0.001	0.043	<0.002	0.0026	0.0041	0.039	0.037	0.0257	<0.005	0.0370	0.0062	0.0214	0.0018	0.0090	0.0289	<0.002
Zinc	3.47	0.804	0.0336	80.4	6.40	0.0064	0.197	54.7	4.51	4.44	14.9	0.166	21.7	0.333	0.0409	0.584	0.264	6.50

Table A4-2: NAG Leachate Results - Waste Rock Samples

Table A4-2: NAG Leachate Resul

Sample ID	BW-ARD-510	BW-ARD-526	BW-ARD-178	BW-ARD-202	BW-ARD-152	BW-ARD-104	Count	Min	Max	Average	Median	25th Percentile	75th Percentile	95th Percentile
ALS Sample ID	L1128048-2	L1128048-3	L1018920-60	L1018920-71	L1018920-45	L1018920-72								
Physical Tests														
Hardness	62.8	6.34	18.6	21.1	15.6	13.4	78	0.500	154.000	29.507	20.750	10.575	39.225	94.025
pH			5.15	2.49	2.51	4.47	72	2.490	8.700	3.950	3.380	2.8875	4.54	7.2955
Anions and Nutrients														
Sulfate	99.2	13.7	49.9	418	374	362	78	0.750	538.000	184.290	151.500	79.075	272.75	461.5
Total Metals														
Aluminum	0.952	10.5	0.0525	20.2	12.4	12.2	78	0.030	26.200	6.612	5.450	0.6945	11.175	20.115
Antimony	0.00047	0.0147	0.00515	<0.001	<0.0005	<0.0005	78	0.000	0.017	0.002	0.001	0.0005025	0.0029675	0.0074445
Arsenic	0.00044	0.0680	0.00036	<0.001	<0.0005	<0.0005	78	0.000	0.237	0.008	0.002	0.000555	0.0026075	0.023715
Barium	0.0446	0.0670	0.0197	0.129	0.118	0.123	78	0.003	0.212	0.084	0.083	0.04355	0.11975	0.16445
Beryllium	0.00062	<0.0005	<0.0005	<0.005	<0.0025	<0.0025	78	0.001	0.011	0.004	0.003	0.0005	0.005	0.01
Bismuth	<0.0005	<0.0005	<0.0005	<0.005	<0.0025	<0.0025	78	0.001	0.010	0.003	0.003	0.0005	0.005	0.01
Boron	0.043	0.035	0.049	<0.1	0.056	<0.05	78	0.023	0.200	0.080	0.057	0.04925	0.1	0.2
Cadmium	0.00618	0.0166	0.00960	0.180	0.137	0.213	78	0.000	2.300	0.168	0.091	0.01165	0.21	0.4856
Calcium	22.0	1.32	3.68	1.16	3.41	3.15	78	0.120	61.500	7.109	3.345	1.5425	8.5575	27.15
Chromium	0.00270	0.00976	0.00910	0.0109	0.0071	0.0048	78	0.001	0.028	0.006	0.005	0.003925	0.00895	0.012645
Cobalt	0.0893	0.00948	0.0264	0.178	0.103	0.104	78	0.000	0.229	0.072	0.064	0.01081	0.11675	0.17545
Copper	0.170	0.0452	0.0140	0.435	0.693	2.10	78	0.001	5.570	0.559	0.329	0.04545	0.63225	1.9385
Iron	0.039	11.4	0.034	3.03	2.46	3.14	78	0.030	11.400	1.265	0.411	0.03525	1.6775	5.592
Lead	0.0122	0.397	0.00285	0.163	0.0782	0.296	78	0.000	8.390	0.566	0.055	0.01205	0.39675	2.98
Lithium	0.0187	0.0108	0.0299	<0.05	<0.025	<0.025	78	0.005	0.100	0.041	0.033	0.0232	0.05	0.1
Magnesium	1.89	0.74	2.30	4.43	1.72	1.36	78	0.100	11.200	2.860	2.225	1.05	4.24	7.666
Manganese	4.04	0.783	1.98	2.23	11.5	7.32	78	0.001	37.000	5.508	2.635	0.987	5.5675	28.515
Molybdenum	0.0142	0.00803	0.0164	0.00052	<0.0003	<0.0003	78	0.000	0.072	0.014	0.014	0.002605	0.01935	0.03828
Nickel	0.120	0.00708	0.0158	0.302	0.180	0.103	78	0.001	0.373	0.103	0.071	0.01	0.1675	0.3032
Phosphorus	<0.3	0.34	<0.3	<0.3	<0.3	<0.3	78	0.300	0.340	0.301	0.300	0.3	0.3	0.3
Potassium	11.5	13.6	14.2	22.6	12.8	11.6	78	2.900	37.200	16.467	15.600	11.775	19.65	28.14
Selenium	<0.001	<0.001	<0.001	<0.01	<0.005	<0.005	78	0.001	0.020	0.006	0.005	0.001	0.01	0.02
Silicon	11.9	28.0	15.0	18.0	13.6	12.8	78	2.730	38.500	13.518	12.750	9.8475	15.975	25.77
Silver	0.00183	0.00109	0.00130	0.00159	0.00132	0.00958	78	0.000	0.023	0.004	0.002	0.001095	0.00473	0.012335
Sodium	4.2	3.3	7.0	7.0	6.9	6.8	78	3.200	9.500	5.191	4.450	3.7	6.8	7.2
Strontium	0.0604	0.0270	0.0241	0.0193	0.0242	0.0236	78	0.001	0.251	0.041	0.025	0.0171	0.038575	0.1328
Thallium	0.00066	0.00109	0.00032	0.0036	0.00135	0.00137	78	0.000	0.007	0.001	0.001	0.0005325	0.002	0.004
Tin	<0.0001	0.0101	<0.0001	<0.001	<0.0005	<0.0005	78	0.000	0.024	0.002	0.001	0.0002	0.001	0.0099215
Titanium	<0.01	0.271	<0.01	<0.01	<0.01	<0.01	78	0.010	0.440	0.028	0.010	0.01	0.01	0.13415
Uranium	0.000377	0.000927	0.000018	0.00198	0.00557	0.0125	78	0.000	0.023	0.003	0.001	0.00010275	0.00398	0.014015
Vanadium	0.0242	0.0188	0.0380	<0.01	<0.005	<0.005	78	0.001	0.070	0.019	0.019	0.0056	0.0276	0.043455
Zinc	2.34	0.718	1.59	33.9	14.9	22.4	78	0.003	95.600	19.663	10.780	2.555	26.975	73.89

Table A4-3: NAG Leachate Results - Ore Samples

Sample ID	BW-ARD2-2	BW-ARD-001	BW-ARD-258	BW-ARD-007	BW-ARD-227	BW-ARD-009	BW-ARD-200
ALS Sample ID	L1018920-78	L1018920-79	L1018920-80	L1018920-81	L1018920-82	L1018920-83	L1018920-84
Physical Tests							
Hardness	5.40	1.71	8.34	1.05	12.4	45.7	11.0
pH	2.78	7.10	2.54	6.45	2.28	2.41	2.17
Anions and Nutrients							
Sulfate	386	0.62	331	2.88	601	621	781
Total Metals							
Aluminum	24.4	8.18	13.0	2.09	13.6	21.3	11.6
Antimony	<0.0005	0.0127	<0.001	0.00686	<0.002	<0.002	<0.001
Arsenic	<0.0005	0.264	0.0049	0.0723	<0.002	<0.002	0.0013
Barium	0.103	0.0415	0.0129	0.0162	0.0230	0.0545	0.0791
Beryllium	0.0045	<0.0005	<0.005	<0.0005	<0.01	<0.01	<0.005
Bismuth	<0.0025	<0.0005	<0.005	<0.0005	<0.01	<0.01	<0.005
Boron	0.051	0.034	<0.1	0.047	<0.2	<0.2	<0.1
Cadmium	0.118	0.00200	0.271	0.000844	0.450	0.791	0.351
Calcium	0.803	0.327	1.58	0.252	2.76	4.73	1.96
Chromium	0.0036	0.00692	<0.005	0.00551	<0.01	<0.01	<0.005
Cobalt	0.0241	0.00173	0.0296	0.00012	0.129	0.187	0.132
Copper	1.29	0.170	2.13	0.0100	2.61	2.35	12.1
Iron	2.72	8.11	2.72	1.31	9.50	11.2	37.6
Lead	0.997	0.00865	1.94	0.0448	1.36	0.0156	0.539
Lithium	<0.025	<0.005	<0.05	<0.005	<0.1	<0.1	<0.05
Magnesium	0.82	0.22	1.07	0.10	1.33	8.22	1.47
Manganese	0.458	1.54	1.89	0.0306	2.88	11.8	11.0
Molybdenum	0.00030	0.00566	<0.0005	0.00425	<0.001	<0.001	<0.0005
Nickel	0.0138	0.00155	<0.005	0.00530	0.182	0.308	0.0417
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	25.0	8.7	12.9	6.5	12.2	30.4	9.2
Selenium	<0.005	<0.001	<0.01	<0.001	<0.02	<0.02	<0.01
Silicon	15.9	15.8	11.1	8.17	12.8	24.1	10.8
Silver	0.00513	0.00213	0.00107	0.00106	0.00146	0.00029	0.00723
Sodium	7.0	4.4	5.2	4.5	5.2	4.9	4.9
Strontium	0.0112	0.00691	0.0117	0.00324	0.0225	0.0430	0.0204
Thallium	0.00099	0.00074	<0.001	0.00016	<0.002	0.0021	<0.001
Tin	0.00062	0.0157	<0.001	0.00375	<0.002	<0.002	<0.001
Titanium	<0.01	0.171	<0.01	0.018	<0.01	0.018	<0.01
Uranium	0.0202	0.00142	0.0155	0.000850	0.00657	0.00117	0.00816
Vanadium	<0.005	0.0099	<0.01	0.0025	<0.02	<0.02	<0.01
Zinc	14.1	0.110	31.2	0.0230	51.5	85.3	31.1

Table A4-4: NAG Leachate Results - Metallurgical Tailings Samples

Sample ID	KM# 2885 Test 1, 2 Rougher Tails	KM# 2885 Test 13,14,15 Cleaner Tails	KM# 2885 Test 8,9 Cyanide Tails	KM# 2885 Blend Comp 1 Whole Ore
Description	Rougher Tails Flotation Cyanidation (-150µm)	Cleaner Tails Flotation Cyanidation (-150µm)	WOL Cyanidation	WOL Cyanidation
Physical Tests				
Hardness	135	504	174	122
pH	8.8	8.7	8.3	5.9
Anions and Nutrients				
Sulphate	108	300	122	173
Total Metals				
Aluminum	<0.20	<0.20	<0.20	<0.20
Antimony	<0.050	<0.050	<0.050	<0.050
Arsenic	<0.050	<0.050	<0.050	<0.050
Barium	<0.010	0.02	<0.010	0.022
Beryllium	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium	<0.010	<0.010	<0.010	0.67
Calcium	52.3	196	65.5	18
Chromium	<0.010	<0.010	<0.010	<0.010
Cobalt	<0.010	<0.010	<0.010	0.16
Copper	<0.010	0.021	<0.010	0.036
Iron	<0.030	<0.030	0.033	0.089
Lead	<0.050	<0.050	<0.050	<0.050
Magnesium	0.66	3	2.3	5
Manganese	<0.0050	0.0065	0.064	13.2
Mercury	<0.000050	<0.000050	<0.000050	<0.000050
Molybdenum	<0.030	0.057	<0.030	<0.030
Nickel	<0.050	<0.050	<0.050	0.2
Selenium	<0.050	<0.050	<0.050	<0.050
Silver	<0.010	0.018	<0.010	<0.010
Thallium	<0.20	<0.20	<0.20	<0.20
Titanium	<0.010	0.013	<0.010	<0.010
Vanadium	<0.030	<0.030	<0.030	<0.030
Zinc	<0.020	<0.020	<0.020	20.4

ANNEX 5
Shake Flask Extraction Test Results

Table A5-1: Shake Flask Extraction Results - Overburden Samples

Parameters	Units	BW-ARD-301	BW-ARD-309	BW-ARD-305	BW-ARD-310	BW-ARD-315	GT12-45 (6.75-6.95m)	GT12-45 (37-37.25m)	GT12-45 (91.15-91.30m)	GT12-46 (5.60-5.80m)	GT12-46 (64.35-64.60m)	GT12-46 (OPEN PIT)	GT12-08 NAG#1 2.60m-2.80m	GT12-08 NAG#2 4.42-4.58m	GT12-08 NAG#3 6.35m-6.24m
		overburden	overburden	overburden	overburden	overburden	overburden	overburden	overburden	overburden	overburden	overburden	overburden	overburden	overburden
Acidity (as CaCO3)	(mg/L)	2.4	2.2	2.8	1.8	1.3	4.7	2.4	2.7	2.3	1.2	4.0	1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	(mg/L)	6.8	6.8	11.8	10.8	23.4	13.2	23.6	39.4	12.6	52.1	28.0	30.6	30.7	34.8
Conductivity	(uS/cm)	29.0	24.9	32.7	28.7	62.3	31.1	32.4	56.5	20.4	97.1	38.2	58.2	61.8	69.3
pH	Unity	7.24	7.50	7.85	8.33	7.86	6.38	7.37	7.74	7.19	8.07	7.52	9.21	9.36	9.18
Sulfate (SO4)	(mg/L)	38.0	31.4	43.5	16.5	6.69	1.54	2.09	6.13	8.89	<0.5000	6.81	<0.5000	<0.5000	<0.5000
Calculated Hardness	(mg/L)	163.72	120.62	224.02	142.51	86.83	97.66	179.67	405.37	280.06	28.60	332.79	20.11	20.15	23.96
Dissolved Metals															
Aluminum	(mg/L)	19.8	16.2	27.2	18.7	11.2	12.3	22.0	60.3	39.6	0.60	44.4	0.363	0.332	0.307
Antimony	(mg/L)	0.00308	0.00156	0.00253	0.00253	0.00513	0.00234	0.00091	0.00321	0.00494	0.0136	0.00213	0.00238	0.00359	0.00802
Arsenic	(mg/L)	0.0270	0.0188	0.0542	0.0266	0.0271	0.0239	0.0101	0.0164	0.0666	0.0666	0.0247	0.0112	0.0150	0.0212
Barium	(mg/L)	0.150	0.156	0.331	0.151	0.0948	0.0835	0.0989	0.0507	0.143	0.0067	0.109	0.0020	0.0033	0.0031
Beryllium	(mg/L)	0.0014	0.0014	0.0019	<0.001	<0.001	0.00056	0.00054	0.00065	0.00082	<0.0005	0.00068	<0.0005	<0.0005	<0.0005
Bismuth	(mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	(mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.0100	<0.0100	<0.0100	0.011	0.012	<0.0100	<0.0100	<0.0100	0.011
Cadmium	(mg/L)	0.00193	0.00242	0.00435	0.00090	0.00532	0.000568	0.000164	0.0208	0.00119	<0.0001	0.000190	<0.0001	<0.0001	<0.0001
Calcium	(mg/L)	3.76	2.67	5.50	2.77	4.18	2.12	2.42	4.05	1.71	9.37	2.84	6.46	6.31	7.44
Chromium	(mg/L)	0.0252	0.0085	0.0265	0.0132	0.0065	0.00805	0.00997	0.0167	0.0130	<0.0005	0.0122	<0.0005	<0.0005	<0.0005
Cobalt	(mg/L)	0.0267	0.00892	0.0298	0.00724	0.00364	0.00441	0.00557	0.0105	0.00603	<0.0001	0.00660	<0.0001	<0.0001	<0.0001
Copper	(mg/L)	0.0282	0.0132	0.0267	0.0202	0.0137	0.0110	0.0123	0.0194	0.0164	<0.0010	0.0175	<0.0010	<0.0010	<0.0010
Iron	(mg/L)	18.0	8.07	24.2	10.1	3.86	10.4	22.1	22.0	25.8	0.265	36.7	<0.0300	<0.0300	<0.0300
Lead	(mg/L)	0.174	0.0207	0.0697	0.0263	0.126	0.0257	0.00417	0.0137	0.0414	<0.0001	0.00767	<0.0001	<0.0001	<0.0001
Lithium	(mg/L)	0.011	<0.01	0.015	<0.01	<0.01	<0.0050	0.0060	0.0386	0.0105	0.0337	0.0095	<0.0050	<0.0050	<0.0050
Magnesium	(mg/L)	2.37	1.74	2.82	2.96	1.46	1.07	2.64	4.33	1.89	0.309	2.93	0.450	0.590	0.858
Manganese	(mg/L)	1.00	1.08	1.78	0.597	0.346	0.398	0.351	0.534	0.656	0.00527	0.394	0.00111	<0.0005	0.00164
Mercury	(mg/L)	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	(mg/L)	0.00131	0.00637	0.00205	0.00418	0.00792	0.00682	0.0498	0.0977	0.0595	0.0999	0.0385	0.00196	0.00142	0.00306
Nickel	(mg/L)	0.0126	0.0090	0.0141	0.0121	0.0068	0.00668	0.00985	0.0158	0.0127	<0.0005	0.0141	<0.0005	<0.0005	<0.0005
Phosphorus	(mg/L)	0.56	<0.6	0.82	<0.6	<0.3	0.57	0.42	<0.3000	0.46	<0.3000	0.30	<0.3000	<0.3000	<0.3000
Potassium	(mg/L)	2.50	2.94	3.80	4.87	7.36	2.06	2.18	6.19	4.73	3.80	3.14	1.92	2.04	3.16
Selenium	(mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Silicon	(mg/L)	26.1	24.7	31.9	23.3	10.8	26.8	55.9	84.6	76.8	7.18	96.2	5.65	5.89	5.57
Silver	(mg/L)	0.00116	0.00015	0.00129	0.00074	0.00039	0.000451	0.000150	0.000193	0.000571	<0.0001	0.000223	<0.0001	<0.0001	<0.0001
Sodium	(mg/L)	4.52	4.05	4.50	4.65	6.26	3.80	6.08	6.99	4.04	10.0	6.77	5.37	5.75	5.54
Strontium	(mg/L)	0.0582	0.0402	0.113	0.0365	0.0474	0.0376	0.0506	0.0959	0.0267	0.0776	0.0498	0.0348	0.0454	0.0639
Thallium	(mg/L)	0.00037	0.00022	0.00036	<0.0002	0.00034	<0.0001	<0.0001	0.00043	0.00023	<0.0001	0.00012	<0.0001	<0.0001	<0.0001
Tin	(mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Titanium	(mg/L)	0.984	0.427	1.36	0.418	0.142	0.640	0.924	0.752	1.06	0.014	1.74	<0.0100	<0.0100	<0.0100
Uranium	(mg/L)	0.00349	0.00406	0.00612	0.00145	0.00165	0.00109	0.000714	0.000653	0.00213	0.000103	0.00112	0.000223	0.000063	0.000213
Vanadium	(mg/L)	0.0922	0.0367	0.118	0.0342	0.0141	0.0261	0.0327	0.0395	0.0322	0.0107	0.0371	0.0190	0.0297	0.0239
Zinc	(mg/L)	0.171	0.120	0.395	0.087	0.303	0.076	0.035	0.927	0.144	<0.0100	0.039	<0.0100	<0.0100	<0.0100

Table AS-2: Shake Flask Extraction Results - Waste Rock Samples

Parameters	Units	BW-ARD-022	023	BW-ARD-9	037	032	019	042	050	106	105	088	079	110	058	052	054	055	057	074	073	114	120	286	253	127	129	237	137	288	139	140	230	143	149	152	153	155	061	069	269	166	076	176	228	178	217	094	095	499 DUP	509 DUP	537 DUP	566_DUP	510_DUP	526_DUP	212	210	204	104
Acidity (as CaCO3)	(mg/L)	2.8	51.5	189	5.1	27.3	3.8	2.0	2.8	4.9	2.8	5.2	2.9	<1.0	8.9	5.1	3.8	4.9	3.3	3.0	4.7	3.3	2.8	2.4	3.0	2.9	9.0	3.2	378	2.3	27.1	4.4	3.7	3.9	3.1	86.2	2.3	75.6	3.7	53.1	1.5	23.0	4.6	<1.0	15.1	3.8	146	1.5	1.2	3.9	2.7	2.6	11.4	<1.0	4.7	9.5	2.3	1.6	6.6
CaCO3)	(mg/L)	40.9	4.3	<2.0	3.6	4.1	24.3	29.8	15.5	5.0	16.2	2.8	5.3	42.1	14.2	8.7	10.6	7.5	4.5	3.6	4.1	4.2	6.2	34.8	10.7	16.9	1.3	4.0	4.1	15.8	5.6	13.1	10.2	12.4	16.3	2.5	28.4	3.4	3.9	2.3	10.2	<2.0	2.9	35.8	4.5	11.3	3.3	8.7	28.9	3.6	14.3	46.8	31.9	39.2	11.3	2.9	<2.0	5.9	2.9
Conductivity	(uS/cm)	337	378	802	221	568	327	165	189	383	108	273	24.4	144	380	394	21.9	158	245	96.1	214	211	33.9	125	108	61.1	276	141	1030	73.5	501	144	117	128	80.2	511	94.9	505	202	410	50.3	149	230	116	224	66.2	580	318	110	196	68.8	210	128	141	65.9	137	105	23.1	204
pH	Units	8.22	5.83	4.56	6.18	5.13	6.65	8.49	7.67	6.76	8.24	6.80	7.87	9.14	6.65	6.68	6.17	5.74	6.65	6.85	6.12	7.01	6.98	8.71	7.56	8.75	6.50	6.98	4.85	7.85	6.07	7.58	7.49	7.50	8.16	5.27	8.63	5.40	6.75	5.81	8.19	4.92	5.99	9.13	6.00	6.87	5.15	6.88	7.99	7.14	8.14	8.23	7.77	8.95	7.79	6.51	6.50	7.27	5.82
Sulfate (SO4)	(mg/L)	107	165	409	72.5	235	109	32.3	47.0	148	26.7	89.5	14.5	17.5	146	136	159	191	79.1	28.5	72.9	66.3	8.3	14.4	26.7	15.9	82.5	35.3	529	22.7	183	39.8	23.7	40.7	17.1	199	12.8	205	63.2	161	6.1	48.5	74.6	13.7	77.5	25.4	250	65.9	27.4	51.1	14.7	38.4	23.7	16.6	24.3	42.0	25.1	3.1	75.8
Calculated Hardness	(mg/L)	115.80	143.82	379.21	22.68	146.17	81.18	42.01	26.86	76.21	53.58	35.96	52.09	91.79	120.70	64.42	103.19	138.62	30.85	8.16	44.97	22.07	22.25	72.10	65.68	306.82	16.92	12.49	472.24	120.87	107.76	193.67	104.44	129.25	169.26	132.06	42.45	147.15	19.95	91.60	115.16	24.20	51.22	31.78	48.37	122.04	189.60	64.38	122.75	23.40	207.14	62.95	35.81	43.12	79.83	19.60	10.38	41.99	43.31
Aluminum	(mg/L)	0.0468	<0.05	4.74	0.0230	0.082	0.100	0.213	1.52	<0.025	4.66	<0.01	6.53	8.17	<0.025	0.081	<0.05	<0.05	0.0150	0.567	<0.01	0.0141	3.47	6.20	6.35	31.2	0.0086	0.0395	0.63	12.3	<0.025	19.0	9.71	13.0	16.9	0.052	3.23	0.041	0.110	<0.025	11.6	0.155	0.0059	1.82	0.0792	15.5	0.39	6.22	12.8	0.104	29.8	0.193	0.760	3.33	7.77	8.95	7.79	6.51	6.50	7.27	5.82
Antimony	(mg/L)	0.0135	0.0113	0.0123	0.00952	0.00064	0.0106	0.0272	0.105	0.00113	0.0318	0.00152	0.00581	0.0476	0.00509	0.00247	0.0038	0.0050	0.00589	0.00951	0.00500	0.0307	0.0104	0.0367	0.0159	0.0395	0.0123	0.00457	0.0108	0.0701	0.00099	0.0506	0.0322	0.0254	0.0356	0.00066	0.0062	<0.0005	0.0114	0.00109	0.0328	0.00150	0.00425	0.0858	0.0339	0.0290	<0.002	0.0168	0.0416	0.00296	0.0682	0.127	0.0143	0.112	0.0212	0.0152	0.0138	0.0317	0.00071
Arsenic	(mg/L)	0.0089	0.089	0.025	0.0095	0.0210	0.0028	0.0226	0.0029	0.0390	0.0035	0.0164	0.0265	0.0169	0.212	0.0254	0.314	0.224	0.0082	0.0915	0.158	0.0047	0.111	0.0162	0.0089	0.0503	0.0337	0.0073	<0.05	0.0193	0.0155	0.0327	0.0396	0.0087	0.0599	0.0097	0.026	<0.005	0.0038	0.0847	0.0140	<0.002	0.0441	0.0225	1.33	<0.01	0.061	0.0039	0.0057	0.0032	0.0160	0.0243	0.0067	0.0196	0.0767	0.0540	0.154	0.0397	0.0294
Barium	(mg/L)	0.0050	0.031	<0.02	0.0156	0.0198	0.0153	0.0071	0.0252	0.0425	0.0564	0.0239	0.133	0.0762	0.0153	0.0119	0.010	0.014	0.0271	0.0066	0.0073	0.0094	0.0221	0.0429	0.0599	0.332	0.0312	0.0349	<0.05	0.128	0.0634	0.179	0.0896	0.164	0.152	0.0346	0.018	0.0386	0.0043	0.0235	0.0755	0.0205	0.0164	0.0145	0.0667	0.086	0.096	0.0395	0.122	0.0029	0.195	0.0045	0.0155	0.0284	0.0294	0.0031	0.0014	0.0611	0.0125
Beryllium	(mg/L)	<0.0005	<0.005	<0.01	<0.0005	<0.0025	<0.001	<0.0005	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0025	<0.001	<0.005	<0.005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	0.00058	<0.0005	0.0014	<0.0005	<0.0005	<0.025	0.00072	<0.0025	<0.001	<0.0005	0.00090	<0.001	<0.0025	<0.005	<0.0025	<0.0005	<0.0025	0.00111	<0.001	<0.0005	<0.0005	<0.0005	<0.005	<0.01	<0.0005	0.00100	<0.0005	<0.0025	<0.0005	<0.0005	<0.0005	<0.0025	<0.001	<0.0005	<0.0005	<0.0005
Bismuth	(mg/L)	<0.0005	<0.005	<0.01	<0.0005	<0.0025	<0.001	<0.0005	<0.0005	<0.0025	0.00143	<0.0005	<0.0005	<0.0005	<0.0025	<0.001	<0.005	<0.005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	0.0025	<0.0005	<0.0005	<0.025	<0.0005	<0.0025	<0.001	0.0140	0.00169	0.0065	0.012	<0.0025	<0.005	<0.0025	<0.0005	<0.0025	0.00111	<0.001	<0.0005	<0.0005	<0.0005	<0.005	<0.01	<0.0005	0.00111	<0.0005	0.0051	<0.0005	<0.0005	<0.0005	<0.0025	<0.001	<0.0005	<0.0005	<0.0005
Boron	(mg/L)	<0.01	<0.1	<0.2	0.019	<0.05	0.025	<0.01	0.013	<0.05	<0.01	0.010	0.023	0.013	<0.05	<0.02	<0.1	<0.1	0.012	0.011	<0.02	0.014	0.027	0.013	0.013	<0.02	0.014	0.021	<0.05	<0.02	0.012	0.020	<0.02	<0.05	<0.1	<0.05	0.010	<0.05	0.016	0.021	0.010	<0.05	0.016	0.012	<0.1	0.024	<0.01	0.010	<0.05	0.016	<0.01	0.015	<0.05	<0.02	0.016	0.013	0.024
Cadmium	(mg/L)	0.000357	0.113	1.31	0.00129	0.0199	0.00042	0.000050	0.000231	0.00104	0.000828	0.000091	0.00564	0.000905	0.00777	0.00032	0.00107	0.00845	<0.00005	0.000191	0.00526	0.000392	0.00461	0.000824	0.000517	0.00183	<0.00005	0.000051	0.513	0.00167	0.00240	0.00243	0.00269	0.00119	0.00089	0.0228	0.00054	0.0202	0.000235	0.0800	0.000292	1.16	0.0196	0.00161	0.0202	<0.0005	1.83	0.000446	0.00136	0.00122	<0.00025	0.000555	0.000085	<0.00005	0.0219	0.000512	0.00529	0.00134	0.0130
Calcium	(mg/L)	40.6	30.1	18.2	2.40	20.9	17.3	14.9	3.25	8.80	2.59	5.57	0.80	7.80	18.8	9.57	9.8	13.7	7.24	1.15	6.06	3.50	0.18	7.42	1.00	1.30	1.64	1.88	17.3	1.24	6.98	1.86	1.12	1.47	2.39	11.1	4.7	22.2	4.37	12.7	1.02	3.94	14.5	6.33	11.9	1.9	9.5	6.28	6.35	5.44	1.00	23.1	10.4	6.79	3.48	2.60	2.28	0.72	5.63
Chromium	(mg/L)	<0.0005	<0.005	<0.01	<0.0005	<0.0025	<0.001	<0.0005	0.00125	<0.0025	0.00673	<0.0005	0.00197	0.0112	<0.0025	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	0.00237	0.00914	0.00897	0.0119	<0.0005	<0.0005	<0.025	0.0166	<0.0025	0.0281	0.0126	0.0140	0.0245	<0.0025	<0.005	<0.0025	<0.0005	<0.0025	0.00283	<0.001	<0.0005	0.00153	<0.0005	0.0136	<0.01	0.00077	0.0132	<0.0005	0.0026	0.0069	<0.001	<0.0005	0.00253	<0.001	<0.0005	<0.0005
Cobalt	(mg/L)	<0.0001	0.128	1.70	0.0260	0.137	0.00736	<0.0001	0.00092	0.0412	0.00162	0.0206	0.00623	0.00315	0.192	0.0470	0.0616	0.0564	0.00323	0.00020	0.00133	0.0115	0.00077	0.00392	0.00443	0.00913	0.0418	0.00475	1.77	0.00732	0.182	0.00650	0.0102	0.00636	0.00348	0.210	0.0014	0.0408	0.00390	0.0884	0.00239	0.0479	0.00241	0.00080	0.0843	0.0050	2.46	0.00410	0.00229	0.00821	0.00334	0.00023	0.00018	0.00069	0.0105	0.0310	0.00642	0.00143	0.0325
Copper	(mg/L)	0.0021	<0.01	0.147	<0.001	<0.005	<0.002	<0.001	<0.001	<0.005	0.0018	<0.001	0.0392	0.0052	<0.005	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	0.0124	0.0043	0.0040	0.0068	<0.001	<0.001	<0.005	0.0056	<0.005	0.0120	0.0034	0.0029	0.0055	<0.005	<0.01	<0.005	<0.001	0.0060	0.212	<0.001	0.0013	<0.001	<0.01	<0.002	<0.001	0.0032	<0.008	0.0254	<0.004	0.0361	<0.022	0.145	<0.002	<0.001	0.0241	<0.001
Iron	(mg/L)	<0.03	0.228	23.1	0.035	6.15	0.045	0.034	1.67	0.190	5.99	0.334	5.68	7.90	<0.03	0.125	0.053	0.121	<0.03	0.083	<0.03	<0.03	0.989	6.53	8.68	51.0	0.199	0.051	2.68	15.7	0.147	28.2	17.3	20.3	22.4	20.9	3.03	18.2	0.104	2.57	22.5	0.217	<0.03	1.35	0.848	10.4	12.7	3.61	11.7	0.081	17.9	<0.03	0.202	1.84	12.0	<0.03	<0.03	2.62	1.05
Lead	(mg/L)	<0.0006	0.0055	4.32	0.00578	0.00376	0.00348	<0.0005	0.00183	<0.0005	0.00631	<0.0006	0.436	0.0168	<0.0005	0.00210	<0.001	<0.001	0.00106	0.00229	0.0252	0.00104	0.199	0.0141	0.0595	0.240	0.00057	0.00012	1.14	0.139	0.00773	0.0346	0.00459	0.0469	0.0108	0.00256	0.0047	0.0124	<0.0008	0.00128	0.0228	10.0	0.102	0.0196	<0.0007	0.0730	2.90	0.0200	0.0292	<0.0004	0.0238	<0.0003	<0.0018	0.00384	0.343	0.00925	0.00117	0.946	0.0123
Lithium	(mg/L)	0.0221	<0.05	<0.1	0.0363	0.105	0.035	0.0218	0.0102	0.053	0.0100	0.0155	<0.005	0.0257	<0.025	0.038	<0.05	<0.05	0.0163	<0.005	<0.01	0.0227	<0.005	0.0225	0.0246	0.046	0.0456	0.0060	<0.25	0.0217	0.051	0.021	0.0156	0.0270	0.018	0.028	<0.05	<0.025	0.0296	0.061	0.0181	<0.01	0.0076	0.0200	0.0466	<0.05	<0.1	0.0383	0.0207	0.0486	<0.025	0.0135	<0.005	0.0234	<0.025	<0.01	0.0383	0.0207	0.0486	<0.025	0.0135	<0.005	0.0134	<0.025	<0.01	<0.005	<0.005	0.0167
Magnesium	(mg/L)	3.31	3.66	18.2	2.68	11.4	6.68	8.21	1.53	6.95	2.22	4.46	0.515	2.80	6.82	5.17	5.11	7.12	2.55	0.315	2.40	2.63	0.083	1.55	2.41	7.07	1.76	1.43	15.5	4.40	9.76	6.80	3.44	3.20	6.49	4.59	1.61	4.27	1.64	3.32	1.42	1.36	2.25	0.779	2.48	2.13	11.1	1.42	3.06	1.66	1.13	0.934	1.08	0.971	0.89	0.77	0.408	0.265	2.56
Manganese	(mg/L)	0.0161	2.67	56.5	2.27	17.5	5.30	0.0263	0.511	13.6	0.616	1.55	0.444	0.496	23.8	9.64	30.5	39.4	1.14	0.354	10.6	1.13	0.0595	0.404	0.739	3.62	0.973	0.827	11.0	0.814	17.7	1.55	0.845	1.20	1.16	23.7	0.197	20.5	0.758	9.89	1.01	0.497	1.60	0.0613	0.984	0.877	8.19	0.888	0.959	1.13	1.09	0.108	0.396	0.151	0.736	0.712	1.02	0.166	6.65
Mercury	(mg/L)	<0.00005	<0.00005	<0.00005

Table A5-3: Shake Flask Extraction Results - Ore Samples

Parameters	Units	BW-ARD2-2	BW-ARD-001	BW-ARD-258	BW-ARD-007	BW-ARD-227	BW-ARD-009	BW-ARD-200	KM# 2885 Whole Ore Composite
Acidity (as CaCO3)	(mg/L)	45.0	1.6	3.4	1.8	1.4	1.5	13.3	
Alkalinity, Total (as CaCO3)	(mg/L)	<2.0	4.7	2.2	6.3	5.0	6.2	3.4	
Conductivity	(uS/cm)	264	17.9	154	23.3	102	224	232	
pH	Units	5.04	6.90	6.15	7.49	6.68	6.50	5.84	5.90
Sulfate (SO4)	(mg/L)	107	<5.0	45.6	10.2	24.7	66.1	76.7	173.0
Calculated Hardness	(mg/L)	72.83	53.08	22.37	90.79	21.43	26.21	60.17	122.33
Dissolved Metals									
Aluminum	(mg/L)	0.487	7.20	0.0097	13.8	2.09	0.0162	0.012	<0.2
Antimony	(mg/L)	0.00762	0.0129	0.00302	0.0193	0.0506	0.0193	0.00326	<0.05
Arsenic	(mg/L)	<0.005	0.132	0.0742	0.554	0.0079	0.0219	0.0036	<0.05
Barium	(mg/L)	0.0564	0.0349	0.0086	0.186	0.0101	0.0118	0.0095	0.022
Beryllium	(mg/L)	0.0070	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.001	<0.005
Bismuth	(mg/L)	<0.0025	<0.0005	<0.0005	0.0021	<0.0005	<0.0005	<0.001	<0.1
Boron	(mg/L)	<0.05	0.015	0.022	0.029	0.021	0.014	<0.02	
Cadmium	(mg/L)	0.0984	0.00281	0.00696	0.0199	0.000403	0.000411	0.0650	0.673
Calcium	(mg/L)	6.22	0.59	4.36	0.54	2.42	3.41	7.53	18.0
Chromium	(mg/L)	<0.0025	0.00274	<0.0005	0.0016	0.00131	<0.0005	<0.001	<0.01
Cobalt	(mg/L)	0.0960	0.00144	0.0164	0.00498	0.00296	0.00841	0.0548	0.164
Copper	(mg/L)	0.214	0.161	<0.001	0.0562	0.0013	<0.001	0.0119	0.036
Iron	(mg/L)	1.96	4.43	0.324	5.69	0.420	0.038	0.037	0.089
Lead	(mg/L)	0.178	0.00646	0.0742	0.275	0.0116	0.00538	0.00776	<0.05
Lithium	(mg/L)	<0.025	0.0059	<0.005	<0.01	0.0129	0.0186	0.015	
Magnesium	(mg/L)	2.96	0.199	1.36	0.27	0.527	2.65	2.58	5.04
Manganese	(mg/L)	2.92	1.40	2.20	0.335	0.376	3.54	11.1	13.2
Mercury	(mg/L)	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.0001
Molybdenum	(mg/L)	<0.0005	0.00272	0.00014	0.00402	0.00149	0.00017	<0.0002	<0.03
Nickel	(mg/L)	0.0998	0.00116	0.0107	0.0025	0.00601	0.0262	0.0611	0.195
Phosphorus	(mg/L)	<0.3	<0.3	<0.3	0.45	<0.3	<0.3	<0.3	<0.3
Potassium	(mg/L)	25.0	5.13	26.1	9.31	22.3	46.1	28.5	38.9
Selenium	(mg/L)	<0.0025	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.001	<0.05
Silicon	(mg/L)	6.88	12.3	6.40	12.1	6.85	4.74	7.83	7.77
Silver	(mg/L)	<0.00025	0.00124	<0.00005	0.00290	0.000080	<0.00005	<0.0001	<0.01
Sodium	(mg/L)	1.81	1.10	1.07	0.83	1.40	1.57	1.34	2.1
Strontium	(mg/L)	0.0390	0.0106	0.0278	0.0127	0.0132	0.0243	0.0485	0.0755
Thallium	(mg/L)	0.00111	0.00044	0.00029	0.00071	<0.0001	<0.0001	<0.0002	<0.2
Tin	(mg/L)	<0.0025	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.001	<0.03
Titanium	(mg/L)	<0.01	0.137	<0.01	0.032	0.016	<0.01	<0.01	<0.01
Uranium	(mg/L)	0.0217	0.00156	0.000201	0.00585	0.000117	0.000021	0.000384	<0.5
Vanadium	(mg/L)	<0.005	0.0042	<0.001	0.0021	0.0027	<0.001	<0.002	<0.03
Zinc	(mg/L)	21.9	0.147	0.791	0.475	0.090	0.097	6.75	20.4

Table A5-4: Shake Flask Extraction Results - Metallurgical Tailings Samples

Parameter	Unit	KM# 2885 Test 1, 2 Rougher Tails	KM# 2885 Test 13,14,15 Cleaner Tails	KM# 2885 Test 8,9 Cyanide Tails	KM# 2885 Blend Comp 1 Whole Ore
		Rougher Tails Flotation Cyanidation (-150µm)	Cleaner Tails Flotation Cyanidation (-150µm)	WOL Cyanidation	WOL Cyanidation
Hardness	(mg/L)	135	504	174	122
pH	Units	8.8	8.7	8.3	5.9
Sulphate	(mg/L)	108	300	122	173
Dissolved Metals					
Aluminum	(mg/L)	<0.2	<0.2	<0.2	<0.2
Antimony	(mg/L)	<0.05	<0.05	<0.05	<0.05
Arsenic	(mg/L)	<0.05	<0.05	<0.05	<0.05
Barium	(mg/L)	<0.01	0.02	<0.01	0.022
Beryllium	(mg/L)	<0.005	<0.005	<0.005	<0.005
Bismuth	(mg/L)	<0.1	<0.1	<0.1	<0.1
Cadmium	(mg/L)	<0.01	<0.01	<0.01	0.67
Calcium	(mg/L)	52.3	196	65.5	18
Chromium	(mg/L)	<0.01	<0.01	<0.01	<0.01
Cobalt	(mg/L)	<0.01	<0.01	<0.01	0.16
Copper	(mg/L)	<0.01	0.021	<0.01	0.036
Iron	(mg/L)	<0.03	<0.03	0.033	0.089
Lead	(mg/L)	<0.05	<0.05	<0.05	<0.05
Magnesium	(mg/L)	0.66	3	2.3	5
Manganese	(mg/L)	<0.005	0.0065	0.064	13.2
Mercury	(mg/L)	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	(mg/L)	<0.03	0.057	<0.03	<0.03
Nickel	(mg/L)	<0.05	<0.05	<0.05	0.2
Selenium	(mg/L)	<0.05	<0.05	<0.05	<0.05
Silver	(mg/L)	<0.01	0.018	<0.01	<0.01
Thallium	(mg/L)	<0.2	<0.2	<0.2	<0.2
Titanium	(mg/L)	<0.01	0.013	<0.01	<0.01
Vanadium	(mg/L)	<0.03	<0.03	<0.03	<0.03
Zinc	(mg/L)	<0.02	<0.02	<0.02	20.4

ANNEX 6
Waste Rock and Ore Humidity Cell and Modified Humidity Cell Test Results

Table A6-1: Results of Waste Rock Humidity Cell Test BW-ARD2-9

Table A6-1: Results of Waste Rock Humidity Cell Test BW-ARD2-9

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Date Sampled		06-Jul-11	13-Jul-11	20-Jul-11	27-Jul-11	03-Aug-11	10-Aug-11	17-Aug-11	24-Aug-11	31-Aug-11	07-Sep-11	14-Sep-11	21-Sep-11	28-Sep-11	05-Oct-11	12-Oct-11	19-Oct-11	26-Oct-11	02-Nov-11	09-Nov-11	16-Nov-11	23-Nov-11
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	620	500	500	500	500	490	475	465	460	475	500	455	460	460	475	500	485	455	485	460	475
Conductivity	mS/cm	1510	1250	660	481	450	577	696	780	860	811	797	797	810	864	752	742	770	875	783	864	910
pH	units	3.98	4.22	4.35	4.36	4.32	4.19	4.12	4.05	4.05	4.08	4.00	3.90	3.86	3.79	3.78	3.76	3.64	3.47	3.42	3.37	3.32
Acidity	mg/L CaCO3	732	375	239	115	109	110	170	161	188	270	177	138	227	166	146	195	267	192	234	260	248
Alkalinity, Total	mg/L CaCO3	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Sulfate	mg/L	1150	844	336	248	228	290	375	414	518	448	421	442	431	483	375	382	379	454	385	431	447
Hardness (calc)		309.33	262.24	107.80	64.42	56.61	67.55	75.66	82.02	90.50	77.60	74.62	71.02	71.36	71.39	63.69	60.80	59.00	63.14	50.99	60.33	60.37
Dissolved Metals																						
Aluminum	mg/L	58.7	14.7	2.69	1.41	1.16	1.46	1.91	2.23	2.17	1.58	1.82	1.95	2.18	2.63	2.15	2.61	3.40	6.15	5.19	7.94	9.11
Antimony	mg/L	0.0077	0.0059	0.0028	0.0016	0.0012	0.0012	0.002	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0050	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020
Arsenic	mg/L	0.0126	0.0188	0.0090	0.0051	0.0045	0.0042	0.0033	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0050	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020
Barium	mg/L	0.0179	0.0152	0.0284	0.0174	0.0106	0.00940	0.0081	0.0065	0.0098	0.0071	0.0088	0.0046	0.0066	0.0075	0.0082	0.0049	0.0039	0.0065	0.0059	0.0064	0.0072
Beryllium	mg/L	0.0349	0.0165	0.0051	0.0033	0.0033	0.0039	0.0047	0.0055	0.0058	0.0047	0.0053	0.0067	0.0062	0.0068	0.0057	0.0065	0.0075	0.0108	0.0095	0.0101	0.0109
Bismuth	mg/L	0.010	0.010	0.005	0.005	0.005	0.005	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.025	0.010	0.010	0.010	0.010	0.010	0.010
Boron	mg/L	0.20	0.20	0.10	0.10	0.10	0.10	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.50	0.20	0.20	0.20	0.20	0.20	0.20
Cadmium	mg/L	3.73	2.95	1.29	0.775	0.700	0.798	0.861	0.920	0.972	0.739	0.696	0.621	0.571	0.577	0.474	0.456	0.460	0.491	0.385	0.505	0.515
Calcium	mg/L	43.3	46.4	21.0	12.1	10.5	12.6	14.1	14.7	15.5	13.2	12.3	10.8	10.6	10.1	8.43	8.1	7.9	8.2	7.46	8.09	7.90
Chromium	mg/L	0.016	0.010	0.005	0.005	0.005	0.005	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.025	0.010	0.010	0.010	0.010	0.010	0.010
Cobalt	mg/L	5.41	3.61	1.38	0.731	0.609	0.661	0.614	0.581	0.548	0.395	0.334	0.291	0.255	0.250	0.196	0.193	0.189	0.202	0.148	0.190	0.187
Copper	mg/L	2.06	0.478	0.148	0.104	0.106	0.116	0.136	0.173	0.159	0.136	0.181	0.219	0.231	0.253	0.159	0.233	0.338	0.471	0.407	0.650	0.599
Iron	mg/L	73.9	33.1	7.39	3.24	2.49	4.45	5.62	6.23	6.59	5.60	6.46	5.08	4.67	9.27	4.73	5.76	5.62	8.70	7.38	9.40	12.0
Lead	mg/L	2.75	2.52	1.65	1.03	0.945	0.865	0.668	0.766	1.12	1.09	1.16	1.27	1.25	1.49	1.40	1.38	1.49	1.43	1.06	1.32	1.50
Lithium	mg/L	0.154	0.106	0.0545	0.0333	0.0296	0.0291	0.026	0.027	0.034	0.022	0.021	0.015	0.016	0.011	<0.025	0.011	<0.01	0.014	0.020	0.015	0.015
Magnesium	mg/L	50.1	36.8	14.0	8.63	7.66	9.10	10.2	11.4	13.0	11.2	11.0	11.0	11.2	11.5	10.6	10.1	9.79	10.6	8.07	9.98	10.1
Manganese	mg/L	120	160	88.4	65.7	72.1	101	133	154	196	168	165	179	187	179	154	148	140	146	106	140	138
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000010	0.000010	0.000010
Molybdenum	mg/L	0.0010	0.0013	0.0006	0.0007	0.0005	0.0005	0.0010	0.0010	0.0010	0.0011	0.0015	0.0017	0.0011	0.0010	0.0025	0.0010	0.0010	0.0010	0.0014	0.0010	0.0010
Nickel	mg/L	4.07	2.87	1.16	0.691	0.618	0.733	0.750	0.793	0.847	0.656	0.618	0.594	0.538	0.558	0.451	0.465	0.473	0.523	0.379	0.498	0.492
Phosphorus	mg/L	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Potassium	mg/L	11.4	4.8	2.8	2.1	1.8	2.1	1.6	1.6	2.0	1.6	1.5	1.4	1.4	1.3	2.5	1.2	1.0	1.1	1.0	1.0	1.0
Selenium	mg/L	0.002	0.002	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.009	0.002	0.002	0.002	0.005	0.002	0.002	0.002	0.002	0.002	0.002
Silicon	mg/L	2.33	8.19	6.40	5.45	5.01	6.13	6.79	6.57	7.78	6.69	7.14	5.98	6.05	7.45	6.42	6.35	6.20	7.42	6.77	7.55	8.34
Silver	mg/L	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Sodium	mg/L	4.5	2.3	0.9	0.5	0.5	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.5	1.0	1.0	1.0	1.0	1.0	1.0
Strontium	mg/L	0.115	0.076	0.059	0.046	0.043	0.045	0.043	0.034	0.036	0.031	0.030	0.021	0.024	0.026	0.029	0.023	0.023	0.027	0.026	0.027	0.037
Sulfur	mg/L	387.0	286.0	133.0	83.9	82.4	105.0	136.0	153.0	176.0	164.0	164.0	160.0	163.0	171.0	142.0	141.0	144.0	169.0	141.0	164.0	164.0
Thallium	mg/L	0.0027	0.0016	0.0013	0.0008	0.0006	0.0014	0.0006	0.0007	0.0011	0.0015	0.0002	0.0005	0.0011	0.0019	0.0005	0.0002	0.0002	0.0003	0.0002	0.0020	0.0022
Tin	mg/L	0.002	0.002	0.001	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.005	0.002	0.002	0.002	0.002	0.002	0.002
Titanium	mg/L	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Uranium	mg/L	0.077	0.025	0.006	0.004	0.004	0.005	0.007	0.008	0.009	0.007	0.008	0.009	0.009	0.010	0.007	0.009	0.011	0.015	0.012	0.014	0.015
Vanadium	mg/L	0.020	0.020	0.010	0.010	0.010	0.010	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.050	0.020	0.020	0.020	0.020	0.020	0.020
Zinc	mg/L	133.0	118.0	55.4	36.6	35.3	41.2	46.5	52.4	59.8	47.8	45.5	44.0	43.3	47.3	38.8	38.1	42.6	49.4	39.5	57.7	62.9

Table A6-1: Results of Waste Rock Humidity Cell Test BW-ARD2-9

Week	Units	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Date Sampled		30-Nov-11	07-Dec-11	14-Dec-11	21-Dec-11	28-Dec-11	04-Jan-12	11-Jan-12	18-Jan-12	25-Jan-12	01-Feb-12	08-Feb-12	15-Feb-12	22-Feb-12	29-Feb-12	07-Mar-12	14-MAR-12	21-MAR-12	28-MAR-12	04-APR-12	11-APR-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	460	460	460	450	465	430	450	450	440	440	455	475	475	465	460	475	460	450	450
Conductivity	mS/cm	889	933	962	1100	1180	1210	1320	1380	1370	1290	1380	1290	1250	1250	1380	1380	1350	1340	1430	1410
pH	units	3.29	3.24	3.22	3.20	3.13	3.11	3.06	2.92	2.93	2.96	2.93	2.95	3.00	2.96	2.91	2.91	2.87	2.89	2.84	2.86
Acidity	mg/L CaCO3	295	274	275	304	345	420	421	441	452	385	514	393	372	420	444	435	406	414	534	444
Alkalinity, Total	mg/L CaCO3	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	<2.0	2
Sulfate	mg/L	430	413	437	436	450	479	525	544	538	484	507	461	481	461	477	486	442	479	484	485
Hardness (calc)		53.23	53.48	51.59	52.06	53.32	50.75	52.19	53.65	52.45	45.99	50.45	44.56	44.67	45.88	44.25	46.84	45.92	45.62	47.32	45.12
Dissolved Metals																					
Aluminum	mg/L	9.12	11.2	12.0	13.6	16.6	17.1	19.8	21.6	21.3	20.1	21.7	19.1	19.0	20.4	21.0	20.0	20.1	22.7	22.0	22.0
Antimony	mg/L	0.0020	0.0050	0.0020	0.0010	0.0020	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0020	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	<0.001	0.001
Arsenic	mg/L	0.0020	0.0050	0.0020	0.0010	0.0020	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0020	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	<0.001	0.001
Barium	mg/L	0.0065	0.0071	0.0079	0.00895	0.0107	0.0108	0.0107	0.0129	0.0128	0.0131	0.0138	0.0116	0.0122	0.0121	0.0123	0.0113	0.00914	0.00831	0.0110	0.00805
Beryllium	mg/L	0.0095	0.0095	0.0092	0.0092	0.0095	0.0090	0.0075	0.0092	0.0084	0.0070	0.0078	0.0064	0.0058	0.0060	0.0053	0.0050	0.0047	0.0048	0.0050	0.0043
Bismuth	mg/L	0.010	0.025	0.010	0.005	0.010	0.005	0.005	0.005	0.005	0.005	0.005	0.010	0.005	0.005	0.005	0.005	0.005	0.005	<0.005	0.005
Boron	mg/L	0.20	0.50	0.20	0.10	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.20	0.10	0.10	0.10	0.10	0.10	0.10	<0.1	0.1
Cadmium	mg/L	0.469	0.486	0.519	0.538	0.595	0.614	0.695	0.740	0.649	0.598	0.611	0.541	0.546	0.530	0.528	0.490	0.461	0.478	0.465	0.460
Calcium	mg/L	7.18	7.42	7.54	7.05	7.37	6.78	6.97	6.91	7.13	6.30	7.03	6.35	5.92	5.93	6.19	6.26	6.37	5.87	6.29	6.31
Chromium	mg/L	0.010	0.025	0.010	0.005	0.010	0.005	0.005	0.006	0.007	0.006	0.007	0.010	0.005	0.007	0.008	0.008	0.007	0.009	0.0093	0.0093
Cobalt	mg/L	0.166	0.163	0.164	0.169	0.179	0.180	0.197	0.194	0.185	0.165	0.180	0.154	0.155	0.147	0.149	0.141	0.136	0.143	0.143	0.139
Copper	mg/L	0.649	0.588	0.626	0.724	0.894	0.926	0.982	1.02	0.941	0.963	1.03	0.829	0.843	0.646	0.809	0.707	0.711	0.799	0.790	0.744
Iron	mg/L	10.8	14.3	14.8	15.2	20.8	22.6	27.8	30.8	30.0	24.8	25.9	26.4	25.2	25.3	31.7	32.4	30.5	29.6	32.2	33.6
Lead	mg/L	1.24	1.18	1.19	0.940	1.03	1.08	0.816	0.990	1.01	0.864	0.866	0.713	0.728	0.807	0.723	0.638	0.532	0.423	0.502	0.315
Lithium	mg/L	<0.01	<0.025	0.015	0.0144	0.016	0.0133	0.0127	0.0205	0.0196	0.0166	0.0183	0.020	0.0179	0.0235	0.0199	0.0201	0.0204	0.0210	0.0185	0.0135
Magnesium	mg/L	8.78	8.70	8.17	8.57	8.69	8.41	8.65	9.04	8.62	7.53	8.19	7.15	7.43	7.72	7.17	7.76	7.47	7.69	7.86	7.31
Manganese	mg/L	122	120	111	99.0	97.1	96.9	103	97.8	90.4	75.5	87.5	68.6	79.1	68.9	65.2	63.8	65.2	67.1	69.7	65.2
Mercury	mg/L	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	<0.00001	0.00001
Molybdenum	mg/L	0.0010	0.0025	0.0010	0.0019	0.0010	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0010	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	0.0005
Nickel	mg/L	0.449	0.447	0.424	0.449	0.472	0.473	0.511	0.495	0.469	0.424	0.457	0.391	0.409	0.374	0.386	0.362	0.354	0.365	0.370	0.353
Phosphorus	mg/L	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	<0.3	0.3
Potassium	mg/L	1.0	2.5	1.0	0.6	1.0	0.5	0.5	0.5	0.5	0.5	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	<0.5	0.5
Selenium	mg/L	0.002	0.005	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	<0.001	0.001
Silicon	mg/L	7.77	8.54	8.92	8.30	9.13	8.68	9.26	10.70	10.80	9.28	9.08	9.60	9.17	10.20	11.10	11.70	11.40	10.00	9.87	11.5
Silver	mg/L	0.0002	0.0005	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00010	0.00015
Sodium	mg/L	1.0	2.5	1.0	0.5	1.0	0.5	0.5	0.5	0.5	0.5	0.5	1.0	0.5	0.5	0.5	3.6	0.5	0.5	<0.5	0.5
Strontium	mg/L	0.043	0.044	0.049	0.053	0.051	0.048	0.043	0.063	0.065	0.062	0.074	0.057	0.061	0.077	0.078	0.080	0.080	0.077	0.0820	0.0727
Sulfur	mg/L	157.0	159.0	168.0	169.0	183.0	182.0	201.0	205.0	204.0	197.0	187.0	184.0	171.0	168.0	178.0	181.0	177.0	161.0	182	189
Thallium	mg/L	0.0027	0.0027	0.0019	0.0001	0.0002	0.0005	0.0016	0.0003	0.0005	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	0.0001
Tin	mg/L	0.002	0.005	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	<0.001	0.001
Titanium	mg/L	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	<0.01	0.01
Uranium	mg/L	0.015	0.014	0.015	0.016	0.016	0.016	0.014	0.017	0.016	0.014	0.014	0.012	0.012	0.011	0.012	0.011	0.010	0.010	0.0103	0.00969
Vanadium	mg/L	0.020	0.050	0.020	0.010	0.020	0.010	0.010	0.010	0.010	0.010	0.010	0.020	0.010	0.010	0.010	0.010	0.010	0.010	<0.01	0.01
Zinc	mg/L	60.3	60.9	67.0	65.2	75.3	85.9	100.0	95.1	91.3	84.5	91.4	65.3	80.2	73.6	76.1	72.6	67.2	65.8	67.4	64.7

Table A6-1: Results of Waste Rock Humidity Cell Test BW-ARD2-9

Week	Units	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Date Sampled		18-APR-12	25-APR-12	02-MAY-12	09-MAY-12	16-MAY-12	23-MAY-12	30-MAY-12	06-JUN-12	13-JUN-12	20-JUN-12	27-JUN-12	04-JUL-12	11-JUL-12	18-JUL-12	25-JUL-12	01-AUG-12	08-AUG-12	15-AUG-12	22-AUG-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	475	440	475	485	455	500	495	450	450	500	490	475	460	470	435	495	475	450	455
Conductivity	mS/cm	1260	1280	1280	1380	1640	1400	1470	1480	1360	1310	1440	1510	1560	1780	1750	1710	2140	2270	2500
pH	units	2.92	2.90	2.91	2.84	2.76	2.84	2.82	2.81	2.82	2.83	2.78	2.73	2.67	2.66	2.68	2.72	2.59	2.55	2.52
Acidity	mg/L CaCO3	399	475	379	405	505.32	470	495	554	414	422	489	474	511	690	565	578	788	882	1040
Alkalinity, Total	mg/L CaCO3	2	2	2	2	<2.0	<2.0	<2.0	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.
Sulfate	mg/L	435	443	462	473	561	441	527	513	461	433	493	510	520	621	642	571	869	972	1020
Hardness (calc)		45.11	46.00	48.02	52.00		50.85		54.93		57.13		55.52		60.16		60.02		71.76	
Dissolved Metals																				
Aluminum	mg/L	20.2	21.9	21.6	23.8		23.4		26.1		19.9		28.2		33.1		33.6		45.3	
Antimony	mg/L	0.001	0.001	0.001	0.001		<0.001		<0.001		<0.001		0.00064		<0.001		0.0010		0.0015	
Arsenic	mg/L	0.001	0.001	0.001	0.001		<0.001		<0.001		<0.001		0.00060		<0.001		0.0012		0.0016	
Barium	mg/L	0.00654	0.00614	0.00528	0.00793		0.00649		0.00785		0.0101		0.00780		0.00592		0.00549		0.00415	
Beryllium	mg/L	0.0033	0.0041	0.0036	0.0038		0.0037		0.0038		0.0031		0.00301		0.0030		0.0034		0.0041	
Bismuth	mg/L	0.005	0.005	0.005	0.005		<0.005		<0.005		<0.005		<0.0025		<0.005		<0.005		<0.005	
Boron	mg/L	0.1	0.1	0.1	0.1		<0.1		<0.1		<0.1		<0.05		<0.1		<0.1		<0.1	
Cadmium	mg/L	0.389	0.402	0.370	0.410		0.374		0.380		0.265		0.283		0.382		0.429		0.613	
Calcium	mg/L	5.93	5.96	6.41	7.06		6.89		6.93		8.24		7.76		7.64		8.30		9.06	
Chromium	mg/L	0.0085	0.0085	0.0087	0.0107		0.0101		0.0135		0.0099		0.0165		0.0203		0.0237		0.0378	
Cobalt	mg/L	0.121	0.126	0.120	0.136		0.124		0.133		0.104		0.125		0.146		0.151		0.208	
Copper	mg/L	0.547	0.632	0.497	0.640		0.615		0.697		0.366		0.691		0.834		0.759		1.19	
Iron	mg/L	28.6	27.6	28.0	30.6		31.9		35.6		26.4		33.3		47.4		38.4		79.8	
Lead	mg/L	0.268	0.278	0.279	0.328		0.245		0.297		0.491		0.236		0.122		0.150		0.0714	
Lithium	mg/L	0.0189	0.0210	0.0224	0.0217		0.0280		0.0269		0.0292		0.0288		0.0297		0.0402		0.0466	
Magnesium	mg/L	7.53	7.73	7.96	8.55		8.37		9.34		9.11		9.00		10.2		9.78		12.2	
Manganese	mg/L	59.7	61.2	65.0	65.2		60.3		64.0		61.8		51.8		50.2		61.6		53.9	
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001	
Molybdenum	mg/L	0.0005	0.0005	0.0005	0.0005		<0.0005		<0.0005		<0.0005		0.00141		<0.0005		<0.0005		<0.0005	
Nickel	mg/L	0.312	0.327	0.309	0.352		0.323		0.364		0.282		0.332		0.377		0.387		0.511	
Phosphorus	mg/L	0.3	0.3	0.3	0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3	
Potassium	mg/L	0.5	0.5	0.5	0.5		<0.5		<0.5		<0.5		<0.25		<0.5		<0.5		<0.5	
Selenium	mg/L	0.001	0.001	0.001	0.001		<0.001		<0.001		<0.001		<0.0005		<0.001		<0.001		<0.001	
Silicon	mg/L	11.3	10.8	12.7	13.5		15.4		16.5		16.2		14.9		17.2		19.7		19.1	
Silver	mg/L	0.00013	0.00015	0.00014	0.00022		0.00028		0.00035		0.00031		0.000381		0.00051		0.00103		0.00053	
Sodium	mg/L	0.5	0.5	0.5	0.5		<0.5		<0.5		<0.5		<0.25		<0.5		<0.5		<0.5	
Strontium	mg/L	0.0654	0.0748	0.0815	0.105		0.0942		0.112		0.141		0.114		0.102		0.133		0.142	
Sulfur	mg/L	161	164	171	181		184		189		160		190		230		225		314	
Thallium	mg/L	0.0001	0.0001	0.0001	0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Tin	mg/L	0.001	0.001	0.001	0.001		<0.001		<0.001		<0.001		<0.0005		<0.001		<0.001		<0.001	
Titanium	mg/L	0.01	0.01	0.01	0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Uranium	mg/L	0.00686	0.00895	0.00709	0.00895		0.00831		0.00813		0.00590		0.00767		0.00809		0.00867		0.0101	
Vanadium	mg/L	0.01	0.01	0.01	0.01		<0.01		<0.01		<0.01		<0.005		<0.01		<0.01		<0.01	
Zinc	mg/L	56.1	57.0	56.2	57.9		55.3		54.0		36.5		41.5		56.8		68.0		87.3	

Table A6-1: Results of Waste Rock Humidity Cell Test BW-ARD2-9

Week	Units	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
Date Sampled		29-AUG-12	05-SEP-12	12-SEP-12	19-SEP-12	26-SEP-12	03-OCT-12	10-OCT-12	17-OCT-12	24-OCT-12	31-OCT-12	07-NOV-12	14-NOV-12	21-NOV-12	28-NOV-12	05-DEC-12	12-DEC-12	19-DEC-12	26-DEC-12	02-JAN-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	480	475	485	460	465	475	455	500	485	420	475	500	465	430	490	460	465	450	500
Conductivity	mS/cm	2440	2560	2570	2700	2710	2490	2640	2460	2480	2620	2050	2430	2860	2850	2900	2690	2920	2660	2820
pH	units	2.55	2.47	2.50	2.39	2.41	2.47	2.42	2.47	2.50	2.38	2.52	2.45	2.35	2.38	2.35	2.39	2.36	2.43	2.39
Acidity	mg/L CaCO3	979	1070	1000	1110	1160	1000	1060	916	928	978	674	903	1080	1150	1150	1080	1200	1030	1090
Alkalinity, Total	mg/L CaCO3	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.00	<2.00	<2.00	<2.00	<2.00	<2.
Sulfate	mg/L	994	1040	1030	1120	1100	1010	1070	933	913	996	704	868	1140	1200	1190	1080	1220	1120	1120
Hardness (calc)		75.23		78.70		84.65		79.59		73.49		65.59		99.23		98.44		87.90		94.50
Dissolved Metals																				
Aluminum	mg/L	45.0		44.7		45.4		42.0		35.2		27.2		45.4		46.4		45.7		41.6
Antimony	mg/L	0.0018		0.0020		0.0022		<0.002		<0.002		0.00196		0.0026		0.0036		0.0025		0.0027
Arsenic	mg/L	0.0015		<0.002		0.0030		<0.002		<0.002		0.00094		0.0016		0.0019		0.0018		0.0016
Barium	mg/L	0.00310		0.0029		0.0026		0.0027		0.0040		0.00260		0.00326		0.00402		0.00270		0.00325
Beryllium	mg/L	0.0039		0.0039		0.0037		0.0032		0.0026		0.00199		0.0027		0.0030		0.0024		0.0024
Bismuth	mg/L	<0.005		<0.01		<0.01		<0.01		<0.01		<0.0025		<0.005		<0.005		<0.005		<0.005
Boron	mg/L	<0.1		<0.2		<0.2		<0.2		<0.2		<0.05		<0.1		<0.10		<0.10		<0.1
Cadmium	mg/L	0.705		0.709		0.707		0.582		0.452		0.358		0.420		0.461		0.436		0.366
Calcium	mg/L	9.31		9.90		10.5		10.1		9.61		8.88		13.5		13.0		11.0		11.7
Chromium	mg/L	0.0406		0.045		0.047		0.049		0.044		0.0398		0.0655		0.0676		0.0687		0.0640
Cobalt	mg/L	0.227		0.229		0.241		0.213		0.166		0.128		0.180		0.188		0.194		0.159
Copper	mg/L	1.28		1.29		1.28		1.10		0.898		0.714		0.887		0.887		0.805		0.683
Iron	mg/L	94.8		118		139		130		115		80.9		146		161		184		153
Lead	mg/L	0.0576		0.0581		0.0549		0.0523		0.0629		0.0585		0.0567		0.0676		0.0530		0.0531
Lithium	mg/L	0.0534		0.051		0.056		0.044		0.040		0.0378		0.0588		0.0632		0.0473		0.0535
Magnesium	mg/L	12.9		13.4		14.5		13.5		12.3		10.8		16.3		16.4		15.0		16.2
Manganese	mg/L	55.8		59.1		57.7		52.3		40.1		35.1		38.0		33.7		28.2		28.1
Mercury	mg/L	<0.00001		<0.00001		<0.		<0.		<0.		<0.		<0.		<0.00001		<0.00001		<0.
Molybdenum	mg/L	<0.0005		<0.001		0.0010		<0.001		<0.001		0.00029		<0.0005		<0.0005		<0.0005		<0.0005
Nickel	mg/L	0.559		0.561		0.585		0.521		0.405		0.315		0.437		0.454		0.469		0.390
Phosphorus	mg/L	<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.30		<0.30		<0.3
Potassium	mg/L	<0.5		<1.		<1.		<1.		<1.		<0.25		<0.5		<0.50		<0.50		<0.5
Selenium	mg/L	<0.001		<0.002		<0.002		<0.002		<0.002		<0.0005		<0.001		<0.001		<0.001		<0.001
Silicon	mg/L	22.1		23.2		26.1		24.7		23.8		24.9		28.3		31.0		25.5		31.3
Silver	mg/L	0.00090		0.00160		0.00287		0.00303		0.00281		0.00221		0.00412		0.00382		0.00293		0.00250
Sodium	mg/L	<0.5		<1.		<1.		<1.		<1.		<0.25		<0.5		<0.50		<0.50		<0.5
Strontium	mg/L	0.153		0.158		0.179		0.179		0.194		0.179		0.262		0.274		0.231		0.266
Sulfur	mg/L	346		370		392		365		312		251		383		399		403		361
Thallium	mg/L	<0.0001		<0.0002		<0.0002		<0.0002		<0.0002		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Tin	mg/L	<0.001		<0.002		<0.002		<0.002		<0.002		<0.0005		<0.001		<0.001		<0.001		<0.001
Titanium	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01
Uranium	mg/L	0.0101		0.00956		0.00926		0.00786		0.00679		0.00496		0.00791		0.00801		0.00682		0.00609
Vanadium	mg/L	<0.01		<0.02		<0.02		<0.02		<0.02		<0.005		<0.01		<0.01		<0.01		<0.01
Zinc	mg/L	98.1		99.2		103		86.5		61.6		53.7		56.4		59.8		59.1		49.7

Table A6-1: Results of Waste Rock Humidity Cell Test BW-ARD2-9

Week	Units	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97
Date Sampled		09-JAN-13	16-JAN-13	23-JAN-13	30-JAN-13	06-FEB-13	13-FEB-13	20-FEB-13	27-FEB-13	06-MAR-13	13-MAR-13	20-MAR-13	27-MAR-13	03-APR-13	10-APR-13	17-APR-13	24-APR-13	01-MAY-13	08-MAY-13	15-MAY-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	475	450	475	450	470	475	430	500	500	465	400	500	450	465	450	490	430	500	475
Conductivity	mS/cm	3080	2990	2810	2500	2560	2480	2550	2490	2550	2640	2420		2410		2440		2170		2270
pH	units	2.34	2.33	2.32	2.38	2.36	2.42	2.41	2.41	2.38	2.39	2.42		2.42		2.42		2.50		2.44
Acidity	mg/L CaCO3	1250	1170	1040	881	945	837	889	848	942	1030	935		1020		995		825		917
Alkalinity, Total	mg/L CaCO3	<2.	<2.	<2.	<2.	<2.	<2.	<2.0	<2.0	<2.0	<2.0	<2.0		<2.0		<2.00		<2.00		<2.00
Sulfate	mg/L	1360	1200	1160	983	944	880	865	932	929	1080	916		880		943		811		868
Hardness (calc)			89.10		83.01		114.59		94.33	93.37	83.04			82.66		96.58		80.65		90.57
Dissolved Metals																				
Aluminum	mg/L		41.4		36.5		39.1		38.7	40.5	42.0			37.1		40.0		33.6		38.0
Antimony	mg/L		0.00238		0.00271		0.00284		0.00273	0.00261	0.00209			0.00230		0.00245		0.00210		0.00203
Arsenic	mg/L		<0.0005		0.00136		0.00190		0.00109	0.00149	0.00150			0.00196		0.00126		0.00131		0.00117
Barium	mg/L		0.00279		0.00336		0.00334		0.00383	0.00461	0.00285			0.00327		0.00218		0.00192		0.00228
Beryllium	mg/L		0.00218		0.00205		0.00198		0.00198	0.00195	0.00160			0.00153		0.00175		0.00141		0.00178
Bismuth	mg/L		<0.0025		<0.0025		<0.0025		<0.0025	<0.0025	<0.0025			<0.0025		<0.0025		<0.001		<0.001
Boron	mg/L		<0.05		<0.05		<0.05		<0.05	<0.05	<0.05			<0.05		<0.05		<0.02		<0.02
Cadmium	mg/L		0.332		0.255		0.232		0.199	0.183	0.191			0.197		0.193		0.141		0.137
Calcium	mg/L		11.5		10.5		11.7		11.8	11.4	10.0			9.84		11.2		9.86		11.6
Chromium	mg/L		0.0661		0.0560		0.0639		0.0662	0.0672	0.0673			0.0671		0.0673		0.0566		0.0612
Cobalt	mg/L		0.158		0.121		0.117		0.113	0.111	0.125			0.111		0.113		0.0871		0.0954
Copper	mg/L		0.639		0.482		0.449		0.406	0.381	0.384			0.354		0.362		0.262		0.274
Iron	mg/L		181		123		112		106	107	153			133		123		98.4		97.1
Lead	mg/L		0.0428		0.0722		0.0572		0.0841	0.0981	0.0372			0.0378		0.0333		0.0253		0.0251
Lithium	mg/L		0.0552		0.0515		0.0587		0.0565	0.0587	0.0500			0.0454		0.0591		0.0509		0.0640
Magnesium	mg/L		15.0		14.1		21.1		16.1	16.1	14.4			14.4		17.0		13.9		15.3
Manganese	mg/L		21.5		18.9		20.9		19.8	17.7	16.0			14.4		15.5		11.6		12.1
Mercury	mg/L		0.000080		<0.		<0.		<0.00001	<0.00001	<0.00001			<0.00001		<0.00001		<0.00001		<0.00001
Molybdenum	mg/L		<0.0003		<0.0003		0.00025		<0.00025	<0.00025	<0.00025			<0.00025		0.00033		<0.0001		<0.0001
Nickel	mg/L		0.381		0.291		0.287		0.280	0.274	0.309			0.288		0.292		0.222		0.240
Phosphorus	mg/L		<0.3		<0.3		<0.3		<0.3	<0.3	<0.3			<0.3		<0.30		<0.30		<0.30
Potassium	mg/L		<0.25		<0.25		<0.25		<0.25	<0.25	<0.25			<0.25		<0.25		<0.10		<0.10
Selenium	mg/L		<0.0005		<0.0005		<0.0005		<0.0005	<0.0005	<0.0005			<0.0005		<0.0005		<0.0002		<0.0002
Silicon	mg/L		26.0		28.0		32.5		33.5	31.3	23.9			24.2		27.4		23.1		25.6
Silver	mg/L		0.00269		0.00156		0.00136		0.00144	0.00148	0.00127			0.000578		0.000501		0.000412		0.000472
Sodium	mg/L		<0.25		<0.25		1.71		<0.25	<0.25	<0.25			<0.25		0.35		<0.10		0.30
Strontium	mg/L		0.259		0.255		0.289		0.287	0.288	0.230			0.236		0.276		0.237		0.286
Sulfur	mg/L		403		309		326		309	323	343			311		318		271		287
Thallium	mg/L		<0.0001		0.000051		<0.0001		<0.00005	0.000057	<0.00005			<0.00005		0.000054		0.000037		0.000061
Tin	mg/L		<0.0005		<0.0005		<0.0005		<0.0005	<0.0005	<0.0005			<0.0005		<0.0005		<0.0002		<0.0002
Titanium	mg/L		<0.01		<0.01		<0.01		<0.01	<0.01	<0.01			<0.01		<0.01		<0.01		<0.01
Uranium	mg/L		0.00557		0.00489		0.00474		0.00467	0.00463	0.00405			0.00404		0.00407		0.00346		0.00377
Vanadium	mg/L		<0.005		<0.005		<0.005		<0.005	<0.005	<0.005			<0.005		<0.005		<0.002		<0.002
Zinc	mg/L		43.7		33.6		31.0		26.2	23.5	26.3			25.6		26.3		17.6		17.5

Table A6-1: Results of Waste Rock Humidity Cell Test BW-ARD2-9

Table A6-1: Results of Waste Rock H

Week	Units	98	99	100	101	102	103	104	105
Date Sampled		22-MAY-13	29-MAY-13	05-JUN-13	12-JUN-13	19-JUN-13	26-JUN-13	03-JUL-13	10-JUL-13
Total Volume In	mL	500	500	500	500	500	500	500	500
Total Volume Out	mL	400	450	425	470	460	460	385	460
Conductivity	mS/cm		2170		2080		1880		1910
pH	units		2.46		2.47		2.49		2.53
Acidity	mg/L CaCO3		785		730		591		478
Alkalinity, Total	mg/L CaCO3		<2.00		<2.00		<2.0		<2.0
Sulfate	mg/L		849		798		617		521
Hardness (calc)			93.62		89.71		77.78		73.30
Dissolved Metals									
Aluminum	mg/L		38.8		35.5		30.3		26.6
Antimony	mg/L		0.00216		0.00178		0.00158		0.00133
Arsenic	mg/L		0.00119		0.00119		0.00091		0.00094
Barium	mg/L		0.00214		0.00235		0.00202		0.00264
Beryllium	mg/L		0.00162		0.00156		0.00140		0.00127
Bismuth	mg/L		<0.001		<0.001		<0.001		<0.001
Boron	mg/L		<0.02		<0.02		<0.02		<0.02
Cadmium	mg/L		0.144		0.140		0.102		0.0846
Calcium	mg/L		12.7		10.9		10.2		9.53
Chromium	mg/L		0.0632		0.0567		0.0476		0.0406
Cobalt	mg/L		0.0970		0.0905		0.0750		0.0628
Copper	mg/L		0.265		0.250		0.189		0.155
Iron	mg/L		101		76.7		58.3		44.2
Lead	mg/L		0.0313		0.0294		0.0235		0.0358
Lithium	mg/L		0.0596		0.0523		0.0536		0.0453
Magnesium	mg/L		15.4		15.5		13.0		12.3
Manganese	mg/L		12.4		11.4		10.0		9.72
Mercury	mg/L		<0.00001		<0.00001		<0.0		<0.0
Molybdenum	mg/L		0.00010		<0.0001		0.00016		<0.0001
Nickel	mg/L		0.252		0.237		0.194		0.168
Phosphorus	mg/L		<0.30		<0.30		<0.3		<0.3
Potassium	mg/L		<0.10		<0.10		<0.1		0.12
Selenium	mg/L		<0.0002		<0.0002		<0.0002		<0.0002
Silicon	mg/L		18.5		23.9		19.1		21.2
Silver	mg/L		0.000374		0.000340		0.000315		0.000283
Sodium	mg/L		<0.10		<0.10		<0.1		0.79
Strontium	mg/L		0.304		0.267		0.255		0.258
Sulfur	mg/L		284		249		217		180
Thallium	mg/L		0.000065		0.000067		0.000044		0.000053
Tin	mg/L		<0.0002		<0.0002		<0.0002		<0.0002
Titanium	mg/L		<0.01		<0.01		<0.01		<0.01
Uranium	mg/L		0.00394		0.00369		0.00317		0.00280
Vanadium	mg/L		<0.002		<0.002		<0.002		<0.002
Zinc	mg/L		17.5		17.1		12.8		11.1

Table A6-2: Results of Waste Rock Humidity Cell Test BW-ARD-037

Table A6-2: Results of Waste Rock Humidity Cell Test BW-ARD-037

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12
Sample ID		BW-ARD-037-0	BW-ARD-037-1	BW-ARD-037-2	BW-ARD-037-3	BW-ARD-037-4	BW-ARD-037-5	BW-ARD-037-6	BW-ARD-037-7	BW-ARD-037-8	BW-ARD-037-9	BW-ARD-037-10	BW-ARD-037-11	BW-ARD-037-12
Date Sampled		06-Jul-11	13-Jul-11	20-Jul-11	27-Jul-11	03-Aug-11	10-Aug-11	17-Aug-11	24-Aug-11	31-Aug-11	07-Sep-11	14-Sep-11	21-Sep-11	28-Sep-11
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	620	500	500	500	500	480	460	475	470	480	475	500	450
Conductivity	mS/cm	475	301	363	357	292	244	237	204	187	177	169	154	157
pH	units	5.41	5.90	5.13	5.16	5.00	5.19	5.15	5.19	5.06	5.23	5.13	5.28	5.18
Acidity	mg/L CaCO3	70.5	40.9	94.6	97.2	85.1	71.9	80.8	70.7	62.7	67.4	60.6	53.1	61.5
Alkalinity, Total	mg/L CaCO3	5.1	2.3	2.6	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Sulfate	mg/L	212	127	181	174	129	108	107	88.4	81.8	76.7	67.9	63.2	67.8
Hardness (calc)		97.62	51.59	60.36	49.28	34.43	25.62	21.76	16.76	13.68	11.92	10.36	9.22	8.83
Dissolved Metals														
Aluminum	mg/L	0.03	0.03	0.06	0.09	0.09	0.07	0.07	0.06	0.05	0.05	0.05	0.05	0.05
Antimony	mg/L	0.003	0.006	0.005	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002
Arsenic	mg/L	0.01	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
Barium	mg/L	0.07	0.04	0.05	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.03
Beryllium	mg/L	0.0005	0.0005	0.0006	0.0008	0.0008	0.0008	0.0007	0.0007	0.0006	0.0005	0.0005	0.0006	0.0006
Bismuth	mg/L	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Boron	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Cadmium	mg/L	0.05	0.03	0.09	0.12	0.12	0.11	0.12	0.10	0.10	0.09	0.09	0.09	0.10
Calcium	mg/L	17.10	8.48	10.20	8.01	5.31	4.15	3.48	2.66	2.18	1.96	1.65	1.45	1.44
Chromium	mg/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cobalt	mg/L	0.31	0.23	0.40	0.38	0.32	0.27	0.25	0.21	0.18	0.17	0.16	0.15	0.15
Copper	mg/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron	mg/L	0.67	0.03	0.73	1.61	1.64	1.57	1.59	1.32	1.09	1.00	0.86	0.78	0.83
Lead	mg/L	0.13	0.09	0.40	0.61	0.63	0.59	0.66	0.63	0.63	0.63	0.60	0.75	0.85
Lithium	mg/L	0.08	0.06	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Magnesium	mg/L	13.80	7.62	8.75	7.33	5.29	3.82	3.27	2.53	2.06	1.76	1.56	1.40	1.31
Manganese	mg/L	13.70	7.94	10.70	9.19	6.90	5.15	4.51	3.70	3.18	2.49	2.54	2.34	2.31
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	mg/L	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Nickel	mg/L	0.53	0.45	0.80	0.80	0.69	0.58	0.54	0.46	0.41	0.37	0.34	0.32	0.31
Phosphorus	mg/L	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Potassium	mg/L	45.40	32.20	28.50	21.80	16.10	13.00	11.40	9.43	8.15	7.19	6.77	6.10	5.88
Selenium	mg/L	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001
Silicon	mg/L	1.84	4.84	7.27	7.20	6.23	6.33	6.82	6.09	5.85	5.47	5.29	4.71	4.89
Silver	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Sodium	mg/L	2.40	1.32	0.62	0.34	0.25	0.30	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Strontium	mg/L	0.11	0.06	0.08	0.06	0.05	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02
Sulfur	mg/L	77.00	51.10	61.20	56.80	46.40	39.20	38.00	31.50	27.90	27.70	24.80	23.50	24.10
Thallium	mg/L	0.0005	0.0003	0.0005	0.0009	0.0005	0.0011	0.0007	0.0007	0.0007	0.0009	0.0001	0.0003	0.0008
Tin	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Titanium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium	mg/L	0.0002	0.0001	0.0003	0.0004	0.0004	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002
Vanadium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Zinc	mg/L	30.60	19.40	41.10	47.60	46.90	39.80	41.00	34.70	32.90	29.00	29.20	28.80	32.00

Table A6-2: Results of Waste Rock Humidity Cell Test BW-ARD-037

Week	Units	13	14	15	16	17	18	19	20	21	22	23	24	25
Sample ID		BW-ARD-037-13	BW-ARD-037-14	BW-ARD-037-15	BW-ARD-037-16	BW-ARD-037-17	BW-ARD-037-18	BW-ARD-037-19	BW-ARD-037-20	BW-ARD-037-21	BW-ARD-037-22	BW-ARD-037-23	BW-ARD-037-24	BW-ARD-037-25
Date Sampled		05-Oct-11	12-Oct-11	19-Oct-11	26-Oct-11	02-Nov-11	09-Nov-11	16-Nov-11	23-Nov-11	30-Nov-11	07-Dec-11	14-Dec-11	21-Dec-11	28-Dec-11
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	480	455	500	500	450	485	460	475	470	475	465	455	475
Conductivity	mS/cm	138	147	136	120	133	132	127	125	127	132	121	129	132
pH	units	5.25	5.28	5.23	5.23	5.19	4.96	5.02	5.14	5.02	4.95	5.15	5.09	5.08
Acidity	mg/L CaCO3	55.3	54.8	57.3	51.0	49.50	48.00	50.20	50.70	47.90	46.80	45.00	44.20	42.90
Alkalinity, Total	mg/L CaCO3	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Sulfate	mg/L	57.2	60.2	55.4	45.7	53.80	48.20	48.90	50.10	47.40	47.90	47.50	46.50	43.90
Hardness (calc)		7.03	7.27	6.14	5.09	5.32	4.92	4.72	4.72	4.02	4.13	3.85	3.65	3.57
Dissolved Metals														
Aluminum	mg/L	0.04	0.05	0.04	0.03	0.04	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03
Antimony	mg/L	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Arsenic	mg/L	0.01	0.01	0.01	0.01	0.01	0.005	0.005	0.005	0.004	0.004	0.004	0.003	0.003
Barium	mg/L	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.02
Beryllium	mg/L	0.0005	0.0010	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bismuth	mg/L	0.0025	0.0050	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Boron	mg/L	0.05	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Cadmium	mg/L	0.08	0.10	0.09	0.08	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10
Calcium	mg/L	1.12	1.15	1.01	0.82	0.89	0.82	0.79	0.76	0.65	0.66	0.64	0.60	0.59
Chromium	mg/L	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cobalt	mg/L	0.13	0.14	0.12	0.11	0.11	0.10	0.10	0.10	0.09	0.10	0.10	0.09	0.09
Copper	mg/L	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron	mg/L	0.71	0.73	0.65	0.52	0.59	0.51	0.47	0.48	0.41	0.42	0.41	0.40	0.38
Lead	mg/L	0.78	0.90	0.86	0.87	0.99	0.99	1.15	1.32	1.33	1.16	1.52	1.27	1.37
Lithium	mg/L	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Magnesium	mg/L	1.06	1.10	0.91	0.76	0.78	0.72	0.69	0.71	0.60	0.62	0.57	0.54	0.53
Manganese	mg/L	1.96	2.05	1.73	1.53	1.60	1.47	1.46	1.43	1.29	1.36	1.34	1.22	1.23
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	mg/L	0.00025	0.00050	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Nickel	mg/L	0.26	0.28	0.25	0.22	0.23	0.20	0.20	0.20	0.18	0.19	0.18	0.17	0.17
Phosphorus	mg/L	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Potassium	mg/L	5.35	5.42	4.63	4.40	4.60	4.56	4.61	4.54	4.26	4.41	4.22	4.22	4.25
Selenium	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Silicon	mg/L	4.14	4.92	4.54	3.85	4.16	3.79	3.64	3.88	3.25	3.50	3.48	2.99	3.15
Silver	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Sodium	mg/L	0.25	0.50	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Strontium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sulfur	mg/L	20.30	21.80	20.20	17.50	20.30	18.00	18.40	18.50	16.90	17.00	17.70	17.30	17.10
Thallium	mg/L	0.0012	0.0001	0.0001	0.0001	0.0003	0.0001	0.0017	0.0019	0.0027	0.0004	0.0022	0.0002	0.0003
Tin	mg/L	0.0005	0.0010	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Titanium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium	mg/L	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Vanadium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Zinc	mg/L	26.60	28.20	24.90	23.30	24.20	23.30	25.30	26.20	24.20	23.00	25.70	21.90	22.50

Table A6-2: Results of Waste Rock Humidity Cell Test BW-ARD-037

Week	Units	26	27	28	29	30	31	32	33	34	35	36	37
Sample ID		BW-ARD-037-26	BW-ARD-037-27	BW-ARD-037-28	BW-ARD-037-29	BW-ARD-037-30	BW-ARD-037-31	BW-ARD-037-32	BW-ARD-037-33	BW-ARD-037-34	BW-ARD-037-35	BW-ARD-037-36	BW-ARD-037-37
Date Sampled		04-Jan-12	11-Jan-12	18-Jan-12	25-Jan-12	01-Feb-12	08-Feb-12	15-Feb-12	22-Feb-12	29-Feb-12	07-Mar-12	14-MAR-12	21-MAR-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	470	450	450	425	450	450	475	475	445	465	475
Conductivity	mS/cm	132	139	137	136	118	121	123	123	122	118	124	113
pH	units	5.06	5.02	4.94	4.93	5.02	5.02	5.07	5.04	5.04	5.00	4.98	5.01
Acidity	mg/L CaCO3	47.90	46.70	44.60	46.10	34.10	44.50	41.50	37.70	42.90	40.00	42.30	36.50
Alkalinity, Total	mg/L CaCO3	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Sulfate	mg/L	45.70	48.90	47.00	43.80	41.60	41.00	38.50	42.30	42.90	37.60	41.70	37.60
Hardness (calc)		3.42	3.46	3.36	3.25	2.72	2.65	2.66	2.65	2.68	2.31	3.58	2.20
Dissolved Metals												FIELD	FIELD
Aluminum	mg/L	0.03	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03
Antimony	mg/L	0.002	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Arsenic	mg/L	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.001	0.002	0.001	0.001	0.001
Barium	mg/L	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
Beryllium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Bismuth	mg/L	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Boron	mg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Cadmium	mg/L	0.10	0.11	0.12	0.11	0.10	0.09	0.10	0.10	0.11	0.10	0.11	0.10
Calcium	mg/L	0.57	0.59	0.55	0.55	0.46	0.46	0.47	0.44	0.42	0.40	0.41	0.37
Chromium	mg/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cobalt	mg/L	0.09	0.09	0.09	0.09	0.07	0.07	0.07	0.07	0.07	0.06	0.07	0.06
Copper	mg/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron	mg/L	0.38	0.41	0.39	0.43	0.34	0.36	0.38	0.35	0.35	0.37	0.38	0.34
Lead	mg/L	1.54	1.70	1.75	1.85	1.59	1.82	1.50	1.93	2.22	1.89	2.08	1.82
Lithium	mg/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Magnesium	mg/L	0.50	0.50	0.50	0.47	0.40	0.38	0.37	0.39	0.41	0.33	0.63	0.32
Manganese	mg/L	1.19	1.26	1.21	1.15	0.97	0.95	0.98	0.98	0.96	0.86	0.92	0.83
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	mg/L	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Nickel	mg/L	0.16	0.17	0.16	0.15	0.13	0.12	0.12	0.13	0.13	0.11	0.12	0.11
Phosphorus	mg/L	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Potassium	mg/L	4.17	4.04	4.27	4.28	3.75	3.78	3.84	3.89	3.91	3.66	3.93	3.60
Selenium	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Silicon	mg/L	3.17	3.30	3.17	3.24	2.51	2.32	2.62	2.58	2.40	2.39	2.65	2.31
Silver	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Sodium	mg/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1.76	0.25
Strontium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sulfur	mg/L	17.00	17.90	17.60	17.70	16.20	15.20	16.10	15.50	15.40	14.10	15.40	13.90
Thallium	mg/L	0.0007	0.0032	0.0005	0.0010	0.0003	0.0004	0.0001	0.0001	0.0002	0.0004	0.0003	0.0003
Tin	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Titanium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002	0.0001
Vanadium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Zinc	mg/L	23.70	26.70	23.60	24.10	21.00	21.30	18.40	22.60	22.00	20.50	22.70	19.80

Table A6-2: Results of Waste Rock Humidity Cell Test BW-ARD-037

Week	Units	38	39	40	41	42	43	44	45	46	47	48	49
Sample ID		BW-ARD-037-38	BW-ARD-037-39	BW-ARD-037-40	BW-ARD-037-41	BW-ARD-037-42	BW-ARD-037-43	BW-ARD-037-44	BW-ARD-037-45	BW-ARD-037-46	BW-ARD-037-47	BW-ARD-037-48	BW-ARD-037-49
Date Sampled		28-MAR-12	04-APR-12	11-APR-12	18-APR-12	25-APR-12	02-MAY-12	09-MAY-12	16-MAY-12	23-MAY-12	30-MAY-12	06-JUN-12	13-JUN-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	450	475	450	470	470	460	460	475	500	500	450
Conductivity	mS/cm	120	120	120	124	119	119	109	125	119	118	113	113
pH	units	5.02	4.98	4.98	4.99	4.97	4.95	5.15	4.92	4.93	4.99	4.95	4.87
Acidity	mg/L CaCO3	40.20	44.5	39.2	40.9	42.8	39.8	34.5	40.8	43.9	42.2	40.5	39.0
Alkalinity, Total	mg/L CaCO3	2.00	<2.0	2.00	2.00	2.00	2.00	2.00	<2.0	<2.0	<1.0	<2.	<2.
Sulfate	mg/L	40.90	40.8	39.4	38.9	39.9	36.7	35.7	39.3	38.0	39.0	37.0	37.9
Hardness (calc)		2.32	2.32	2.26	2.27	2.23	2.28	2.20	0.00	2.15	0.00	2.12	0.00
Dissolved Metals		FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD		FIELD		FIELD	
Aluminum	mg/L	0.03	0.033	0.03	0.03	0.03	0.03	0.03		0.034		0.034	
Antimony	mg/L	0.001	0.00112	0.001	0.001	0.001	0.001	0.001		0.00108		0.00099	
Arsenic	mg/L	0.001	0.00117	0.001	0.001	0.001	0.001	0.001		0.00065		0.00067	
Barium	mg/L	0.01	0.0109	0.01	0.02	0.01	0.01	0.01		0.00690		0.00894	
Beryllium	mg/L	0.0005	<0.0005	0.001	0.001	0.001	0.001	0.001		<0.0005		<0.0005	
Bismuth	mg/L	0.0025	<0.0025	0.003	0.003	0.003	0.003	0.003		<0.0025		<0.0025	
Boron	mg/L	0.05	<0.05	0.05	0.05	0.05	0.05	0.05		<0.05		<0.05	
Cadmium	mg/L	0.11	0.108	0.11	0.11	0.11	0.11	0.11		0.106		0.109	
Calcium	mg/L	0.37	0.381	0.38	0.37	0.37	0.37	0.34		0.373		0.359	
Chromium	mg/L	0.00	<0.0025	0.003	0.003	0.003	0.003	0.003		<0.0025		<0.0025	
Cobalt	mg/L	0.06	0.0638	0.06	0.06	0.06	0.06	0.06		0.0521		0.0522	
Copper	mg/L	0.00	<0.0025	0.00	0.00	0.00	0.00	0.00		<0.0025		<0.0025	
Iron	mg/L	0.40	0.399	0.41	0.43	0.44	0.47	0.42		0.480		0.504	
Lead	mg/L	2.08	2.10	2.12	2.59	2.41	2.24	2.13		2.39		2.59	
Lithium	mg/L	0.00	<0.0025	0.003	0.003	0.003	0.003	0.003		0.0041		<0.0025	
Magnesium	mg/L	0.35	0.343	0.33	0.34	0.33	0.34	0.34		0.306		0.308	
Manganese	mg/L	0.88	0.893	0.87	0.87	0.83	0.82	0.81		0.770		0.799	
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001		<0.00001		<0.00001	
Molybdenum	mg/L	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025		<0.00025		<0.00025	
Nickel	mg/L	0.11	0.110	0.10	0.11	0.10	0.10	0.10		0.0884		0.0918	
Phosphorus	mg/L	0.30	<0.3	0.30	0.30	0.30	0.30	0.30		<0.3		<0.3	
Potassium	mg/L	3.83	4.00	3.71	3.94	3.77	3.82	3.86		3.40		3.71	
Selenium	mg/L	0.001	<0.0005	0.001	0.001	0.001	0.001	0.001		<0.0005		<0.0005	
Silicon	mg/L	2.33	2.33	2.44	2.54	2.48	2.47	2.29		2.63		2.61	
Silver	mg/L	0.0001	<0.00005	0.0001	0.0001	0.0001	0.0001	0.0001		<0.00005		<0.00005	
Sodium	mg/L	0.25	<0.25	0.25	0.25	0.25	0.25	0.25		<0.25		<0.25	
Strontium	mg/L	0.01	0.00684	0.01	0.01	0.01	0.01	0.01		0.0067		0.0066	
Sulfur	mg/L	13.90	15.0	15.00	14.70	14.70	15.00	13.70		14.8		14.5	
Thallium	mg/L	0.0004	0.000111	0.0001	0.0001	0.0001	0.0001	0.0001		<0.0002		0.000094	
Tin	mg/L	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005		<0.0005		<0.0005	
Titanium	mg/L	0.01	<0.01	0.01	0.01	0.01	0.01	0.01		<0.01		<0.01	
Uranium	mg/L	0.0001	0.000148	0.0001	0.0001	0.0001	0.0001	0.0001		0.000151		0.000141	
Vanadium	mg/L	0.01	<0.005	0.01	0.01	0.01	0.01	0.01		<0.005		<0.005	
Zinc	mg/L	21.20	21.5	20.70	21.40	20.80	21.60	20.30		20.7		20.3	

Table A6-2: Results of Waste Rock Humidity Cell Test BW-ARD-037

Week	Units	50	51	52	53	54	55	56	57	58	59	60	61
Sample ID		BW-ARD-037-50	BW-ARD-037-51	BW-ARD-037-52	BW-ARD-037-53	BW-ARD-037-54	BW-ARD-037-55	BW-ARD-037-56	BW-ARD-037-57	BW-ARD-037-58	BW-ARD-037-59	BW-ARD-037-60	BW-ARD-037-61
Date Sampled		20-JUN-12	27-JUN-12	04-JUL-12	11-JUL-12	18-JUL-12	25-JUL-12	01-AUG-12	08-AUG-12	15-AUG-12	22-AUG-12	29-AUG-12	05-SEP-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	475	470	465	470	470	465	470	465	455	470	470	475
Conductivity	mS/cm	112	105	107	100	93.6	101	97.2	103	96.6	99.2	97.3	104
pH	units	4.93	5.08	4.92	5.03	5.08	5.04	5.11	5.05	5.13	5.03	5.04	4.92
Acidity	mg/L CaCO3	38.2	40.6	37.2	36.3	43.2	37.2	37.7	39.5	40.5	36.2	38.9	34.8
Alkalinity, Total	mg/L CaCO3	<2.	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.	<2.	<2.	<2.
Sulfate	mg/L	36.4	37.0	35.2	31.8	34.0	32.3	31.7	35.2	37.3	32.1	25.5	31.8
Hardness (calc)		2.06	0.00	1.97	0.00	1.83	0.00	1.85	0.00	1.84	0.00	1.97	0.00
Dissolved Metals		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD	
Aluminum	mg/L	0.030		0.030		0.034		0.033		0.031		0.036	
Antimony	mg/L	0.00095		0.00105		0.00096		0.00098		0.00092		0.00094	
Arsenic	mg/L	0.00072		0.00064		0.00061		0.00077		0.00056		0.00062	
Barium	mg/L	0.00900		0.00915		0.00806		0.00900		0.0103		0.0137	
Beryllium	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		0.00030		<0.0005	
Bismuth	mg/L	<0.0025		<0.0025		<0.0025		<0.0025		<0.001		<0.0025	
Boron	mg/L	<0.05		<0.05		<0.05		<0.05		<0.02		<0.05	
Cadmium	mg/L	0.106		0.0996		0.0916		0.0972		0.0951		0.101	
Calcium	mg/L	0.351		0.330		0.314		0.319		0.317		0.331	
Chromium	mg/L	<0.0025		<0.0025		<0.0025		<0.0025		<0.001		<0.0025	
Cobalt	mg/L	0.0496		0.0478		0.0425		0.0437		0.0419		0.0438	
Copper	mg/L	0.0028		0.0034		0.0037		0.0037		0.0046		0.0057	
Iron	mg/L	0.493		0.457		0.455		0.429		0.450		0.457	
Lead	mg/L	2.71		2.60		2.37		2.97		2.61		2.69	
Lithium	mg/L	0.0026		0.0028		<0.0025		0.0046		0.0032		0.0040	
Magnesium	mg/L	0.298		0.288		0.263		0.264		0.263		0.286	
Manganese	mg/L	0.738		0.735		0.657		0.687		0.662		0.691	
Mercury	mg/L	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001	
Molybdenum	mg/L	<0.00025		<0.00025		<0.00025		<0.00025		<0.0001		<0.00025	
Nickel	mg/L	0.0834		0.0799		0.0697		0.0710		0.0672		0.0724	
Phosphorus	mg/L	<0.3		<0.3		<0.3		<0.3		<0.3		<0.3	
Potassium	mg/L	3.64		3.69		3.20		3.46		3.48		3.47	
Selenium	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0002		<0.0005	
Silicon	mg/L	2.46		2.29		2.26		2.25		2.25		2.37	
Silver	mg/L	<0.00005		<0.00005		<0.00005		<0.00005		<0.00002		<0.00005	
Sodium	mg/L	<0.25		<0.25		<0.25		<0.25		<0.1		<0.25	
Strontium	mg/L	0.0063		0.0063		0.0064		0.0067		0.00630		0.0067	
Sulfur	mg/L	13.9		13.0		12.5		12.2		11.7		12.0	
Thallium	mg/L	0.000102		0.000099		0.000173		0.000110		0.000095		0.000104	
Tin	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0002		<0.0005	
Titanium	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Uranium	mg/L	0.000150		0.000156		0.000156		0.000167		0.000149		0.000151	
Vanadium	mg/L	<0.005		<0.005		<0.005		<0.005		<0.002		<0.005	
Zinc	mg/L	19.8		18.4		16.3		18.1		16.7		16.7	

Table A6-2: Results of Waste Rock Humidity Cell Test BW-ARD-037

Table A6-2: Results of Waste Rock H

Week	Units	62	63	64	65	66	67	68	69
Sample ID		BW-ARD-037-62	BW-ARD-037-63	BW-ARD-037-64	BW-ARD-037-65	BW-ARD-037-66	BW-ARD-037-67	BW-ARD-037-68	BW-ARD-037-69
Date Sampled		12-SEP-12	19-SEP-12	26-SEP-12	03-OCT-12	10-OCT-12	17-OCT-12	24-OCT-12	31-OCT-12
Total Volume In	mL	500	500	500	500	500	500	500	500
Total Volume Out	mL	480	475	475	475	475	465	475	495
Conductivity	mS/cm	92.2	102	95.5	94.2	95.4	91.8	83.2	86.5
pH	units	5.12	4.68	4.77	4.84	4.75	4.86	5.10	4.93
Acidity	mg/L CaCO3	34.0	34.5	38.6	31.4	27.0	32.2	35.0	26.7
Alkalinity, Total	mg/L CaCO3	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.
Sulfate	mg/L	30.4	31.3	30.2	29.6	29.9	29.1	28.0	29.2
Hardness (calc)		1.92	0.00	1.88	0.00	1.76	0.00	1.84	1.76
Dissolved Metals		FIELD		FIELD		FIELD		FIELD	FIELD
Aluminum	mg/L	0.032		0.031		0.033		0.031	0.030
Antimony	mg/L	0.00080		0.00085		0.00078		0.00071	0.00074
Arsenic	mg/L	0.00046		0.00041		0.00033		0.00038	0.00035
Barium	mg/L	0.0153		0.0181		0.0186		0.0238	0.0264
Beryllium	mg/L	0.00027		0.00028		0.00029		0.00025	0.00026
Bismuth	mg/L	<0.001		<0.001		<0.001		<0.001	<0.001
Boron	mg/L	<0.02		<0.02		<0.02		<0.02	<0.02
Cadmium	mg/L	0.0961		0.0928		0.0862		0.0865	0.0845
Calcium	mg/L	0.340		0.328		0.304		0.317	0.309
Chromium	mg/L	<0.001		<0.001		<0.001		<0.001	<0.001
Cobalt	mg/L	0.0408		0.0397		0.0374		0.0376	0.0345
Copper	mg/L	0.0068		0.0075		0.0086		0.0102	0.0100
Iron	mg/L	0.449		0.412		0.364		0.331	0.336
Lead	mg/L	2.69		2.65		3.01		2.40	2.61
Lithium	mg/L	0.0029		0.0031		0.0028		0.0026	0.0029
Magnesium	mg/L	0.269		0.266		0.252		0.263	0.248
Manganese	mg/L	0.710		0.668		0.671		0.664	0.609
Mercury	mg/L	<0.		<0.		<0.		<0.	<0.
Molybdenum	mg/L	<0.0001		<0.0001		<0.0001		<0.0001	<0.0001
Nickel	mg/L	0.0651		0.0637		0.0607		0.0587	0.0547
Phosphorus	mg/L	<0.3		<0.3		<0.3		<0.3	<0.3
Potassium	mg/L	3.29		3.34		3.17		3.16	3.12
Selenium	mg/L	<0.0002		<0.0002		<0.0002		<0.0002	<0.0002
Silicon	mg/L	2.17		2.33		1.99		1.97	1.99
Silver	mg/L	<0.		<0.		<0.		<0.	<0.
Sodium	mg/L	<0.1		<0.1		<0.1		<0.1	<0.1
Strontium	mg/L	0.00661		0.00661		0.00757		0.00691	0.00640
Sulfur	mg/L	11.5		11.1		10.6		10.2	10.2
Thallium	mg/L	0.000109		0.000102		0.000115		0.000096	0.000091
Tin	mg/L	<0.0002		<0.0002		<0.0002		<0.0002	<0.0002
Titanium	mg/L	<0.01		<0.01		<0.01		<0.01	<0.01
Uranium	mg/L	0.000151		0.000147		0.000155		0.000136	0.000125
Vanadium	mg/L	<0.002		<0.002		<0.002		<0.002	<0.002
Zinc	mg/L	16.8		16.8		15.8		14.9	15.7

Table A6-3: Results of Waste Rock Humidity Cell Test BW-ARD-509

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12
Sample ID		BW-ARD-509-0	BW-ARD-509-1	BW-ARD-509-2	BW-ARD-509-3	BW-ARD-509-4	BW-ARD-509-5	BW-ARD-509-6	BW-ARD-509-7	BW-ARD-509-8	BW-ARD-509-9	BW-ARD-509-10	BW-ARD-509-11	BW-ARD-509-12
Date Sampled		21-MAR-12	28-MAR-12	04-APR-12	11-APR-12	18-APR-12	25-APR-12	02-MAY-12	09-MAY-12	16-MAY-12	23-MAY-12	30-MAY-12	06-JUN-12	13-JUN-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	600	475	465	425	450	465	460	485	475	450	495	500	465
Conductivity	mS/cm	164	134	105	110	114	122	128	151	190	257	368	436	471
pH	units	7.38	7.63	7.46	7.47	7.49	6.98	6.96	6.81	6.58	6.08	5.51	5.15	4.96
Acidity	mg/L CaCO3	<1.0	2.2	<1.	2.6	7.5	1	4.5	3.4	5.2	7.7	26.7	87.1	102
Alkalinity, Total	mg/L CaCO3	8.1	9.5	5.8	4.6	4.6	3.4	3.1	2.9	3.1	2.8	2.8	3.1	2.1
Sulfate (SO4)	mg/L	37.1	33.3	28.8	31.5	32.5	36.9	38.1	42.8	61.7	87.5	143	171	198
Dissolved Metals														
Aluminum	mg/L	0.34	0.90	0.401	0.227	0.179	0.113	0.0589	0.0163	0.0070	<0.01	<0.025	0.047	0.100
Antimony	mg/L	0.03	0.09	0.0641	0.0544	0.0455	0.0358	0.0228	0.0196	0.0117	0.00528	0.00190	0.00084	0.00062
Arsenic	mg/L	0.01	0.01	0.00640	0.00445	0.00227	0.00212	0.00183	0.00200	0.00235	0.00221	0.00163	0.00100	0.00110
Barium	mg/L	0.0048	0.0113	0.00486	0.00342	0.00334	0.00333	0.00306	0.00333	0.00489	0.00889	0.0216	0.0346	0.0480
Beryllium	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0002	<0.0005	0.00062	0.00109
Bismuth	mg/L	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	<0.001	<0.0025	<0.0025	<0.0025
Boron	mg/L	0.010	0.014	0.011	0.011	0.012	0.010	0.01	0.011	0.011	<0.02	<0.05	<0.05	<0.05
Cadmium	mg/L	0.00001	0.00002	0.000026	0.000050	0.000110	0.000203	0.000334	0.000611	0.00137	0.00331	0.00747	0.00877	0.0110
Calcium	mg/L	1.66	1.63	1.22	1.76	2.36	3.28	4.16	5.97	9.24	13.9	19.2	18.3	15.6
Chromium	mg/L	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	<0.001	<0.0025	<0.0025	<0.0025
Cobalt	mg/L	0.0002	0.0004	0.00037	0.00057	0.00102	0.00165	0.00257	0.00504	0.0110	0.0293	0.0841	0.145	0.186
Copper	mg/L	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	<0.001	<0.0025	<0.0025	<0.0025
Iron	mg/L	0.12	0.33	0.164	0.095	0.090	0.065	0.03	0.03	0.03	0.468	6.87	25.2	46.3
Lead	mg/L	0.0002	0.0007	0.000305	0.000199	0.000205	0.000160	0.000113	0.00005	0.000058	0.00011	0.00046	0.00100	0.00146
Lithium	mg/L	0.02	0.02	0.0126	0.0149	0.0145	0.0164	0.0140	0.0171	0.0159	0.0151	0.0178	0.0117	0.0160
Magnesium	mg/L	0.41	0.42	0.326	0.406	0.597	0.786	0.980	1.35	2.08	2.96	4.26	4.12	3.61
Manganese	mg/L	0.20	0.35	0.351	0.541	0.868	1.30	2.03	3.34	6.56	12.4	24.9	28.5	30.2
Mercury	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.01	0.01	0.00528	0.00346	0.00218	0.00148	0.000754	0.000518	0.000192	0.00013	<0.00025	<0.00025	<0.00025
Nickel	mg/L	0.0011	0.0011	0.00066	0.00063	0.00099	0.00123	0.00155	0.00283	0.00655	0.0194	0.0711	0.143	0.209
Phosphorus	mg/L	0.30	0.30	<0.3	0.3	0.3	0.3	0.3	0.3	0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	33.70	28.60	22.1	21.8	22.2	22.0	21.7	21.0	24.1	23.9	27.6	24.7	23.1
Selenium	mg/L	0.00010	0.00010	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0002	<0.0005	<0.0005	<0.0005
Silicon	mg/L	3.05	6.73	5.14	5.16	5.13	5.85	5.85	6.56	7.55	7.73	8.60	9.28	9.96
Silver	mg/L	0.00001	0.00001	<0.00001	0.000013	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00002	<0.00005	<0.00005	<0.00005
Sodium	mg/L	3.33	2.53	1.62	1.40	1.11	0.905	0.716	0.632	0.582	0.51	0.55	0.41	0.33
Strontium	mg/L	0.01	0.01	0.00425	0.00651	0.00911	0.0123	0.0143	0.0245	0.0349	0.0601	0.105	0.123	0.118
Sulfur	mg/L	19.30	13.60	9.93	11.4	11.8	13.5	13.5	16.4	22.9	32.9	59.8	83.9	89.0
Thallium	mg/L	0.0001	0.0001	0.000077	0.000093	0.000108	0.000125	0.000112	0.000156	0.000182	0.000218	0.000266	0.000272	0.000307
Tin	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0002	<0.0005	<0.0005	<0.0005
Titanium	mg/L	0.01	0.02	<0.01	0.01	0.01	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0001	0.0003	0.000162	0.000101	0.000121	0.000099	0.000059	0.000079	0.000073	0.000176	0.000523	0.00105	0.00212
Vanadium	mg/L	0.0010	0.0010	<0.001	0.001	0.001	0.001	0.001	0.001	0.001	<0.002	<0.005	<0.005	<0.005
Zinc	mg/L	0.0030	0.0030	0.0039	0.0045	0.0107	0.0217	0.0339	0.0597	0.137	0.411	1.12	1.63	2.08

Table A6-3: Results of Waste Rock H

Week	Units	13	14	15	16	17	18	19	20	21	22	23	24	25
Sample ID		BW-ARD-509-13	BW-ARD-509-14	BW-ARD-509-15	BW-ARD-509-16	BW-ARD-509-17	BW-ARD-509-18	BW-ARD-509-19	BW-ARD-509-20	BW-ARD-509-21	BW-ARD-509-22	BW-ARD-509-23	BW-ARD-509-24	BW-ARD-509-25
Date Sampled		20-JUN-12	27-JUN-12	04-JUL-12	11-JUL-12	18-JUL-12	25-JUL-12	01-AUG-12	08-AUG-12	15-AUG-12	22-AUG-12	29-AUG-12	05-SEP-12	12-SEP-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	465	475	485	425	470	470	475	455	470	460	470	475	480
Conductivity	mS/cm	460	428	397	335	293	271	240	249	208	207	190	186	180
pH	units	4.77	4.58	4.61	4.59	4.66	4.71	4.80	4.76	4.84	4.81	4.83	4.76	4.78
Acidity	mg/L CaCO3	132	127	87.2	65.3	69.2	34.6	34.4	28.7	28.5	28.1	24.4	29.1	23.6
Alkalinity, Total	mg/L CaCO3	<2.	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.	<2.	<2.	<2.	<2.
Sulfate (SO4)	mg/L	199	192	179	150	126	110	95.9	105	87.7	79.7	71.3	70.3	67.7
Dissolved Metals														
Aluminum	mg/L	0.184	0.272	0.299	0.258	0.193	0.160	0.117	0.136	0.095	0.095	0.099	0.098	0.121
Antimony	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.00182	0.00208	0.00140	0.00070	0.00061	0.00130	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Barium	mg/L	0.0522	0.0466	0.0381	0.0303	0.0226	0.0202	0.0177	0.0188	0.0160	0.0169	0.0160	0.0168	0.0186
Beryllium	mg/L	0.00144	0.00171	0.00186	0.00160	0.00129	0.00123	0.00103	0.00090	0.00089	0.00083	0.00085	0.00091	0.00105
Bismuth	mg/L	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Boron	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	mg/L	0.0103	0.00897	0.00776	0.00656	0.00517	0.00474	0.00414	0.00430	0.00347	0.00332	0.00326	0.00329	0.00329
Calcium	mg/L	11.2	8.48	6.99	5.47	4.98	4.15	3.67	4.05	3.17	3.41	3.21	3.12	3.00
Chromium	mg/L	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cobalt	mg/L	0.189	0.168	0.153	0.115	0.0867	0.0764	0.0649	0.0644	0.0525	0.0524	0.0500	0.0478	0.0489
Copper	mg/L	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.0028
Iron	mg/L	54.4	50.7	40.9	25.9	18.0	11.6	8.53	8.22	6.12	6.26	5.88	5.97	6.49
Lead	mg/L	0.00293	0.00319	0.00333	0.00311	0.00275	0.00259	0.00237	0.00227	0.00199	0.00234	0.00210	0.00216	0.00244
Lithium	mg/L	0.0162	0.0175	0.0175	0.0147	0.0133	0.0134	0.0132	0.0132	0.0114	0.0130	0.0120	0.0109	0.0097
Magnesium	mg/L	3.31	2.97	2.67	2.16	1.88	1.73	1.38	1.49	1.21	1.25	1.13	1.09	1.07
Manganese	mg/L	30.3	31.6	33.8	35.9	34.1	42.5	38.3	37.5	28.6	29.7	26.3	26.2	25.9
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.0003	<0.0003
Nickel	mg/L	0.230	0.207	0.189	0.145	0.112	0.0979	0.0822	0.0836	0.0645	0.0646	0.0594	0.0543	0.0540
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	19.3	17.7	14.1	12.1	9.70	9.10	7.88	7.59	6.66	6.33	5.94	5.79	5.28
Selenium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Silicon	mg/L	10.3	9.73	10.0	8.88	8.74	8.13	7.72	9.13	7.56	7.91	7.70	7.82	7.08
Silver	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.0001	<0.0001
Sodium	mg/L	0.28	0.26	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Strontium	mg/L	0.0852	0.0615	0.0491	0.0338	0.0263	0.0248	0.0202	0.0192	0.0163	0.0168	0.0155	0.0156	0.0156
Sulfur	mg/L	80.5	66.3	61.2	51.3	45.9	39.6	34.8	36.9	29.5	30.8	27.1	25.3	24.8
Thallium	mg/L	0.000299	0.000277	0.000268	0.000244	0.000222	0.000199	0.000180	0.000174	0.000152	0.000151	0.000148	0.000142	0.000137
Tin	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.00278	0.00360	0.00420	0.00359	0.00316	0.00287	0.00241	0.00225	0.00178	0.00186	0.00192	0.00211	0.00241
Vanadium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	mg/L	2.03	1.77	1.53	1.16	0.865	0.771	0.672	0.664	0.559	0.606	0.564	0.645	0.665

Table A6-3: Results of Waste Rock H

Week	Units	26	27	28	29	30	31	32	33	34	35	36	37	38
Sample ID		BW-ARD-509-26	BW-ARD-509-27	BW-ARD-509-28	BW-ARD-509-29	BW-ARD-509-30	BW-ARD-509-31	BW-ARD-509-32	BW-ARD-509-33	BW-ARD-509-34	BW-ARD-509-35	BW-ARD-509-36	BW-ARD-509-37	BW-ARD-509-38
Date Sampled		19-SEP-12	26-SEP-12	03-OCT-12	10-OCT-12	17-OCT-12	24-OCT-12	31-OCT-12	07-NOV-12	14-NOV-12	21-NOV-12	28-NOV-12	05-DEC-12	12-DEC-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	475	475	475	475	480	475	475	465	450	450	465	450
Conductivity	mS/cm	220	246	247	233	237	200	194	208	234	226	231	224	213
pH	units	4.61	4.54	4.47	4.41	4.40	4.42	4.33	4.34	4.25	4.26	4.20	4.23	4.20
Acidity	mg/L CaCO3	38.7	71.1	66.8	74.5	76.6	70.6	58.1	61.1	80.1	73.2	73.8	78.0	73.4
Alkalinity, Total	mg/L CaCO3	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.00	<2.00	<2.00
Sulfate (SO4)	mg/L	89.0	98.9	104	96.9	96.5	77.6	74.2	79.4	89.9	88.8	87.8	86.2	75.0
Dissolved Metals														
Aluminum	mg/L	0.231	0.378	0.509	0.563	0.668	0.645	0.675	0.738	1.02	1.03	1.25	1.36	1.39
Antimony	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00025	0.00021	<0.0002	0.00036	0.00026	0.00027	0.00036	0.00033
Barium	mg/L	0.0258	0.0329	0.0356	0.0336	0.0365	0.0339	0.0325	0.0336	0.0402	0.0403	0.0405	0.0426	0.0424
Beryllium	mg/L	0.00168	0.00237	0.00305	0.00324	0.00346	0.00327	0.00346	0.00361	0.00461	0.00473	0.00536	0.00565	0.00593
Bismuth	mg/L	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cadmium	mg/L	0.00445	0.00474	0.00485	0.00426	0.00433	0.00398	0.00371	0.00389	0.00455	0.00471	0.00486	0.00514	0.00530
Calcium	mg/L	3.86	3.86	3.63	3.10	2.93	2.34	2.27	2.30	2.59	2.37	2.44	2.34	2.12
Chromium	mg/L	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	0.0627	0.0676	0.0674	0.0590	0.0560	0.0484	0.0427	0.0438	0.0475	0.0456	0.0427	0.0412	0.0390
Copper	mg/L	0.0036	0.0048	0.0047	0.0053	0.0058	0.0064	0.0067	0.0069	0.0097	0.0102	0.0113	0.0148	0.0163
Iron	mg/L	10.9	16.5	21.0	22.3	23.9	20.4	21.1	22.7	27.9	26.6	25.0	26.9	24.3
Lead	mg/L	0.00358	0.00528	0.00671	0.00707	0.00864	0.00723	0.00818	0.00903	0.0122	0.0127	0.0144	0.0147	0.0177
Lithium	mg/L	0.0129	0.0137	0.0132	0.0131	0.0129	0.0108	0.0114	0.0101	0.0123	0.0119	0.0127	0.0137	0.0125
Magnesium	mg/L	1.28	1.33	1.26	1.07	1.06	0.898	0.793	0.756	0.860	0.877	0.864	0.800	0.794
Manganese	mg/L	28.1	28.9	26.5	22.5	19.7	15.8	14.0	14.1	13.4	13.1	13.0	10.2	10.3
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.00012	<0.0001	0.00010	<0.0001	<0.0001	<0.0001	0.00010	<0.0001
Nickel	mg/L	0.0677	0.0725	0.0717	0.0636	0.0607	0.0523	0.0469	0.0493	0.0533	0.0524	0.0506	0.0502	0.0460
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30
Potassium	mg/L	5.90	6.17	5.88	5.36	5.34	4.93	4.61	4.32	4.79	5.05	4.55	4.78	4.66
Selenium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Silicon	mg/L	8.77	8.88	8.45	8.39	8.42	7.47	7.63	7.49	8.87	8.16	8.47	8.24	7.79
Silver	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Sodium	mg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10
Strontium	mg/L	0.0201	0.0210	0.0197	0.0173	0.0165	0.0134	0.0122	0.0118	0.0134	0.0119	0.0121	0.0121	0.0114
Sulfur	mg/L	32.3	35.0	36.9	34.1	33.7	27.5	27.2	28.2	33.0	30.9	32.5	30.8	28.0
Thallium	mg/L	0.000153	0.000171	0.000178	0.000165	0.000179	0.000146	0.000157	0.000145	0.000181	0.000166	0.000185	0.000186	0.000200
Tin	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.00410	0.00632	0.00805	0.00822	0.00925	0.00836	0.00890	0.00903	0.0130	0.0124	0.0137	0.0144	0.0152
Vanadium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc	mg/L	0.952	1.19	1.32	1.24	1.20	1.17	1.13	1.17	1.34	1.41	1.35	1.44	1.49

Table A6-3: Results of Waste Rock H

Week	Units	39	40	41	42	43	44	45	46	47	48	49	50	51
Sample ID		BW-ARD-509-39	BW-ARD-509-40	BW-ARD-509-41	BW-ARD-509-42	BW-ARD-509-43	BW-ARD-509-44	BW-ARD-509-45	BW-ARD-509-46	BW-ARD-509-47	BW-ARD-509-48	BW-ARD-509-49	BW-ARD-509-50	BW-ARD-509-51
Date Sampled		19-DEC-12	26-DEC-12	02-JAN-13	09-JAN-13	16-JAN-13	23-JAN-13	30-JAN-13	06-FEB-13	13-FEB-13	20-FEB-13	27-FEB-13	06-MAR-13	13-MAR-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	425	460	500	425	475	475	450	460	450	495	450	425	465
Conductivity	mS/cm	205	203	201	215	211	212	244	269	287	289	288	293	287
pH	units	4.16	4.12	4.10	4.03	4.00	3.87	3.74	3.68	3.67	3.65	3.65	3.63	3.66
Acidity	mg/L CaCO3	68.9	64.7	66.5	72.5	61.2	58.8	65.0	78.9	86.0	93.9	87.6	98.3	90.6
Alkalinity, Total	mg/L CaCO3	<2.00	<2.00	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.0	<2.0	<2.0	<2.0
Sulfate (SO4)	mg/L	76.4	77.7	69.6	74.9	73.8	70.3	85.9	95.7	98.9	108	102	97.8	92.9
Dissolved Metals														
Aluminum	mg/L	1.49	1.50	1.53	2.46	2.65	3.81	5.36	8.26	8.93	9.39	8.67	9.32	8.93
Antimony	mg/L	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	0.00012	<0.0002	0.00010	0.00027	<0.0002
Arsenic	mg/L	0.00033	0.00028	0.00025	0.00038	0.00057	0.00049	0.00112	0.00148	0.00181	0.00161	0.00081	0.00135	0.00094
Barium	mg/L	0.0417	0.0416	0.0430	0.0507	0.0509	0.0573	0.0553	0.0569	0.0504	0.0472	0.0383	0.0383	0.0395
Beryllium	mg/L	0.00587	0.00594	0.00646	0.00803	0.00906	0.0110	0.0150	0.0152	0.0156	0.0159	0.0136	0.0138	0.0119
Bismuth	mg/L	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.001
Boron	mg/L	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02
Cadmium	mg/L	0.00590	0.00655	0.00792	0.0116	0.0156	0.0237	0.0311	0.0424	0.0469	0.0491	0.0476	0.0515	0.0510
Calcium	mg/L	2.12	2.09	2.17	2.33	2.19	2.24	2.13	2.04	2.00	1.90	1.84	2.03	2.10
Chromium	mg/L	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0359	0.0350	0.0327	0.0388	0.0373	0.0421	0.0473	0.0600	0.0629	0.0642	0.0568	0.0557	0.0533
Copper	mg/L	0.0185	0.0199	0.0236	0.0410	0.0534	0.0970	0.169	0.273	0.403	0.511	0.607	0.710	0.759
Iron	mg/L	22.4	21.3	20.1	17.7	13.4	8.23	2.85	0.804	0.264	0.146	0.129	0.120	0.111
Lead	mg/L	0.0175	0.0186	0.0205	0.0273	0.0314	0.0447	0.0653	0.0707	0.0847	0.0840	0.0884	0.0925	0.0894
Lithium	mg/L	0.0120	0.0110	0.0117	0.0125	0.0135	0.0158	0.0255	0.0292	0.0323	0.0294	0.0249	0.0246	0.0208
Magnesium	mg/L	0.759	0.718	0.672	0.750	0.726	0.791	0.851	1.11	1.20	1.25	1.14	1.23	1.25
Manganese	mg/L	9.26	9.17	7.51	8.58	7.62	7.47	7.33	7.98	7.19	6.42	5.03	5.10	4.98
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	<0.0001	<0.0001	0.000083	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.000083	<0.0001	<0.00005	0.000064	<0.0001
Nickel	mg/L	0.0451	0.0437	0.0416	0.0500	0.0477	0.0532	0.0596	0.0762	0.0807	0.0825	0.0695	0.0684	0.0661
Phosphorus	mg/L	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	4.43	4.36	4.09	4.68	4.33	4.61	4.76	5.42	5.42	5.48	4.95	4.99	4.89
Selenium	mg/L	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0002
Silicon	mg/L	7.52	8.06	8.33	7.96	8.04	8.74	8.89	10.4	10.6	10.9	9.49	10.4	10.7
Silver	mg/L	<0.00002	<0.00002	<0.	0.000011	0.000013	0.000018	0.000049	0.000068	0.000079	0.000067	0.000070	0.000078	0.000066
Sodium	mg/L	0.20	<0.10	0.059	0.070	0.061	0.064	0.061	<0.1	0.086	<0.1	0.076	0.088	<0.1
Strontium	mg/L	0.0106	0.00998	0.0107	0.0110	0.0107	0.0104	0.0122	0.0109	0.0104	0.0105	0.00986	0.0102	0.0101
Sulfur	mg/L	26.6	26.6	25.7	27.4	26.2	27.6	29.6	33.2	38.7	35.8	34.8	37.7	34.1
Thallium	mg/L	0.000188	0.000189	0.000214	0.000231	0.000246	0.000311	0.000436	0.000482	0.000562	0.000604	0.000629	0.000686	0.000626
Tin	mg/L	<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0002	<0.0001	<0.0001	<0.0002
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0145	0.0147	0.0151	0.0200	0.0215	0.0294	0.0354	0.0384	0.0394	0.0378	0.0352	0.0341	0.0300
Vanadium	mg/L	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.002	<0.001	<0.001	<0.002
Zinc	mg/L	1.55	1.73	1.96	2.88	3.51	5.38	7.15	10.3	10.5	10.2	10.0	10.7	10.2

Table A6-3: Results of Waste Rock H

Week	Units	52	53	54	55	56	57	58	59	60	61	62	63	64
Sample ID		BW-ARD-509-52	BW-ARD-509-53	BW-ARD-509-54	BW-ARD-509-55	BW-ARD-509-56	BW-ARD-509-57	BW-ARD-509-58	BW-ARD-509-59	BW-ARD-509-60	BW-ARD-509-61	BW-ARD-509-62	BW-ARD-509-63	BW-ARD-509-64
Date Sampled		20-MAR-13	27-MAR-13	03-APR-13	10-APR-13	17-APR-13	24-APR-13	01-MAY-13	08-MAY-13	15-MAY-13	22-MAY-13	29-MAY-13	05-JUN-13	12-JUN-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	460	465	465	465	455	460	455	450	475	450	450	465	450
Conductivity	mS/cm	276		259		240		215		211		198		190
pH	units	3.65		3.65		3.65		3.69		3.70		3.71		3.73
Acidity	mg/L CaCO3	85.4		73.0		64.9		54.1		49.5		49.3		44.3
Alkalinity, Total	mg/L CaCO3	<2.0		<2.0		<2.00		<2.00		<2.00		<2.00		<2.00
Sulfate (SO4)	mg/L	86.2		79.2		68.7		69.5		65.1		56.7		53.5
Dissolved Metals														
Aluminum	mg/L	8.69		7.25		6.14		5.48		5.07		4.43		4.19
Antimony	mg/L	<0.0002		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Arsenic	mg/L	0.00148		0.00053		0.00053		0.00045		0.00044		0.00067		0.00055
Barium	mg/L	0.0388		0.0372		0.0356		0.0356		0.0355		0.0354		0.0364
Beryllium	mg/L	0.0111		0.00838		0.00776		0.00615		0.00554		0.00479		0.00444
Bismuth	mg/L	<0.001		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005
Boron	mg/L	<0.02		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01
Cadmium	mg/L	0.0496		0.0403		0.0327		0.0254		0.0208		0.0172		0.0150
Calcium	mg/L	2.27		2.53		2.72		3.06		3.39		3.70		3.79
Chromium	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005
Cobalt	mg/L	0.0485		0.0401		0.0338		0.0285		0.0260		0.0215		0.0190
Copper	mg/L	0.797		0.789		0.710		0.550		0.504		0.372		0.315
Iron	mg/L	0.102		0.093		0.079		0.075		0.055		0.049		0.048
Lead	mg/L	0.0905		0.0887		0.0840		0.0783		0.0712		0.0644		0.0615
Lithium	mg/L	0.0191		0.0138		0.0150		0.0129		0.0116		0.0119		0.00995
Magnesium	mg/L	1.15		1.10		1.02		0.918		0.908		0.849		0.733
Manganese	mg/L	4.44		3.88		3.46		3.00		2.75		2.40		2.10
Mercury	mg/L	<0.00001		0.000085		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001
Molybdenum	mg/L	<0.0001		<0.00005		<0.00005		<0.00005		<0.00005		<0.00005		<0.00005
Nickel	mg/L	0.0611		0.0509		0.0427		0.0348		0.0330		0.0266		0.0231
Phosphorus	mg/L	<0.3		<0.3		<0.30		<0.30		<0.30		<0.30		<0.30
Potassium	mg/L	4.74		4.29		3.85		3.37		3.71		3.14		3.05
Selenium	mg/L	<0.0002		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Silicon	mg/L	11.1		10.8		10.3		10.0		10.6		9.24		9.67
Silver	mg/L	0.000084		0.000102		0.000094		0.000106		0.000097		0.000097		0.000097
Sodium	mg/L	<0.1		0.069		0.061		0.050		0.055		0.065		0.059
Strontium	mg/L	0.0102		0.00965		0.0102		0.0104		0.0106		0.0116		0.0117
Sulfur	mg/L	33.2		29.7		26.6		24.5		22.4		21.3		19.4
Thallium	mg/L	0.000640		0.000613		0.000614		0.000562		0.000543		0.000478		0.000455
Tin	mg/L	<0.0002		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Titanium	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01
Uranium	mg/L	0.0277		0.0228		0.0188		0.0156		0.0135		0.0114		0.0101
Vanadium	mg/L	<0.002		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001
Zinc	mg/L	9.90		8.10		6.77		4.94		4.15		3.20		2.64

Table A6-3: Results of Waste Rock H

Week	Units	65	66	67	68	69
Sample ID		BW-ARD-509-65	BW-ARD-509-66	BW-ARD-509-67	BW-ARD-509-68	BW-ARD-509-69
Date Sampled		19-JUN-13	26-JUN-13	03-JUL-13	10-JUL-13	17-JUL-13
Total Volume In	mL	500	500	500	500	Total Volume In
Total Volume Out	mL	450	450	455	450	Total Volume Out
Conductivity	mS/cm		184		187	Conductivity
pH	units		3.74		3.74	pH
Acidity	mg/L CaCO3		43.3		37.5	Alkalinity, Total
Alkalinity, Total	mg/L CaCO3		<2.0		<2.0	Sulfate
Sulfate (SO4)	mg/L		50.4		49.9	Sulfate (SO4)
Dissolved Metals						**Dissolved Metals**
Aluminum	mg/L		3.85		3.80	Aluminum
Antimony	mg/L		<0.0001		<0.0001	Antimony
Arsenic	mg/L		0.00045		0.00058	Arsenic
Barium	mg/L		0.0359		0.0372	Barium
Beryllium	mg/L		0.00432		0.00381	Beryllium
Bismuth	mg/L		<0.0005		<0.0005	Bismuth
Boron	mg/L		<0.01		<0.01	Boron
Cadmium	mg/L		0.0130		0.0115	Cadmium
Calcium	mg/L		4.13		4.26	Calcium
Chromium	mg/L		<0.0005		<0.0005	Chromium
Cobalt	mg/L		0.0171		0.0156	Cobalt
Copper	mg/L		0.259		0.244	Copper
Iron	mg/L		0.043		0.041	Iron
Lead	mg/L		0.0612		0.0567	Lead
Lithium	mg/L		0.0117		0.00945	Lithium
Magnesium	mg/L		0.683		0.657	Magnesium
Manganese	mg/L		1.99		1.99	Manganese
Mercury	mg/L		<0.0		<0.0	Mercury
Molybdenum	mg/L		<0.0001		<0.0001	Molybdenum
Nickel	mg/L		0.0208		0.0190	Nickel
Phosphorus	mg/L		<0.3		<0.3	Phosphorus
Potassium	mg/L		2.83		2.84	Potassium
Selenium	mg/L		<0.0001		<0.0001	Selenium
Silicon	mg/L		9.41		9.48	Silicon
Silver	mg/L		0.000103		0.000102	Silver
Sodium	mg/L		0.062		<0.05	Sodium
Strontium	mg/L		0.0123		0.0124	Strontium
Sulfur	mg/L		18.7		17.6	Sulfur
Thallium	mg/L		0.000475		0.000444	Thallium
Tin	mg/L		<0.0001		<0.0001	Tin
Titanium	mg/L		<0.01		<0.01	Titanium
Uranium	mg/L		0.00928		0.00830	Uranium
Vanadium	mg/L		<0.001		<0.001	Vanadium
Zinc	mg/L		2.41		2.09	Zinc

Table A6-4: Results of Waste Rock Humidity Cell Test BW-ARD-566

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12
Sample ID		BW-ARD-566-0	BW-ARD-566-1	BW-ARD-566-2	BW-ARD-566-3	BW-ARD-566-4	BW-ARD-566-5	BW-ARD-566-6	BW-ARD-566-7	BW-ARD-566-8	BW-ARD-566-9	BW-ARD-566-10	BW-ARD-566-11	BW-ARD-566-12
Date Sampled		03-APR-12	10-APR-12	17-APR-12	24-APR-12	01-MAY-12	08-MAY-12	15-MAY-12	22-MAY-12	29-MAY-12	05-JUN-12	12-JUN-12	19-JUN-12	26-JUN-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	625	500	475	455	470	445	435	500	470	475	445	475	470
Conductivity	mS/cm	231	242	191	132	113	102	102	94.5	91.0	89.8	83.0	85.7	85.3
pH	units	7.46	7.52	7.53	7.59	7.60	7.49	7.49	7.49	7.37	7.44	7.38	7.43	7.34
Acidity	mg/L CaCO3	2.5	3.1	1.9	2.1	2.9	3.0	3.2	2.2	4.4	2.7	2.5	2.7	7.8
Alkalinity, Total	mg/L CaCO3	15.8	15.2	14.1	11.3	11.1	7.8	7.8	9.9	8.1	9.5	7.2	9.3	9.5
Sulfate (SO4)	mg/L	66.3	74.5	56.3	39.4	30.2	27.4	29.5	27.2	35.7	26.9	24.6	24.0	25.0
Dissolved Metals														
Aluminum	mg/L	0.01	0.03	0.0377	0.0462	0.0987	0.111	0.0687	0.0565	0.0862	0.0716	0.0571	0.0565	0.0742
Antimony	mg/L	0.003	0.006	0.00818	0.00892	0.00963	0.00789	0.00860	0.00930	0.00910	0.00919	0.00901	0.00919	0.00918
Arsenic	mg/L	0.002	0.002	0.00213	0.00205	0.00217	0.00177	0.00184	0.00172	0.00174	0.00156	0.00168	0.00150	0.00148
Barium	mg/L	0.02	0.02	0.0104	0.00679	0.00663	0.00612	0.00548	0.00536	0.00573	0.00551	0.00511	0.00548	0.00567
Beryllium	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.01	0.01	<0.01	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.0005	0.0004	0.000349	0.000302	0.000410	0.000450	0.000537	0.000717	0.000752	0.000923	0.000927	0.00132	0.00147
Calcium	mg/L	19.10	22.00	17.1	12.1	10.4	9.65	9.24	9.34	9.06	9.14	8.66	9.21	8.99
Chromium	mg/L	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0009	0.0005	0.00027	0.00017	0.00019	0.00017	0.00016	0.00021	0.00024	0.00024	0.00022	0.00030	0.00032
Copper	mg/L	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	0.03	0.03	<0.03	0.03	0.03	0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0001	0.0001	<0.00005	0.00005	0.00005	0.000051	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	0.0034	0.0022	0.00159	0.00142	0.00120	0.00157	0.00162	0.00178	0.00193	0.00142	0.00198	0.00175	0.00172
Magnesium	mg/L	2.23	2.33	1.70	1.08	1.01	0.867	0.869	0.851	0.787	0.749	0.799	0.801	0.747
Manganese	mg/L	1.26	1.09	0.731	0.474	0.463	0.431	0.447	0.501	0.480	0.464	0.493	0.602	0.588
Mercury	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.0004	0.0017	0.00193	0.00147	0.00130	0.000924	0.000857	0.000928	0.000787	0.000745	0.000662	0.000744	0.000654
Nickel	mg/L	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	0.30	0.30	<0.3	0.3	0.3	0.3	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	14.60	13.40	11.1	8.84	7.91	7.08	6.77	6.45	6.08	5.62	5.45	5.31	4.86
Selenium	mg/L	0.00	0.00	<0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.73	2.88	3.79	4.16	4.57	4.47	4.64	5.08	4.95	5.24	5.39	5.34	5.32
Silver	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	8.08	7.22	5.60	3.59	2.69	2.10	1.79	1.55	1.28	1.14	1.01	0.956	0.800
Strontium	mg/L	0.10	0.09	0.0678	0.0441	0.0398	0.0348	0.0332	0.0332	0.0334	0.0318	0.0308	0.0346	0.0318
Sulfur	mg/L	31.50	27.10	21.0	14.0	11.6	10.7	10.8	9.69	9.20	9.14	8.95	8.77	8.50
Thallium	mg/L	0.00004	0.00003	0.000026	0.000023	0.000022	0.000021	0.000021	0.000021	0.000022	0.000024	0.000020	0.000021	0.000022
Tin	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.01	0.01	<0.01	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0001	0.0002	0.000117	0.000087	0.000092	0.000072	0.000072	0.000091	0.000076	0.000072	0.000059	0.000079	0.000074
Vanadium	mg/L	0.001	0.001	<0.001	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.08	0.05	0.0362	0.0259	0.0361	0.0366	0.0357	0.0581	0.0579	0.0686	0.0667	0.101	0.114

Table A6-4: Results of Waste Rock Humidity Cell Test BW-ARD-566

Week	Units	13	14	15	16	17	18	19	20	21	22	23	24
Sample ID		BW-ARD-566-13	BW-ARD-566-14	BW-ARD-566-15	BW-ARD-566-16	BW-ARD-566-17	BW-ARD-566-18	BW-ARD-566-19	BW-ARD-566-20	BW-ARD-566-21	BW-ARD-566-22	BW-ARD-566-23	BW-ARD-566-24
Date Sampled		03-JUL-12	10-JUL-12	17-JUL-12	24-JUL-12	31-JUL-12	07-AUG-12	14-AUG-12	21-AUG-12	28-AUG-12	04-SEP-12	11-SEP-12	18-SEP-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	500	500	440	475	490	450	500	480	475	410	500	470
Conductivity	mS/cm	86.5	80.8	78.8	86.3	83.5	89.7	89.2	92.5	96.1	106	103	109
pH	units	7.39	7.26	7.22	7.08	7.14	6.96	7.03	6.82	6.62	6.59	6.79	6.56
Acidity	mg/L CaCO3	2.2	7.5	5.4	3.0	3.4	2.6	2.4	5.9	3.4	4.7	3.4	5.3
Alkalinity, Total	mg/L CaCO3	8.7	6.9	4.8	4.8	3.9	3.6	3.0	3.6	2.8	2.3	2.3	2.5
Sulfate (SO4)	mg/L	25.4	23.0	24.8	26.1	22.9	29.1	28.6	29.8	21.4	36.4	35.1	37.1
Dissolved Metals													
Aluminum	mg/L	0.0461	0.0481	0.0553	0.0399	0.0502	0.0314	0.0176	0.0207	0.0194	0.0125	0.0118	0.0070
Antimony	mg/L	0.00924	0.00864	0.00706	0.00782	0.00738	0.00708	0.00680	0.00576	0.00543	0.00467	0.00531	0.00473
Arsenic	mg/L	0.00163	0.00133	0.00115	0.00118	0.00108	0.00133	0.00109	0.00096	0.00097	0.00095	0.00090	0.00079
Barium	mg/L	0.00542	0.00539	0.00537	0.00590	0.00547	0.00627	0.00676	0.00735	0.00818	0.00905	0.0108	0.0104
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00179	0.00166	0.00171	0.00224	0.00253	0.00316	0.00373	0.00458	0.00508	0.00594	0.00727	0.00731
Calcium	mg/L	9.24	8.33	8.56	9.12	8.71	9.53	10.4	10.3	10.4	11.8	12.0	12.1
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00040	0.00037	0.00036	0.00049	0.00056	0.00068	0.00081	0.00098	0.00116	0.00136	0.00181	0.00167
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.0001	<0.0001
Lithium	mg/L	0.00219	0.00137	0.00180	0.00199	0.00175	0.00226	0.00230	0.00231	0.00259	0.00263	0.00320	0.00240
Magnesium	mg/L	0.769	0.697	0.711	0.756	0.711	0.795	0.784	0.785	0.860	0.850	0.909	0.952
Manganese	mg/L	0.656	0.597	0.655	0.745	0.749	0.882	1.01	1.04	1.18	1.36	1.55	1.70
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000626	0.000570	0.000444	0.000488	0.000417	0.000404	0.000426	0.000300	0.000276	0.000221	0.000263	0.000175
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	4.98	4.54	4.49	4.47	4.15	4.51	4.33	4.09	4.39	4.25	4.44	4.32
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	5.60	5.00	5.06	5.33	5.31	5.98	5.77	5.17	5.14	5.17	5.86	5.90
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.768	0.687	0.634	0.602	0.569	0.578	0.540	0.506	0.519	0.479	0.511	0.464
Strontium	mg/L	0.0322	0.0308	0.0299	0.0334	0.0316	0.0347	0.0366	0.0377	0.0397	0.0431	0.0451	0.0458
Sulfur	mg/L	8.57	8.51	8.78	9.13	8.80	10.1	10.3	10.8	11.1	12.5	12.6	14.8
Thallium	mg/L	0.000020	0.000022	0.000021	0.000023	0.000024	0.000027	0.000026	0.000027	0.000031	0.000032	0.000034	0.000036
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000073	0.000057	0.000039	0.000039	0.000041	0.000034	0.000035	0.000025	0.000025	0.000026	0.000033	0.000030
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.138	0.129	0.133	0.192	0.231	0.278	0.369	0.453	0.548	0.680	0.827	0.845

Table A6-4: Results of Waste Rock Humidity Cell Test BW-ARD-566

Week	Units	25	26	27	28	29	30	31	32	33	34	35	36
Sample ID		BW-ARD-566-25	BW-ARD-566-26	BW-ARD-566-27	BW-ARD-566-28	BW-ARD-566-29	BW-ARD-566-30	BW-ARD-566-31	BW-ARD-566-32	BW-ARD-566-33	BW-ARD-566-34	BW-ARD-566-35	BW-ARD-566-36
Date Sampled		25-SEP-12	02-OCT-12	09-OCT-12	16-OCT-12	23-OCT-12	30-OCT-12	06-NOV-12	13-NOV-12	20-NOV-12	27-NOV-12	04-DEC-12	11-DEC-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	490	475	480	480	475	470	500	480	475	470	450	440
Conductivity	mS/cm	116	117	124	137	134	135	146	147	162	170	179	193
pH	units	6.52	6.39	6.27	6.12	6.08	5.82	5.80	5.60	5.51	5.34	5.31	5.08
Acidity	mg/L CaCO3	6.2	4.9	6.1	6.3	5.2	5.2	6.7	6.4	7.2	8.2	8.8	10.8
Alkalinity, Total	mg/L CaCO3	<2.	<2.	2.1	<2.	<2.	<2.	<2.	<2.	<2.	<2.00	<2.00	<2.00
Sulfate (SO4)	mg/L	38.7	40.9	43.2	45.0	46.9	49.4	54.1	51.0	62.2	64.2	69.3	70.5
Dissolved Metals													
Aluminum	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0059	0.0087	0.0123	0.0133	0.0299
Antimony	mg/L	0.00397	0.00395	0.00300	0.00284	0.00234	0.00214	0.00186	0.00191	0.00155	0.00137	0.00119	0.00094
Arsenic	mg/L	0.00075	0.00080	0.00079	0.00089	0.00082	0.00092	0.00101	0.00133	0.00160	0.00187	0.00182	0.00219
Barium	mg/L	0.0129	0.0131	0.0149	0.0162	0.0165	0.0171	0.0216	0.0237	0.0288	0.0326	0.0303	0.0391
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00011	0.00014	0.00017	0.00017	0.00023
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00853	0.00936	0.00977	0.0116	0.0117	0.0124	0.0140	0.0153	0.0184	0.0199	0.0216	0.0235
Calcium	mg/L	12.7	12.6	14.2	15.8	15.6	15.0	16.7	16.2	19.1	20.1	20.3	21.8
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00200	0.00213	0.00230	0.00265	0.00274	0.00279	0.00330	0.00358	0.00442	0.00488	0.00558	0.00593
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00066	0.00055	0.00076	0.00095	0.00089	0.00102
Iron	mg/L	0.063	0.059	0.150	0.166	0.218	0.237	0.345	0.409	0.571	0.593	0.610	0.933
Lead	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.000055	0.000073	0.000068	0.000108
Lithium	mg/L	0.00258	0.00291	0.00288	0.00312	0.00288	0.00330	0.00311	0.00344	0.00412	0.00397	0.00434	0.00397
Magnesium	mg/L	0.948	1.02	0.998	1.15	1.05	1.05	1.11	1.15	1.28	1.29	1.36	1.30
Manganese	mg/L	1.73	1.99	2.12	2.37	2.41	2.58	3.07	3.08	3.74	4.31	4.57	5.31
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000163	0.000139	<0.0001	0.000074	0.000068	0.000056	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00066	0.00070	0.00140	0.00098	0.00109	0.00117
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30
Potassium	mg/L	4.34	4.27	4.18	4.41	3.97	3.85	3.98	4.28	4.51	4.61	4.65	4.22
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	5.53	5.45	5.36	5.28	5.29	5.19	5.58	6.11	6.53	6.47	6.19	6.78
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.535	0.432	0.430	0.445	0.399	0.382	0.399	0.408	0.447	0.454	0.447	0.449
Strontium	mg/L	0.0485	0.0569	0.0575	0.0572	0.0604	0.0609	0.0664	0.0639	0.0728	0.0826	0.0853	0.0972
Sulfur	mg/L	14.3	14.9	15.5	17.5	17.3	17.4	19.3	18.9	21.8	23.7	24.4	26.9
Thallium	mg/L	0.000033	0.000034	0.000038	0.000031	0.000035	0.000037	0.000041	0.000043	0.000047	0.000049	0.000050	0.000047
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000032	0.000030	0.000043	0.000042	0.000049	0.000059	0.000068	0.000095	0.000125	0.000141	0.000141	0.000197
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	1.01	1.11	1.20	1.40	1.41	1.44	1.73	1.91	2.28	2.63	2.84	3.14

Table A6-5: Results of Waste Rock Humidity Cell Test BW-ARD-537

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample ID		BW-ARD-537-0	BW-ARD-537-1	BW-ARD-537-2	BW-ARD-537-3	BW-ARD-537-4	BW-ARD-537-5	BW-ARD-537-6	BW-ARD-537-7	BW-ARD-537-8	BW-ARD-537-9	10	11	12	13	14
Date Sampled		21-MAR-12	28-MAR-12	04-APR-12	11-APR-12	18-APR-12	25-APR-12	02-MAY-12	09-MAY-12	16-MAY-12	23-MAY-12	30-MAY-12	06-JUN-12	13-JUN-12	20-JUN-12	27-JUN-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	550	470	410	450	455	465	475	475	475	455	500	485	440	490	475
Conductivity	mS/cm	468	318	225	200	187	191	187	186	194	169	167	152	150	146	134
pH	units	6.35	6.91	6.80	6.80	6.80	6.56	6.54	6.51	6.66	6.32	6.27	6.25	6.17	6.26	6.15
Acidity	mg/L CaCO3	6.1	6.1	7.8	6.2	12.1	14.4	12.9	10.4	9.5	13.3	11.4	21.6	16.0	20.6	18.0
Alkalinity, Total	mg/L CaCO3	4.8	4.6	3.5	3.3	3.4	3.1	2.5	2.3	3.3	2.4	2.7	2.4	<2.	<2.	<2.0
Sulfate (SO4)	mg/L	172	107	72.9	64.4	66.1	67.2	68.7	63.7	67.1	55.5	57.7	52.6	54.8	52.0	44.9
Aluminum	mg/L	0.01	0.01	0.0051	0.005	0.0067	0.005	0.005	0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Antimony	mg/L	0.001	0.002	0.00187	0.00185	0.00199	0.00182	0.00168	0.00177	0.00176	0.00144	0.00143	0.00135	0.00131	0.00133	0.00117
Arsenic	mg/L	0.003	0.01	0.00667	0.00573	0.00543	0.00459	0.00405	0.00362	0.00348	0.00272	0.00267	0.00233	0.00217	0.00222	0.00196
Barium	mg/L	0.01	0.00	0.00220	0.00200	0.00219	0.00225	0.00226	0.00238	0.00255	0.00231	0.00249	0.00232	0.00248	0.00233	0.00228
Beryllium	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.01	0.02	0.014	0.013	0.013	0.010	0.011	0.010	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.01	0.01	0.00518	0.00653	0.00905	0.0116	0.0144	0.0165	0.0204	0.0205	0.0233	0.0235	0.0258	0.0275	0.0264
Calcium	mg/L	28.60	16.00	10.2	9.46	9.29	9.54	9.55	9.44	9.81	8.23	7.64	6.94	6.78	6.35	5.68
Chromium	mg/L	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.07	0.04	0.0286	0.0323	0.0403	0.0485	0.0557	0.0617	0.0691	0.0661	0.0709	0.0681	0.0688	0.0711	0.0655
Copper	mg/L	0.002	0.001	0.00061	0.00060	0.00075	0.00081	0.00113	0.00129	0.00156	0.00189	0.00255	0.00243	0.00318	0.00379	0.00398
Iron	mg/L	0.03	0.03	<0.03	0.03	0.03	0.03	0.03	0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0001	0.0001	<0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	0.09	0.07	0.0612	0.0537	0.0494	0.0471	0.0422	0.0422	0.0368	0.0305	0.0302	0.0260	0.0246	0.0244	0.0213
Magnesium	mg/L	7.75	4.32	2.77	2.39	2.56	2.54	2.52	2.35	2.41	2.08	2.02	1.80	1.64	1.67	1.41
Manganese	mg/L	2.79	2.66	2.35	2.72	3.47	4.01	4.97	5.22	5.96	5.54	6.11	5.51	5.72	6.14	5.60
Mercury	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.0006	0.0012	0.00140	0.00123	0.00103	0.000866	0.000702	0.000655	0.000546	0.000448	0.000378	0.000379	0.000370	0.000312	0.000247
Nickel	mg/L	0.11	0.06	0.0422	0.0434	0.0497	0.0556	0.0592	0.0626	0.0668	0.0625	0.0641	0.0595	0.0606	0.0621	0.0562
Phosphorus	mg/L	0.30	0.30	<0.3	0.3	0.3	0.3	0.3	0.3	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	57.80	40.70	30.1	25.4	23.6	21.3	20.6	17.5	17.7	14.6	13.9	11.8	11.2	10.8	9.69
Selenium	mg/L	0.001	0.001	0.00022	0.00015	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	4.12	7.89	7.15	7.46	7.78	8.03	8.04	8.34	9.16	7.45	7.46	7.13	7.33	7.52	6.74
Silver	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	6.72	3.74	1.79	1.05	0.702	0.466	0.345	0.265	0.231	0.184	0.159	0.131	0.112	0.111	0.096
Strontium	mg/L	0.29	0.16	0.102	0.0959	0.101	0.0979	0.102	0.107	0.105	0.0908	0.0904	0.0806	0.0805	0.0756	0.0682
Sulfur	mg/L	70.50	47.80	27.5	24.9	23.8	24.8	24.0	24.0	24.9	21.4	21.2	19.7	19.3	18.6	17.1
Thallium	mg/L	0.0012	0.0008	0.000639	0.000623	0.000661	0.000658	0.000614	0.000649	0.000693	0.000593	0.000611	0.000559	0.000547	0.000521	0.000480
Tin	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.01	0.01	<0.01	0.01	0.01	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Vanadium	mg/L	0.0010	0.0010	<0.001	0.001	0.001	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	1.49	0.93	0.840	1.14	1.68	2.41	3.29	3.83	4.90	5.39	5.92	5.85	6.71	7.63	7.17

Table A6-5: Results of Waste Rock Hun

Week	Units	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Sample ID		15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Date Sampled		04-JUL-12	11-JUL-12	18-JUL-12	25-JUL-12	01-AUG-12	08-AUG-12	15-AUG-12	22-AUG-12	29-AUG-12	05-SEP-12	12-SEP-12	19-SEP-12	26-SEP-12	03-OCT-12	10-OCT-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	475	450	460	470	450	475	470	465	480	475	420	500	475	420	465
Conductivity	mS/cm	140	126	128	121	119	118	112	117	114	104	95.7	99.9	96.9	93.4	92.0
pH	units	6.10	6.07	6.07	6.04	6.01	5.95	5.94	5.89	5.89	5.84	5.84	5.84	5.77	5.73	5.69
Acidity	mg/L CaCO3	15.7	15.5	26.8	22.9	18.0	18.0	18.4	19.5	19.0	18.8	16.5	17.9	19.5	17.9	17.9
Alkalinity, Total	mg/L CaCO3	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.
Sulfate (SO4)	mg/L	50.5	41.2	44.2	39.6	42.0	38.4	40.2	38.0	36.9	36.6	31.7	31.5	32.9	31.6	31.8
Aluminum	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Antimony	mg/L	0.00116	0.00107	0.00103	0.00105	0.00108	0.00090	0.00085	0.00082	0.00079	0.00077	0.00063	0.00070	0.00064	0.00057	0.00058
Arsenic	mg/L	0.00198	0.00163	0.00161	0.00154	0.00153	0.00147	0.00137	0.00138	0.00139	0.00130	0.00096	0.00119	0.00110	0.00091	0.00089
Barium	mg/L	0.00239	0.00221	0.00234	0.00210	0.00227	0.00228	0.00217	0.00253	0.00241	0.00225	0.00204	0.00218	0.00239	0.00228	0.00208
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.0291	0.0283	0.0304	0.0285	0.0307	0.0333	0.0313	0.0336	0.0361	0.0320	0.0319	0.0346	0.0353	0.0345	0.0327
Calcium	mg/L	5.89	5.04	5.23	4.58	4.40	4.43	3.81	4.13	4.00	3.45	3.03	3.06	2.90	2.79	2.56
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0715	0.0650	0.0662	0.0615	0.0636	0.0646	0.0592	0.0641	0.0642	0.0565	0.0545	0.0567	0.0569	0.0554	0.0514
Copper	mg/L	0.00416	0.00438	0.00541	0.00558	0.00644	0.00752	0.00714	0.00852	0.00952	0.00949	0.00938	0.0110	0.0121	0.0128	0.0123
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	mg/L	0.0233	0.0195	0.0210	0.0185	0.0211	0.0181	0.0168	0.0177	0.0177	0.0165	0.0124	0.0151	0.0151	0.0135	0.0156
Magnesium	mg/L	1.42	1.18	1.15	1.05	0.920	0.980	0.870	0.919	0.855	0.717	0.680	0.660	0.662	0.603	0.558
Manganese	mg/L	6.06	5.32	5.41	5.88	5.71	5.57	4.58	5.20	5.05	4.44	4.65	4.36	4.58	4.51	4.33
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000249	0.000209	0.000189	0.000164	0.000166	0.000133	0.000134	0.000126	0.000113	0.000142	0.000086	0.000098	0.000073	0.000063	<0.0001
Nickel	mg/L	0.0616	0.0538	0.0565	0.0509	0.0527	0.0549	0.0495	0.0593	0.0540	0.0468	0.0452	0.0478	0.0480	0.0480	0.0452
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	9.47	8.58	8.34	7.42	7.45	7.53	7.21	7.18	7.05	6.08	5.71	6.23	6.21	5.77	5.63
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	7.86	6.90	6.97	6.69	6.71	7.10	6.32	6.76	6.82	6.65	5.25	6.29	5.97	5.26	5.41
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.100	0.093	0.101	0.058	0.078	0.073	0.071	0.073	0.074	0.068	0.062	0.061	0.059	0.053	0.053
Strontium	mg/L	0.0732	0.0611	0.0608	0.0618	0.0656	0.0580	0.0517	0.0545	0.0533	0.0461	0.0424	0.0449	0.0444	0.0410	0.0456
Sulfur	mg/L	18.5	16.2	16.8	15.6	15.4	15.5	14.1	15.4	14.5	12.9	11.8	12.5	11.7	12.0	11.1
Thallium	mg/L	0.000518	0.000473	0.000496	0.000466	0.000526	0.000476	0.000454	0.000467	0.000458	0.000402	0.000383	0.000413	0.000405	0.000376	0.000408
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.000011	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.000020	<0.00001
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	7.72	7.24	7.51	8.58	8.75	8.38	7.43	8.62	8.60	7.42	7.57	7.98	8.27	8.16	7.72

Table A6-5: Results of Waste Rock Hun

Week	Units	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Sample ID		30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Date Sampled		17-OCT-12	24-OCT-12	31-OCT-12	07-NOV-12	14-NOV-12	21-NOV-12	28-NOV-12	05-DEC-12	12-DEC-12	19-DEC-12	26-DEC-12	02-JAN-13	09-JAN-13	16-JAN-13	23-JAN-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	500	435	470	500	440	500	450	390	480	420	500	475	455	475	460
Conductivity	mS/cm	91.6	94.5	83.0	80.2	97.3	82.6	87.4	95.7	84.5	85.7	75.5	77.8	82.7	76.1	75.2
pH	units	5.75	5.79	5.69	5.67	5.61	5.61	5.57	5.50	5.50	5.49	5.45	5.47	5.45	5.43	5.41
Acidity	mg/L CaCO3	17.6	20.0	14.5	13.1	19.7	15.3	15.7	18.5	17.1	17.2	14.2	16.3	18.3	15.2	14.1
Alkalinity, Total	mg/L CaCO3	<2.	<2.	<2.	<2.	<2.	<2.	<2.00	<2.00	<2.00	<2.00	<2.00	<2.	<2.	<2.	<2.
Sulfate (SO4)	mg/L	24.9	26.5	28.1	28.5	30.8	29.6	28.9	31.5	28.9	28.8	27.4	28.7	31.2	27.4	26.8
Aluminum	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0060	0.0056	0.0051	<0.005	<0.005	0.0051	0.0066	0.0067	0.0066
Antimony	mg/L	0.00057	0.00048	0.00052	0.00050	0.00052	0.00047	0.00047	0.00047	0.00047	0.00045	0.00045	0.00039	0.00038	0.00039	0.00039
Arsenic	mg/L	0.00103	0.00098	0.00081	0.00085	0.00099	0.00087	0.00081	0.00087	0.00082	0.00083	0.00082	0.00074	0.00083	0.00071	0.00076
Barium	mg/L	0.00221	0.00246	0.00204	0.00195	0.00263	0.00229	0.00242	0.00291	0.00242	0.00275	0.00245	0.00250	0.00267	0.00252	0.00252
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.0341	0.0392	0.0334	0.0320	0.0428	0.0366	0.0385	0.0414	0.0379	0.0390	0.0345	0.0359	0.0388	0.0354	0.0347
Calcium	mg/L	2.53	2.60	2.23	2.05	2.60	2.10	2.25	2.41	1.98	2.08	1.76	1.81	1.95	1.70	1.65
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0525	0.0582	0.0482	0.0461	0.0577	0.0505	0.0515	0.0563	0.0492	0.0500	0.0448	0.0458	0.0493	0.0441	0.0440
Copper	mg/L	0.0139	0.0160	0.0139	0.0144	0.0200	0.0183	0.0200	0.0237	0.0204	0.0219	0.0199	0.0219	0.0247	0.0227	0.0230
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	mg/L	0.0132	0.0104	0.0113	0.0109	0.0122	0.0110	0.0124	0.0133	0.0128	0.0128	0.0113	0.0112	0.0110	0.0109	0.0111
Magnesium	mg/L	0.555	0.588	0.480	0.446	0.526	0.456	0.461	0.467	0.416	0.421	0.361	0.365	0.370	0.329	0.330
Manganese	mg/L	4.22	4.60	3.95	3.77	4.32	3.94	4.25	4.00	3.83	4.08	3.63	3.62	3.95	3.28	3.39
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000064	0.000082	0.000075	0.000066	0.000067	<0.0001	0.000055	0.000071	<0.00005	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.0457	0.0500	0.0421	0.0397	0.0499	0.0445	0.0459	0.0504	0.0433	0.0453	0.0403	0.0414	0.0458	0.0408	0.0403
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	5.78	5.82	5.17	4.94	5.51	5.29	5.05	5.30	5.34	5.37	5.05	4.93	5.14	4.64	4.60
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	5.39	5.42	4.96	4.54	5.89	4.94	5.09	6.01	5.30	5.24	4.73	4.86	5.07	4.18	4.29
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.052	0.056	<0.05	<0.05	<0.05	<0.05	<0.05	0.062	0.060	0.072	0.050	0.050	<0.05	<0.05	<0.05
Strontium	mg/L	0.0380	0.0386	0.0355	0.0336	0.0416	0.0342	0.0367	0.0399	0.0369	0.0355	0.0309	0.0312	0.0340	0.0305	0.0293
Sulfur	mg/L	11.1	11.3	10.2	9.61	12.1	9.87	10.7	11.6	9.96	10.2	9.03	9.25	9.83	8.97	9.15
Thallium	mg/L	0.000373	0.000338	0.000368	0.000323	0.000413	0.000359	0.000378	0.000437	0.000402	0.000407	0.000380	0.000380	0.000384	0.000364	0.000363
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	<0.00001	<0.00001	0.000013	<0.00001	0.000013	0.000013	0.000011	0.000015	0.000014	0.000013	0.000012	0.000014	0.000012	0.000012	0.000012
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	7.83	8.44	7.71	7.15	8.84	7.81	8.26	8.05	7.62	7.71	7.14	7.17	7.58	6.51	6.78

Table A6-5: Results of Waste Rock Hun

Week	Units	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Sample ID		45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Date Sampled		30-JAN-13	06-FEB-13	13-FEB-13	20-FEB-13	27-FEB-13	06-MAR-13	13-MAR-13	20-MAR-13	27-MAR-13	03-APR-13	10-APR-13	17-APR-13	24-APR-13	01-MAY-13	08-MAY-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	490	400	500	500	430	375	500	480	400	500	450	495	410	475	485
Conductivity	mS/cm	75.3	75.8	71.0	77.9	72.2	73.4	65.1	66.7		65.6		69.3		60.3	
pH	units	5.26	5.28	5.35	5.23	5.25	5.25	5.32	5.32		5.26		5.30		5.27	
Acidity	mg/L CaCO3	13.2	14.7	14.4	16.8	13.7	18.1	13.7	16.1		13.5		14.2		11.1	
Alkalinity, Total	mg/L CaCO3	<2.	<2.	<2.	<2.0	<2.0	<2.0	<2.0	<2.0		<2.0		<2.00		<2.00	
Sulfate (SO4)	mg/L	26.4	26.3	24.3	25.5	24.3	24.4	21.6	22.6		22.6		21.4		19.7	
Aluminum	mg/L	0.0075	0.0099	0.0078	0.0123	0.0087	0.0108	0.0087	0.0085		0.0101		0.0103		0.0102	
Antimony	mg/L	0.00036	0.00037	0.00037	0.00039	0.00034	0.00038	0.00031	0.00034		0.00033		0.00034		0.00030	
Arsenic	mg/L	0.00075	0.00075	0.00078	0.00074	0.00085	0.00082	0.00071	0.00081		0.00076		0.00077		0.00070	
Barium	mg/L	0.00247	0.00266	0.00247	0.00228	0.00262	0.00282	0.00230	0.00264		0.00299		0.00263		0.00242	
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001	
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005	
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01		<0.01	
Cadmium	mg/L	0.0356	0.0372	0.0351	0.0304	0.0345	0.0363	0.0321	0.0349		0.0321		0.0344		0.0307	
Calcium	mg/L	1.66	1.64	1.55	1.69	1.48	1.55	1.34	1.44		1.34		1.42		1.24	
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005	
Cobalt	mg/L	0.0429	0.0439	0.0411	0.0359	0.0404	0.0417	0.0369	0.0389		0.0369		0.0383		0.0333	
Copper	mg/L	0.0233	0.0243	0.0239	0.0232	0.0263	0.0276	0.0230	0.0253		0.0249		0.0269		0.0243	
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		<0.03		<0.03		<0.03	
Lead	mg/L	<0.0001	0.000076	<0.0001	0.000066	<0.00005	<0.00005	<0.00005	<0.00005		<0.00005		<0.00005		<0.00005	
Lithium	mg/L	0.00957	0.0113	0.0102	0.0117	0.0105	0.0112	0.00954	0.00943		0.00830		0.00985		0.00790	
Magnesium	mg/L	0.316	0.316	0.296	0.259	0.267	0.280	0.249	0.254		0.241		0.248		0.202	
Manganese	mg/L	3.38	3.60	3.27	2.81	2.98	3.13	2.75	2.99		2.79		2.84		2.45	
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001		<0.00001		<0.00001		<0.00001	
Molybdenum	mg/L	0.000051	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005		<0.00005		<0.00005		<0.00005	
Nickel	mg/L	0.0396	0.0410	0.0387	0.0340	0.0382	0.0396	0.0348	0.0380		0.0362		0.0373		0.0339	
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3		<0.3		<0.30		<0.30	
Potassium	mg/L	4.56	4.59	4.47	3.81	4.55	4.76	4.19	4.33		4.21		4.50		3.85	
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001	
Silicon	mg/L	4.40	4.37	4.26	5.34	4.18	4.52	3.71	4.04		4.14		4.31		3.52	
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001		<0.00001		<0.00001		<0.00001	
Sodium	mg/L	0.051	<0.05	0.054	<0.05	0.050	0.060	<0.05	<0.05		<0.05		<0.05		<0.05	
Strontium	mg/L	0.0285	0.0293	0.0270	0.0315	0.0282	0.0283	0.0243	0.0239		0.0246		0.0254		0.0212	
Sulfur	mg/L	8.81	8.67	8.89	8.92	8.24	8.60	7.31	7.70		7.49		7.79		6.66	
Thallium	mg/L	0.000351	0.000353	0.000334	0.000403	0.000348	0.000373	0.000311	0.000321		0.000341		0.000350		0.000299	
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001	
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01		<0.01	
Uranium	mg/L	0.000013	0.000014	0.000013	0.000045	0.000014	0.000016	0.000012	0.000015		0.000026		0.000016		0.000020	
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001		<0.001		<0.001	
Zinc	mg/L	6.95	7.53	6.81	5.69	6.24	6.45	5.68	6.21		5.51		5.86		4.85	

Table A6-5: Results of Waste Rock Hun

Week	Units	60	61	62	63	64	65	66	67	68	69
Sample ID		60	61	62	63	64	65	66	67	68	69
Date Sampled		15-MAY-13	22-MAY-13	29-MAY-13	05-JUN-13	12-JUN-13	19-JUN-13	26-JUN-13	03-JUL-13	10-JUL-13	17-JUL-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	400	500	450	415	450	500	455	405	450	475
Conductivity	mS/cm	71.6		62.1		64.0		58.0		57.1	
pH	units	5.13		5.24		5.06		5.13		5.13	
Acidity	mg/L CaCO3	12.4		14.2		17.0		13.6		11.1	
Alkalinity, Total	mg/L CaCO3	<2.00		<2.00		<2.00		<2.0		<2.0	
Sulfate (SO4)	mg/L	21.9		20.2		20.6		19.2		20.0	
Aluminum	mg/L	0.0144		0.0145		0.0152		0.0159		0.0158	
Antimony	mg/L	0.00026		0.00027		0.00026		0.00027		0.00027	
Arsenic	mg/L	0.00083		0.00083		0.00067		0.00078		0.00071	
Barium	mg/L	0.00314		0.00283		0.00290		0.00263		0.00263	
Beryllium	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Bismuth	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Boron	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01	
Cadmium	mg/L	0.0376		0.0355		0.0354		0.0327		0.0317	
Calcium	mg/L	1.58		1.39		1.40		1.29		1.27	
Chromium	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Cobalt	mg/L	0.0420		0.0371		0.0353		0.0327		0.0321	
Copper	mg/L	0.0349		0.0309		0.0323		0.0289		0.0298	
Iron	mg/L	<0.03		<0.03		<0.03		<0.03		<0.03	
Lead	mg/L	<0.00005		<0.00005		<0.00005		<0.0001		<0.0001	
Lithium	mg/L	0.00844		0.00816		0.00769		0.00709		0.00708	
Magnesium	mg/L	0.258		0.231		0.213		0.195		0.189	
Manganese	mg/L	3.09		2.67		2.54		2.39		2.47	
Mercury	mg/L	<0.00001		<0.00001		<0.00001		<0.0		<0.0	
Molybdenum	mg/L	<0.00005		<0.00005		<0.00005		<0.0001		<0.0001	
Nickel	mg/L	0.0432		0.0374		0.0367		0.0343		0.0341	
Phosphorus	mg/L	<0.30		<0.30		<0.30		<0.3		<0.3	
Potassium	mg/L	4.44		3.91		3.67		3.58		3.52	
Selenium	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Silicon	mg/L	4.90		3.98		4.28		3.60		3.67	
Silver	mg/L	0.000012		<0.00001		<0.00001		<0.0		<0.0	
Sodium	mg/L	<0.05		<0.05		<0.05		<0.05		<0.05	
Strontium	mg/L	0.0243		0.0234		0.0232		0.0202		0.0197	
Sulfur	mg/L	8.23		7.45		7.21		6.58		6.36	
Thallium	mg/L	0.000354		0.000316		0.000303		0.000307		0.000304	
Tin	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Titanium	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01	
Uranium	mg/L	0.000020		0.000021		0.000020		0.000024		0.000019	
Vanadium	mg/L	<0.001		<0.001		<0.001		<0.001		<0.001	
Zinc	mg/L	6.50		5.54		5.22		5.13		5.07	

Table A6-6: Results of Waste Rock Humidity Cell Test BW-ARD-499

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12
Sample ID		BW-ARD-499-0	BW-ARD-499-1	BW-ARD-499-2	BW-ARD-499-3	BW-ARD-499-4	BW-ARD-499-5	BW-ARD-499-6	BW-ARD-499-7	BW-ARD-499-8	BW-ARD-499-9	BW-ARD-499-10	BW-ARD-499-11	BW-ARD-499-12
Date Sampled		21-MAR-12	28-MAR-12	04-APR-12	11-APR-12	18-APR-12	25-APR-12	02-MAY-12	09-MAY-12	16-MAY-12	23-MAY-12	30-MAY-12	06-JUN-12	13-JUN-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	600	455	425	475	480	410	475	450	475	450	495	445	500
Conductivity	mS/cm	429	400	296	229	219	195	184	174	190	178	176	166	161
pH	units	8.16	8.13	8.15	8.20	8.15	8.16	8.18	8.19	8.21	8.10	8.18	8.12	8.16
Acidity	mg/L CaCO3	1.00	1.7	<1.	1	4.3	1	4.0	1.9	3.0	3.2	2.8	6.5	2.5
Alkalinity, Total	mg/L CaCO3	60.0	57.8	47.7	44.5	55.8	63.9	51.6	48.7	57.5	47.4	49.8	48.3	53.4
Sulfate (SO4)	mg/L	125	118	78.7	51.9	42.4	35.8	33.4	29.9	31.4	28.9	27.7	24.6	24.0
Dissolved Metals														
Aluminum	mg/L	0.03	0.02	0.0233	0.0303	0.0371	0.0418	0.0503	0.0661	0.0576	0.0485	0.0381	0.0367	0.0379
Antimony	mg/L	0.05	0.09	0.0718	0.0623	0.0805	0.0663	0.0661	0.0574	0.0656	0.0542	0.0534	0.0513	0.0511
Arsenic	mg/L	0.01	0.02	0.0206	0.0239	0.0289	0.0320	0.0316	0.0301	0.0332	0.0330	0.0334	0.0331	0.0333
Barium	mg/L	0.01	0.01	0.00547	0.00402	0.00400	0.00350	0.00335	0.00309	0.00348	0.00315	0.00307	0.00287	0.00285
Beryllium	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.02	0.02	0.018	0.015	0.017	0.013	0.014	0.012	0.014	0.012	0.011	<0.01	<0.01
Cadmium	mg/L	0.00001	0.00003	0.000036	0.000041	0.000044	0.000043	0.000068	0.000074	0.000115	0.000092	0.000085	0.000100	0.000091
Calcium	mg/L	61.50	57.40	41.9	31.2	31.9	26.7	26.1	24.4	28.9	25.9	25.6	24.1	24.5
Chromium	mg/L	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0003	0.0004	0.00023	0.00017	0.00019	0.00016	0.00016	0.00014	0.00017	0.00019	0.00019	0.00018	0.00017
Copper	mg/L	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	0.03	0.03	<0.03	0.03	0.03	0.03	0.03	0.03	0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0001	0.0001	<0.00005	0.00005	0.00005	0.00005	0.000096	0.00005	0.000105	<0.00005	<0.00005	<0.00005	<0.00005
Lithium	mg/L	0.02	0.02	0.0127	0.0101	0.00967	0.00920	0.00809	0.00814	0.00842	0.00721	0.00745	0.00616	0.00707
Magnesium	mg/L	2.24	2.23	1.61	1.20	1.25	1.10	1.08	0.982	1.11	1.05	1.07	1.00	0.933
Manganese	mg/L	0.27	0.38	0.292	0.235	0.242	0.215	0.229	0.220	0.237	0.252	0.269	0.260	0.248
Mercury	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.03	0.03	0.0177	0.0112	0.00807	0.00518	0.00383	0.00312	0.00283	0.00248	0.00220	0.00199	0.00178
Nickel	mg/L	0.002	0.001	0.00053	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	0.30	0.30	<0.3	0.3	0.3	0.3	0.3	0.3	0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	19.30	17.60	14.4	12.3	12.0	10.8	10.9	9.36	10.2	9.20	9.07	8.21	7.90
Selenium	mg/L	0.0004	0.0003	0.00013	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	3.35	4.75	4.35	4.30	4.47	4.57	4.53	4.31	4.92	4.47	4.48	4.39	4.53
Silver	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	8.21	7.21	4.51	3.14	2.56	1.87	1.55	1.22	1.15	0.957	0.882	0.737	0.642
Strontium	mg/L	0.20	0.18	0.129	0.0997	0.0996	0.0824	0.0812	0.0793	0.0837	0.0766	0.0728	0.0712	0.0685
Sulfur	mg/L	49.70	46.90	28.1	19.8	15.8	13.3	11.1	10.3	11.4	10.4	9.55	8.81	8.03
Thallium	mg/L	0.0002	0.0002	0.000118	0.000108	0.000110	0.000104	0.000093	0.000096	0.000105	0.000100	0.000097	0.000091	0.000097
Tin	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.01	0.01	<0.01	0.01	0.01	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.004	0.005	0.00245	0.00156	0.00176	0.00137	0.00117	0.00125	0.00144	0.00125	0.00117	0.00106	0.00106
Vanadium	mg/L	0.001	0.002	0.0021	0.0026	0.0029	0.0032	0.0032	0.0032	0.0035	0.0032	0.0032	0.0032	0.0032
Zinc	mg/L	0.003	0.003	<0.003	0.003	0.003	0.003	0.003	0.0031	0.0037	<0.003	<0.003	<0.003	<0.003

Table A6-6: Results of Waste Rock H

Week	Units	13	14	15	16	17	18	19	20	21	22	23	24
Sample ID		BW-ARD-499-13	BW-ARD-499-14	BW-ARD-499-15	BW-ARD-499-16	BW-ARD-499-17	BW-ARD-499-18	BW-ARD-499-19	BW-ARD-499-20	BW-ARD-499-21	BW-ARD-499-22	BW-ARD-499-23	BW-ARD-499-24
Date Sampled		20-JUN-12	27-JUN-12	04-JUL-12	11-JUL-12	18-JUL-12	25-JUL-12	01-AUG-12	08-AUG-12	15-AUG-12	22-AUG-12	29-AUG-12	05-SEP-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	450	450	440	475	475	440	450	500	470	445	475	500
Conductivity	mS/cm	159	156	157	151	147	148	150	153	144	152	141	145
pH	units	8.13	8.10	8.14	8.08	8.17	8.10	8.12	8.09	8.13	8.07	8.11	8.07
Acidity	mg/L CaCO3	2.7	2.6	1.1	1.8	3.6	<1.0	1.6	1.9	2.1	2.6	1.9	1.8
Alkalinity, Total	mg/L CaCO3	47.2	46.4	47.3	45.5	45.5	45.3	46.8	47.3	45.1	45.9	43.8	45.9
Sulfate (SO4)	mg/L	22.8	24.3	22.2	21.9	21.3	22.0	22.6	23.4	21.4	23.5	20.5	21.6
Dissolved Metals													
Aluminum	mg/L	0.0318	0.0329	0.0250	0.0381	0.0399	0.0315	0.0304	0.0311	0.0315	0.0340	0.0425	0.0267
Antimony	mg/L	0.0461	0.0466	0.0463	0.0434	0.0409	0.0410	0.0430	0.0416	0.0393	0.0386	0.0360	0.0370
Arsenic	mg/L	0.0343	0.0357	0.0341	0.0349	0.0322	0.0339	0.0353	0.0361	0.0345	0.0337	0.0351	0.0363
Barium	mg/L	0.00268	0.00274	0.00262	0.00253	0.00236	0.00209	0.00243	0.00239	0.00226	0.00231	0.00218	0.00206
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000130	0.000135	0.000151	0.000176	0.000099	0.000103	0.000132	0.000137	0.000136	0.000146	0.000127	0.000138
Calcium	mg/L	24.0	23.7	24.0	22.5	23.7	22.5	23.5	24.9	22.3	24.9	23.4	23.3
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00020	0.00019	0.00020	0.00018	0.00016	0.00014	0.00019	0.00019	0.00017	0.00018	0.00015	0.00016
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	0.093	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.0001
Lithium	mg/L	0.00698	0.00715	0.00692	0.00636	0.00621	0.00551	0.00618	0.00631	0.00582	0.00615	0.00615	0.00669
Magnesium	mg/L	0.992	0.975	0.947	0.897	0.870	0.792	0.804	0.884	0.841	0.911	0.804	0.789
Manganese	mg/L	0.260	0.265	0.286	0.269	0.246	0.243	0.285	0.291	0.266	0.305	0.255	0.284
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00166	0.00165	0.00155	0.00140	0.00134	0.00133	0.00138	0.00168	0.00183	0.00191	0.00168	0.00169
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	7.87	7.89	7.32	7.11	6.47	5.73	6.55	6.36	6.28	6.39	5.69	4.98
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	4.37	4.20	4.32	4.31	4.25	4.19	4.35	4.41	4.16	4.29	4.10	4.25
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.588	0.586	0.527	0.487	0.436	0.375	0.456	0.386	0.374	0.370	0.337	0.327
Strontium	mg/L	0.0686	0.0680	0.0680	0.0634	0.0602	0.0558	0.0631	0.0635	0.0585	0.0601	0.0572	0.0573
Sulfur	mg/L	7.94	8.05	8.06	7.43	7.59	7.46	7.51	7.81	7.12	8.30	7.15	7.22
Thallium	mg/L	0.000089	0.000088	0.000095	0.000090	0.000088	0.000072	0.000096	0.000092	0.000091	0.000090	0.000083	0.000081
Tin	mg/L	<0.0001	0.00046	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000941	0.00105	0.00101	0.000936	0.000973	0.000877	0.000967	0.00106	0.000870	0.000947	0.000808	0.000847
Vanadium	mg/L	0.0032	0.0034	0.0031	0.0033	0.0031	0.0029	0.0031	0.0032	0.0030	0.0029	0.0029	0.0029
Zinc	mg/L	<0.003	0.0038	0.0039	0.0051	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Table A6-6: Results of Waste Rock H

Week	Units	25	26	27	28	29	30	31	32	33	34	35	36
Sample ID		BW-ARD-499-25	BW-ARD-499-26	BW-ARD-499-27	BW-ARD-499-28	BW-ARD-499-29	BW-ARD-499-30	BW-ARD-499-31	BW-ARD-499-32	BW-ARD-499-33	BW-ARD-499-34	BW-ARD-499-35	BW-ARD-499-36
Date Sampled		12-SEP-12	19-SEP-12	26-SEP-12	03-OCT-12	10-OCT-12	17-OCT-12	24-OCT-12	31-OCT-12	07-NOV-12	14-NOV-12	21-NOV-12	28-NOV-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	475	500	470	465	435	500	475	485	500	450	425	425
Conductivity	mS/cm	138	140	142	126	143	126	131	132	124	144	133	144
pH	units	8.10	8.06	8.13	8.06	8.09	8.01	8.08	8.05	7.99	8.17	8.03	8.03
Acidity	mg/L CaCO3	1.7	2.2	2.8	2.8	1.4	2.5	2.0	<1.	1.9	2.0	2.0	1.5
Alkalinity, Total	mg/L CaCO3	44.8	42.2	44.3	38.7	42.3	37.5	41.8	42.7	37.3	44.2	39.0	43.0
Sulfate (SO4)	mg/L	20.7	21.5	23.4	20.7	22.1	20.4	19.9	19.7	20.0	23.8	22.6	24.3
Dissolved Metals													
Aluminum	mg/L	0.0248	0.0283	0.0227	0.0327	0.0247	0.0391	0.0343	0.0411	0.0402	0.0242	0.0276	0.0252
Antimony	mg/L	0.0340	0.0305	0.0336	0.0273	0.0280	0.0233	0.0273	0.0273	0.0226	0.0287	0.0214	0.0257
Arsenic	mg/L	0.0350	0.0340	0.0352	0.0330	0.0304	0.0301	0.0321	0.0309	0.0286	0.0322	0.0316	0.0293
Barium	mg/L	0.00222	0.00207	0.00221	0.00194	0.00217	0.00190	0.00216	0.00198	0.00184	0.00224	0.00212	0.00217
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000160	0.000148	0.000146	0.000127	0.000159	0.000138	0.000160	0.000154	0.000148	0.000208	0.000170	0.000180
Calcium	mg/L	23.3	22.2	23.0	20.1	30.7	20.0	21.2	21.8	19.9	23.5	21.3	23.8
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00018	0.00019	0.00019	0.00017	0.00020	0.00019	0.00020	0.00019	0.00019	0.00023	0.00020	0.00020
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005
Lithium	mg/L	0.00681	0.00536	0.00586	0.00509	0.00584	0.00495	0.00468	0.00518	0.00476	0.00505	0.00457	0.00557
Magnesium	mg/L	0.846	0.810	0.847	0.743	0.811	0.722	0.829	0.773	0.704	0.830	0.787	0.821
Manganese	mg/L	0.318	0.277	0.311	0.269	0.341	0.266	0.344	0.308	0.277	0.358	0.323	0.337
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00139	0.00136	0.00126	0.00112	0.00115	0.000997	0.00105	0.000944	0.000872	0.00109	0.000829	0.00106
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30
Potassium	mg/L	5.54	5.47	5.62	5.06	5.23	4.82	5.02	4.81	4.41	5.04	5.12	4.81
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	4.00	3.94	4.11	3.50	1.26	3.39	3.45	3.53	3.41	3.72	3.51	3.72
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.327	0.307	0.295	0.262	0.267	0.236	0.245	0.231	0.211	0.235	0.225	0.221
Strontium	mg/L	0.0573	0.0574	0.0582	0.0510	0.0606	0.0472	0.0527	0.0528	0.0483	0.0575	0.0457	0.0614
Sulfur	mg/L	7.21	7.39	7.19	6.92	21.3	6.90	6.74	6.58	6.62	8.09	7.52	8.29
Thallium	mg/L	0.000084	0.000087	0.000085	0.000080	0.000085	0.000088	0.000083	0.000080	0.000076	0.000092	0.000074	0.000087
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000808	0.000829	0.000828	0.000702	0.000794	0.000667	0.000762	0.000709	0.000621	0.000873	0.000644	0.000819
Vanadium	mg/L	0.0029	0.0027	0.0028	0.0026	0.0025	0.0024	0.0025	0.0024	0.0022	0.0025	0.0026	0.0023
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0032	<0.003	<0.003	0.0035	0.0032	0.0030

Table A6-6: Results of Waste Rock H

Week	Units	37	38	39	40	41	42	43	44	45	46	47	48
Sample ID		BW-ARD-499-37	BW-ARD-499-38	BW-ARD-499-39	BW-ARD-499-40	BW-ARD-499-41	BW-ARD-499-42	BW-ARD-499-43	BW-ARD-499-44	BW-ARD-499-45	BW-ARD-499-46	BW-ARD-499-47	BW-ARD-499-48
Date Sampled		05-DEC-12	12-DEC-12	19-DEC-12	26-DEC-12	02-JAN-13	09-JAN-13	16-JAN-13	23-JAN-13	30-JAN-13	06-FEB-13	13-FEB-13	20-FEB-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	455	455	485	445	475	405	475	450	470	450	460	455
Conductivity	mS/cm	144	142	141	127	127	159	139	143	147	144	145	140
pH	units	8.08	8.00	8.07	8.04	7.86	8.04	8.03	7.97	7.99	8.02	8.05	7.99
Acidity	mg/L CaCO3	1.9	2.1	1.9	2.2	1.9	2.9	4.0	2.5	1.9	1.8	1.8	2.4
Alkalinity, Total	mg/L CaCO3	42.0	42.7	43.8	38.6	35.9	43.2	38.7	39.6	38.1	37.0	38.2	37.2
Sulfate (SO4)	mg/L	24.4	23.0	23.9	22.1	24.1	31.1	27.5	28.9	29.0	27.8	29.5	26.9
Dissolved Metals													
Aluminum	mg/L	0.0336	0.0324	0.0299	0.0369	0.0268	0.0238	0.0277	0.0644	0.0273	0.0262	0.0293	0.0219
Antimony	mg/L	0.0256	0.0259	0.0264	0.0224	0.0190	0.0235	0.0213	0.0193	0.0212	0.0193	0.0196	0.0181
Arsenic	mg/L	0.0293	0.0290	0.0284	0.0294	0.0259	0.0262	0.0237	0.0224	0.0229	0.0221	0.0223	0.0198
Barium	mg/L	0.00216	0.00212	0.00206	0.00205	0.00187	0.00232	0.00204	0.00250	0.00216	0.00216	0.00216	0.00185
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000179	0.000178	0.000173	0.000165	0.000178	0.000222	0.000199	0.000218	0.000229	0.000212	0.000227	0.000211
Calcium	mg/L	23.4	23.0	23.5	20.7	20.9	26.2	22.7	23.6	24.4	22.1	23.4	23.1
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00021	0.00018	0.00021	0.00018	0.00019	0.00023	0.00023	0.00023	0.00023	0.00021	0.00023	0.00019
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00061	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.000090	<0.0001	0.000112
Lithium	mg/L	0.00497	0.00514	0.00527	0.00487	0.00449	0.00518	0.00466	0.00520	0.00479	0.00519	0.00504	0.00503
Magnesium	mg/L	0.793	0.755	0.818	0.720	0.702	0.865	0.744	0.801	0.817	0.764	0.791	0.688
Manganese	mg/L	0.326	0.315	0.339	0.302	0.314	0.434	0.336	0.380	0.391	0.372	0.385	0.345
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00106	0.00103	0.00101	0.000881	0.000916	0.00113	0.000988	0.000959	0.000996	0.000995	0.000959	0.000920
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00299	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.30	<0.30	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	4.49	4.30	4.61	4.39	4.19	4.71	4.21	4.29	4.34	4.10	4.22	3.67
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	3.65	3.62	3.61	3.35	3.29	3.62	3.30	3.34	3.26	3.10	3.17	3.17
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.229	0.212	0.253	0.194	0.182	0.205	0.176	0.182	0.181	0.168	0.178	0.153
Strontium	mg/L	0.0545	0.0543	0.0546	0.0491	0.0476	0.0586	0.0524	0.0560	0.0565	0.0538	0.0559	0.0518
Sulfur	mg/L	8.14	7.90	7.98	7.14	7.74	10.4	8.97	9.91	10.1	9.90	10.6	9.16
Thallium	mg/L	0.000086	0.000083	0.000083	0.000085	0.000080	0.000091	0.000089	0.000091	0.000087	0.000085	0.000087	0.000087
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000832	0.000759	0.000768	0.000618	0.000596	0.000855	0.000682	0.000747	0.000748	0.000715	0.000691	0.000658
Vanadium	mg/L	0.0023	0.0023	0.0022	0.0023	0.0020	0.0020	0.0019	0.0018	0.0018	0.0017	0.0018	0.0015
Zinc	mg/L	0.0038	0.0035	0.0031	0.0031	0.0032	0.0038	0.0033	0.0049	0.0039	0.0043	0.0043	0.0048

Table A6-6: Results of Waste Rock H

Week	Units	49	50	51	52	53	54	55	56	57	58	59	60
Sample ID		BW-ARD-499-49	BW-ARD-499-50	BW-ARD-499-51	BW-ARD-499-52	BW-ARD-499-53	BW-ARD-499-54	BW-ARD-499-55	BW-ARD-499-56	BW-ARD-499-57	BW-ARD-499-58	BW-ARD-499-59	BW-ARD-499-60
Date Sampled		27-FEB-13	06-MAR-13	13-MAR-13	20-MAR-13	27-MAR-13	03-APR-13	10-APR-13	17-APR-13	24-APR-13	01-MAY-13	08-MAY-13	15-MAY-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	475	400	500	475	450	480	500	410	470	430	450	425
Conductivity	mS/cm	147	148	135	141		140		139		137		144
pH	units	7.99	7.98	7.95	8.11		7.93		8.03		8.02		7.98
Acidity	mg/L CaCO3	1.8	4.4	2.1	2.0		2.1		1.7		1.4		2.4
Alkalinity, Total	mg/L CaCO3	40.0	37.8	34.4	37.7		35.3		35.1		34.1		34.4
Sulfate (SO4)	mg/L	28.6	27.3	26.8	27.6		28.2		28.0		26.8		27.3
Dissolved Metals													
Aluminum	mg/L	0.0250	0.0445	0.0406	0.0205		0.0291		0.0298		0.0265		0.0242
Antimony	mg/L	0.0203	0.0188	0.0166	0.0182		0.0181		0.0169		0.0167		0.0190
Arsenic	mg/L	0.0217	0.0220	0.0190	0.0155		0.0199		0.0202		0.0196		0.0216
Barium	mg/L	0.00206	0.00220	0.00214	0.00163		0.00206		0.00204		0.00211		0.00208
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01		<0.01		<0.01
Cadmium	mg/L	0.000230	0.000252	0.000228	0.000174		0.000231		0.000233		0.000239		0.000233
Calcium	mg/L	24.1	24.3	22.0	23.6		22.6		22.8		22.9		24.2
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005
Cobalt	mg/L	0.00021	0.00022	0.00020	0.00018		0.00022		0.00021		0.00022		0.00022
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03		<0.03		<0.03		<0.03		<0.03
Lead	mg/L	<0.00005	<0.00005	<0.00005	<0.00005		<0.00005		<0.00005		<0.00005		<0.00005
Lithium	mg/L	0.00514	0.00563	0.00495	0.00514		0.00416		0.00505		0.00439		0.00436
Magnesium	mg/L	0.758	0.787	0.731	0.547		0.722		0.709		0.656		0.700
Manganese	mg/L	0.413	0.435	0.404	0.305		0.410		0.413		0.416		0.445
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001
Molybdenum	mg/L	0.000988	0.000950	0.000832	0.000946		0.000895		0.000900		0.000993		0.00106
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3		<0.3		<0.30		<0.30		<0.30
Potassium	mg/L	4.08	4.18	3.92	2.93		3.76		3.87		3.69		3.67
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Silicon	mg/L	3.27	3.24	2.92	3.13		3.03		3.00		2.84		3.07
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001
Sodium	mg/L	0.164	0.175	0.155	0.120		0.150		0.145		0.152		0.148
Strontium	mg/L	0.0571	0.0549	0.0489	0.0497		0.0503		0.0498		0.0489		0.0480
Sulfur	mg/L	9.82	10.2	8.86	9.39		9.56		9.85		10.5		11.2
Thallium	mg/L	0.000089	0.000087	0.000076	0.000084		0.000088		0.000084		0.000086		0.000093
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01		<0.01		<0.01
Uranium	mg/L	0.000720	0.000686	0.000554	0.000619		0.000572		0.000539		0.000510		0.000529
Vanadium	mg/L	0.0016	0.0016	0.0014	0.0011		0.0014		0.0014		0.0014		0.0015
Zinc	mg/L	0.0040	0.0049	0.0046	0.0037		0.0044		0.0041		0.0041		0.0045

Table A6-6: Results of Waste Rock HUmidity Cell Test BW-ARD-499

Table A6-6: Results of Waste Rock H

Week	Units	61	62	63	64	65	66	67	68	69
Sample ID		BW-ARD-499-61	BW-ARD-499-62	BW-ARD-499-63	BW-ARD-499-64	BW-ARD-499-65	BW-ARD-499-66	BW-ARD-499-67	BW-ARD-499-68	BW-ARD-499-69
Date Sampled		22-MAY-13	29-MAY-13	05-JUN-13	12-JUN-13	19-JUN-13	26-JUN-13	03-JUL-13	10-JUL-13	17-JUL-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	485	425	485	475	435	460	475	455	435
Conductivity	mS/cm		136		137		133		141	
pH	units		7.99		7.92		7.91		7.93	
Acidity	mg/L CaCO3		2.9		6.3		5.4		1.6	
Alkalinity, Total	mg/L CaCO3		29.7		30.9		29.7		31.2	
Sulfate (SO4)	mg/L		27.6		27.9		26.0		29.1	
Dissolved Metals										
Aluminum	mg/L		0.0289		0.0214		0.0292		0.0218	
Antimony	mg/L		0.0156		0.0165		0.0150		0.0149	
Arsenic	mg/L		0.0200		0.0217		0.0202		0.0203	
Barium	mg/L		0.00209		0.00200		0.00201		0.00194	
Beryllium	mg/L		<0.0001		<0.0001		<0.0001		<0.0001	
Bismuth	mg/L		<0.0005		<0.0005		<0.0005		<0.0005	
Boron	mg/L		<0.01		<0.01		<0.01		<0.01	
Cadmium	mg/L		0.000240		0.000236		0.000239		0.000248	
Calcium	mg/L		22.2		23.2		22.3		22.2	
Chromium	mg/L		<0.0005		<0.0005		<0.0005		<0.0005	
Cobalt	mg/L		0.00021		0.00021		0.00020		0.00020	
Copper	mg/L		<0.0005		<0.0005		<0.0005		<0.0005	
Iron	mg/L		<0.03		<0.03		<0.03		<0.03	
Lead	mg/L		<0.00005		<0.00005		<0.0001		<0.0001	
Lithium	mg/L		0.00450		0.00453		0.00430		0.00437	
Magnesium	mg/L		0.672		0.670		0.623		0.639	
Manganese	mg/L		0.402		0.425		0.400		0.406	
Mercury	mg/L		<0.00001		<0.00001		<0.0		<0.0	
Molybdenum	mg/L		0.00114		0.00112		0.00106		0.00102	
Nickel	mg/L		<0.0005		<0.0005		<0.0005		<0.0005	
Phosphorus	mg/L		<0.30		<0.30		<0.3		<0.3	
Potassium	mg/L		3.48		3.51		3.36		3.41	
Selenium	mg/L		<0.0001		<0.0001		<0.0001		<0.0001	
Silicon	mg/L		2.71		2.78		2.69		2.68	
Silver	mg/L		<0.00001		<0.00001		<0.0		<0.0	
Sodium	mg/L		0.142		0.141		0.137		0.119	
Strontium	mg/L		0.0462		0.0462		0.0445		0.0440	
Sulfur	mg/L		11.7		10.8		10.6		10.3	
Thallium	mg/L		0.000082		0.000088		0.000083		0.000094	
Tin	mg/L		<0.0001		<0.0001		<0.0001		<0.0001	
Titanium	mg/L		<0.01		<0.01		<0.01		<0.01	
Uranium	mg/L		0.000452		0.000476		0.000419		0.000405	
Vanadium	mg/L		0.0014		0.0014		0.0013		0.0013	
Zinc	mg/L		0.0041		0.0041		0.0047		0.0043	

Table A6-7: Results of Waste Rock Humidity Cell Test BW-ARD-510

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12
Sample ID		BW-ARD-510-0	BW-ARD-510-1	BW-ARD-510-2	BW-ARD-510-3	BW-ARD-510-4	BW-ARD-510-5	BW-ARD-510-6	BW-ARD-510-7	BW-ARD-510-8	BW-ARD-510-9	BW-ARD-510-10	BW-ARD-510-11	BW-ARD-510-12
Date Sampled		03-APR-12	10-APR-12	17-APR-12	24-APR-12	01-MAY-12	08-MAY-12	15-MAY-12	22-MAY-12	29-MAY-12	05-JUN-12	12-JUN-12	19-JUN-12	26-JUN-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	575	500	475	445	430	425	450	475	460	475	430	460	475
Conductivity	mS/cm	301	245	254	193	144	138	138	127	134	139	131	140	166
pH	units	8.36	8.14	8.10	8.16	8.25	8.23	8.19	8.11	8.08	8.05	8.04	8.00	7.94
Acidity	mg/L CaCO3	1.6	2.3	1.4	1.0	1.8	1.9	2.7	1.5	3.2	2.2	1.9	2.7	6.0
Alkalinity, Total	mg/L CaCO3	38.1	40.9	33.5	36.7	36.7	34.3	35.8	34.6	33.5	34.1	31.1	31.3	31.8
Sulfate (SO4)	mg/L	61.7	52.8	66.3	43.3	26.4	24.3	23.7	21.1	24.1	24.6	24.8	25.2	33.9
Dissolved Metals														
Aluminum	mg/L	0.08	0.11	0.105	0.119	0.184	0.207	0.200	0.158	0.155	0.143	0.154	0.133	0.101
Antimony	mg/L	0.04	0.20	0.130	0.120	0.115	0.0930	0.0931	0.0866	0.0836	0.0755	0.0581	0.0559	0.0596
Arsenic	mg/L	0.005	0.01	0.0139	0.0206	0.0232	0.0223	0.0256	0.0251	0.0232	0.0226	0.0209	0.0193	0.0176
Barium	mg/L	0.005	0.003	0.00320	0.00247	0.00237	0.00270	0.00230	0.00173	0.00199	0.00188	0.00184	0.00170	0.00202
Beryllium	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.02	0.02	0.017	0.014	0.014	0.011	0.012	0.011	0.010	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00002	0.00001	0.000028	0.000024	0.000027	0.000030	0.000035	0.000036	0.000046	0.000061	0.000056	0.000082	0.000110
Calcium	mg/L	18.90	18.90	23.4	18.6	15.2	14.7	14.4	14.4	15.4	17.0	16.7	17.8	21.8
Chromium	mg/L	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0002	0.0003	0.00048	0.00043	0.00038	0.00040	0.00040	0.00043	0.00051	0.00052	0.00048	0.00063	0.00080
Copper	mg/L	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	0.03	0.03	<0.03	0.03	0.03	0.046	0.039	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0001	0.0001	<0.00005	0.00005	0.000060	0.000092	0.000074	0.000051	0.000068	0.000066	0.000092	0.000060	0.000053
Lithium	mg/L	0.02	0.01	0.0160	0.0146	0.0137	0.0126	0.0133	0.0117	0.0119	0.0118	0.00951	0.00930	0.0108
Magnesium	mg/L	2.35	2.04	2.35	1.63	1.34	1.19	1.19	1.15	1.17	1.13	1.21	1.17	1.34
Manganese	mg/L	0.21	0.28	0.403	0.307	0.280	0.263	0.283	0.293	0.323	0.321	0.359	0.438	0.542
Mercury	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.003	0.005	0.00285	0.00194	0.00159	0.00122	0.00106	0.000975	0.000960	0.000856	0.000702	0.000654	0.000723
Nickel	mg/L	0.001	0.001	0.00089	0.00053	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	0.30	0.30	<0.3	0.3	0.3	0.3	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	37.70	26.80	22.3	19.4	15.7	13.3	13.0	11.7	11.2	10.1	9.42	8.67	8.75
Selenium	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.36	2.20	2.02	2.60	2.70	2.69	2.96	2.87	2.77	2.86	2.82	2.68	2.82
Silver	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	8.73	5.15	3.39	2.42	1.64	1.20	1.08	0.910	0.770	0.678	0.579	0.552	0.532
Strontium	mg/L	0.12	0.11	0.133	0.0876	0.0735	0.0665	0.0628	0.0583	0.0653	0.0643	0.0595	0.0587	0.0746
Sulfur	mg/L	43.70	19.30	24.3	15.4	9.51	8.50	8.24	7.33	8.11	8.31	8.62	9.37	12.8
Thallium	mg/L	0.0001	0.0001	0.000054	0.000044	0.000038	0.000038	0.000042	0.000038	0.000038	0.000038	0.000037	0.000033	0.000041
Tin	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00017
Titanium	mg/L	0.01	0.01	<0.01	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0001	0.0003	0.000346	0.000240	0.000204	0.000202	0.000209	0.000194	0.000226	0.000260	0.000239	0.000249	0.000380
Vanadium	mg/L	0.001	0.001	<0.001	0.0014	0.0016	0.0017	0.0021	0.0021	0.0020	0.0019	0.0019	0.0017	0.0016
Zinc	mg/L	0.003	0.003	<0.003	0.003	0.0032	0.0034	0.0037	0.0042	0.0050	0.0083	0.0067	0.0094	0.0119

Table A6-7: Results of Waste Rock

Week	Units	13	14	15	16	17	18	19	20	21	22	23	24	25
Sample ID		BW-ARD-510-13	BW-ARD-510-14	BW-ARD-510-15	BW-ARD-510-16	BW-ARD-510-17	BW-ARD-510-18	BW-ARD-510-19	BW-ARD-510-20	BW-ARD-510-21	BW-ARD-510-22	BW-ARD-510-23	BW-ARD-510-24	BW-ARD-510-25
Date Sampled		03-JUL-12	10-JUL-12	17-JUL-12	24-JUL-12	31-JUL-12	07-AUG-12	14-AUG-12	21-AUG-12	28-AUG-12	04-SEP-12	11-SEP-12	18-SEP-12	25-SEP-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	480	445	475	475	450	445	480	475	450	430	500	475
Conductivity	mS/cm	166	159	145	142	132	126	136	133	117	114	131	124	118
pH	units	7.89	7.84	7.89	7.91	7.89	7.90	7.85	7.85	7.83	7.79	7.92	7.84	7.86
Acidity	mg/L CaCO3	1.7	3.8	5.1	2.5	2.7	6.8	1.9	2.7	2.1	2.4	1.6	2.9	2.9
Alkalinity, Total	mg/L CaCO3	28.9	30.0	26.3	27.8	27.8	25.7	31.8	30.7	26.8	25.4	32.7	30.3	28.5
Sulfate (SO4)	mg/L	30.4	30.9	28.5	29.3	24.2	26.6	25.8	23.3	23.5	22.8	23.4	23.9	21.7
Dissolved Metals														
Aluminum	mg/L	0.0858	0.0818	0.118	0.104	0.111	0.115	0.0957	0.0956	0.103	0.0805	0.0858	0.0875	0.0854
Antimony	mg/L	0.0546	0.0559	0.0503	0.0502	0.0476	0.0426	0.0478	0.0435	0.0409	0.0368	0.0425	0.0366	0.0326
Arsenic	mg/L	0.0146	0.0142	0.0156	0.0155	0.0155	0.0149	0.0155	0.0134	0.0137	0.0129	0.0149	0.0127	0.0123
Barium	mg/L	0.00185	0.00190	0.00188	0.00161	0.00171	0.00153	0.00165	0.00134	0.00146	0.00111	0.00147	0.00144	0.00115
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000120	0.000125	0.000109	0.000100	0.000095	0.000085	0.000103	0.000104	0.000100	0.000087	0.000104	0.000101	0.000105
Calcium	mg/L	22.4	21.2	20.1	19.9	18.4	17.6	20.8	18.6	17.4	17.1	20.3	18.5	17.1
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00087	0.00097	0.00063	0.00065	0.00058	0.00046	0.00063	0.00055	0.00059	0.00048	0.00060	0.00057	0.00051
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000073	0.000061	0.000091	0.000069	0.000097	0.000073	0.000067	0.000064	0.000067	<0.00005	0.000058	0.000068	<0.0001
Lithium	mg/L	0.0114	0.00954	0.00818	0.00748	0.00707	0.00710	0.00697	0.00644	0.00638	0.00527	0.00652	0.00529	0.00496
Magnesium	mg/L	1.26	1.16	1.05	0.973	0.854	0.810	0.845	0.724	0.731	0.578	0.761	0.685	0.622
Manganese	mg/L	0.590	0.633	0.514	0.518	0.481	0.428	0.542	0.491	0.521	0.426	0.580	0.607	0.523
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000778	0.000838	0.000813	0.000826	0.000741	0.000767	0.000830	0.000752	0.000828	0.000717	0.000832	0.000747	0.000749
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	8.19	7.55	6.75	6.65	5.59	5.80	5.82	4.90	5.29	4.27	5.25	4.75	4.43
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	2.81	2.84	2.92	2.87	2.91	2.91	3.26	2.78	2.83	2.68	3.17	3.03	2.75
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.471	0.464	0.409	0.379	0.360	0.348	0.364	0.310	0.321	0.262	0.338	0.286	0.292
Strontium	mg/L	0.0734	0.0719	0.0631	0.0617	0.0536	0.0501	0.0563	0.0502	0.0486	0.0405	0.0517	0.0488	0.0436
Sulfur	mg/L	13.3	12.4	11.3	10.5	9.11	9.03	9.04	8.18	7.94	7.54	8.12	8.55	7.63
Thallium	mg/L	0.000042	0.000043	0.000035	0.000035	0.000038	0.000036	0.000037	0.000034	0.000035	0.000031	0.000035	0.000033	0.000030
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000337	0.000297	0.000245	0.000251	0.000211	0.000203	0.000233	0.000219	0.000196	0.000162	0.000227	0.000212	0.000197
Vanadium	mg/L	0.0014	0.0014	0.0016	0.0015	0.0015	0.0016	0.0016	0.0015	0.0015	0.0014	0.0017	0.0016	0.0015
Zinc	mg/L	0.0138	0.0139	0.0109	0.0100	0.0097	0.0081	0.0104	0.0094	0.0102	0.0079	0.0092	0.0103	0.0096

Table A6-7: Results of Waste Rock

Week	Units	26	27	28	29	30	31	32	33	34	35	36	37
Sample ID		BW-ARD-510-26	BW-ARD-510-27	BW-ARD-510-28	BW-ARD-510-29	BW-ARD-510-30	BW-ARD-510-31	BW-ARD-510-32	BW-ARD-510-33	BW-ARD-510-34	BW-ARD-510-35	BW-ARD-510-36	BW-ARD-510-37
Date Sampled		02-OCT-12	09-OCT-12	16-OCT-12	23-OCT-12	30-OCT-12	06-NOV-12	13-NOV-12	20-NOV-12	27-NOV-12	04-DEC-12	11-DEC-12	18-DEC-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	475	500	460	450	480	455	480	470	420	460	450
Conductivity	mS/cm	117	114	115	113	54.4	114	129	125	117	98.6	114	123
pH	units	7.89	7.75	7.81	7.76	7.74	7.72	7.76	7.86	7.72	7.69	7.75	7.69
Acidity	mg/L CaCO3	2.5	2.4	2.9	1.8	1.8	1.7	1.9	1.5	1.9	2.1	1.9	2.1
Alkalinity, Total	mg/L CaCO3	26.1	24.7	23.6	23.2	21.8	22.8	27.2	25.5	22.8	18.6	19.6	22.0
Sulfate (SO4)	mg/L	22.4	22.9	23.7	24.2	24.6	26.5	27.9	28.2	25.9	22.5	26.2	26.4
Dissolved Metals													
Aluminum	mg/L	0.0805	0.0913	0.0790	0.0867	0.0932	0.0866	0.0835	0.0832	0.0861	0.124	0.0864	0.0806
Antimony	mg/L	0.0309	0.0283	0.0278	0.0242	0.0230	0.0222	0.0274	0.0273	0.0206	0.0169	0.0213	0.0206
Arsenic	mg/L	0.0123	0.0116	0.0112	0.0105	0.00974	0.00915	0.0110	0.0106	0.00982	0.00837	0.00831	0.00850
Barium	mg/L	0.00105	0.00118	0.00115	0.00106	0.00113	0.00123	0.00134	0.00116	0.00114	0.00113	0.00107	0.00114
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000095	0.000096	0.000103	0.000083	0.000093	0.000097	0.000114	0.000109	0.000086	0.000073	0.000110	0.000111
Calcium	mg/L	16.7	17.4	17.3	17.3	16.9	17.5	19.6	19.6	17.7	15.0	17.3	18.9
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00051	0.00050	0.00054	0.00045	0.00045	0.00047	0.00057	0.00054	0.00043	0.00032	0.00038	0.00047
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	<0.0001	0.000057	<0.0001	<0.0001	0.000060	0.000057	0.000063	<0.0001	<0.00005	0.000063	<0.00005	<0.00005
Lithium	mg/L	0.00492	0.00495	0.00483	0.00435	0.00470	0.00433	0.00489	0.00567	0.00412	0.00367	0.00436	0.00388
Magnesium	mg/L	0.631	0.569	0.569	0.522	0.532	0.506	0.601	0.566	0.486	0.401	0.436	0.508
Manganese	mg/L	0.554	0.550	0.534	0.491	0.494	0.522	0.626	0.619	0.562	0.448	0.505	0.597
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000748	0.000725	0.000734	0.000731	0.000781	0.000730	0.000829	0.000925	0.000764	0.000741	0.000845	0.000841
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30
Potassium	mg/L	4.36	4.12	3.99	3.65	3.55	3.45	4.12	3.98	3.71	3.02	3.25	3.66
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	2.59	2.68	2.38	2.56	2.40	2.34	2.93	2.82	2.53	2.02	2.31	2.57
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.266	0.250	0.247	0.232	0.221	0.219	0.260	0.254	0.233	0.182	0.214	0.243
Strontium	mg/L	0.0459	0.0435	0.0403	0.0406	0.0406	0.0399	0.0443	0.0458	0.0373	0.0340	0.0374	0.0419
Sulfur	mg/L	7.86	7.56	8.29	8.29	8.51	8.91	9.50	9.55	8.86	7.52	9.21	10.2
Thallium	mg/L	0.000028	0.000032	0.000026	0.000029	0.000033	0.000028	0.000033	0.000036	0.000031	0.000027	0.000029	0.000030
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000197	0.000191	0.000192	0.000188	0.000192	0.000171	0.000223	0.000225	0.000160	0.000121	0.000158	0.000188
Vanadium	mg/L	0.0015	0.0015	0.0014	0.0013	0.0012	0.0011	0.0014	0.0015	0.0013	0.0010	0.0011	0.0012
Zinc	mg/L	0.0078	0.0096	0.0098	0.0074	0.0087	0.0090	0.0108	0.0092	0.0074	0.0059	0.0080	0.0096

Table A6-7: Results of Waste Rock

Week	Units	38	39	40	41	42	43	44	45	46	47	48	49
Sample ID		BW-ARD-510-38	BW-ARD-510-39	BW-ARD-510-40	BW-ARD-510-41	BW-ARD-510-42	BW-ARD-510-43	BW-ARD-510-44	BW-ARD-510-45	BW-ARD-510-46	BW-ARD-510-47	BW-ARD-510-48	BW-ARD-510-49
Date Sampled		24-DEC-12	31-DEC-12	08-JAN-13	15-JAN-13	22-JAN-13	29-JAN-13	05-FEB-13	12-FEB-13	19-FEB-13	26-FEB-13	05-MAR-13	12-MAR-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	490	450	450	475	475	450	475	460	440	450	450
Conductivity	mS/cm	110	122	121	116	120	124	120	106	119	118	124	115
pH	units	7.74	7.83	7.79	7.77	7.66	7.70	7.68	7.81	7.72	7.67	7.81	7.73
Acidity	mg/L CaCO3	2.2	4.1	3.3	2.5	2.1	2.1	2.1	2.1	3.3	2.6	2.7	2.4
Alkalinity, Total	mg/L CaCO3	21.9	26.1	21.5	24.0	22.6	20.7	22.0	20.9	20.7	23.4	23.9	23.2
Sulfate (SO4)	mg/L	24.3	29.0	28.4	27.7	28.0	27.9	30.0	24.9	27.6	27.9	31.1	27.1
Dissolved Metals													
Aluminum	mg/L	0.0901	0.0722	0.0798	0.0756	0.0736	0.0720	0.0710	0.0798	0.0728	0.0693	0.0670	0.0715
Antimony	mg/L	0.0191	0.0202	0.0178	0.0182	0.0170	0.0160	0.0166	0.0150	0.0160	0.0164	0.0164	0.0152
Arsenic	mg/L	0.00769	0.00865	0.00832	0.00755	0.00668	0.00651	0.00656	0.00626	0.00565	0.00682	0.00636	0.00622
Barium	mg/L	0.00127	0.00117	0.00110	0.00104	0.00133	0.00113	0.00114	0.00107	0.00126	0.00130	0.00123	0.00129
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000097	0.000110	0.000091	0.000101	0.000119	0.000108	0.000109	0.000093	0.000119	0.000118	0.000117	0.000112
Calcium	mg/L	16.5	19.4	18.8	18.4	18.4	17.9	18.5	16.1	18.2	18.6	19.2	18.4
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00049	0.00052	0.00041	0.00044	0.00054	0.00046	0.00049	0.00041	0.00053	0.00049	0.00047	0.00045
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00399	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000075	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.000216	<0.0001	<0.00005	<0.00005	0.000053	<0.00005
Lithium	mg/L	0.00424	0.00420	0.00367	0.00423	0.00327	0.00393	0.00396	0.00379	0.00361	0.00391	0.00393	0.00346
Magnesium	mg/L	0.442	0.481	0.452	0.437	0.438	0.427	0.409	0.351	0.417	0.396	0.404	0.381
Manganese	mg/L	0.577	0.604	0.598	0.597	0.655	0.660	0.656	0.566	0.676	0.635	0.710	0.662
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000732	0.000776	0.000837	0.000794	0.000745	0.000797	0.000815	0.000699	0.000768	0.000796	0.000774	0.000752
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	3.49	3.73	3.54	3.49	3.48	3.36	3.32	3.00	3.15	3.47	3.42	3.32
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	2.45	2.80	2.61	2.56	2.46	2.39	2.60	2.28	2.45	2.85	2.83	2.72
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.241	0.250	0.233	0.228	0.231	0.217	0.232	0.195	0.212	0.233	0.243	0.221
Strontium	mg/L	0.0366	0.0407	0.0406	0.0382	0.0385	0.0375	0.0368	0.0320	0.0360	0.0380	0.0394	0.0358
Sulfur	mg/L	8.43	9.18	9.78	9.23	9.99	9.96	9.67	8.29	9.95	9.41	10.3	9.24
Thallium	mg/L	0.000034	0.000035	0.000031	0.000030	0.000033	0.000031	0.000028	0.000028	0.000029	0.000031	0.000034	0.000032
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000138	0.000175	0.000157	0.000153	0.000146	0.000145	0.000133	0.000106	0.000144	0.000132	0.000153	0.000124
Vanadium	mg/L	0.0012	0.0012	0.0012	0.0011	0.0011	0.0010	0.0011	0.0010	<0.001	0.0011	0.0011	0.0010
Zinc	mg/L	0.0105	0.0089	0.0075	0.0077	0.0124	0.0087	0.0119	0.0088	0.0101	0.0103	0.0105	0.0113

Table A6-7: Results of Waste Rock

Week	Units	50	51	52	53	54	55	56	57	58	59	60	61
Sample ID		BW-ARD-510-50	BW-ARD-510-51	BW-ARD-510-52	BW-ARD-510-53	BW-ARD-510-54	BW-ARD-510-55	BW-ARD-510-56	BW-ARD-510-57	BW-ARD-510-58	BW-ARD-510-59	BW-ARD-510-60	BW-ARD-510-61
Date Sampled		19-MAR-13	26-MAR-13	02-APR-13	09-APR-13	16-APR-13	23-APR-13	30-APR-13	07-MAY-13	14-MAY-13	21-MAY-13	28-MAY-13	04-JUN-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	455	450	445	500	450	435	455	425	445	400	450	490
Conductivity	mS/cm	112	103	115		115		104		115		122	
pH	units	7.75	7.74	7.78		7.75		7.68		7.57		7.62	
Acidity	mg/L CaCO3	3.8	1.6	1.9		27.8		3.5		3.1		3.2	
Alkalinity, Total	mg/L CaCO3	20.9	18.5	22.4		22.0		13.8		13.8		15.5	
Sulfate (SO4)	mg/L	25.4	24.2	26.6		28.0		27.2		35.2		30.5	
Dissolved Metals													
Aluminum	mg/L	0.0649	0.0730	0.0743		0.0757		0.106		0.0913		0.107	
Antimony	mg/L	0.0145	0.0128	0.0147		0.0139		0.0110		0.0113		0.0123	
Arsenic	mg/L	0.00575	0.00529	0.00580		0.00622		0.00571		0.00699		0.00782	
Barium	mg/L	0.00113	0.00124	0.00128		0.00122		0.00109		0.00108		0.00113	
Beryllium	mg/L	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Bismuth	mg/L	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Boron	mg/L	<0.01	<0.01	<0.01		<0.01		<0.01		<0.01		<0.01	
Cadmium	mg/L	0.000112	0.000095	0.000101		0.000101		0.000067		0.000071		0.000064	
Calcium	mg/L	17.7	15.5	17.9		18.4		16.4		18.1		19.0	
Chromium	mg/L	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Cobalt	mg/L	0.00047	0.00040	0.00042		0.00040		0.00022		0.00024		0.00023	
Copper	mg/L	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Iron	mg/L	<0.03	<0.03	<0.03		<0.03		<0.03		<0.03		<0.03	
Lead	mg/L	<0.00005	0.000051	0.000054		<0.00005		0.000067		<0.00005		<0.00005	
Lithium	mg/L	0.00333	0.00306	0.00324		0.00331		0.00173		0.00213		0.00221	
Magnesium	mg/L	0.350	0.316	0.359		0.350		0.254		0.283		0.307	
Manganese	mg/L	0.653	0.588	0.662		0.646		0.394		0.433		0.481	
Mercury	mg/L	<0.00001	<0.00001	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001	
Molybdenum	mg/L	0.000729	0.000746	0.000737		0.000694		0.000680		0.000755		0.000967	
Nickel	mg/L	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Phosphorus	mg/L	<0.3	<0.3	<0.3		<0.30		<0.30		<0.30		<0.30	
Potassium	mg/L	3.13	3.07	3.25		3.40		2.73		2.98		3.04	
Selenium	mg/L	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Silicon	mg/L	2.52	2.29	2.59		2.74		2.18		2.24		2.28	
Silver	mg/L	<0.00001	<0.00001	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001	
Sodium	mg/L	0.203	0.189	0.210		0.218		0.162		0.199		0.231	
Strontium	mg/L	0.0341	0.0304	0.0349		0.0351		0.0270		0.0299		0.0325	
Sulfur	mg/L	9.21	8.27	9.10		9.73		10.0		12.0		12.8	
Thallium	mg/L	0.000031	0.000033	0.000030		0.000032		0.000029		0.000031		0.000027	
Tin	mg/L	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Titanium	mg/L	<0.01	<0.01	<0.01		<0.01		<0.01		<0.01		<0.01	
Uranium	mg/L	0.000111	0.000094	0.000122		0.000105		0.000062		0.000060		0.000075	
Vanadium	mg/L	<0.001	<0.001	0.0010		0.0011		0.0011		0.0011		0.0012	
Zinc	mg/L	0.0105	0.0090	0.0080		0.0077		0.0045		0.0057		0.0048	

Table A6-7: Results of Waste Rock

Week	Units	62	63	64	65	66	67
Sample ID		BW-ARD-510-62	BW-ARD-510-63	BW-ARD-510-64	BW-ARD-510-65	BW-ARD-510-66	BW-ARD-510-67
Date Sampled		11-JUN-13	18-JUN-13	25-JUN-13	02-JUL-13	09-JUL-13	15-JUL-13
Total Volume In	mL	500	500	500	500	500	500
Total Volume Out	mL	460	440	435	360	500	495
Conductivity	mS/cm	112		111		113	
pH	units	7.63		7.45		7.74	
Acidity	mg/L CaCO3	1.6		2.0		1.6	
Alkalinity, Total	mg/L CaCO3	<2.00		13.1		12.8	
Sulfate (SO4)	mg/L	25.6		30.3		31.2	
Dissolved Metals							
Aluminum	mg/L	0.0965		0.109		0.110	
Antimony	mg/L	0.0100		0.00896		0.0105	
Arsenic	mg/L	0.00645		0.00658		0.00565	
Barium	mg/L	0.00107		0.00110		0.00110	
Beryllium	mg/L	<0.0001		<0.0001		<0.0001	
Bismuth	mg/L	<0.0005		<0.0005		<0.0005	
Boron	mg/L	<0.01		<0.01		<0.01	
Cadmium	mg/L	0.000069		0.000070		0.000064	
Calcium	mg/L	17.6		17.1		17.1	
Chromium	mg/L	<0.0005		<0.0005		<0.0005	
Cobalt	mg/L	0.00024		0.00023		0.00021	
Copper	mg/L	<0.0005		<0.0005		<0.0005	
Iron	mg/L	<0.03		<0.03		<0.03	
Lead	mg/L	<0.00005		<0.0001		0.000056	
Lithium	mg/L	0.00281		0.00201		0.00275	
Magnesium	mg/L	0.275		0.247		0.263	
Manganese	mg/L	0.459		0.432		0.467	
Mercury	mg/L	<0.00001		<0.0		<0.0	
Molybdenum	mg/L	0.000840		0.000727		0.000911	
Nickel	mg/L	<0.0005		<0.0005		<0.0005	
Phosphorus	mg/L	<0.30		<0.3		<0.3	
Potassium	mg/L	2.83		2.93		2.88	
Selenium	mg/L	<0.0001		<0.0001		<0.0001	
Silicon	mg/L	2.32		2.13		2.13	
Silver	mg/L	<0.00001		<0.0		<0.0	
Sodium	mg/L	0.222		0.204		0.203	
Strontium	mg/L	0.0294		0.0276		0.0279	
Sulfur	mg/L	11.2		11.6		10.9	
Thallium	mg/L	0.000029		0.000037		0.000032	
Tin	mg/L	<0.0001		<0.0001		<0.0001	
Titanium	mg/L	<0.01		<0.01		<0.01	
Uranium	mg/L	0.000061		0.000049		0.000065	
Vanadium	mg/L	0.0013		0.0010		0.0010	
Zinc	mg/L	0.0056		0.0050		0.0054	

Table A6-8: Results of Waste Rock Humidity Cell Test BW-ARD-176

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Sample ID		BW-ARD-176-0	BW-ARD-176-1	BW-ARD-176-2	BW-ARD-176-3	BW-ARD-176-4	BW-ARD-176-5	BW-ARD-176-6	BW-ARD-176-7	BW-ARD-176-8	BW-ARD-176-9	BW-ARD-176-10	BW-ARD-176-11	BW-ARD-176-12	BW-ARD-176-13	BW-ARD-176-14	BW-ARD-176-15	BW-ARD-176-16
Date Sampled		06-Jul-11	13-Jul-11	20-Jul-11	27-Jul-11	03-Aug-11	10-Aug-11	17-Aug-11	24-Aug-11	31-Aug-11	07-Sep-11	14-Sep-11	21-Sep-11	28-Sep-11	05-Oct-11	12-Oct-11	19-Oct-11	26-Oct-11
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	625	500	500	500	500	485	475	475	480	450	475	475	455	460	475	470	500
Conductivity	mS/cm	183	166	205	241	224	205	206	188	191	187	180	177	180	169	182	169	161
pH	units	8.32	8.15	7.98	8.05	8.00	8.00	7.98	7.98	7.98	8.01	8.00	7.93	7.98	7.95	7.97	7.89	7.95
Acidity	mg/L CaCO3	1.9	2.5	3.7	2.7	2.2	1.2	2.0	3.3	2.1	5.0	2.1	1.0	2.3	2.6	3.1	3.1	4.4
Alkalinity, Total	mg/L CaCO3	33.2	45.4	44.9	44.2	40.0	38.6	42.1	38.6	40.8	40.2	37.3	36.6	38.7	36.5	44.4	40.3	38.7
Sulfate (SO4)	mg/L	39.4	27.5	46.8	68.1	62.3	52.5	53.2	48.2	49.1	44.1	40.5	43.7	47.5	43.0	39.4	38.5	35.9
Dissolved Metals																		
Aluminum	mg/L	0.10	0.09	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.04
Antimony	mg/L	0.04	0.15	0.11	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.03	0.04	0.03	0.03	0.03	0.03
Arsenic	mg/L	0.005	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.004
Barium	mg/L	0.0036	0.0033	0.0044	0.0054	0.0050	0.0044	0.0045	0.0040	0.0040	0.0038	0.0036	0.0037	0.0038	0.0033	0.0039	0.0035	0.0033
Beryllium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Boron	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cadmium	mg/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium	mg/L	17.50	17.30	23.70	31.80	30.80	29.00	29.80	25.70	26.70	28.80	25.80	25.90	28.90	24.40	29.50	26.30	24.80
Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Cobalt	mg/L	0.0001	0.0002	0.0003	0.0004	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002
Copper	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Iron	mg/L	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Lead	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
Lithium	mg/L	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Magnesium	mg/L	0.91	0.93	1.34	1.86	1.69	1.51	1.53	1.37	1.42	1.38	1.24	1.33	1.29	1.20	1.33	1.21	1.10
Manganese	mg/L	0.03	0.07	0.13	0.18	0.17	0.15	0.16	0.15	0.16	0.15	0.14	0.15	0.16	0.15	0.19	0.17	0.17
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	mg/L	0.00491	0.00404	0.00217	0.00139	0.00116	0.00116	0.00125	0.00116	0.00121	0.00116	0.00113	0.00115	0.00123	0.00112	0.00126	0.00115	0.00116
Nickel	mg/L	0.00050	0.00050	0.00050	0.00052	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Phosphorus	mg/L	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Potassium	mg/L	20.00	15.30	16.80	17.60	16.70	15.70	15.10	12.90	13.20	11.80	11.50	11.50	11.00	10.40	10.00	9.37	8.95
Selenium	mg/L	0.0005	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon	mg/L	1.80	2.63	3.02	3.18	3.36	3.52	3.60	3.24	3.67	3.32	3.52	3.20	3.33	3.05	3.40	3.31	2.97
Silver	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Sodium	mg/L	7.85	6.42	6.33	4.73	3.58	2.52	2.18	1.56	1.39	1.14	0.93	0.84	0.75	0.63	0.62	0.53	0.46
Strontium	mg/L	0.17	0.14	0.21	0.28	0.27	0.24	0.25	0.21	0.22	0.21	0.19	0.20	0.20	0.18	0.20	0.18	0.17
Sulfur	mg/L	18.20	15.00	18.00	24.10	22.60	20.30	19.70	17.50	16.80	16.90	15.80	15.80	16.50	14.90	14.80	14.20	13.20
Thallium	mg/L	0.00002	0.00001	0.00001	0.00002	0.00002	0.00001	0.00002	0.00002	0.00001	0.00002	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Tin	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium	mg/L	0.00004	0.00006	0.00012	0.00015	0.00011	0.00009	0.00010	0.00007	0.00008	0.00007	0.00006	0.00006	0.00006	0.00005	0.00007	0.00005	0.00005
Vanadium	mg/L	0.0028	0.0039	0.0037	0.0035	0.0039	0.0043	0.0042	0.0042	0.0043	0.0037	0.0037	0.0034	0.0033	0.0031	0.0029	0.0029	0.0023
Zinc	mg/L	0.003	0.003	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.02

Table A6-8: Results of Waste Rock Humidity Cell Test BW-ARD-176

Week	Units	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Sample ID		BW-ARD-176-17	BW-ARD-176-18	BW-ARD-176-19	BW-ARD-176-20	BW-ARD-176-21	BW-ARD-176-22	BW-ARD-176-23	BW-ARD-176-24	BW-ARD-176-25	BW-ARD-176-26	BW-ARD-176-27	BW-ARD-176-28	BW-ARD-176-29	BW-ARD-176-30	BW-ARD-176-31	BW-ARD-176-32	BW-ARD-176-33
Date Sampled		02-Nov-11	09-Nov-11	16-Nov-11	23-Nov-11	30-Nov-11	07-Dec-11	14-Dec-11	21-Dec-11	28-Dec-11	04-Jan-12	11-Jan-12	18-Jan-12	25-Jan-12	01-Feb-12	08-Feb-12	15-Feb-12	22-Feb-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	490	475	475	480	470	465	460	425	450	450	450	450	440	430	435	460
Conductivity	mS/cm	174	160	166	161	161	161	161	177	186	177	183	170	175	166	167	159	157
pH	units	7.90	7.85	7.93	7.94	7.89	7.85	7.87	7.98	8.02	7.77	7.87	7.88	7.90	8.01	7.98	7.87	8.11
Acidity	mg/L CaCO3	2.0	2.4	3.4	1.8	3.0	2.5	3.0	3.0	2.9	3.4	3.6	2.9	4.5	1	3.7	3.9	1.5
Alkalinity, Total	mg/L CaCO3	43.9	39.4	41.8	41.9	40.2	42.1	42.0	39.6	39.7	36.6	40.4	37.8	38.1	37.9	41.0	37.2	33.4
Sulfate (SO4)	mg/L	39.5	33.6	37.0	34.5	36.3	34.1	35.3	36.6	37.7	38.9	37.7	33.7	32.3	33.9	34.4	31.1	33.8
Dissolved Metals																		
Aluminum	mg/L	0.04	0.05	0.03	0.04	0.03	0.04	0.04	0.03	0.04	0.04	0.05	0.04	0.04	0.05	0.03	0.04	0.04
Antimony	mg/L	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.01
Arsenic	mg/L	0.005	0.004	0.004	0.004	0.003	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002
Barium	mg/L	0.0036	0.0032	0.0034	0.0032	0.0032	0.0032	0.0032	0.0031	0.0034	0.0031	0.0035	0.0033	0.0033	0.0032	0.0032	0.0030	0.0034
Beryllium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Boron	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cadmium	mg/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calcium	mg/L	28.90	25.50	28.90	26.70	25.00	25.50	26.00	25.50	28.00	25.80	26.90	24.90	27.00	25.40	26.80	25.70	23.40
Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Cobalt	mg/L	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Copper	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Iron	mg/L	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Lead	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Lithium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Magnesium	mg/L	1.22	1.08	1.09	1.10	1.03	1.06	1.03	1.00	1.07	0.99	1.02	0.99	0.97	0.90	0.96	0.87	0.86
Manganese	mg/L	0.20	0.16	0.19	0.18	0.17	0.17	0.18	0.16	0.17	0.15	0.17	0.16	0.15	0.15	0.17	0.16	0.16
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	mg/L	0.00113	0.00105	0.00110	0.00107	0.00107	0.00113	0.00110	0.00110	0.00120	0.00120	0.00114	0.00120	0.00136	0.00123	0.00124	0.00108	0.00112
Nickel	mg/L	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Phosphorus	mg/L	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Potassium	mg/L	9.58	8.31	8.46	8.54	8.08	8.11	7.81	7.68	7.81	7.90	7.75	7.51	7.31	6.74	7.29	6.77	6.49
Selenium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon	mg/L	3.21	2.87	2.97	2.96	2.74	2.74	2.79	2.57	2.70	2.55	2.66	2.39	2.65	2.41	2.46	2.28	1.96
Silver	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Sodium	mg/L	0.47	0.39	0.36	0.36	0.31	0.33	0.30	0.29	0.30	0.28	0.27	0.24	0.25	0.22	0.23	0.20	0.19
Strontium	mg/L	0.19	0.16	0.17	0.17	0.17	0.15	0.16	0.15	0.15	0.16	0.16	0.14	0.14	0.14	0.15	0.12	0.13
Sulfur	mg/L	14.50	12.60	13.30	12.70	12.80	12.30	12.80	13.60	14.50	14.10	14.00	12.90	13.20	13.30	12.10	12.30	12.00
Thallium	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Tin	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium	mg/L	0.00006	0.00005	0.00005	0.00005	0.00004	0.00005	0.00004	0.00004	0.00004	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00002	0.00002
Vanadium	mg/L	0.0024	0.0021	0.0019	0.0019	0.0018	0.0017	0.0016	0.0015	0.0015	0.0015	0.0014	0.0012	0.0013	0.0012	0.0011	0.0010	0.0010
Zinc	mg/L	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Week	Units	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
Sample ID		BW-ARD-176-34	BW-ARD-176-35	BW-ARD-176-36	BW-ARD-176-37	BW-ARD-176-38	BW-ARD-176-39	BW-ARD-176-40	BW-ARD-176-41	BW-ARD-176-42	BW-ARD-176-43	BW-ARD-176-44	BW-ARD-176-45	BW-ARD-176-46	BW-ARD-176-47	BW-ARD-176-48	BW-ARD-176-49
Date Sampled		29-Feb-12	07-Mar-12	14-MAR-12	21-MAR-12	28-MAR-12	04-APR-12	11-APR-12	18-APR-12	25-APR-12	02-MAY-12	09-MAY-12	16-MAY-12	23-MAY-12	30-MAY-12	06-JUN-12	13-JUN-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	475	460	470	500	450	450	440	455	470	475	465	460	500	495	500	450
Conductivity	mS/cm	169	165	170	161	160	162	158	171	166	154	157	175	166	173	163	168
pH	units	7.98	7.99	7.94	7.96	8.00	7.98	8.00	7.98	7.98	7.98	8.00	7.94	7.98	8.00	7.97	7.97
Acidity	mg/L CaCO3	4.5	3.3	2.4	3.9	3.1	3.0	2.0	2.9	8.5	4.9	3.0	4.1	3.4	5.3	7.3	3.1
Alkalinity, Total	mg/L CaCO3	38.7	36.7	38.3	36.1	34.4	33.1	30.9	34.5	35.1	32.1	32.6	33.7	34.8	37.3	35.5	36.8
Sulfate (SO4)	mg/L	33.5	30.7	34.2	32.9	34.0	35.5	34.7	34.9	35.4	35.9	32.7	39.1	33.8	36.7	33.7	37.2
Dissolved Metals				FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD		FIELD		FIELD	
Aluminum	mg/L	0.04	0.04	0.04	0.04	0.05	0.0450	0.0558	0.0456	0.0391	0.0539	0.0376		0.0410		0.0348	
Antimony	mg/L	0.01	0.01	0.01	0.01	0.01	0.0109	0.00936	0.0112	0.00991	0.00922	0.00986		0.00982		0.00928	
Arsenic	mg/L	0.002	0.002	0.002	0.002	0.002	0.00199	0.00175	0.00181	0.00160	0.00153	0.00146		0.00142		0.00138	
Barium	mg/L	0.0031	0.0032	0.0032	0.0032	0.0030	0.00300	0.00279	0.00317	0.00299	0.00280	0.00285		0.00304		0.00285	
Beryllium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		<0.0001		<0.0001	
Bismuth	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005		<0.0005		<0.0005	
Boron	mg/L	0.01	0.01	0.01	0.01	0.01	<0.01	0.01	0.01	0.01	0.01	0.01		<0.01		<0.01	
Cadmium	mg/L	0.00	0.00	0.00	0.00	0.00	0.00159	0.00143	0.00185	0.00180	0.00156	0.00160		0.00184		0.00198	
Calcium	mg/L	24.80	24.50	25.50	23.90	23.20	24.2	24.6	25.6	25.5	23.8	24.1		26.5		25.4	
Chromium	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005		<0.0005		<0.0005	
Cobalt	mg/L	0.0003	0.0003	0.0003	0.0002	0.0002	0.00018	0.00014	0.00020	0.00020	0.00016	0.00016		0.00019		0.00023	
Copper	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005		<0.0005		<0.0005	
Iron	mg/L	0.03	0.03	0.03	0.03	0.03	<0.03	0.03	0.03	0.03	0.03	0.03		<0.03		<0.03	
Lead	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.000079	0.000076	0.000081	0.000059	0.000162	0.000061		0.000068		0.000052	
Lithium	mg/L	0.01	0.01	0.01	0.01	0.01	0.00845	0.00740	0.00881	0.00859	0.00731	0.00818		0.00776		0.00736	
Magnesium	mg/L	0.96	0.83	0.89	0.85	0.83	0.810	0.775	0.851	0.811	0.760	0.736		0.796		0.766	
Manganese	mg/L	0.18	0.17	0.18	0.17	0.15	0.149	0.132	0.164	0.161	0.144	0.145		0.166		0.180	
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001		<0.00001		<0.00001	
Molybdenum	mg/L	0.00119	0.00113	0.00117	0.00106	0.00104	0.00110	0.00117	0.00126	0.00112	0.00102	0.00118		0.00122		0.00117	
Nickel	mg/L	0.00050	0.00050	0.00050	0.00050	0.00050	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005		<0.0005		<0.0005	
Phosphorus	mg/L	0.30	0.30	0.30	0.30	0.30	<0.3	0.3	0.3	0.3	0.3	0.3		<0.3		<0.3	
Potassium	mg/L	6.70	6.16	6.10	6.04	5.94	6.03	5.51	5.99	5.75	5.48	5.43		5.56		5.59	
Selenium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		<0.0001		<0.0001	
Silicon	mg/L	2.16	2.13	2.17	2.01	1.88	2.02	1.77	1.93	1.93	1.81	1.77		1.85		1.87	
Silver	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001		<0.00001		<0.00001	
Sodium	mg/L	0.21	0.17	0.18	0.17	0.17	0.168	0.148	0.165	0.161	0.139	0.142		0.144		0.147	
Strontium	mg/L	0.14	0.13	0.14	0.13	0.12	0.124	0.126	0.133	0.126	0.121	0.128		0.126		0.118	
Sulfur	mg/L	12.30	11.60	12.50	11.60	11.50	12.5	13.2	13.4	12.7	12.1	12.5		13.3		12.8	
Thallium	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.000012		<0.00001		0.000010	
Tin	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001		<0.0001		<0.0001	
Titanium	mg/L	0.01	0.01	0.01	0.01	0.01	<0.01	0.01	0.01	0.01	0.01	0.01		<0.01		<0.01	
Uranium	mg/L	0.00003	0.00003	0.00003	0.00003	0.00002	0.000025	0.000025	0.000026	0.000024	0.000021	0.000024		0.000028		0.000022	
Vanadium	mg/L	0.0010	0.0010	0.0010	0.0010	0.0010	<0.001	0.001	0.001	0.001	0.001	0.001		<0.001		<0.001	
Zinc	mg/L	0.02	0.02	0.02	0.02	0.01	0.0141	0.0109	0.0197	0.0144	0.0141	0.0158		0.0146		0.0162	

Week	Units	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
Sample ID		BW-ARD-176-50	BW-ARD-176-51	BW-ARD-176-52	BW-ARD-176-53	BW-ARD-176-54	BW-ARD-176-55	BW-ARD-176-56	BW-ARD-176-57	BW-ARD-176-58	BW-ARD-176-59	BW-ARD-176-60	BW-ARD-176-61	BW-ARD-176-62	BW-ARD-176-63	BW-ARD-176-64	BW-ARD-176-65
Date Sampled		20-JUN-12	27-JUN-12	04-JUL-12	11-JUL-12	18-JUL-12	25-JUL-12	01-AUG-12	08-AUG-12	15-AUG-12	22-AUG-12	29-AUG-12	05-SEP-12	12-SEP-12	19-SEP-12	26-SEP-12	03-OCT-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	455	490	465	465	475	450	475	465	465	470	475	475	475	465	475	475
Conductivity	mS/cm	164	167	168	168	171	169	161	179	170	177	167	166	161	191	170	166
pH	units	7.89	7.97	7.91	7.92	7.91	7.92	7.91	7.97	7.92	7.92	7.88	7.93	7.87	7.90	7.86	7.90
Acidity	mg/L CaCO3	4.9	8.7	2.8	2.7	9.5	1.7	2.7	3.7	5.4	7.0	3.6	4.7	2.1	2.9	6.5	4.2
Alkalinity, Total	mg/L CaCO3	36.3	35.5	33.6	33.7	33.8	33.9	32.9	34.8	33.2	34.0	31.5	33.6	31.0	38.0	35.4	32.5
Sulfate (SO4)	mg/L	36.9	38.2	36.3	37.2	38.0	36.2	37.2	42.2	44.0	39.2	34.7	39.3	38.6	43.2	38.1	37.0
Dissolved Metals		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD	
Aluminum	mg/L	0.0410		0.0330		0.0312		0.0330		0.0392		0.0312		0.0303		0.0354	
Antimony	mg/L	0.00940		0.00856		0.00888		0.00753		0.00788		0.00729		0.00658		0.00720	
Arsenic	mg/L	0.00139		0.00136		0.00123		0.00131		0.00131		0.00108		0.00103		0.00118	
Barium	mg/L	0.00327		0.00303		0.00309		0.00312		0.00322		0.00301		0.00294		0.00335	
Beryllium	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Bismuth	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Boron	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Cadmium	mg/L	0.00229		0.00203		0.00204		0.00208		0.00207		0.00196		0.00205		0.00211	
Calcium	mg/L	26.3		29.0		29.5		29.4		26.8		30.7		29.6		29.4	
Chromium	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Cobalt	mg/L	0.00030		0.00025		0.00024		0.00024		0.00023		0.00019		0.00021		0.00025	
Copper	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Iron	mg/L	<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03	
Lead	mg/L	0.000068		0.000055		0.000051		<0.00005		<0.00005		<0.00005		<0.0001		<0.0001	
Lithium	mg/L	0.00856		0.00828		0.00766		0.00667		0.00774		0.00715		0.00744		0.00707	
Magnesium	mg/L	0.799		0.737		0.705		0.624		0.660		0.666		0.638		0.658	
Manganese	mg/L	0.185		0.178		0.168		0.171		0.157		0.159		0.171		0.175	
Mercury	mg/L	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.		<0.	
Molybdenum	mg/L	0.00118		0.00121		0.00124		0.00111		0.00122		0.00114		0.00109		0.00116	
Nickel	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Phosphorus	mg/L	<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3	
Potassium	mg/L	5.68		5.40		5.20		4.96		5.54		5.35		4.90		5.42	
Selenium	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Silicon	mg/L	1.89		1.77		1.82		1.73		1.75		1.60		1.53		1.74	
Silver	mg/L	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001	
Sodium	mg/L	0.139		0.135		0.139		0.137		0.127		0.170		0.119		0.168	
Strontium	mg/L	0.126		0.125		0.124		0.114		0.123		0.112		0.110		0.115	
Sulfur	mg/L	14.1		13.9		14.4		14.3		14.6		14.8		14.5		13.8	
Thallium	mg/L	0.000011		0.000010		0.000012		<0.00001		0.000010		<0.00001		<0.		0.000010	
Tin	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Titanium	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Uranium	mg/L	0.000024		0.000023		0.000021		0.000017		0.000018		0.000018		0.000027		0.000017	
Vanadium	mg/L	<0.001		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001	
Zinc	mg/L	0.0205		0.0190		0.0169		0.0173		0.0154		0.0140		0.0148		0.0177	

Week	Units	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
Sample ID		BW-ARD-176-66	BW-ARD-176-67	BW-ARD-176-68	BW-ARD-176-69	BW-ARD-176-70	BW-ARD-176-71	BW-ARD-176-72	BW-ARD-176-73	BW-ARD-176-74	BW-ARD-176-75	BW-ARD-176-76	BW-ARD-176-77	BW-ARD-176-78	BW-ARD-176-79	BW-ARD-176-80	BW-ARD-176-81
Date Sampled		10-OCT-12	17-OCT-12	24-OCT-12	31-OCT-12	07-NOV-12	14-NOV-12	21-NOV-12	28-NOV-12	05-DEC-12	12-DEC-12	19-DEC-12	26-DEC-12	02-JAN-13	09-JAN-13	16-JAN-13	23-JAN-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	475	440	500	480	475	490	460	465	480	450	475	470	500	450	475	475
Conductivity	mS/cm	162	168	159	169	154	178	174	174	178	174	176	162	178	187	175	167
pH	units	7.83	7.88	7.89	7.91	7.79	7.92	7.79	7.83	7.89	7.90	7.91	7.88	7.92	7.85	7.78	7.78
Acidity	mg/L CaCO3	2.8	3.3	4.0	2.0	1.7	3.2	2.3	1.9	2.3	2.8	2.6	1.8	3.2	7.7	3.1	1.9
Alkalinity, Total	mg/L CaCO3	30.8	33.2	34.5	37.7	31.4	38.3	34.2	34.3	36.3	34.3	36.2	35.0	38.7	35.8	34.6	33.6
Sulfate (SO4)	mg/L	37.7	38.3	33.7	37.6	36.2	39.6	42.5	42.5	42.2	40.0	40.2	38.4	41.8	48.1	41.6	35.5
Dissolved Metals		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD	
Aluminum	mg/L	0.0335		0.0281		0.0362		0.0235		0.0276		0.0326		0.0321		0.0209	
Antimony	mg/L	0.00573		0.00630		0.00547		0.00628		0.00638		0.00566		0.00571		0.00518	
Arsenic	mg/L	0.00088		0.00091		0.00075		0.00089		0.00109		0.00094		0.00091		0.00078	
Barium	mg/L	0.00303		0.00283		0.00330		0.00324		0.00322		0.00345		0.00343		0.00326	
Beryllium	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Bismuth	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Boron	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Cadmium	mg/L	0.00209		0.00210		0.00209		0.00243		0.00211		0.00207		0.00209		0.00235	
Calcium	mg/L	26.2		25.7		25.5		30.5		30.7		29.5		31.0		30.1	
Chromium	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Cobalt	mg/L	0.00026		0.00026		0.00025		0.00029		0.00027		0.00025		0.00031		0.00031	
Copper	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Iron	mg/L	<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03	
Lead	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.00005		<0.00005		<0.0001		<0.0001	
Lithium	mg/L	0.00588		0.00622		0.00556		0.00661		0.00637		0.00570		0.00648		0.00612	
Magnesium	mg/L	0.588		0.579		0.528		0.599		0.574		0.547		0.562		0.512	
Manganese	mg/L	0.180		0.175		0.166		0.191		0.170		0.170		0.181		0.175	
Mercury	mg/L	<0.		<0.		<0.		<0.		<0.00001		<0.00001		<0.		<0.	
Molybdenum	mg/L	0.00103		0.00129		0.000913		0.00113		0.00123		0.00138		0.00114		0.00109	
Nickel	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Phosphorus	mg/L	<0.3		<0.3		<0.3		<0.3		<0.30		<0.30		<0.3		<0.3	
Potassium	mg/L	5.15		4.72		4.49		5.39		4.95		5.09		5.18		5.08	
Selenium	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Silicon	mg/L	1.49		1.41		1.40		1.53		1.59		1.47		1.50		1.40	
Silver	mg/L	<0.		<0.		<0.		<0.		<0.00001		<0.00001		<0.		<0.	
Sodium	mg/L	0.108		0.103		0.096		0.110		0.116		0.113		0.117		0.106	
Strontium	mg/L	0.106		0.104		0.102		0.113		0.108		0.110		0.115		0.103	
Sulfur	mg/L	13.6		12.3		12.9		14.9		15.0		14.9		14.7		13.4	
Thallium	mg/L	0.000010		0.000010		<0.		0.000011		0.000013		0.000010		0.000010		<0.	
Tin	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Titanium	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Uranium	mg/L	0.000016		0.000017		0.000014		0.000021		0.000019		0.000019		0.000020		0.000016	
Vanadium	mg/L	<0.001		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001	
Zinc	mg/L	0.0184		0.0176		0.0179		0.0202		0.0172		0.0159		0.0184		0.0203	

Week	Units	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97
Sample ID		BW-ARD-176-82	BW-ARD-176-83	BW-ARD-176-84	BW-ARD-176-85	BW-ARD-176-86	BW-ARD-176-87	BW-ARD-176-88	BW-ARD-176-89	BW-ARD-176-90	BW-ARD-176-91	BW-ARD-176-92	BW-ARD-176-93	BW-ARD-176-94	BW-ARD-176-95	BW-ARD-176-96	BW-ARD-176-97
Date Sampled		30-JAN-13	06-FEB-13	13-FEB-13	20-FEB-13	27-FEB-13	06-MAR-13	13-MAR-13	20-MAR-13	27-MAR-13	03-APR-13	10-APR-13	17-APR-13	24-APR-13	01-MAY-13	08-MAY-13	15-MAY-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	475	475	475	495	455	445	500	475	470	475	470	470	475	455	475	475
Conductivity	mS/cm	168	173	170	169	168	181	165	172		180		180		167		184
pH	units	7.82	7.80	7.81	7.85	7.79	7.87	7.88	7.86		7.85		7.81		7.75		7.69
Acidity	mg/L CaCO3	2.1	2.1	3.1	4.5	2.5	7.4	2.8	2.1		2.6		1.8		2.2		5.4
Alkalinity, Total	mg/L CaCO3	30.8	31.6	31.6	31.9	31.0	33.6	30.1	30.8		31.1		32.7		24.1		30.0
Sulfate (SO4)	mg/L	39.0	40.1	40.7	38.9	41.4	42.0	38.6	43.5		43.8		40.5		48.1		53.0
Dissolved Metals		FIELD		FIELD		FIELD	FIELD	FIELD			FIELD		FIELD		FIELD		FIELD
Aluminum	mg/L	0.0300		0.0201		0.0361	0.0239	0.0320			0.0336		0.0347		0.0276		0.0308
Antimony	mg/L	0.00444		0.00491		0.00450	0.00479	0.00429			0.00470		0.00435		0.00427		0.00454
Arsenic	mg/L	0.00068		0.00061		0.00059	0.00069	0.00061			0.00061		0.00063		0.00059		0.00070
Barium	mg/L	0.00318		0.00317		0.00318	0.00333	0.00311			0.00346		0.00362		0.00312		0.00337
Beryllium	mg/L	<0.0001		<0.0001		<0.0001	<0.0001	<0.0001			<0.0001		<0.0001		<0.0001		<0.0001
Bismuth	mg/L	<0.0005		<0.0005		<0.0005	<0.0005	<0.0005			<0.0005		<0.0005		<0.0005		<0.0005
Boron	mg/L	<0.01		<0.01		<0.01	<0.01	<0.01			<0.01		<0.01		<0.01		<0.01
Cadmium	mg/L	0.00230		0.00241		0.00201	0.00221	0.00199			0.00225		0.00226		0.00200		0.00188
Calcium	mg/L	29.2		30.5		29.7	32.3	29.4			30.8		31.2		26.8		31.7
Chromium	mg/L	<0.0005		<0.0005		<0.0005	<0.0005	<0.0005			<0.0005		<0.0005		<0.0005		<0.0005
Cobalt	mg/L	0.00031		0.00030		0.00023	0.00025	0.00024			0.00031		0.00032		0.00026		0.00024
Copper	mg/L	<0.0005		<0.0005		<0.0005	<0.0005	<0.0005			<0.0005		<0.0005		<0.0005		<0.0005
Iron	mg/L	<0.03		<0.03		<0.03	<0.03	<0.03			<0.03		<0.03		<0.03		<0.03
Lead	mg/L	0.000137		0.000057		<0.00005	<0.00005	<0.00005			<0.00005		<0.00005		<0.00005		0.000051
Lithium	mg/L	0.00528		0.00578		0.00513	0.00614	0.00569			0.00493		0.00624		0.00501		0.00555
Magnesium	mg/L	0.505		0.493		0.455	0.495	0.436			0.459		0.464		0.374		0.425
Manganese	mg/L	0.176		0.182		0.166	0.176	0.167			0.177		0.183		0.147		0.146
Mercury	mg/L	<0.		<0.		<0.00001	<0.00001	<0.00001			<0.00001		<0.00001		<0.00001		<0.00001
Molybdenum	mg/L	0.000994		0.00116		0.00104	0.00125	0.00111			0.00121		0.00130		0.00138		0.00145
Nickel	mg/L	<0.0005		<0.0005		<0.0005	<0.0005	<0.0005			<0.0005		<0.0005		<0.0005		<0.0005
Phosphorus	mg/L	<0.3		<0.3		<0.3	<0.3	<0.3			<0.3		<0.30		<0.30		<0.30
Potassium	mg/L	5.05		4.90		4.64	5.13	4.69			4.91		5.17		4.79		5.17
Selenium	mg/L	<0.0001		<0.0001		<0.0001	<0.0001	<0.0001			<0.0001		<0.0001		<0.0001		<0.0001
Silicon	mg/L	1.31		1.28		1.25	1.35	1.17			1.33		1.33		1.12		1.30
Silver	mg/L	<0.		<0.		<0.00001	<0.00001	<0.00001			<0.00001		<0.00001		<0.00001		<0.00001
Sodium	mg/L	0.102		0.108		0.095	0.119	0.102			0.104		0.109		0.113		0.108
Strontium	mg/L	0.0899		0.104		0.0926	0.109	0.0939			0.103		0.102		0.0912		0.102
Sulfur	mg/L	15.2		16.5		14.8	16.7	14.5			16.3		16.1		16.6		18.3
Thallium	mg/L	0.000010		0.000012		0.000010	0.000011	<0.00001			0.000013		0.000012		0.000012		0.000012
Tin	mg/L	<0.0001		<0.0001		<0.0001	<0.0001	<0.0001			<0.0001		<0.0001		<0.0001		<0.0001
Titanium	mg/L	<0.01		<0.01		<0.01	<0.01	<0.01			<0.01		<0.01		<0.01		<0.01
Uranium	mg/L	0.000012		0.000015		0.000013	0.000019	<0.00001			0.000017		0.000016		0.000011		0.000013
Vanadium	mg/L	<0.001		<0.001		<0.001	<0.001	<0.001			<0.001		<0.001		<0.001		<0.001
Zinc	mg/L	0.0217		0.0200		0.0162	0.0162	0.0160			0.0194		0.0198		0.0164		0.0169

Week	Units	98	99	100	101	102	103	104	105	106
Sample ID		BW-ARD-176-98	BW-ARD-176-99	BW-ARD-176-100	BW-ARD-176-101	BW-ARD-176-102	BW-ARD-176-103	BW-ARD-176-104	BW-ARD-176-105	BW-ARD-176-106
Date Sampled		22-MAY-13	29-MAY-13	05-JUN-13	12-JUN-13	19-JUN-13	26-JUN-13	03-JUL-13	10-JUL-13	17-JUL-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	425	470	420	415	500	410	500	450	460
Conductivity	mS/cm		178		171		164		173	
pH	units		7.67		7.73		7.74		7.78	
Acidity	mg/L CaCO3		2.6		4.6		3.3		1.6	
Alkalinity, Total	mg/L CaCO3		22.4		20.1		18.5		21.7	
Sulfate (SO4)	mg/L		54.6		51.0		49.1		49.6	
Dissolved Metals			FIELD		FIELD		FIELD		FIELD	
Aluminum	mg/L		0.0312		0.0350		0.0452		0.0330	
Antimony	mg/L		0.00387		0.00360		0.00337		0.00370	
Arsenic	mg/L		0.00063		0.00068		0.00065		0.00066	
Barium	mg/L		0.00316		0.00292		0.00286		0.00305	
Beryllium	mg/L		<0.0001		<0.0001		<0.0001		<0.0001	
Bismuth	mg/L		<0.0005		<0.0005		<0.0005		<0.0005	
Boron	mg/L		<0.01		<0.01		<0.01		<0.01	
Cadmium	mg/L		0.00168		0.00104		0.00109		0.00138	
Calcium	mg/L		30.6		30.7		28.6		29.0	
Chromium	mg/L		<0.0005		<0.0005		<0.0005		<0.0005	
Cobalt	mg/L		0.00020		<0.0001		<0.0001		0.00015	
Copper	mg/L		<0.0005		<0.0005		<0.0005		<0.0005	
Iron	mg/L		<0.03		<0.03		<0.03		<0.03	
Lead	mg/L		<0.00005		<0.00005		<0.0001		<0.0001	
Lithium	mg/L		0.00445		0.00434		0.00640		0.00490	
Magnesium	mg/L		0.379		0.357		0.323		0.334	
Manganese	mg/L		0.114		0.0811		0.0796		0.0931	
Mercury	mg/L		<0.00001		<0.00001		<0.0		<0.0	
Molybdenum	mg/L		0.00137		0.00132		0.00120		0.00130	
Nickel	mg/L		<0.0005		<0.0005		<0.0005		<0.0005	
Phosphorus	mg/L		<0.30		<0.30		<0.3		<0.3	
Potassium	mg/L		4.48		4.24		4.08		4.52	
Selenium	mg/L		<0.0001		<0.0001		<0.0001		<0.0001	
Silicon	mg/L		1.12		1.02		0.985		1.10	
Silver	mg/L		<0.00001		<0.00001		<0.0		<0.0	
Sodium	mg/L		0.101		0.092		0.107		0.100	
Strontium	mg/L		0.0899		0.0872		0.0800		0.0870	
Sulfur	mg/L		19.5		18.8		18.1		17.4	
Thallium	mg/L		0.000011		<0.00001		<0.0		0.000013	
Tin	mg/L		<0.0001		<0.0001		<0.0001		<0.0001	
Titanium	mg/L		<0.01		<0.01		<0.01		<0.01	
Uranium	mg/L		<0.00001		<0.00001		<0.0		<0.0	
Vanadium	mg/L		<0.001		<0.001		<0.001		<0.001	
Zinc	mg/L		0.0136		0.0062		0.0075		0.0112	

Table A6-9: Results of Waste Rock Humidity Cell Test BW-ARD-288

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample ID		BW-ARD-288-0	BW-ARD-288-1	BW-ARD-288-2	BW-ARD-288-3	BW-ARD-288-4	BW-ARD-288-5	BW-ARD-288-6	BW-ARD-288-7	BW-ARD-288-8	BW-ARD-288-9	BW-ARD-288-10	BW-ARD-288-11	BW-ARD-288-12	BW-ARD-288-13	BW-ARD-288-14
Date Sampled		06-Jul-11	13-Jul-11	20-Jul-11	27-Jul-11	03-Aug-11	10-Aug-11	17-Aug-11	24-Aug-11	31-Aug-11	07-Sep-11	14-Sep-11	21-Sep-11	28-Sep-11	05-Oct-11	12-Oct-11
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	690	500	500	500	500	475	455	470	470	460	465	480	460	470	460
Conductivity	mS/cm	108	99.7	81.3	70.8	60.8	60.6	63.4	59.6	60.2	55.8	60.3	54.6	52.1	48.1	43.6
pH	units	6.43	6.36	6.31	6.54	6.19	6.31	6.26	6.24	6.11	6.21	6.24	6.31	6.19	6.21	6.17
Acidity	mg/L CaCO3	5.0	4.1	6.0	5.0	3.4	3.0	5.4	5.7	4.6	7.6	6.3	5.5	6.7	6.4	5.2
Alkalinity, Total	mg/L CaCO3	4.8	2.3	2.00	2.00	2.00		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Sulfate (SO4)	mg/L	29.7	30.6	27.6	25.6	20.7	21.5	22.4	21.8	21.6	21.3	21.2	20.3	19.0	17.6	16.0
Dissolved Metals																
Aluminum	mg/L	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Antimony	mg/L	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Arsenic	mg/L	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.005	0.004
Barium	mg/L	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Beryllium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Bismuth	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Boron	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cadmium	mg/L	0.002	0.002	0.001	0.001	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.004	0.005	0.004	0.004
Calcium	mg/L	3.66	3.73	3.08	2.80	2.33	2.53	2.78	2.67	2.65	2.57	2.56	2.55	2.60	2.17	2.01
Chromium	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
Copper	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Iron	mg/L	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Lead	mg/L	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.004	0.004	0.004	0.01	0.01	0.01	0.01	0.01
Lithium	mg/L	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.004	0.005	0.004	0.003	0.004	0.003
Magnesium	mg/L	1.39	1.46	1.23	1.18	0.98	1.03	1.11	1.05	1.06	0.98	0.98	1.00	0.92	0.85	0.75
Manganese	mg/L	0.52	0.55	0.51	0.50	0.43	0.48	0.57	0.57	0.59	0.58	0.61	0.65	0.66	0.61	0.56
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	mg/L	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel	mg/L	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Phosphorus	mg/L	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Potassium	mg/L	18.40	13.10	10.30	8.51	6.86	7.11	6.78	6.01	5.73	5.08	5.27	4.73	4.30	4.09	3.50
Selenium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon	mg/L	1.94	3.78	3.78	3.54	2.66	2.92	3.06	2.83	2.77	2.55	2.83	2.59	2.21	2.17	1.75
Silver	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Sodium	mg/L	2.58	2.10	1.39	0.82	0.55	0.49	0.41	0.33	0.29	0.25	0.24	0.20	0.18	0.16	0.13
Strontium	mg/L	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Sulfur	mg/L	12.50	14.30	10.10	8.45	7.11	7.39	7.85	7.40	7.22	7.10	7.26	6.96	6.79	6.14	5.57
Thallium	mg/L	0.00003	0.00002	0.00002	0.00002	0.00001	0.00002	0.00002	0.00002	0.00002	0.00002	0.00001	0.00001	0.00001	0.00002	0.00001
Tin	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Vanadium	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	mg/L	1.31	1.22	1.15	1.19	1.11	1.25	1.58	1.63	1.72	1.76	1.84	1.91	2.07	1.88	1.73

Table A6-9: Results of Waste Rock

Week	Units	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Sample ID		BW-ARD-288-15	BW-ARD-288-16	BW-ARD-288-17	BW-ARD-288-18	BW-ARD-288-19	BW-ARD-288-20	BW-ARD-288-21	BW-ARD-288-22	BW-ARD-288-23	BW-ARD-288-24	BW-ARD-288-25	BW-ARD-288-26	BW-ARD-288-27	BW-ARD-288-28	BW-ARD-288-29
Date Sampled		19-Oct-11	26-Oct-11	02-Nov-11	09-Nov-11	16-Nov-11	23-Nov-11	30-Nov-11	07-Dec-11	14-Dec-11	21-Dec-11	28-Dec-11	04-Jan-12	11-Jan-12	18-Jan-12	25-Jan-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	500	490	460	475	480	460	460	490	475	450	465	460	450	450	465
Conductivity	mS/cm	42.0	48.0	45.9	53.5	43.7	47.0	48.4	54.1	47.7	54.5	50.3	58.8	67.6	58.7	65.3
pH	units	6.17	6.22	6.18	5.98	6.13	6.20	6.03	6.00	6.20	6.12	6.05	6.05	5.95	6.00	5.94
Acidity	mg/L CaCO3	6.3	7.4	6.5	6.1	6.7	5.8	6.7	7.0	5.6	8.0	7.1	8.5	10.5	9.0	9.8
Alkalinity, Total	mg/L CaCO3	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Sulfate (SO4)	mg/L	14.6	16.5	16.6	18.1	15.4	17.5	15.9	17.8	17.6	18.5	17.1	21.5	23.9	20.7	22.9
Dissolved Metals																
Aluminum	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Antimony	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004	0.003
Arsenic	mg/L	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Barium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
Beryllium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Bismuth	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Boron	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cadmium	mg/L	0.004	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Calcium	mg/L	1.95	2.27	2.13	2.39	2.09	2.28	2.00	2.33	2.30	2.44	2.24	2.62	3.06	2.49	3.07
Chromium	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	mg/L	0.01	0.02	0.02	0.02	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02
Copper	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Iron	mg/L	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Lead	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
Lithium	mg/L	0.003	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.003
Magnesium	mg/L	0.73	0.83	0.81	0.86	0.70	0.80	0.73	0.83	0.76	0.83	0.76	0.91	1.02	0.88	0.96
Manganese	mg/L	0.56	0.67	0.70	0.72	0.65	0.74	0.71	0.84	0.85	0.87	0.84	1.09	1.32	1.10	1.26
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel	mg/L	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.03
Phosphorus	mg/L	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Potassium	mg/L	3.16	3.55	3.45	3.49	2.91	3.14	2.79	2.98	2.81	3.04	2.75	2.96	2.98	2.91	2.86
Selenium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon	mg/L	1.65	2.12	2.02	2.13	1.69	1.99	1.53	1.85	1.79	1.56	1.38	1.46	1.67	1.48	1.54
Silver	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Sodium	mg/L	0.12	0.14	0.15	0.14	0.10	0.12	0.10	0.11	0.10	0.11	0.10	0.11	0.11	0.10	0.10
Strontium	mg/L	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Sulfur	mg/L	5.47	6.37	6.21	6.39	5.44	6.04	5.47	6.16	6.18	6.57	5.87	6.96	8.14	6.88	7.97
Thallium	mg/L	0.00001	0.00001	0.00002	0.00001	0.00002	0.00002	0.00003	0.00003	0.00002	0.00001	0.00001	0.00004	0.00004	0.00001	0.00002
Tin	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium	mg/L	0.00001	0.00001	0.00001	0.00001	0.00002	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Vanadium	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	mg/L	1.67	2.21	2.14	2.35	2.13	2.46	2.22	2.75	2.77	2.73	2.60	3.64	4.43	3.28	4.13

Table A6-9: Results of Waste Rock

Week	Units	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Sample ID		BW-ARD-288-30	BW-ARD-288-31	BW-ARD-288-32	BW-ARD-288-33	BW-ARD-288-34	BW-ARD-288-35	BW-ARD-288-36	BW-ARD-288-37	BW-ARD-288-38	BW-ARD-288-39	BW-ARD-288-40	BW-ARD-288-41	BW-ARD-288-42	BW-ARD-288-43	BW-ARD-288-44
Date Sampled		01-Feb-12	08-Feb-12	15-Feb-12	22-Feb-12	29-Feb-12	07-Mar-12	14-MAR-12	21-MAR-12	28-MAR-12	04-APR-12	11-APR-12	18-APR-12	25-APR-12	02-MAY-12	09-MAY-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	455	475	480	475	475	475	470	480	450	475	475	475	475	475
Conductivity	mS/cm	62.3	62.8	61.2	66.3	72.0	56.2	58.3	58.1	57.4	59.8	63.7	61.1	62.1	59.9	57.6
pH	units	6.11	6.07	6.07	6.05	6.07	6.04	5.98	5.95	5.99	5.93	5.92	5.98	5.91	5.93	6.03
Acidity	mg/L CaCO3	7.7	11.5	12.3	11.8	13.8	8.5	10.2	10.4	11.6	10.1	10.9	10.7	14.1	13.3	11.3
Alkalinity, Total	mg/L CaCO3	2.00	2.00	2.00	2.00	2.00	2.00	2	2	2	<2.0	2	2	2	2	2
Sulfate (SO4)	mg/L	22.3	22.8	22.6	24.1	25.2	20.6	20.9	19.9	19.7	20.7	21.7	21.1	21.3	21.0	20.4
Dissolved Metals								FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD
Aluminum	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	<0.005	0.005	0.005	0.005	0.005	0.005
Antimony	mg/L	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.00217	0.00222	0.00204	0.00189	0.00194	0.00201
Arsenic	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.00072	0.00070	0.00065	0.00062	0.00061	0.00064
Barium	mg/L	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.0167	0.0177	0.0171	0.0178	0.0175	0.0168
Beryllium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Bismuth	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Boron	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	<0.01	0.01	0.01	0.01	0.01	0.01
Cadmium	mg/L	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.0157	0.0188	0.0179	0.0186	0.0186	0.0174
Calcium	mg/L	2.82	2.91	2.77	2.86	2.93	2.31	2.38	2.26	2.25	2.39	2.56	2.32	2.37	2.26	2.23
Chromium	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Cobalt	mg/L	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.0222	0.0245	0.0230	0.0232	0.0224	0.0220
Copper	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Iron	mg/L	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	<0.03	0.03	0.03	0.03	0.03	0.03
Lead	mg/L	0.02	0.02	0.02	0.03	0.04	0.03	0.03	0.03	0.03	0.0344	0.0433	0.0405	0.0415	0.0441	0.0454
Lithium	mg/L	0.003	0.002	0.003	0.003	0.004	0.003	0.003	0.003	0.002	0.00209	0.00200	0.00242	0.00242	0.00240	0.00221
Magnesium	mg/L	0.97	0.91	0.84	0.94	0.97	0.70	0.75	0.73	0.74	0.735	0.744	0.704	0.711	0.674	0.636
Manganese	mg/L	1.36	1.33	1.20	1.52	1.53	1.19	1.26	1.29	1.34	1.38	1.50	1.42	1.46	1.49	1.41
Mercury	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Nickel	mg/L	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.0271	0.0292	0.0278	0.0281	0.0267	0.0270
Phosphorus	mg/L	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	<0.3	0.3	0.3	0.3	0.3	0.3
Potassium	mg/L	2.70	2.47	2.36	2.61	2.63	2.17	2.17	2.13	2.03	2.12	2.09	2.02	2.04	2.01	1.95
Selenium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Silicon	mg/L	1.31	1.11	1.28	1.40	1.63	1.29	1.29	1.21	1.07	1.08	1.36	1.22	1.31	1.24	1.22
Silver	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Sodium	mg/L	0.09	0.08	0.08	0.10	0.10	0.08	0.08	0.08	0.08	0.078	0.088	0.085	0.083	0.078	0.079
Strontium	mg/L	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.0186	0.0201	0.0181	0.0179	0.0178	0.0184
Sulfur	mg/L	8.13	7.49	7.40	8.06	8.56	6.71	7.06	6.77	6.42	7.10	7.68	6.95	7.14	7.04	6.95
Thallium	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Tin	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	<0.01	0.01	0.01	0.01	0.01	0.01
Uranium	mg/L	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Vanadium	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	0.001	0.001
Zinc	mg/L	4.66	4.65	3.74	5.25	5.71	4.32	4.96	4.97	4.52	4.89	5.38	5.20	5.36	5.48	5.22

Table A6-9: Results of Waste Rock Humidity Cell Test BW-ARD-288

Table A6-9: Results of Waste Rock

Week	Units	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Sample ID		BW-ARD-288-45	BW-ARD-288-46	BW-ARD-288-47	BW-ARD-288-48	BW-ARD-288-49	BW-ARD-288-50	BW-ARD-288-51	BW-ARD-288-52	BW-ARD-288-53	BW-ARD-288-54	BW-ARD-288-55	BW-ARD-288-56	BW-ARD-288-57	BW-ARD-288-58	BW-ARD-288-59
Date Sampled		16-MAY-12	23-MAY-12	30-MAY-12	06-JUN-12	13-JUN-12	20-JUN-12	27-JUN-12	04-JUL-12	11-JUL-12	18-JUL-12	25-JUL-12	01-AUG-12	08-AUG-12	15-AUG-12	22-AUG-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	475	500	480	475	480	480	460	475	475	475	480	475	470	475
Conductivity	mS/cm	59.1	55.9	64.9	56.3	58.9	58.0	56.7	56.8	53.1	54.2	51.2	54.0	59.6	52.1	53.1
pH	units	5.94	5.93	5.90	5.92	5.88	5.86	6.01	5.87	5.92	5.98	5.95	5.98	5.93	5.95	5.94
Acidity	mg/L CaCO3	7.8	11.8	11.8	12.3	12.2	12.9	10.4	11.5	10.9	15.6	10.2	11.8	14.0	14.8	14.2
Alkalinity, Total	mg/L CaCO3	<2.0	<2.0	<2.0	<2.	<2.	<2.	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.	<2.
Sulfate (SO4)	mg/L	20.4	19.9	22.6	19.5	20.5	19.6	21.2	20.5	19.7	18.7	18.5	19.7	22.7	19.6	19.4
Dissolved Metals			FIELD		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD	
Aluminum	mg/L		<0.005		<0.005		<0.005		<0.005		<0.005		<0.005		<0.005	
Antimony	mg/L		0.00187		0.00181		0.00170		0.00166		0.00160		0.00141		0.00151	
Arsenic	mg/L		0.00058		0.00056		0.00056		0.00055		0.00047		0.00060		0.00050	
Barium	mg/L		0.0169		0.0167		0.0173		0.0182		0.0161		0.0172		0.0175	
Beryllium	mg/L		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Bismuth	mg/L		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Boron	mg/L		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Cadmium	mg/L		0.0177		0.0188		0.0199		0.0193		0.0184		0.0207		0.0203	
Calcium	mg/L		2.19		2.06		2.13		2.07		1.94		1.95		1.86	
Chromium	mg/L		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Cobalt	mg/L		0.0211		0.0214		0.0215		0.0214		0.0191		0.0203		0.0194	
Copper	mg/L		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	
Iron	mg/L		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03	
Lead	mg/L		0.0472		0.0534		0.0562		0.0673		0.0602		0.0683		0.0803	
Lithium	mg/L		0.00261		0.00153		0.00236		0.00263		0.00214		0.00180		0.00233	
Magnesium	mg/L		0.625		0.617		0.593		0.568		0.523		0.470		0.482	
Manganese	mg/L		1.39		1.41		1.48		1.47		1.35		1.48		1.38	
Mercury	mg/L		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001	
Molybdenum	mg/L		<0.00005		<0.00005		<0.00005		<0.00005		<0.00005		<0.00005		<0.00005	
Nickel	mg/L		0.0261		0.0260		0.0270		0.0269		0.0241		0.0252		0.0236	
Phosphorus	mg/L		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3	
Potassium	mg/L		1.86		1.95		1.85		1.92		1.72		1.62		1.80	
Selenium	mg/L		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Silicon	mg/L		1.21		1.30		1.26		1.22		1.17		1.15		1.26	
Silver	mg/L		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001	
Sodium	mg/L		0.079		0.093		0.078		0.085		0.085		0.083		0.084	
Strontium	mg/L		0.0165		0.0162		0.0163		0.0159		0.0153		0.0141		0.0146	
Sulfur	mg/L		6.78		6.78		7.17		6.77		6.50		6.57		6.44	
Thallium	mg/L		0.000010		<0.00001		<0.00001		<0.00001		0.000010		<0.00001		<0.00001	
Tin	mg/L		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
Titanium	mg/L		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Uranium	mg/L		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001	
Vanadium	mg/L		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001	
Zinc	mg/L		5.40		5.25		5.70		5.67		5.13		6.25		5.42	

Table A6-9: Results of Waste Rock

Week	Units	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74
Sample ID		BW-ARD-288-60	BW-ARD-288-61	BW-ARD-288-62	BW-ARD-288-63	BW-ARD-288-64	BW-ARD-288-65	BW-ARD-288-66	BW-ARD-288-67	BW-ARD-288-68	BW-ARD-288-69	BW-ARD-288-70	BW-ARD-288-71	BW-ARD-288-72	BW-ARD-288-73	BW-ARD-288-74
Date Sampled		29-AUG-12	05-SEP-12	12-SEP-12	19-SEP-12	26-SEP-12	03-OCT-12	10-OCT-12	17-OCT-12	24-OCT-12	31-OCT-12	07-NOV-12	14-NOV-12	21-NOV-12	28-NOV-12	05-DEC-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	480	490	490	475	475	475	495	475	490	480	475	495	450	450	440
Conductivity	mS/cm	53.4	53.3	48.0	55.6	51.0	47.0	52.4	45.7	46.7	46.7	41.5	51.9	43.8	47.0	48.7
pH	units	5.96	5.81	5.98	5.86	5.79	5.90	5.78	5.94	5.96	5.87	5.81	5.70	5.72	5.83	5.86
Acidity	mg/L CaCO3	13.6	14.5	11.0	13.3	14.7	11.3	13.5	11.4	12.2	9.8	7.9	12.9	9.0	11.5	11.0
Alkalinity, Total	mg/L CaCO3	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.00	<2.00
Sulfate (SO4)	mg/L	19.3	18.3	16.8	19.2	18.0	16.1	18.0	15.7	16.6	16.1	14.0	18.0	15.0	17.2	17.6
Dissolved Metals		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD
Aluminum	mg/L	<0.005		<0.005		<0.005		<0.005		<0.005		<0.005		<0.005		<0.005
Antimony	mg/L	0.00150		0.00123		0.00137		0.00114		0.00125		0.00107		0.00120		0.00134
Arsenic	mg/L	0.00056		0.00049		0.00051		0.00042		0.00041		0.00038		0.00047		0.00055
Barium	mg/L	0.0185		0.0155		0.0182		0.0166		0.0159		0.0128		0.0146		0.0168
Beryllium	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Bismuth	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005
Boron	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01
Cadmium	mg/L	0.0223		0.0191		0.0212		0.0206		0.0208		0.0166		0.0187		0.0216
Calcium	mg/L	1.86		1.65		1.65		1.61		1.52		1.25		1.35		1.64
Chromium	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005
Cobalt	mg/L	0.0197		0.0170		0.0181		0.0180		0.0169		0.0138		0.0149		0.0175
Copper	mg/L	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		0.00070		0.00063
Iron	mg/L	<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03
Lead	mg/L	0.0873		0.0701		0.0848		0.0870		0.0816		0.0675		0.0864		0.103
Lithium	mg/L	0.00257		0.00219		0.00228		0.00189		0.00202		0.00152		0.00170		0.00185
Magnesium	mg/L	0.474		0.409		0.438		0.413		0.396		0.315		0.337		0.383
Manganese	mg/L	1.45		1.39		1.45		1.52		1.34		1.19		1.30		1.36
Mercury	mg/L	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001
Molybdenum	mg/L	<0.00005		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.00005
Nickel	mg/L	0.0242		0.0209		0.0224		0.0226		0.0206		0.0171		0.0181		0.0216
Phosphorus	mg/L	<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.30
Potassium	mg/L	1.71		1.43		1.65		1.53		1.51		1.25		1.32		1.46
Selenium	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Silicon	mg/L	1.34		1.08		1.33		1.20		1.20		0.916		0.952		0.999
Silver	mg/L	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001
Sodium	mg/L	0.090		0.074		0.087		0.082		0.081		0.076		0.102		0.082
Strontium	mg/L	0.0145		0.0119		0.0129		0.0129		0.0130		0.00952		0.0106		0.0130
Sulfur	mg/L	6.49		5.72		6.00		5.87		5.63		4.71		4.97		6.02
Thallium	mg/L	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		0.000014		<0.00001		0.000016
Tin	mg/L	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Titanium	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01
Uranium	mg/L	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001
Vanadium	mg/L	<0.001		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001
Zinc	mg/L	5.79		5.08		5.66		5.76		5.19		4.55		4.93		5.30

Table A6-9: Results of Waste Rock Humidity Cell Test BW-ARD-288

Table A6-9: Results of Waste Rock

Week	Units	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
Sample ID		BW-ARD-288-75	BW-ARD-288-76	BW-ARD-288-77	BW-ARD-288-78	BW-ARD-288-79	BW-ARD-288-80	BW-ARD-288-81	BW-ARD-288-82	BW-ARD-288-83	BW-ARD-288-84	BW-ARD-288-85	BW-ARD-288-86	BW-ARD-288-87	BW-ARD-288-88	BW-ARD-288-89
Date Sampled		12-DEC-12	19-DEC-12	26-DEC-12	02-JAN-13	09-JAN-13	16-JAN-13	23-JAN-13	30-JAN-13	06-FEB-13	13-FEB-13	20-FEB-13	27-FEB-13	06-MAR-13	13-MAR-13	20-MAR-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	470	465	475	450	475	475	465	470	455	470	470	475	460	460
Conductivity	mS/cm	51.5	47.6	38.4	42.1	50.3	47.8	48.0	47.6	48.3	44.7	52.9	45.8	45.2	46.0	43.2
pH	units	5.96	6.03	6.10	5.98	5.94	5.96	5.31	5.32	5.61	5.86	5.46	5.38	5.62	5.07	5.84
Acidity	mg/L CaCO3	13.0	11.4	8.9	12.2	15.5	11.0	11.0	8.7	11.3	11.5	13.2	10.7	16.6	12.0	10.3
Alkalinity, Total	mg/L CaCO3	<2.00	<2.00	<2.00	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.0	<2.0	<2.0	<2.0	<2.0
Sulfate (SO4)	mg/L	17.8	16.1	13.9	15.4	18.2	15.4	16.3	16.0	15.8	15.5	17.0	14.1	14.6	14.0	15.0
Dissolved Metals			FIELD		FIELD		FIELD		FIELD		FIELD		FIELD	FIELD	FIELD	
Aluminum	mg/L		<0.005		<0.005		<0.005		<0.005		<0.005		<0.005	<0.005	<0.005	
Antimony	mg/L		0.00135		0.00122		0.00113		0.00111		0.00116		0.00110	0.00116	0.00111	
Arsenic	mg/L		0.00047		0.00048		0.00041		0.00040		0.00044		0.00038	0.00046	0.00043	
Barium	mg/L		0.0177		0.0164		0.0152		0.0139		0.0153		0.0159	0.0180	0.0160	
Beryllium	mg/L		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	<0.0001	<0.0001	
Bismuth	mg/L		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	<0.0005	<0.0005	
Boron	mg/L		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	<0.01	<0.01	
Cadmium	mg/L		0.0215		0.0192		0.0202		0.0199		0.0210		0.0201	0.0215	0.0193	
Calcium	mg/L		1.45		1.29		1.34		1.28		1.28		1.21	1.26	1.13	
Chromium	mg/L		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005		<0.0005	<0.0005	<0.0005	
Cobalt	mg/L		0.0167		0.0145		0.0149		0.0145		0.0144		0.0141	0.0144	0.0131	
Copper	mg/L		0.00078		0.00069		0.00056		0.00058		0.00062		0.00079	0.00083	0.00076	
Iron	mg/L		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03	<0.03	<0.03	
Lead	mg/L		0.106		0.108		0.0935		0.100		0.101		0.101	0.108	0.0928	
Lithium	mg/L		0.00145		0.00162		0.00113		0.00190		0.00125		0.00152	0.00236	0.00165	
Magnesium	mg/L		0.353		0.321		0.321		0.316		0.317		0.285	0.302	0.284	
Manganese	mg/L		1.36		1.29		1.28		1.30		1.31		1.24	1.29	1.27	
Mercury	mg/L		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001	<0.00001	<0.00001	
Molybdenum	mg/L		<0.00005		<0.0001		<0.0001		<0.0001		<0.0001		<0.00005	<0.00005	<0.00005	
Nickel	mg/L		0.0202		0.0177		0.0184		0.0174		0.0174		0.0166	0.0170	0.0155	
Phosphorus	mg/L		<0.30		<0.3		<0.3		<0.3		<0.3		<0.3	<0.3	<0.3	
Potassium	mg/L		1.61		1.39		1.41		1.38		1.36		1.35	1.46	1.33	
Selenium	mg/L		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	<0.0001	<0.0001	
Silicon	mg/L		1.31		0.988		0.998		0.983		1.04		1.21	1.20	1.00	
Silver	mg/L		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001	<0.00001	<0.00001	
Sodium	mg/L		0.091		0.084		0.077		0.082		0.086		0.082	0.093	0.086	
Strontium	mg/L		0.0121		0.0105		0.0111		0.0109		0.0105		0.0104	0.0107	0.00936	
Sulfur	mg/L		5.49		4.85		5.26		5.13		5.61		5.02	5.21	4.58	
Thallium	mg/L		0.000017		0.000010		<0.		<0.		0.000012		0.000014	0.000016	<0.00001	
Tin	mg/L		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	<0.0001	<0.0001	
Titanium	mg/L		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	<0.01	<0.01	
Uranium	mg/L		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001		<0.00001	<0.00001	<0.00001	
Vanadium	mg/L		<0.001		<0.001		<0.001		<0.001		<0.001		<0.001	<0.001	<0.001	
Zinc	mg/L		5.21		4.86		4.82		4.86		5.21		4.68	4.94	4.64	

Table A6-9: Results of Waste Rock

Week	Units	90	91
Sample ID		BW-ARD-288-90	LEACH
Date Sampled		27-MAR-13	27-MAR-13
Total Volume In	mL	500	3000
Total Volume Out	mL	450	2940
Conductivity	mS/cm	45.5	56.1
pH	units	5.97	7.11
Acidity	mg/L CaCO3	8.9	2.2
Alkalinity, Total	mg/L CaCO3	<2.0	3.9
Sulfate (SO4)	mg/L	15.5	15.9
Dissolved Metals		FIELD	FIELD
Aluminum	mg/L	<0.005	0.473
Antimony	mg/L	0.00123	0.0107
Arsenic	mg/L	0.00045	0.00485
Barium	mg/L	0.0161	0.00577
Beryllium	mg/L	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005
Boron	mg/L	<0.01	0.011
Cadmium	mg/L	0.0209	0.000345
Calcium	mg/L	1.20	0.107
Chromium	mg/L	0.00127	0.00053
Cobalt	mg/L	0.0139	0.00032
Copper	mg/L	0.00058	<0.0005
Iron	mg/L	<0.03	0.409
Lead	mg/L	0.0998	0.0214
Lithium	mg/L	0.00203	0.00642
Magnesium	mg/L	0.298	0.168
Manganese	mg/L	1.32	0.0840
Mercury	mg/L	<0.00001	<0.00001
Molybdenum	mg/L	<0.00005	0.000371
Nickel	mg/L	0.0164	0.00064
Phosphorus	mg/L	<0.3	<0.3
Potassium	mg/L	1.60	13.3
Selenium	mg/L	<0.0001	<0.0001
Silicon	mg/L	1.18	7.40
Silver	mg/L	<0.00001	0.000035
Sodium	mg/L	0.105	1.14
Strontium	mg/L	0.0101	0.00159
Sulfur	mg/L	4.96	5.13
Thallium	mg/L	0.000011	0.000028
Tin	mg/L	0.00010	<0.0001
Titanium	mg/L	<0.01	0.025
Uranium	mg/L	<0.00001	0.000026
Vanadium	mg/L	<0.001	<0.001
Zinc	mg/L	4.74	0.0641

Table A6-10: Results of Waste Rock Humidity Cell Test BW-ARD-526

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12
Sample ID		BW-ARD-526-0	BW-ARD-526-1	BW-ARD-526-2	BW-ARD-526-3	BW-ARD-526-4	BW-ARD-526-5	BW-ARD-526-6	BW-ARD-526-7	BW-ARD-526-8	BW-ARD-526-9	BW-ARD-526-10	BW-ARD-526-11	BW-ARD-526-12
Date Sampled		03-APR-12	10-APR-12	17-APR-12	24-APR-12	01-MAY-12	08-MAY-12	15-MAY-12	22-MAY-12	29-MAY-12	05-JUN-12	12-JUN-12	19-JUN-12	26-JUN-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	575	500	490	425	470	440	445	460	400	495	500	450	475
Conductivity	mS/cm	154	155	124	107	90.7	85.4	82.7	78.8	85.8	85.5	75.1	73.4	65.6
pH	units	7.21	7.17	7.18	7.19	7.21	7.15	7.11	7.15	7.07	7.11	7.03	7.19	7.06
Acidity	mg/L CaCO3	2.4	3.3	2.2	2.5	2.8	3.8	3.5	2.8	9.7	3.2	2.6	3.1	5.0
Alkalinity, Total	mg/L CaCO3	5.9	6.0	5.5	5.0	4.1	4.7	4.2	4.5	4.6	5.0	3.9	4.2	4.5
Sulfate (SO4)	mg/L	47.4	46.6	36.6	34.5	28.7	27.2	25.4	23.9	25.4	23.6	21.4	17.4	17.3
Dissolved Metals														
Aluminum	mg/L	0.04	0.06	0.109	0.0710	0.0652	0.137	0.0799	0.0819	0.0544	0.0830	0.0310	0.0513	0.0434
Antimony	mg/L	0.01	0.01	0.00800	0.00745	0.00791	0.00808	0.00784	0.00737	0.00663	0.00618	0.00648	0.00640	0.00647
Arsenic	mg/L	0.01	0.01	0.00833	0.00847	0.00816	0.00867	0.00947	0.00904	0.00747	0.00642	0.00695	0.00707	0.00678
Barium	mg/L	0.001	0.001	0.00136	0.00121	0.00101	0.00125	0.00104	0.00102	0.00123	0.00132	0.00115	0.00103	0.00110
Beryllium	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.01	0.02	0.013	0.012	0.012	0.01	0.010	0.010	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.003	0.004	0.00375	0.00371	0.00391	0.00399	0.00429	0.00452	0.00602	0.00654	0.00649	0.00646	0.00660
Calcium	mg/L	9.97	9.85	8.13	7.42	6.81	6.39	5.56	5.66	6.80	7.04	5.95	5.83	5.10
Chromium	mg/L	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.002	0.001	0.00079	0.00077	0.00081	0.00087	0.00092	0.00104	0.00138	0.00139	0.00156	0.00154	0.00181
Copper	mg/L	0.001	0.001	<0.0005	0.0005	0.0005	0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	0.03	0.04	0.054	0.072	0.039	0.095	0.035	0.049	0.033	0.722	<0.03	0.033	0.031
Lead	mg/L	0.0004	0.0008	0.000997	0.000980	0.000672	0.00164	0.000860	0.000860	0.000584	0.00110	0.000580	0.000757	0.000554
Lithium	mg/L	0.02	0.02	0.0166	0.0154	0.0144	0.0139	0.0129	0.0118	0.0120	0.0124	0.0108	0.0108	0.00961
Magnesium	mg/L	1.51	1.60	1.29	1.13	1.09	1.00	0.918	0.935	1.08	1.01	1.01	0.915	0.799
Manganese	mg/L	0.07	0.16	0.194	0.215	0.238	0.267	0.287	0.318	0.426	0.383	0.433	0.468	0.461
Mercury	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.01	0.01	0.0123	0.0119	0.0127	0.0134	0.0128	0.0116	0.00828	0.00684	0.00714	0.00665	0.00640
Nickel	mg/L	0.005	0.003	0.00258	0.00251	0.00242	0.00218	0.00211	0.00237	0.00278	0.00308	0.00276	0.00291	0.00278
Phosphorus	mg/L	0.30	0.30	<0.3	0.3	0.3	0.3	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	12.50	12.80	10.7	10.1	9.51	8.79	8.23	7.98	8.43	7.78	7.26	6.82	6.15
Selenium	mg/L	0.0002	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	5.01	8.45	8.09	8.71	9.07	9.13	9.38	9.93	9.94	10.3	10.4	10.9	10.6
Silver	mg/L	0.00001	0.00001	<0.00001	0.00001	0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	6.33	4.85	3.10	2.18	1.58	1.14	0.870	0.697	0.558	0.433	0.342	0.296	0.231
Strontium	mg/L	0.06	0.06	0.0552	0.0458	0.0440	0.0439	0.0377	0.0372	0.0445	0.0442	0.0418	0.0405	0.0354
Sulfur	mg/L	19.00	17.00	13.6	11.9	10.4	9.56	8.75	8.34	8.57	8.66	7.05	6.18	5.63
Thallium	mg/L	0.0001	0.0001	0.000119	0.000118	0.000111	0.000124	0.000118	0.000116	0.000126	0.000124	0.000128	0.000116	0.000122
Tin	mg/L	0.0001	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.01	0.01	<0.01	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.00001	0.00001	0.000016	0.000011	0.00001	0.000017	0.000013	<0.00001	<0.00001	0.000012	<0.00001	0.000010	<0.00001
Vanadium	mg/L	0.001	0.001	<0.001	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.06	0.07	0.0779	0.0826	0.0954	0.0966	0.0915	0.119	0.149	0.167	0.172	0.178	0.174

Table A6-10: Results of Waste Rock Humidity Cell Test BW-ARD-526

Table A6-10: Results of Waste Rock

Week	Units	13	14	15	16	17	18	19	20	21	22	23	24
Sample ID		BW-ARD-526-13	BW-ARD-526-14	BW-ARD-526-15	BW-ARD-526-16	BW-ARD-526-17	BW-ARD-526-18	BW-ARD-526-19	BW-ARD-526-20	BW-ARD-526-21	BW-ARD-526-22	BW-ARD-526-23	BW-ARD-526-24
Date Sampled		03-JUL-12	10-JUL-12	17-JUL-12	24-JUL-12	31-JUL-12	07-AUG-12	14-AUG-12	21-AUG-12	28-AUG-12	04-SEP-12	11-SEP-12	18-SEP-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	450	500	410	495	455	400	425	500	500	375	500	465
Conductivity	mS/cm	63.7	54.0	55.3	52.6	53.3	57.2	49.0	47.0	44.6	50.0	41.1	42.1
pH	units	7.14	6.95	7.01	6.93	6.98	6.90	7.04	6.91	6.94	6.94	6.98	6.90
Acidity	mg/L CaCO3	2.4	4.0	4.4	3.2	3.4	2.8	2.3	4.3	2.9	3.9	2.2	3.9
Alkalinity, Total	mg/L CaCO3	5.0	3.7	2.8	3.1	3.2	3.1	2.8	3.6	3.0	3.4	2.3	2.8
Sulfate (SO4)	mg/L	16.2	13.2	14.4	13.2	12.4	14.5	11.2	10.8	9.99	11.6	9.57	9.98
Dissolved Metals													
Aluminum	mg/L	0.0522	0.0612	0.103	0.0599	0.0654	0.0711	0.0553	0.0970	0.0897	0.0550	0.0824	0.0257
Antimony	mg/L	0.00608	0.00554	0.00508	0.00525	0.00551	0.00566	0.00500	0.00476	0.00465	0.00489	0.00453	0.00424
Arsenic	mg/L	0.00597	0.00583	0.00543	0.00536	0.00560	0.00606	0.00570	0.00535	0.00559	0.00547	0.00523	0.00475
Barium	mg/L	0.000875	0.000954	0.00124	0.00113	0.000916	0.00103	0.000878	0.00104	0.000942	0.000981	0.000917	0.000779
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00595	0.00595	0.00672	0.00655	0.00711	0.00749	0.00668	0.00703	0.00684	0.00755	0.00664	0.00686
Calcium	mg/L	4.95	4.00	4.28	4.09	3.97	4.39	3.77	3.48	3.35	4.02	3.20	3.04
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00150	0.00140	0.00155	0.00163	0.00173	0.00188	0.00164	0.00160	0.00162	0.00196	0.00154	0.00165
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	0.035	0.059	0.080	0.042	0.035	0.032	0.032	0.048	0.053	0.075	0.071	<0.03
Lead	mg/L	0.000584	0.000984	0.00116	0.000877	0.000710	0.000685	0.000628	0.00101	0.000892	0.00121	0.00126	0.000599
Lithium	mg/L	0.0101	0.00797	0.00829	0.00793	0.00783	0.00866	0.00733	0.00745	0.00728	0.00704	0.00692	0.00574
Magnesium	mg/L	0.721	0.632	0.703	0.664	0.617	0.712	0.572	0.570	0.563	0.601	0.494	0.505
Manganese	mg/L	0.416	0.378	0.429	0.437	0.427	0.487	0.418	0.403	0.415	0.488	0.394	0.435
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00568	0.00553	0.00495	0.00512	0.00485	0.00509	0.00479	0.00440	0.00426	0.00397	0.00376	0.00355
Nickel	mg/L	0.00243	0.00237	0.00259	0.00253	0.00238	0.00268	0.00211	0.00224	0.00221	0.00256	0.00203	0.00203
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	5.48	5.25	5.22	5.08	4.44	5.04	4.46	4.46	4.31	4.33	3.90	3.74
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	10.4	8.70	8.72	8.63	8.92	10.8	8.69	8.33	8.28	9.81	7.89	7.75
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.186	0.181	0.159	0.125	0.132	0.129	0.110	0.104	0.092	0.092	0.079	0.073
Strontium	mg/L	0.0332	0.0280	0.0305	0.0292	0.0277	0.0310	0.0259	0.0256	0.0238	0.0274	0.0216	0.0222
Sulfur	mg/L	5.22	4.41	4.60	4.40	4.21	4.67	3.97	3.67	3.50	3.82	3.26	3.66
Thallium	mg/L	0.000114	0.000104	0.000107	0.000110	0.000111	0.000118	0.000108	0.000103	0.000103	0.000105	0.000096	0.000097
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	<0.00001	<0.00001	0.000012	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.160	0.176	0.192	0.194	0.203	0.195	0.184	0.185	0.193	0.212	0.180	0.193

Table A6-10: Results of Waste Rock Humidity Cell Test BW-ARD-526

Table A6-10: Results of Waste Rock

Week	Units	25	26	27	28	29	30	31	32	33	34	35	36
Sample ID		BW-ARD-526-25	BW-ARD-526-26	BW-ARD-526-27	BW-ARD-526-28	BW-ARD-526-29	BW-ARD-526-30	BW-ARD-526-31	BW-ARD-526-32	BW-ARD-526-33	BW-ARD-526-34	BW-ARD-526-35	BW-ARD-526-36
Date Sampled		25-SEP-12	02-OCT-12	09-OCT-12	16-OCT-12	23-OCT-12	30-OCT-12	06-NOV-12	13-NOV-12	20-NOV-12	27-NOV-12	04-DEC-12	11-DEC-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	455	445	450	500	375	500	500	365	490	450	430	435
Conductivity	mS/cm	41.6	41.2	38.9	39.4	40.1	36.7	36.1	40.0	40.5	41.5	38.4	40.9
pH	units	6.95	6.92	6.86	6.83	6.90	6.74	6.83	6.75	6.85	6.81	6.64	6.75
Acidity	mg/L CaCO3	4.0	2.7	3.5	5.2	3.0	2.0	2.4	2.6	2.4	2.3	3.5	2.8
Alkalinity, Total	mg/L CaCO3	2.8	2.3	3.0	2.2	2.3	3.3	2.7	2.1	<2.	<2.00	<2.00	3.0
Sulfate (SO4)	mg/L	9.21	9.31	9.35	9.12	9.36	8.87	9.17	10.1	11.1	10.8	10.1	10.5
Dissolved Metals													
Aluminum	mg/L	0.0232	0.0428	0.0623	0.0737	0.0546	0.0897	0.0839	0.0412	0.0735	0.0699	0.0549	0.0438
Antimony	mg/L	0.00405	0.00420	0.00364	0.00348	0.00371	0.00365	0.00334	0.00373	0.00391	0.00344	0.00344	0.00308
Arsenic	mg/L	0.00478	0.00435	0.00444	0.00443	0.00401	0.00391	0.00358	0.00404	0.00392	0.00344	0.00327	0.00326
Barium	mg/L	0.000744	0.000784	0.000940	0.000948	0.000798	0.000882	0.000924	0.000847	0.00105	0.000956	0.000890	0.000919
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00735	0.00769	0.00718	0.00786	0.00763	0.00785	0.00745	0.00868	0.00943	0.00935	0.00897	0.00971
Calcium	mg/L	3.24	2.84	3.03	3.06	3.16	2.80	2.77	3.20	3.25	3.25	2.97	3.12
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00175	0.00182	0.00173	0.00175	0.00181	0.00163	0.00161	0.00195	0.00209	0.00209	0.00196	0.00203
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00057
Iron	mg/L	<0.03	<0.03	0.052	0.066	<0.03	0.045	0.059	<0.03	<0.03	<0.03	0.065	<0.03
Lead	mg/L	0.000392	0.000575	0.00109	0.00108	0.000568	0.00101	0.00105	0.000566	0.000802	0.000725	0.000575	0.000545
Lithium	mg/L	0.00599	0.00618	0.00587	0.00534	0.00549	0.00560	0.00512	0.00563	0.00686	0.00606	0.00551	0.00579
Magnesium	mg/L	0.507	0.506	0.456	0.478	0.478	0.440	0.428	0.490	0.527	0.502	0.474	0.475
Manganese	mg/L	0.431	0.449	0.423	0.422	0.441	0.394	0.406	0.464	0.512	0.520	0.466	0.486
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00314	0.00330	0.00307	0.00273	0.00287	0.00294	0.00250	0.00245	0.00254	0.00218	0.00214	0.00189
Nickel	mg/L	0.00218	0.00221	0.00216	0.00217	0.00216	0.00191	0.00206	0.00225	0.00240	0.00240	0.00224	0.00231
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30
Potassium	mg/L	3.73	3.59	3.41	3.35	3.23	2.99	2.97	3.26	3.45	3.37	3.04	3.00
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	7.44	6.55	7.10	6.64	6.89	6.39	6.19	6.55	6.63	6.33	6.15	6.11
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.073	0.069	0.065	0.062	0.063	0.051	0.059	0.056	0.058	0.058	0.050	0.052
Strontium	mg/L	0.0229	0.0247	0.0217	0.0197	0.0231	0.0205	0.0202	0.0221	0.0260	0.0253	0.0230	0.0230
Sulfur	mg/L	3.35	3.18	3.14	3.27	3.18	3.09	3.14	3.30	3.61	3.66	3.38	3.60
Thallium	mg/L	0.000093	0.000093	0.000095	0.000081	0.000091	0.000095	0.000086	0.000095	0.000114	0.000097	0.000093	0.000092
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	<0.00001	<0.00001	<0.00001	0.000011	<0.00001	<0.00001	0.000010	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.210	0.213	0.211	0.229	0.221	0.206	0.215	0.249	0.265	0.267	0.248	0.263

Table A6-10: Results of Waste Rock Humidity Cell Test BW-ARD-526

Table A6-10: Results of Waste Rock

Week	Units	37	38	39	40	41	42	43	44	45	46	47	48
Sample ID		BW-ARD-526-37	BW-ARD-526-38	BW-ARD-526-39	BW-ARD-526-40	BW-ARD-526-41	BW-ARD-526-42	BW-ARD-526-43	BW-ARD-526-44	BW-ARD-526-45	BW-ARD-526-46	BW-ARD-526-47	BW-ARD-526-48
Date Sampled		18-DEC-12	24-DEC-12	31-DEC-12	08-JAN-13	15-JAN-13	22-JAN-13	29-JAN-13	05-FEB-13	12-FEB-13	19-FEB-13	26-FEB-13	05-MAR-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	490	475	490	475	475	440	500	435	475	500	450	430
Conductivity	mS/cm	39.6	34.1	35.5	37.8	35.5	36.7	34.7	38.3	34.0	32.4	32.0	34.8
pH	units	6.85	6.82	6.88	6.77	6.82	6.78	6.73	6.77	6.92	6.73	6.87	6.76
Acidity	mg/L CaCO3	3.2	3.2	4.3	4.4	2.7	2.6	2.7	2.6	3.0	3.1	3.3	2.7
Alkalinity, Total	mg/L CaCO3	2.6	2.4	2.7	<2.	2.1	2.7	<2.	2.4	2.6	2.3	3.0	2.5
Sulfate (SO4)	mg/L	10.4	9.02	9.54	9.58	8.94	8.81	9.69	10.4	8.57	7.92	7.88	9.09
Dissolved Metals													
Aluminum	mg/L	0.0430	0.0304	0.0715	0.0652	0.0891	0.0863	0.0907	0.0748	0.0662	0.0857	0.0864	0.0832
Antimony	mg/L	0.00312	0.00336	0.00304	0.00299	0.00294	0.00291	0.00284	0.00296	0.00310	0.00263	0.00279	0.00277
Arsenic	mg/L	0.00301	0.00348	0.00337	0.00293	0.00301	0.00320	0.00273	0.00289	0.00290	0.00270	0.00266	0.00254
Barium	mg/L	0.000818	0.000704	0.000967	0.00109	0.00105	0.00102	0.00104	0.000989	0.000892	0.00100	0.00109	0.000996
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00995	0.00870	0.00940	0.0104	0.0100	0.0102	0.0104	0.0110	0.0102	0.0109	0.0103	0.0117
Calcium	mg/L	3.09	2.63	2.77	2.95	2.79	2.84	2.68	2.88	2.65	2.46	2.44	2.66
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00213	0.00183	0.00199	0.00214	0.00205	0.00227	0.00213	0.00244	0.00210	0.00217	0.00214	0.00229
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	0.040	0.034	0.051	0.065	0.046	0.040	<0.03	0.049	0.034	0.047
Lead	mg/L	0.000533	0.000524	0.000826	0.000624	0.000901	0.000933	0.000928	0.000827	0.000718	0.000885	0.000955	0.00102
Lithium	mg/L	0.00486	0.00531	0.00490	0.00465	0.00522	0.00431	0.00483	0.00516	0.00491	0.00446	0.00488	0.00485
Magnesium	mg/L	0.491	0.412	0.433	0.449	0.426	0.451	0.436	0.468	0.396	0.407	0.378	0.413
Manganese	mg/L	0.481	0.431	0.445	0.501	0.453	0.515	0.491	0.566	0.480	0.476	0.441	0.512
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00185	0.00210	0.00180	0.00169	0.00173	0.00164	0.00165	0.00161	0.00175	0.00144	0.00152	0.00137
Nickel	mg/L	0.00242	0.00198	0.00224	0.00230	0.00233	0.00241	0.00237	0.00254	0.00223	0.00224	0.00217	0.00244
Phosphorus	mg/L	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	3.05	2.84	2.79	2.80	2.70	2.74	2.65	2.73	2.49	2.53	2.43	2.55
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	6.30	6.21	5.86	6.02	5.97	6.07	5.62	5.96	6.08	5.30	5.45	5.46
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	<0.05	<0.05	0.059	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.064
Strontium	mg/L	0.0233	0.0206	0.0207	0.0222	0.0204	0.0219	0.0203	0.0248	0.0199	0.0189	0.0189	0.0213
Sulfur	mg/L	3.45	3.05	3.07	3.26	3.19	3.26	3.06	3.22	2.82	2.86	2.77	3.20
Thallium	mg/L	0.000092	0.000085	0.000091	0.000091	0.000087	0.000095	0.000095	0.000094	0.000084	0.000086	0.000085	0.000094
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	0.000011	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.281	0.241	0.261	0.287	0.274	0.302	0.297	0.327	0.286	0.305	0.293	0.348

Table A6-10: Results of Waste Rock

Week	Units	49	50	51	52	53	54	55	56	57	58	59	60
Sample ID		BW-ARD-526-49	BW-ARD-526-50	BW-ARD-526-51	BW-ARD-526-52	BW-ARD-526-53	BW-ARD-526-54	BW-ARD-526-55	BW-ARD-526-56	BW-ARD-526-57	BW-ARD-526-58	BW-ARD-526-59	BW-ARD-526-60
Date Sampled		12-MAR-13	19-MAR-13	26-MAR-13	02-APR-13	09-APR-13	16-APR-13	23-APR-13	30-APR-13	07-MAY-13	14-MAY-13	21-MAY-13	28-MAY-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	500	470	425	445	460	400	500	435	500	450	375	465
Conductivity	mS/cm	33.6	33.1	29.6	31.6		34.2		34.8		32.3		34.8
pH	units	6.79	6.76	6.75	6.71		6.69		6.70		6.62		6.46
Acidity	mg/L CaCO3	2.4	4.1	1.9	2.6		4.8		3.4		2.4		3.8
Alkalinity, Total	mg/L CaCO3	2.8	2.0	2.2	<2.0		2.4		<2.00		<2.00		<2.00
Sulfate (SO4)	mg/L	9.00	7.69	7.16	8.22		9.44		7.61		8.60		10.0
Dissolved Metals													
Aluminum	mg/L	0.0626	0.0342	0.0626	0.137		0.0549		0.0192		0.0511		0.0320
Antimony	mg/L	0.00271	0.00271	0.00261	0.00267		0.00250		0.00239		0.00266		0.00233
Arsenic	mg/L	0.00255	0.00270	0.00271	0.00265		0.0123		0.00231		0.00254		0.00213
Barium	mg/L	0.000883	0.000813	0.000799	0.00122		0.000982		0.000791		0.000946		0.00102
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01		<0.01		<0.01
Cadmium	mg/L	0.0114	0.0112	0.0101	0.0114		0.0136		0.0119		0.0132		0.0157
Calcium	mg/L	2.61	2.58	2.17	2.40		2.57		2.68		2.36		2.52
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005		<0.0005		<0.0005		<0.0005
Cobalt	mg/L	0.00227	0.00230	0.00207	0.00223		0.00261		0.00228		0.00248		0.00297
Copper	mg/L	<0.0005	<0.0005	<0.0005	0.00051		<0.0005		<0.0005		<0.0005		<0.0005
Iron	mg/L	0.033	<0.03	<0.03	0.072		0.037		<0.03		0.032		<0.03
Lead	mg/L	0.000705	0.000413	0.000585	0.00145		0.000691		0.000359		0.000708		0.000484
Lithium	mg/L	0.00470	0.00465	0.00444	0.00448		0.00480		0.00449		0.00495		0.00475
Magnesium	mg/L	0.411	0.389	0.349	0.368		0.410		0.368		0.355		0.395
Manganese	mg/L	0.500	0.506	0.453	0.482		0.576		0.493		0.491		0.584
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001
Molybdenum	mg/L	0.00141	0.00147	0.00148	0.00133		0.00119		0.00111		0.00115		0.000919
Nickel	mg/L	0.00240	0.00217	0.00201	0.00232		0.00256		0.00211		0.00234		0.00271
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3		<0.30		<0.30		<0.30		<0.30
Potassium	mg/L	2.56	2.45	2.36	2.38		2.57		2.31		2.40		2.49
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Silicon	mg/L	5.42	5.58	4.79	5.09		5.08		4.92		5.35		4.92
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001		<0.00001		<0.00001		<0.00001		<0.00001
Sodium	mg/L	<0.05	<0.05	<0.05	<0.05		0.057		<0.05		<0.05		0.059
Strontium	mg/L	0.0199	0.0200	0.0178	0.0188		0.0205		0.0206		0.0189		0.0211
Sulfur	mg/L	3.07	2.93	2.62	2.79		3.16		3.37		3.07		3.40
Thallium	mg/L	0.000085	0.000083	0.000082	0.000090		0.000092		0.000089		0.000095		0.000095
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01		<0.01		<0.01		<0.01		<0.01
Uranium	mg/L	<0.00001	<0.00001	<0.00001	0.000011		<0.00001		<0.00001		<0.00001		<0.00001
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001		<0.001		<0.001		<0.001		<0.001
Zinc	mg/L	0.334	0.318	0.286	0.319		0.383		0.326		0.363		0.408

Table A6-10: Results of Waste Rock

Week	Units	61	62	63	64	65	66	67
Sample ID		BW-ARD-526-61	BW-ARD-526-62	BW-ARD-526-63	BW-ARD-526-64	BW-ARD-526-65	BW-ARD-526-66	BW-ARD-526-67
Date Sampled		04-JUN-13	11-JUN-13	18-JUN-13	25-JUN-13	02-JUL-13	09-JUL-13	15-JUL-13
Total Volume In	mL	500	500	500	500	500	500	500
Total Volume Out	mL	495	525	450	430	400	500	470
Conductivity	mS/cm		34.1		30.7		30.9	
pH	units		6.48		6.37		6.79	
Acidity	mg/L CaCO3		3.4		2.5		1.9	
Alkalinity, Total	mg/L CaCO3		38.1		<2.0		2.4	
Sulfate (SO4)	mg/L		9.93		8.49		7.86	
Dissolved Metals								
Aluminum	mg/L		0.0142		0.0417		0.0158	
Antimony	mg/L		0.00225		0.00239		0.00238	
Arsenic	mg/L		0.00222		0.00233		0.00235	
Barium	mg/L		0.000973		0.000972		0.000887	
Beryllium	mg/L		<0.0001		<0.0001		<0.0001	
Bismuth	mg/L		<0.0005		<0.0005		<0.0005	
Boron	mg/L		<0.01		<0.01		<0.01	
Cadmium	mg/L		0.0143		0.0144		0.0127	
Calcium	mg/L		2.54		2.15		2.37	
Chromium	mg/L		<0.0005		<0.0005		<0.0005	
Cobalt	mg/L		0.00285		0.00263		0.00247	
Copper	mg/L		<0.0005		<0.0005		<0.0005	
Iron	mg/L		<0.03		<0.03		<0.03	
Lead	mg/L		0.000339		0.000616		0.000316	
Lithium	mg/L		0.00491		0.00460		0.00481	
Magnesium	mg/L		0.376		0.315		0.487	
Manganese	mg/L		0.595		0.509		0.496	
Mercury	mg/L		<0.00001		<0.0		<0.0	
Molybdenum	mg/L		0.000916		0.000946		0.00124	
Nickel	mg/L		0.00254		0.00222		0.00214	
Phosphorus	mg/L		<0.30		<0.3		<0.3	
Potassium	mg/L		2.43		2.33		2.18	
Selenium	mg/L		<0.0001		<0.0001		<0.0001	
Silicon	mg/L		5.00		4.89		4.51	
Silver	mg/L		<0.00001		<0.0		<0.0	
Sodium	mg/L		0.058		<0.05		<0.05	
Strontium	mg/L		0.0206		0.0179		0.0184	
Sulfur	mg/L		3.33		2.89		2.63	
Thallium	mg/L		0.000093		0.000100		0.000088	
Tin	mg/L		<0.0001		<0.0001		<0.0001	
Titanium	mg/L		<0.01		<0.01		<0.01	
Uranium	mg/L		<0.00001		<0.0		<0.0	
Vanadium	mg/L		<0.001		<0.001		<0.001	
Zinc	mg/L		0.396		0.363		0.342	

Table A6-11: Results of Waste Rock Humidity Cell Test BW-ARD-606

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11
Sample ID		BW-ARD-606-0	BW-ARD-606-1	BW-ARD-606-2	BW-ARD-606-3	BW-ARD-606-4	BW-ARD-606-5	BW-ARD-606-6	BW-ARD-606-7	BW-ARD-606-8	BW-ARD-606-9	BW-ARD-606-10	BW-ARD-606-11
Date Sampled		15-SEP-12	22-SEP-12	29-SEP-12	06-OCT-12	13-OCT-12	20-OCT-12	27-OCT-12	03-NOV-12	10-NOV-12	17-NOV-12	24-NOV-12	01-DEC-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	655	470	475	450	470	465	475	490	450	475	475	455
Conductivity	mS/cm	169	174	131	118	146	155	159	148	151	148	145	142
pH	units	8.61	8.13	8.22	8.28	8.03	8.15	8.01	8.05	7.96	8.05	7.98	8.05
Acidity	mg/L CaCO3	2.3	3.4	3.4	3.4	2.8	1.9	1.8	3.8	1.8	2.9	2.0	2.7
Alkalinity, Total	mg/L CaCO3	36.9	33.6	34.3	31.9	30.7	30.1	29.8	29.7	27.3	27.0	26.8	27.0
Sulfate (SO4)	mg/L	29.7	38.5	24.8	21.3	30.7	22.7	34.4	29.9	30.6	30.0	31.0	28.8
Dissolved Metals													
Aluminum	mg/L	0.146	0.115	0.147	0.149	0.106	0.0939	0.0839	0.0912	0.0941	0.0937	0.0943	0.0958
Antimony	mg/L	0.128	0.177	0.154	0.141	0.128	0.108	0.120	0.102	0.0959	0.0938	0.0814	0.0809
Arsenic	mg/L	0.00847	0.0160	0.0256	0.0385	0.0369	0.0367	0.0374	0.0367	0.0416	0.0393	0.0385	0.0371
Barium	mg/L	0.00268	0.00260	0.00217	0.00186	0.00243	0.00250	0.00256	0.00230	0.00242	0.00241	0.00221	0.00212
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000031	0.000046	0.000037	0.000042	0.000089	0.000157	0.000260	0.000307	0.000349	0.000418	0.000392	0.000361
Calcium	mg/L	20.6	20.6	16.5	14.8	21.4	22.7	22.8	21.3	22.6	22.2	22.1	22.0
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00016	0.00016	0.00014	0.00015	0.00029	0.00044	0.00065	0.00064	0.00072	0.00084	0.00067	0.00064
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000082	<0.0001	<0.0001	0.000059	0.000053	0.000058	0.000156	0.000064	0.000077	0.000072	0.000072	0.000071
Lithium	mg/L	0.0150	0.0129	0.0109	0.0103	0.0105	0.00991	0.0107	0.00897	0.00871	0.00949	0.00843	0.00733
Magnesium	mg/L	0.796	0.814	0.665	0.628	0.825	0.889	0.933	0.830	0.853	0.879	0.850	0.778
Manganese	mg/L	0.0587	0.0927	0.0914	0.0857	0.133	0.169	0.200	0.203	0.202	0.223	0.196	0.189
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00640	0.00734	0.00395	0.00243	0.00170	0.00149	0.00149	0.00145	0.00157	0.00180	0.00183	0.00182
Nickel	mg/L	0.00177	0.00098	0.00065	<0.0005	<0.0005	<0.0005	0.00057	<0.0005	0.00051	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30
Potassium	mg/L	6.92	5.92	4.76	4.34	4.55	4.20	4.04	3.73	3.75	3.69	3.38	3.30
Selenium	mg/L	0.00012	0.00011	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.92	2.69	2.64	2.45	2.56	2.34	2.30	2.17	2.35	2.16	2.31	2.12
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	7.95	7.25	5.14	4.18	3.53	2.96	2.73	2.01	1.86	1.69	1.50	1.28
Strontium	mg/L	0.159	0.147	0.118	0.115	0.155	0.165	0.172	0.155	0.149	0.157	0.148	0.150
Sulfur	mg/L	13.1	15.2	8.84	7.39	11.9	11.8	11.6	10.4	11.0	11.0	11.0	10.4
Thallium	mg/L	0.000041	0.000040	0.000029	0.000026	0.000027	0.000027	0.000025	0.000026	0.000026	0.000026	0.000022	0.000021
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000631	0.00129	0.00112	0.00108	0.00100	0.000845	0.000696	0.000579	0.000485	0.000487	0.000396	0.000360
Vanadium	mg/L	0.0018	0.0024	0.0029	0.0029	0.0022	0.0018	0.0016	0.0015	0.0016	0.0015	0.0014	0.0013
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	0.0032	0.0054	0.0058	0.0076	0.0076	0.0074	0.0060

Table A6-12: Results of Waste Rock Humidity Cell Test BW-ARD-648

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Sample ID		648-0	648-1	648-2	648-3	648-4	648-5	648-6	648-7	648-8	648-9	648-10	648-11	648-12	648-13	648-14	648-15	648-16	648-17	648-18	648-19	648-20
Date Sampled		15-SEP-12	22-SEP-12	29-SEP-12	06-OCT-12	13-OCT-12	20-OCT-12	27-OCT-12	03-NOV-12	10-NOV-12	17-NOV-12	24-NOV-12	01-DEC-12	08-DEC-12	15-DEC-12	22-DEC-12	29-DEC-12	05-JAN-13	12-JAN-13	19-JAN-13	26-JAN-13	02-FEB-13
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	640	465	475	450	465	460	465	475	475	455	465	455	475	470	475	470	475	470	475	600	475
Conductivity	mS/cm	63.5	79.5	72.8	64.4	72.6	62.2	59.2	53.9	54.6	52.5	58.5	59.1	57.0	59.2	57.4	51.4	50.3	51.7	51.4	46.8	50.8
pH	units	8.96	8.15	8.03	7.96	7.79	7.82	7.74	7.73	7.66	7.64	7.55	7.54	7.39	7.37	7.34	7.55	7.38	7.45	7.21	7.25	7.23
Acidity	mg/L CaCO3	<1.	3.0	2.1	2.8	2.5	2.3	1.8	1.9	1.6	2.7	1.9	2.6	3.0	4.1	2.9	2.6	3.0	2.1	4.1	4.2	2.3
Alkalinity, Total	mg/L CaCO3	22.4	25.1	21.7	17.3	14.3	13.3	14.0	12.0	11.5	10.1	9.1	9.2	8.7	9.3	9.2	8.2	8.2	8.2	8.1	6.6	7.9
Sulfate (SO4)	mg/L	2.86	8.91	9.88	9.00	14.7	13.7	12.2	10.4	10.7	11.8	14.6	14.6	13.5	13.2	12.3	11.5	11.6	11.9	12.5	10.9	10.7
Dissolved Metals																						
Aluminum	mg/L	0.350	0.276	0.240	0.211	0.157	0.147	0.124	0.144	0.122	0.0982	0.101	0.105	0.0771	0.0883	0.0709	0.0590	0.0667	0.0915	0.0669	0.0786	0.0643
Antimony	mg/L	0.0346	0.0549	0.0399	0.0288	0.0248	0.0212	0.0206	0.0182	0.0182	0.0139	0.0139	0.0135	0.0125	0.0123	0.0120	0.0104	0.00986	0.0100	0.00891	0.00821	0.00815
Arsenic	mg/L	0.0172	0.0191	0.0188	0.0197	0.0131	0.0122	0.0106	0.0106	0.0110	0.00918	0.00809	0.00746	0.00655	0.00644	0.00574	0.00552	0.00534	0.00540	0.00477	0.00350	0.00358
Barium	mg/L	0.00103	0.00179	0.00168	0.00133	0.00182	0.00158	0.00177	0.00147	0.00150	0.00140	0.00158	0.00162	0.00138	0.00149	0.00147	0.00106	0.00128	0.00159	0.00130	0.00182	0.00129
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	<0.00001	<0.00001	0.000021	0.000035	0.000076	0.000096	0.000145	0.000133	0.000176	0.000208	0.000334	0.000374	0.000430	0.000438	0.000593	0.000517	0.000645	0.000596	0.000605	0.000618	0.000574
Calcium	mg/L	4.73	6.94	7.06	6.39	7.97	7.03	6.97	5.94	6.23	6.17	6.74	6.89	7.01	6.86	6.68	5.79	5.86	6.01	5.76	5.30	5.95
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.00013	0.00015	0.00018	0.00014	0.00017	0.00020	0.00025	0.00026	0.00032	0.00036	0.00039	0.00033	0.00037	0.00038	0.00036	0.00036	0.00040
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	0.069	0.071	0.045	0.054	0.058	0.052	0.045	0.054	0.043	0.052	0.050	0.039	0.045	0.037	<0.03	0.036	0.053	0.040	0.042	0.036
Lead	mg/L	<0.0001	<0.0001	0.000079	0.000067	0.000104	0.000122	0.000128	0.000121	0.000152	0.000122	0.000162	0.000163	0.000150	0.000174	0.000147	0.000090	0.000147	0.000265	0.000158	0.000156	0.000134
Lithium	mg/L	0.0148	0.0136	0.0127	0.0103	0.0100	0.00891	0.00863	0.00673	0.00690	0.00653	0.00726	0.00659	0.00713	0.00635	0.00587	0.00575	0.00523	0.00534	0.00599	0.00475	0.00488
Magnesium	mg/L	0.257	0.418	0.474	0.449	0.503	0.448	0.462	0.390	0.408	0.407	0.446	0.417	0.434	0.438	0.452	0.383	0.387	0.404	0.379	0.341	0.356
Manganese	mg/L	0.0245	0.0727	0.102	0.112	0.148	0.159	0.176	0.158	0.184	0.201	0.253	0.278	0.289	0.301	0.365	0.310	0.334	0.333	0.331	0.278	0.288
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00169	0.00210	0.00106	0.000602	0.000476	0.000430	0.000375	0.000312	0.000344	0.000285	0.000329	0.000298	0.000305	0.000300	0.000285	0.000284	0.000256	0.000267	0.000270	0.000227	0.000252
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	7.79	7.32	6.64	5.83	5.64	4.71	4.29	3.95	3.97	3.58	3.49	3.47	3.27	3.35	3.17	2.86	2.81	3.01	2.70	2.59	2.47
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.46	2.07	1.97	1.79	1.91	1.84	1.85	1.78	2.01	1.77	2.06	2.01	2.10	2.04	2.21	2.03	2.06	2.13	1.95	1.84	1.91
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	2.88	2.92	1.93	1.40	1.04	0.762	0.543	0.478	0.444	0.387	0.366	0.317	0.286	0.291	0.276	0.225	0.211	0.229	0.188	0.174	0.181
Strontium	mg/L	0.0242	0.0354	0.0381	0.0349	0.0399	0.0346	0.0334	0.0283	0.0282	0.0260	0.0300	0.0301	0.0322	0.0300	0.0277	0.0256	0.0255	0.0258	0.0264	0.0224	0.0236
Sulfur	mg/L	1.84	3.30	3.50	3.38	5.37	4.79	4.31	3.55	3.69	4.05	4.99	4.95	4.65	4.64	4.49	3.86	3.75	3.96	3.89	3.84	3.55
Thallium	mg/L	0.000019	0.000022	0.000019	0.000018	0.000018	0.000016	0.000016	<0.00001	0.000016	0.000014	0.000017	0.000015	0.000019	0.000015	0.000017	0.000013	0.000014	0.000015	0.000014	0.000013	0.000013
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000193	0.000787	0.000699	0.000470	0.000372	0.000239	0.000200	0.000162	0.000152	0.000134	0.000106	0.000087	0.000095	0.000083	0.000078	0.000056	0.000051	0.000052	0.000045	0.000035	0.000039
Vanadium	mg/L	0.0025	0.0028	0.0028	0.0026	0.0019	0.0017	0.0016	0.0015	0.0017	0.0014	0.0013	0.0012	0.0010	0.0011	0.0011	<0.001	<0.001	0.0010	<0.001	<0.001	<0.001
Zinc	mg/L	<0.003	<0.003	<0.003	0.0044	0.0062	0.0072	0.0099	0.0079	0.0100	0.0120	0.0186	0.0208	0.0261	0.0266	0.0301	0.0264	0.0330	0.0278	0.0322	0.0339	0.0312

Table A6-12: Results of Waste R

Week	Units	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Sample ID		648-21	648-22	648-23	648-24	648-25	648-26	648-27	648-28	648-29	648-30	648-31	648-32	648-33	648-34	648-35	648-36	648-37	648-38	648-39	648-40
Date Sampled		09-FEB-13	16-FEB-13	23-FEB-13	02-MAR-13	09-MAR-13	16-MAR-13	23-MAR-13	30-MAR-13	06-APR-13	13-APR-13	20-APR-13	27-APR-13	04-May-13	11-May-13	18-MAY-13	25-MAY-13	01-JUN-13	08-JUN-13	15-JUN-13	22-JUN-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	475	475	475	475	470	470	455	475	475	465	475	450	475	450	450	445	430	450	445
Conductivity	mS/cm	48.2	48.1	47.4	46.9	49.9	44.1	50.2	48.1	43.8	44.7	43.6	44.4	41.4	41.1	41.6	42.5	45.1	44.9	44.6	42.0
pH	units	7.42	7.32	7.41	7.13	7.36	7.35	7.52	7.29	7.38	7.35	7.31	7.19	7.18	7.22	7.18	7.14	7.10	7.15	6.93	6.90
Acidity	mg/L CaCO3	2.5	2.9	2.2	3.2	2.3	4.7	4.0	3.5	3.3	2.2	3.1	2.2	6.0	4.8	3.7	2.8	7.0	4.0	1.9	1.7
Alkalinity, Total	mg/L CaCO3	6.1	6.5	7.0	6.5	6.4	5.9	7.0	5.9	5.1	5.7	4.4	4.9	3.0	3.8	2.6	3.3	2.9	2.7	2.6	2.4
Sulfate (SO4)	mg/L	10.9	11.1	11.5	11.0	11.5	10.1	11.7	12.3	10.9	11.7	11.0	11.9	11.8	11.0	12.4	12.9	15.2	14.3	13.4	13.1
Dissolved Metals																					
Aluminum	mg/L	0.0723	0.0636	0.0549	0.0649	0.0588	0.0632	0.0701	0.0630	0.0585	0.0576	0.0686	0.0616	0.0568	0.0815	0.0653	0.0499	0.0757	0.0610	0.0388	0.0581
Antimony	mg/L	0.00763	0.00710	0.00716	0.00719	0.00745	0.00606	0.00651	0.00611	0.00577	0.00552	0.00558	0.00541	0.00473	0.00549	0.00472	0.00450	0.00469	0.00441	0.00407	0.00368
Arsenic	mg/L	0.00380	0.00348	0.00337	0.00341	0.00310	0.00303	0.00281	0.00275	0.00269	0.00241	0.00233	0.00215	0.00230	0.00280	0.00252	0.00242	0.00234	0.00222	0.00178	0.00190
Barium	mg/L	0.00143	0.00134	0.00123	0.00138	0.00135	0.00125	0.00152	0.00136	0.00115	0.00125	0.00129	0.00151	0.00121	0.00137	0.00131	0.00116	0.00150	0.00137	0.00113	0.00134
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000591	0.000636	0.000632	0.000694	0.000836	0.000748	0.000827	0.000887	0.000792	0.000868	0.000876	0.000928	0.00107	0.000826	0.000891	0.000885	0.00105	0.00108	0.00116	0.00109
Calcium	mg/L	5.56	5.69	5.56	5.35	5.94	5.22	5.65	5.64	5.04	5.17	4.82	5.10	4.51	4.53	4.53	4.74	4.96	5.15	5.02	4.47
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00038	0.00041	0.00041	0.00047	0.00055	0.00050	0.00056	0.00056	0.00050	0.00056	0.00055	0.00058	0.00049	0.00048	0.00049	0.00045	0.00054	0.00056	0.00062	0.00052
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	0.038	0.032	<0.03	0.032	0.032	0.035	0.039	0.036	0.030	0.031	0.036	0.035	0.030	0.047	0.036	<0.03	0.038	0.031	<0.03	0.031
Lead	mg/L	0.000167	0.000132	0.000123	0.000158	0.000152	0.000150	0.000172	0.000164	0.000144	0.000158	0.000163	0.000158	0.000154	0.000237	0.000198	0.000119	0.000212	0.000187	0.000099	0.000193
Lithium	mg/L	0.00502	0.00502	0.00468	0.00509	0.00478	0.00440	0.00530	0.00532	0.00417	0.00484	0.00443	0.00479	0.00440	0.00428	0.00407	0.00394	0.00433	0.00415	0.00463	0.00360
Magnesium	mg/L	0.343	0.343	0.335	0.355	0.362	0.316	0.351	0.330	0.303	0.323	0.313	0.312	0.284	0.284	0.284	0.285	0.313	0.300	0.298	0.259
Manganese	mg/L	0.295	0.323	0.307	0.339	0.397	0.350	0.389	0.392	0.388	0.382	0.404	0.449	0.433	0.415	0.495	0.507	0.644	0.629	0.650	0.595
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000273	0.000240	0.000263	0.000272	0.000277	0.000240	0.000282	0.000270	0.000276	0.000266	0.000267	0.000260	0.000279	0.000278	0.000242	0.000291	0.000299	0.000272	0.000269	0.000266
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.3	<0.3
Potassium	mg/L	2.43	2.43	2.38	2.42	2.45	2.18	2.55	2.32	2.22	2.13	2.26	2.24	1.97	1.95	1.92	1.90	2.02	1.91	1.97	1.80
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.86	1.91	1.81	1.79	2.13	1.88	1.92	2.08	1.74	1.86	1.80	1.82	1.66	2.08	1.83	1.62	1.87	1.99	1.73	1.63
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.180	0.167	0.171	0.170	0.172	0.155	0.176	0.172	0.123	0.161	0.162	0.149	0.139	0.141	0.134	0.162	0.160	0.136	0.145	0.131
Strontium	mg/L	0.0243	0.0234	0.0237	0.0241	0.0245	0.0204	0.0229	0.0241	0.0204	0.0216	0.0206	0.0213	0.0190	0.0181	0.0181	0.0187	0.0202	0.0195	0.0199	0.0182
Sulfur	mg/L	3.93	3.97	3.95	3.72	3.89	3.76	4.08	4.08	3.79	3.91	4.00	3.82	4.05	3.72	4.16	4.14	4.75	4.46	4.44	4.23
Thallium	mg/L	0.000014	0.000011	0.000013	0.000016	0.000014	0.000012	0.000013	0.000014	0.000014	0.000013	0.000011	0.000013	0.000013	0.000014	0.000011	0.000013	0.000013	0.000013	0.000012	0.000012
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000035	0.000032	0.000030	0.000033	0.000032	0.000023	0.000024	0.000023	0.000018	0.000019	0.000014	0.000012	0.000011	0.000013	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.0313	0.0335	0.0340	0.0383	0.0447	0.0399	0.0442	0.0469	0.0405	0.0446	0.0461	0.0500	0.0432	0.0428	0.0417	0.0397	0.0478	0.0509	0.0557	0.0541

Table A6-12: Results of Waste R

Week	Units	41	42	43
Sample ID		648-41	648-42	648-43
Date Sampled		29-JUN-13	06-JUL-13	13-JUL-13
Total Volume In	mL	500	500	500
Total Volume Out	mL	425	450	445
Conductivity	mS/cm	42.1	43.4	43.0
pH	units	7.09	6.95	7.01
Acidity	mg/L CaCO3	1.6	2.2	1.3
Alkalinity, Total	mg/L CaCO3	2.6	3.2	2.3
Sulfate (SO4)	mg/L	13.1	12.6	13.4
Dissolved Metals				
Aluminum	mg/L	0.106	0.0770	0.0639
Antimony	mg/L	0.00393	0.00375	0.00332
Arsenic	mg/L	0.00192	0.00178	0.00163
Barium	mg/L	0.00203	0.00156	0.00139
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00126	0.00123	0.00136
Calcium	mg/L	4.61	4.73	4.50
Chromium	mg/L	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00061	0.00062	0.00068
Copper	mg/L	<0.0005	<0.0005	<0.0005
Iron	mg/L	0.055	0.044	0.032
Lead	mg/L	0.000339	0.000250	0.000208
Lithium	mg/L	0.00440	0.00417	0.00418
Magnesium	mg/L	0.284	0.282	0.282
Manganese	mg/L	0.658	0.738	0.770
Mercury	mg/L	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000262	0.000281	0.000231
Nickel	mg/L	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3
Potassium	mg/L	1.94	1.89	1.87
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.90	1.81	1.60
Silver	mg/L	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.143	0.142	0.132
Strontium	mg/L	0.0192	0.0189	0.0187
Sulfur	mg/L	4.26	4.38	4.55
Thallium	mg/L	0.000014	0.000013	0.000015
Tin	mg/L	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01
Uranium	mg/L	0.000011	<0.00001	<0.00001
Vanadium	mg/L	<0.001	<0.001	<0.001
Zinc	mg/L	0.0624	0.0610	0.0662

Table A6-13: Results of Waste Rock Humidity Cell Test BW-ARD-692

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12
Sample ID		BW-ARD-692-0	BW-ARD-692-1	BW-ARD-692-2	BW-ARD-692-3	BW-ARD-692-4	BW-ARD-692-5	BW-ARD-692-6	BW-ARD-692-7	BW-ARD-692-8	BW-ARD-692-9	BW-ARD-692-10	BW-ARD-692-11	BW-ARD-692-12
Date Sampled		15-SEP-12	22-SEP-12	29-SEP-12	06-OCT-12	13-OCT-12	20-OCT-12	27-OCT-12	03-NOV-12	10-NOV-12	17-NOV-12	24-NOV-12	01-DEC-12	08-DEC-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	650	460	470	450	470	465	470	475	475	470	470	475	465
Conductivity	mS/cm	61.2	72.5	66.7	62.9	62.1	60.3	64.6	62.3	58.8	57.0	58.7	59.4	57.2
pH	units	9.24	8.59	8.39	8.47	8.20	8.35	8.12	8.17	8.01	8.11	8.10	8.09	7.94
Acidity	mg/L CaCO3	<1.	2.5	2.0	1.8	2.1	1.6	1.2	1.9	1.5	2.3	1.8	1.9	2.3
Alkalinity, Total	mg/L CaCO3	26.3	31.5	29.7	27.0	25.1	24.5	25.0	24.0	24.1	21.8	21.6	22.0	20.2
Sulfate (SO4)	mg/L	0.99	3.66	3.65	2.93	4.40	4.83	5.52	5.91	4.85	4.69	4.88	4.23	3.61
Dissovled Metals														
Aluminum	mg/L	0.269	0.318	0.331	0.314	0.284	0.277	0.245	0.266	0.245	0.217	0.261	0.257	0.228
Antimony	mg/L	0.107	0.225	0.176	0.134	0.124	0.0961	0.0850	0.0924	0.0774	0.0601	0.0635	0.0572	0.0514
Arsenic	mg/L	0.00550	0.00595	0.00476	0.00393	0.00317	0.00275	0.00255	0.00222	0.00241	0.00215	0.00203	0.00190	0.00176
Barium	mg/L	0.000541	0.000810	0.000790	0.000505	0.000623	0.000556	0.000523	0.000606	0.000557	0.000434	0.000547	0.000598	0.000418
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	0.000013	0.000018	0.000033	0.000037	0.000039	0.000042	0.000042	0.000052	0.000047
Calcium	mg/L	5.59	8.07	8.26	7.94	8.45	8.36	9.35	8.93	9.26	8.65	8.86	9.49	8.71
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	<0.0001	<0.0001	0.000081	0.000066	0.000087	0.000105	0.000080	0.000094	0.000110	0.000053	0.000114	0.000107	0.000105
Lithium	mg/L	0.0104	0.0125	0.00975	0.00811	0.00669	0.00619	0.00558	0.00522	0.00471	0.00418	0.00442	0.00372	0.00384
Magnesium	mg/L	0.104	0.179	0.190	0.182	0.182	0.192	0.217	0.207	0.199	0.192	0.191	0.188	0.169
Manganese	mg/L	0.00738	0.0199	0.0233	0.0243	0.0272	0.0315	0.0405	0.0417	0.0412	0.0382	0.0377	0.0428	0.0378
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00272	0.00341	0.00188	0.00128	0.00103	0.000860	0.000696	0.000676	0.000668	0.000564	0.000625	0.000577	0.000552
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30
Potassium	mg/L	4.35	4.04	3.42	2.85	2.61	2.36	2.35	2.19	2.09	1.90	1.85	1.81	1.65
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	2.30	2.63	2.47	2.12	2.05	1.88	1.90	1.80	1.92	1.69	1.88	1.81	1.65
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	4.30	4.63	3.61	2.82	2.16	1.85	1.76	1.52	1.31	1.15	1.07	0.965	0.836
Strontium	mg/L	0.0176	0.0243	0.0244	0.0238	0.0244	0.0240	0.0227	0.0249	0.0242	0.0208	0.0236	0.0234	0.0218
Sulfur	mg/L	1.10	1.58	1.33	1.35	1.79	1.91	2.11	2.07	1.90	1.77	1.79	1.58	1.43
Thallium	mg/L	0.000014	0.000015	0.000015	0.000013	0.000012	0.000012	<0.00001	<0.00001	0.000012	<0.00001	<0.00001	0.000011	0.000011
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.00122	0.00515	0.00471	0.00322	0.00258	0.00206	0.00158	0.00156	0.00135	0.00111	0.000986	0.000931	0.000819
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Table A6-13: Results of Waste Rock

Week	Units	13	14	15	16	17	18	19	20	21	22	23	24	25
Sample ID		BW-ARD-692-13	BW-ARD-692-14	BW-ARD-692-15	BW-ARD-692-16	BW-ARD-692-17	BW-ARD-692-18	BW-ARD-692-19	BW-ARD-692-20	BW-ARD-692-21	BW-ARD-692-22	BW-ARD-692-23	BW-ARD-692-24	BW-ARD-692-25
Date Sampled		15-DEC-12	22-DEC-12	29-DEC-12	05-JAN-13	12-JAN-13	19-JAN-13	26-JAN-13	02-FEB-13	09-FEB-13	16-FEB-13	23-FEB-13	02-MAR-13	09-MAR-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	475	475	460	475	470	475	480	480	465	475	490	475	485
Conductivity	mS/cm	56.4	56.8	53.7	57.0	57.0	56.5	54.8	54.8	50.7	50.7	51.7	51.2	56.5
pH	units	8.00	8.06	8.17	7.95	8.00	7.82	7.96	7.89	7.97	7.83	8.00	7.73	7.89
Acidity	mg/L CaCO3	1.9	1.8	1.8	2.7	1.8	2.3	2.3	1.9	2.1	2.0	1.8	1.5	1.7
Alkalinity, Total	mg/L CaCO3	20.5	20.9	19.3	21.3	21.6	20.8	20.5	21.3	17.5	17.3	18.6	18.0	20.2
Sulfate (SO4)	mg/L	3.37	3.36	3.68	3.35	3.60	4.10	3.35	3.60	4.64	4.28	4.27	4.12	3.95
Dissovled Metals														
Aluminum	mg/L	0.240	0.223	0.225	0.220	0.210	0.176	0.209	0.189	0.220	0.204	0.195	0.196	0.160
Antimony	mg/L	0.0479	0.0495	0.0416	0.0436	0.0407	0.0394	0.0369	0.0359	0.0329	0.0318	0.0332	0.0305	0.0307
Arsenic	mg/L	0.00174	0.00168	0.00157	0.00158	0.00244	0.00137	0.00141	0.00135	0.00141	0.00129	0.00129	0.00137	0.00134
Barium	mg/L	0.000495	0.000425	0.000367	0.000537	0.000818	0.000340	0.000440	0.000383	0.000521	0.000519	0.000408	0.000525	0.000467
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000046	0.000048	0.000048	0.000060	0.000082	0.000062	0.000062	0.000062	0.000057	0.000055	0.000058	0.000064	0.000073
Calcium	mg/L	8.79	8.86	8.24	9.07	8.97	8.84	8.72	8.84	7.90	7.99	7.88	8.01	9.40
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.00016	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	0.00166	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000113	0.000087	0.000062	0.000094	0.000065	0.000056	<0.0001	0.000061	0.000087	0.000081	0.000070	0.000091	0.000082
Lithium	mg/L	0.00313	0.00344	0.00309	0.00298	0.00273	0.00328	0.00311	0.00283	0.00250	0.00261	0.00223	0.00219	0.00199
Magnesium	mg/L	0.174	0.175	0.166	0.176	0.330	0.168	0.170	0.169	0.145	0.155	0.155	0.161	0.173
Manganese	mg/L	0.0420	0.0421	0.0399	0.0469	0.0455	0.0499	0.0499	0.0514	0.0438	0.0471	0.0494	0.0519	0.0595
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000513	0.000479	0.000469	0.000471	0.000482	0.000476	0.000509	0.000509	0.000483	0.000561	0.000569	0.000550	0.000561
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	1.66	1.60	1.48	1.51	1.49	1.38	1.34	1.23	1.16	1.24	1.20	1.21	1.27
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.71	1.69	1.62	1.72	1.70	1.58	1.65	1.65	1.54	1.55	1.51	1.57	1.71
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.834	0.785	0.690	0.680	1.72	0.613	0.582	0.559	0.518	0.518	0.521	0.502	0.512
Strontium	mg/L	0.0204	0.0213	0.0202	0.0223	0.0226	0.0220	0.0217	0.0204	0.0183	0.0195	0.0200	0.0192	0.0220
Sulfur	mg/L	1.38	1.35	1.29	1.30	1.39	1.40	1.43	1.48	1.54	1.52	1.46	1.55	1.50
Thallium	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.000010
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000657	0.000711	0.000633	0.000578	0.000521	0.000461	0.000417	0.000397	0.000336	0.000307	0.000281	0.000259	0.000266
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	0.0035	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Table A6-13: Results of Waste Rock

Week	Units	26	27	28	29	30	31	32	33	34	35	36	37	38
Sample ID		BW-ARD-692-26	BW-ARD-692-27	BW-ARD-692-28	BW-ARD-692-29	BW-ARD-692-30	BW-ARD-692-31	BW-ARD-692-32	BW-ARD-692-33	BW-ARD-692-34	BW-ARD-692-35	BW-ARD-692-36	BW-ARD-692-37	BW-ARD-692-38
Date Sampled		16-MAR-13	23-MAR-13	30-MAR-13	06-APR-13	13-APR-13	20-APR-13	27-APR-13	04-May-13	11-MAY-13	18-MAY-13	25-MAY-13	01-JUN-13	08-JUN-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	470	470	460	475	480	475	475	455	470	470	450	435	430
Conductivity	mS/cm	46.4	57.7	48.0	43.7	44.0	42.6	41.8	36.0	44.8	42.9	40.8	40.6	40.4
pH	units	7.93	7.94	8.03	7.99	7.94	7.89	7.84	7.82	8.38	7.99	7.88	8.03	7.98
Acidity	mg/L CaCO3	2.6	2.9	1.4	2.0	1.7	1.8	82.4	34.8	9.2	3.0	2.4	12.5	2.6
Alkalinity, Total	mg/L CaCO3	15.9	21.4	17.2	14.3	15.5	14.1	14.4	11.6	17.0	13.5	13.0	12.8	13.2
Sulfate (SO4)	mg/L	3.37	4.37	4.16	3.84	3.45	2.87	3.17	3.34	3.09	4.30	4.16	3.82	3.90
Dissovled Metals														
Aluminum	mg/L	0.205	0.175	0.206	0.198	0.170	0.201	0.186	0.227	0.258	0.305	0.294	0.370	0.356
Antimony	mg/L	0.0238	0.0297	0.0239	0.0227	0.0216	0.0221	0.0206	0.0192	0.0191	0.0188	0.0138	0.0157	0.0151
Arsenic	mg/L	0.00137	0.00136	0.00139	0.00110	0.00103	0.00107	0.00098	0.00136	0.00188	0.00193	0.00187	0.00186	0.00194
Barium	mg/L	0.000666	0.000411	0.000580	0.000489	0.000382	0.000584	0.000623	0.000429	0.000408	0.000503	0.000454	0.000833	0.000629
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000056	0.000076	0.000064	0.000053	0.000058	0.000052	0.000056	0.000033	0.000034	0.000031	0.000032	0.000032	0.000031
Calcium	mg/L	7.48	9.53	7.88	6.97	7.06	6.83	6.82	5.65	7.49	6.73	6.45	6.61	6.55
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000102	0.000069	0.000120	0.000118	0.000075	0.000122	0.000115	0.000074	0.000071	0.000106	0.000064	0.000180	0.000170
Lithium	mg/L	0.00158	0.00256	0.00212	0.00202	0.00209	0.00173	0.00231	0.00147	0.00158	0.00158	0.00117	0.00123	0.00146
Magnesium	mg/L	0.139	0.184	0.138	0.128	0.133	0.132	0.127	0.101	0.121	0.114	0.110	0.106	0.0992
Manganese	mg/L	0.0445	0.0613	0.0454	0.0471	0.0430	0.0464	0.0448	0.0280	0.0302	0.0281	0.0286	0.0263	0.0235
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000538	0.000624	0.000561	0.000615	0.000557	0.000591	0.000568	0.000615	0.000621	0.000757	0.000646	0.000737	0.000757
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	mg/L	1.11	1.29	1.11	1.08	1.01	1.07	1.05	0.932	0.939	0.921	0.937	0.934	0.941
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.54	1.70	1.67	1.40	1.40	1.48	1.45	1.34	1.62	1.61	1.47	1.68	1.66
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.433	0.534	0.434	0.377	0.407	0.404	0.368	0.338	0.347	0.352	0.366	0.362	0.339
Strontium	mg/L	0.0170	0.0215	0.0178	0.0164	0.0164	0.0146	0.0159	0.0122	0.0146	0.0144	0.0123	0.0137	0.0145
Sulfur	mg/L	1.45	1.59	1.37	1.33	1.29	1.31	1.16	1.31	1.27	1.75	1.58	1.63	1.55
Thallium	mg/L	<0.00001	<0.00001	<0.00001	0.000011	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.000010	<0.00001
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000203	0.000264	0.000219	0.000170	0.000156	0.000149	0.000126	0.000144	0.000244	0.000216	0.000145	0.000200	0.000228
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Table A6-13: Results of Waste Rock

Week	Units	39	40	41	42	43
Sample ID		BW-ARD-692-39	BW-ARD-692-40	BW-ARD-692-41	BW-ARD-692-42	BW-ARD-692-43
Date Sampled		15-JUN-13	22-JUN-13	29-JUN-13	06-JUL-13	13-JUL-13
Total Volume In	mL	500	500	500	500	500
Total Volume Out	mL	450	445	430	450	445
Conductivity	mS/cm	38.2	35.3	37.6	37.1	35.1
pH	units	7.94	7.82	7.93	8.00	7.95
Acidity	mg/L CaCO3	1.4	1.7	1.2	1.5	1.6
Alkalinity, Total	mg/L CaCO3	11.6	11.3	12.8	12.3	11.5
Sulfate (SO4)	mg/L	3.51	3.29	3.15	2.89	3.02
Dissovled Metals						
Aluminum	mg/L	0.292	0.301	0.281	0.294	0.270
Antimony	mg/L	0.0149	0.0133	0.0142	0.0139	0.0123
Arsenic	mg/L	0.00160	0.00158	0.00161	0.00155	0.00142
Barium	mg/L	0.000411	0.000531	0.000577	0.000615	0.000512
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000025	0.000031	0.000046	0.000034	0.000035
Calcium	mg/L	6.20	5.45	6.03	6.03	5.40
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000083	0.000139	0.000172	0.000191	0.000144
Lithium	mg/L	0.00144	0.00061	0.00133	0.00147	0.00086
Magnesium	mg/L	0.101	0.0877	0.0974	0.0944	0.0894
Manganese	mg/L	0.0238	0.0221	0.0248	0.0247	0.0257
Mercury	mg/L	<0.0	<0.0	<0.0	<0.0	<0.0
Molybdenum	mg/L	0.000729	0.000683	0.000762	0.000733	0.000662
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	0.879	0.850	0.907	0.880	0.816
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.36	1.35	1.49	1.47	1.32
Silver	mg/L	<0.0	<0.0	<0.0	<0.0	<0.0
Sodium	mg/L	0.328	0.302	0.312	0.305	0.282
Strontium	mg/L	0.0131	0.0116	0.0132	0.0126	0.0119
Sulfur	mg/L	1.45	1.32	1.38	1.32	1.32
Thallium	mg/L	<0.0	<0.0	0.000016	<0.0	<0.0
Tin	mg/L	0.00031	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000173	0.000128	0.000162	0.000153	0.000130
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003

Table A6-14: Results of Waste Rock Humidity Cell Test BW-ARD-153

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Sample ID		BW-ARD-153-0	BW-ARD-153-1	BW-ARD-153-2	BW-ARD-153-3	BW-ARD-153-4	BW-ARD-153-5	BW-ARD-153-6	BW-ARD-153-7	BW-ARD-153-8	BW-ARD-153-9	BW-ARD-153-10	BW-ARD-153-11	BW-ARD-153-12	BW-ARD-153-13
Date Sampled		20-FEB-13	27-FEB-13	06-MAR-13	13-MAR-13	20-MAR-13	27-MAR-13	03-APR-13	10-APR-13	17-APR-13	24-APR-13	01-MAY-13	08-MAY-13	15-MAY-13	22-MAY-13
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	575	500	460	470	445	450	455	450	445	485	410	450	465	450
Conductivity	mS/cm	136	112	82.5	72.7	97.5	113	101	83.5	78.9	69.8	61.6	56.0	60.1	56.3
pH	units	8.01	7.84	7.65	7.69	7.49	7.38	7.33	7.28	7.40	7.26	6.92	6.92	6.95	6.93
Acidity	mg/L CaCO3	3.1	1.9	4.5	3.1	3.0	2.0	1.8	2.4	2.1	3.0	1.9	2.1	1.2	1.7
Alkalinity, Total	mg/L CaCO3	38.9	24.3	17.2	16.8	13.8	10.8	9.2	8.5	9.9	8.7	3.2	3.0	2.2	5.1
Sulfate (SO4)	mg/L	14.0	21.6	17.7	13.6	22.7	30.6	26.8	20.6	17.1	16.9	16.9	15.1	16.3	14.6
Dissolved Metals															
Aluminum	mg/L	0.0672	0.0842	0.0972	0.0734	0.118	0.0774	0.0597	0.0729	0.0714	0.0571	0.109	0.0528	0.0389	0.0341
Antimony	mg/L	0.00281	0.00378	0.00334	0.00324	0.00319	0.00242	0.00217	0.00226	0.00239	0.00185	0.00181	0.00148	0.00158	0.00149
Arsenic	mg/L	0.0109	0.0103	0.0140	0.0134	0.00706	0.00453	0.00375	0.00382	0.00393	0.00379	0.00454	0.00368	0.00342	0.00336
Barium	mg/L	0.00260	0.00247	0.00205	0.00193	0.00341	0.00408	0.00356	0.00299	0.00327	0.00261	0.00295	0.00215	0.00242	0.00227
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000081	0.000091	0.000090	0.000066	0.000148	0.000226	0.000231	0.000210	0.000253	0.000228	0.000256	0.000225	0.000265	0.000272
Calcium	mg/L	7.09	4.90	3.39	3.00	4.99	6.51	5.99	4.74	4.67	4.04	3.42	3.06	3.43	3.27
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00019	0.00016	0.00014	0.00010	0.00019	0.00030	0.00035	0.00032	0.00040	0.00036	0.00043	0.00039	0.00049	0.00051
Copper	mg/L	0.00143	0.00087	0.00094	0.00074	0.00102	0.00068	0.00059	0.00062	0.00060	<0.0005	0.00052	<0.0005	<0.0005	<0.0005
Iron	mg/L	0.033	0.102	0.133	0.108	0.187	0.115	0.108	0.109	0.134	0.086	0.170	0.086	0.061	0.048
Lead	mg/L	<0.00005	0.000054	0.000071	0.000053	0.000127	0.000077	0.000058	0.000070	0.000079	0.000054	0.000086	<0.00005	<0.00005	<0.00005
Lithium	mg/L	0.0169	0.0186	0.0140	0.0130	0.0165	0.0170	0.0139	0.0130	0.0139	0.0113	0.0110	0.00931	0.00880	0.00902
Magnesium	mg/L	1.30	0.894	0.638	0.603	0.965	1.29	1.16	0.883	0.919	0.791	0.723	0.601	0.673	0.625
Manganese	mg/L	0.0266	0.0440	0.0329	0.0300	0.0555	0.0821	0.0900	0.0800	0.0954	0.0839	0.0839	0.0751	0.0902	0.0899
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00371	0.00550	0.00424	0.00272	0.00180	0.00126	0.00108	0.00124	0.00116	0.000903	0.00105	0.000974	0.000911	0.00107
Nickel	mg/L	0.00108	0.00092	0.00063	<0.0005	0.00052	0.00068	0.00078	0.00071	0.00071	0.00064	0.00082	0.00069	0.00073	0.00069
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	mg/L	7.39	6.69	5.70	5.44	7.07	7.49	7.28	6.49	6.26	6.16	5.95	5.18	5.79	5.41
Selenium	mg/L	0.00026	0.00016	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	4.65	6.21	6.62	6.62	7.42	6.44	6.56	6.41	6.85	5.83	5.78	5.18	5.70	5.33
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	14.9	11.1	7.56	6.47	7.49	6.78	5.65	4.49	3.67	3.15	2.80	2.22	2.28	1.96
Strontium	mg/L	0.0411	0.0302	0.0201	0.0173	0.0298	0.0410	0.0363	0.0309	0.0292	0.0248	0.0206	0.0199	0.0203	0.0199
Sulfur	mg/L	5.21	7.49	6.06	4.52	7.72	10.5	9.11	6.77	6.24	5.50	5.34	4.95	5.28	4.73
Thallium	mg/L	0.000019	0.000012	0.000011	<0.00001	0.000018	0.000020	0.000022	0.000021	0.000024	0.000022	0.000021	0.000023	0.000024	0.000027
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000086	0.000033	0.000017	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Vanadium	mg/L	0.0016	0.0020	0.0026	0.0025	0.0020	0.0015	0.0014	0.0015	0.0015	0.0013	0.0017	0.0013	0.0014	0.0013
Zinc	mg/L	0.0047	0.0078	0.0086	0.0080	0.0145	0.0149	0.0151	0.0150	0.0174	0.0150	0.0225	0.0160	0.0180	0.0178

Table A6-14: Results of Waste Rock

Week	Units	14	15	16	17	18	19	20	21
Sample ID		BW-ARD-153-14	BW-ARD-153-15	BW-ARD-153-16	BW-ARD-153-17	BW-ARD-153-18	BW-ARD-153-19	BW-ARD-153-20	BW-ARD-153-21
Date Sampled		29-MAY-13	05-JUN-13	12-JUN-13	19-JUN-13	26-JUN-13	03-JUL-13	10-JUL-13	17-JUL-13
Total Volume In	mL	500	500	500	500	500	500	500	500
Total Volume Out	mL	430	485	470	420	425	490	435	455
Conductivity	mS/cm	58.0	53.7	53.1	50.2	52.3	47.6	50.9	47.2
pH	units	6.94	6.84	6.86	6.85	6.99	7.01	7.03	7.05
Acidity	mg/L CaCO3	4.6	5.0	2.5	2.5	2.5	1.8	2.0	3.2
Alkalinity, Total	mg/L CaCO3	4.2	3.6	3.3	2.9	4.2	4.2	4.8	5.1
Sulfate (SO4)	mg/L	14.9	15.3	13.5	12.4	12.8	11.7	11.8	11.0
Dissolved Metals									
Aluminum	mg/L	0.0583	0.0319	0.0322	0.0374	0.0363	0.0257	0.0294	0.0329
Antimony	mg/L	0.00136	0.00124	0.00125	0.00123	0.00109	0.00110	0.00117	0.00109
Arsenic	mg/L	0.00323	0.00327	0.00325	0.00341	0.00323	0.00320	0.00297	0.00315
Barium	mg/L	0.00249	0.00217	0.00215	0.00206	0.00223	0.00193	0.00200	0.00177
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000315	0.000302	0.000312	0.000301	0.000330	0.000289	0.000319	0.000290
Calcium	mg/L	3.49	3.32	3.45	3.01	3.38	3.04	3.16	2.97
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00057	0.00056	0.00058	0.00054	0.00061	0.00055	0.00061	0.00054
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	0.085	0.045	0.040	0.059	0.058	0.037	0.060	0.059
Lead	mg/L	0.000057	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	mg/L	0.00857	0.00820	0.00832	0.00790	0.00829	0.00758	0.00765	0.00752
Magnesium	mg/L	0.684	0.601	0.625	0.577	0.636	0.582	0.619	0.589
Manganese	mg/L	0.0912	0.0834	0.0892	0.0823	0.0917	0.0860	0.0944	0.0858
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.0	<0.0	<0.0	<0.0	<0.0
Molybdenum	mg/L	0.000966	0.00104	0.00105	0.00108	0.00101	0.000964	0.000899	0.000941
Nickel	mg/L	0.00076	0.00072	0.00076	0.00070	0.00076	0.00067	0.00074	0.00064
Phosphorus	mg/L	<0.30	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	5.45	5.16	5.18	5.13	5.12	5.04	5.12	4.92
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	5.34	4.98	4.82	4.84	4.71	4.43	4.62	4.44
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	1.88	1.54	1.45	1.26	1.23	1.09	1.02	0.932
Strontium	mg/L	0.0214	0.0188	0.0199	0.0180	0.0201	0.0185	0.0199	0.0181
Sulfur	mg/L	5.04	4.77	4.57	4.37	4.39	3.87	3.86	3.81
Thallium	mg/L	0.000023	0.000025	0.000024	0.000025	0.000026	0.000024	0.000028	0.000026
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Vanadium	mg/L	0.0012	0.0012	0.0011	0.0011	0.0010	0.0010	<0.001	<0.001
Zinc	mg/L	0.0209	0.0197	0.0197	0.0189	0.0196	0.0171	0.0205	0.0162

Table A6-15: Results of Waste Rock Humidity Cell Test BW-ARD-238

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12
Sample ID		BW-ARD-238-0	BW-ARD-238-1	BW-ARD-238-2	BW-ARD-238-3	BW-ARD-238-4	BW-ARD-238-5	BW-ARD-238-6	BW-ARD-238-7	BW-ARD-238-8	BW-ARD-238-9	BW-ARD-238-10	BW-ARD-238-11	BW-ARD-238-12
Date Sampled		20-FEB-13	27-FEB-13	06-MAR-13	13-MAR-13	20-MAR-13	27-MAR-13	03-APR-13	10-APR-13	17-APR-13	24-APR-13	01-MAY-13	08-MAY-13	15-MAY-13
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	650	485	450	465	450	460	450	450	475	475	425	460	470
Conductivity	mS/cm	370	155	63.1	45.9	38.0	38.1	39.1	42.2	44.3	47.9	47.5	46.1	42.5
pH	units	6.61	6.80	6.84	6.96	6.85	6.94	6.92	6.83	6.87	6.83	6.72	6.65	6.64
Acidity	mg/L CaCO3	6.3	3.2	5.0	3.7	2.6	2.0	3.6	1.8	2.6	3.7	2.5	2.5	1.5
Alkalinity, Total	mg/L CaCO3	5.0	3.0	3.1	3.1	2.7	3.2	2.9	2.7	2.6	2.4	<2.00	<2.00	<2.00
Sulfate (SO4)	mg/L	157	53.7	20.3	14.3	11.4	11.1	11.7	13.0	13.1	16.3	16.6	15.6	15.5
Dissolved Metals														
Aluminum	mg/L	<0.005	<0.005	0.0198	0.0373	0.0274	0.0772	0.0468	0.0287	0.0253	0.0142	0.0320	0.0215	0.0295
Antimony	mg/L	0.00619	0.00687	0.00685	0.00746	0.00717	0.00821	0.00764	0.00728	0.00772	0.00796	0.00666	0.00655	0.00718
Arsenic	mg/L	0.00347	0.00648	0.00362	0.00181	0.00127	0.00125	0.00132	0.00089	0.00081	0.00072	0.00073	0.00058	0.00064
Barium	mg/L	0.0574	0.0487	0.0133	0.00881	0.00703	0.00805	0.00900	0.00837	0.00969	0.0110	0.0122	0.0109	0.0109
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.0110	0.00426	0.00165	0.00116	0.00100	0.00112	0.00146	0.00147	0.00178	0.00215	0.00239	0.00240	0.00239
Calcium	mg/L	40.6	11.8	3.69	2.41	2.00	1.96	2.12	2.43	2.67	2.95	3.07	2.98	2.68
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0181	0.00787	0.00271	0.00197	0.00160	0.00170	0.00201	0.00208	0.00221	0.00251	0.00264	0.00254	0.00234
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	0.054	0.034	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0686	0.0252	0.00999	0.00739	0.00631	0.00984	0.00908	0.00927	0.0107	0.0122	0.0158	0.0145	0.0168
Lithium	mg/L	0.0114	0.00764	0.00514	0.00414	0.00348	0.00368	0.00303	0.00314	0.00345	0.00373	0.00376	0.00309	0.00289
Magnesium	mg/L	5.25	1.69	0.558	0.400	0.328	0.352	0.422	0.398	0.448	0.489	0.517	0.483	0.446
Manganese	mg/L	9.05	3.11	1.13	0.814	0.698	0.804	0.988	0.965	1.06	1.25	1.33	1.36	1.31
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000124	0.000140	0.000161	0.000141	0.000131	0.000148	0.000126	0.000109	0.000107	0.000102	0.000072	0.000093	0.000099
Nickel	mg/L	0.0117	0.00554	0.00183	0.00124	0.00101	0.00108	0.00115	0.00114	0.00105	0.00110	0.00119	0.00121	0.00104
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	mg/L	17.1	9.84	5.57	4.62	3.98	3.83	4.65	4.28	4.14	4.44	4.19	4.22	3.70
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.80	3.20	2.87	2.77	2.49	2.71	2.56	2.25	2.45	2.64	1.94	2.10	2.37
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	5.49	3.17	1.39	1.01	0.746	0.640	0.572	0.462	0.384	0.340	0.291	0.248	0.209
Strontium	mg/L	0.391	0.154	0.0482	0.0301	0.0235	0.0246	0.0259	0.0292	0.0325	0.0345	0.0365	0.0355	0.0301
Sulfur	mg/L	55.8	19.0	7.28	4.68	3.89	3.81	4.02	4.47	4.84	5.29	5.34	5.18	4.73
Thallium	mg/L	0.000149	0.000077	0.000046	0.000032	0.000032	0.000035	0.000035	0.000035	0.000043	0.000042	0.000043	0.000045	0.000038
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.709	0.288	0.109	0.0827	0.0695	0.0754	0.0947	0.0950	0.108	0.127	0.136	0.137	0.136

Table A6-15: Results of Waste Roc

Week	Units	13	14	15	16	17	18	19	20	21
Sample ID		BW-ARD-238-13	BW-ARD-238-14	BW-ARD-238-15	BW-ARD-238-16	BW-ARD-238-17	BW-ARD-238-18	BW-ARD-238-19	BW-ARD-238-20	BW-ARD-238-21
Date Sampled		22-MAY-13	29-MAY-13	05-JUN-13	12-JUN-13	19-JUN-13	26-JUN-13	03-JUL-13	10-JUL-13	17-JUL-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	450	450	440	470	420	440	450	455	465
Conductivity	mS/cm	39.6	39.6	39.3	41.4	35.6	50.5	43.9	43.7	44.5
pH	units	6.68	6.73	6.67	6.70	6.62	6.75	6.74	6.73	6.73
Acidity	mg/L CaCO3	1.8	14.1	3.9	5.6	2.5	2.5	2.8	2.1	3.9
Alkalinity, Total	mg/L CaCO3	2.7	2.2	<2.00	<2.00	<2.0	2.8	2.4	2.6	2.6
Sulfate (SO4)	mg/L	12.8	12.4	13.0	11.9	9.14	13.9	12.2	11.5	11.9
Dissolved Metals										
Aluminum	mg/L	0.0355	0.0288	0.0123	0.0273	0.0193	0.0153	0.0138	0.0133	0.0114
Antimony	mg/L	0.00652	0.00568	0.00557	0.00606	0.00469	0.00551	0.00474	0.00474	0.00539
Arsenic	mg/L	0.00061	0.00056	0.00054	0.00057	0.00054	0.00105	0.00057	0.00055	0.00067
Barium	mg/L	0.00968	0.00973	0.0100	0.0112	0.00925	0.0152	0.0135	0.0137	0.0158
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00227	0.00244	0.00259	0.00306	0.00260	0.00447	0.00415	0.00438	0.00521
Calcium	mg/L	2.46	2.49	2.56	2.70	2.26	3.51	2.90	2.78	2.87
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00328	<0.0005
Cobalt	mg/L	0.00205	0.00213	0.00213	0.00236	0.00213	0.00340	0.00318	0.00338	0.00380
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.0159	0.0154	0.0145	0.0192	0.0198	0.0234	0.0220	0.0265	0.0274
Lithium	mg/L	0.00294	0.00255	0.00280	0.00293	0.00237	0.00350	0.00302	0.00321	0.00375
Magnesium	mg/L	0.404	0.417	0.395	0.445	0.368	0.542	0.467	0.448	0.479
Manganese	mg/L	1.30	1.27	1.27	1.51	1.32	1.96	1.84	1.89	1.97
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000158	0.000070	0.000079	0.000077	0.000059	0.000084	0.000074	0.000085	0.000064
Nickel	mg/L	0.00091	0.00085	0.00082	0.00092	0.00080	0.00120	0.00114	0.00136	0.00130
Phosphorus	mg/L	<0.30	<0.30	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	3.38	3.17	3.15	3.18	2.70	3.57	3.20	3.04	3.14
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	2.10	1.82	1.87	2.11	1.45	2.02	1.85	1.86	2.18
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.186	0.163	0.148	0.141	0.115	0.148	0.112	0.104	0.104
Strontium	mg/L	0.0281	0.0284	0.0273	0.0320	0.0246	0.0393	0.0335	0.0328	0.0349
Sulfur	mg/L	4.17	4.20	4.14	4.07	3.30	4.72	3.98	3.83	4.04
Thallium	mg/L	0.000037	0.000034	0.000037	0.000039	0.000033	0.000042	0.000043	0.000041	0.000036
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.120	0.123	0.130	0.138	0.129	0.203	0.204	0.210	0.250

Table A6-16: Results of Waste Rock Humidity Cell Test BW-ARD-473

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Sample ID		473-0	473-1	473-2	473-3	473-4	473-5	473-6	473-7	473-8	473-9	473-10	473-11	473-12	473-13	473-14	473-15	473-16	473-17	473-18	473-19
Date Sampled		15-DEC-12	22-DEC-12	29-DEC-12	05-JAN-13	12-JAN-13	19-JAN-13	26-JAN-13	02-FEB-13	09-FEB-13	16-FEB-13	23-FEB-13	02-MAR-13	09-MAR-13	16-MAR-13	23-MAR-13	30-MAR-13	06-APR-13	13-APR-13	20-APR-13	27-APR-13
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	670	470	475	465	470	465	500	475	465	465	480	480	475	490	475	465	475	485	475	475
Conductivity	mS/cm	158	117	74.3	66.0	61.9	61.7	59.7	58.1	53.7	52.5	53.2	51.2	51.7	45.2	47.6	44.7	40.4	42.5	40.1	39.4
pH	units	7.37	7.56	7.55	7.53	7.53	7.46	7.49	7.44	7.54	7.44	7.50	7.38	7.46	7.45	7.53	7.54	7.50	7.44	7.42	7.47
Acidity	mg/L CaCO3	3.9	2.4	2.2	3.1	3.4	2.6	3.4	2.6	2.2	3.1	3.0	2.5	2.4	4.6	3.9	2.2	2.6	2.4	4.3	2.9
Alkalinity, Total	mg/L CaCO3	16.4	11.8	9.9	10.8	10.6	10.5	9.7	10.7	9.6	9.4	10.7	9.4	10.0	8.5	10.2	9.3	8.5	9.4	8.8	8.3
Sulfate (SO4)	mg/L	39.2	33.3	21.0	17.1	13.7	11.9	10.4	9.22	8.75	8.13	8.65	8.17	7.50	6.49	6.40	6.68	5.62	5.93	5.50	4.94
Dissolved Metals																					
Aluminum	mg/L	0.0329	0.0544	0.0590	0.0873	0.208	0.0442	0.148	0.105	0.0300	0.0517	0.154	0.0556	0.0600	0.0269	0.158	0.107	0.0442	0.112	0.0981	0.0713
Antimony	mg/L	0.00611	0.00808	0.00699	0.00906	0.00924	0.00864	0.00829	0.00764	0.00707	0.00540	0.00699	0.00685	0.00694	0.00639	0.00630	0.00595	0.00511	0.00492	0.00511	0.00515
Arsenic	mg/L	0.00196	0.00228	0.00150	0.00138	0.00137	0.00122	0.00113	0.00128	0.00149	0.00158	0.00156	0.00176	0.00176	0.00182	0.00167	0.00170	0.00156	0.00156	0.00153	0.00146
Barium	mg/L	0.0196	0.0143	0.00881	0.00882	0.0102	0.00880	0.00977	0.00968	0.00840	0.00803	0.00918	0.00805	0.00831	0.00664	0.00837	0.00670	0.00567	0.00659	0.00550	0.00578
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000222	0.000196	0.000152	0.000154	0.000155	0.000210	0.000246	0.000278	0.000267	0.000270	0.000314	0.000338	0.000379	0.000325	0.000356	0.000334	0.000317	0.000348	0.000342	0.000334
Calcium	mg/L	9.42	7.11	4.28	3.93	3.73	3.87	3.81	3.98	3.55	3.53	3.68	3.49	3.62	3.10	3.35	3.09	2.78	2.98	2.75	2.72
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00323	0.00169	0.00135	0.00145	0.00165	0.00215	0.00277	0.00347	0.00311	0.00311	0.00385	0.00419	0.00473	0.00405	0.00490	0.00438	0.00416	0.00458	0.00462	0.00451
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	0.050	<0.03	<0.03	<0.03	<0.03	<0.03	0.031	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000188	0.000204	0.000160	0.000274	0.000701	0.000259	0.000525	0.000438	0.000498	0.000327	0.000749	0.000464	0.000570	0.000423	0.000774	0.000688	0.000517	0.000868	0.000586	0.000556
Lithium	mg/L	0.0345	0.0257	0.0165	0.0137	0.0118	0.0103	0.00801	0.00761	0.00622	0.00438	0.00543	0.00548	0.00462	0.00424	0.00503	0.00443	0.00375	0.00406	0.00422	0.00395
Magnesium	mg/L	1.82	1.50	0.831	0.788	0.764	0.732	0.771	0.805	0.660	0.712	0.739	0.734	0.738	0.637	0.714	0.613	0.561	0.615	0.577	0.547
Manganese	mg/L	3.07	2.78	2.08	1.88	1.74	2.04	2.16	2.42	2.06	2.23	2.27	2.40	2.60	2.28	2.34	2.19	2.14	1.99	2.18	2.06
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00309	0.00349	0.00269	0.00280	0.00247	0.00205	0.00169	0.00159	0.00140	0.00115	0.00139	0.00141	0.00142	0.00139	0.00137	0.00137	0.00117	0.00123	0.00132	0.00152
Nickel	mg/L	0.00793	0.00266	0.00176	0.00164	0.00179	0.00210	0.00235	0.00281	0.00219	0.00219	0.00247	0.00268	0.00288	0.00228	0.00265	0.00230	0.00214	0.00225	0.00220	0.00215
Phosphorus	mg/L	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	mg/L	13.2	9.75	6.36	6.13	6.10	5.28	5.10	4.79	3.77	3.85	3.99	3.83	3.66	3.40	3.50	3.09	2.94	2.83	2.82	2.63
Selenium	mg/L	0.00017	0.00016	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.72	2.93	2.10	2.60	2.77	2.19	2.12	2.10	1.82	1.68	1.96	1.69	1.76	1.50	1.66	1.64	1.35	1.63	1.47	1.44
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	5.68	3.59	1.81	1.38	0.983	0.683	0.489	0.383	0.265	0.229	0.199	0.164	0.139	0.121	0.115	0.106	0.057	0.091	0.088	0.069
Strontium	mg/L	0.0451	0.0337	0.0206	0.0184	0.0183	0.0195	0.0189	0.0187	0.0168	0.0132	0.0182	0.0177	0.0173	0.0147	0.0169	0.0152	0.0132	0.0140	0.0127	0.0143
Sulfur	mg/L	15.4	12.6	6.78	5.56	4.45	3.93	3.63	3.27	2.86	2.83	2.88	2.74	2.60	2.40	2.38	2.23	1.99	2.03	2.02	1.84
Thallium	mg/L	0.000086	0.000062	0.000046	0.000047	0.000047	0.000038	0.000048	0.000041	0.000032	0.000027	0.000039	0.000033	0.000035	0.000027	0.000032	0.000029	0.000027	0.000032	0.000027	0.000028
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000041	0.000043	0.000029	0.000039	0.000049	0.000024	0.000035	0.000030	0.000023	0.000018	0.000028	0.000021	0.000025	0.000018	0.000029	0.000020	0.000016	0.000023	0.000018	0.000017
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.429	0.204	0.173	0.129	0.124	0.163	0.183	0.204	0.169	0.151	0.172	0.184	0.207	0.153	0.177	0.156	0.146	0.158	0.153	0.144

Table A6-16: Results of Waste Roc

Week	Units	20	21	22	23	24	25	26	27	28	29	30
Sample ID		473-20	473-21	473-22	473-23	473-24	473-25	473-26	473-27	473-28	473-29	473-30
Date Sampled			11-MAY-13	18-MAY-13	25-MAY-13	01-JUN-13	08-JUN-13	15-JUN-13	22-JUN-13	29-JUN-13	06-JUL-13	13-JUL-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	450	475	475	430	450	430	470	450	425	460	450
Conductivity	mS/cm	31.1	38.2	35.0	33.9	33.8	33.2	34.5	30.8	32.4	32.4	32.3
pH	units	7.36	7.41	7.44	7.44	7.39	7.43	7.42	7.35	7.43	7.43	7.50
Acidity	mg/L CaCO3	3.5	2.4	4.7	3.0	2.2	3.2	1.9	1.7	1.7	1.9	1.3
Alkalinity, Total	mg/L CaCO3	6.1	8.7	6.6	6.7	6.1	6.3	25.3	5.9	6.6	6.1	6.7
Sulfate (SO4)	mg/L	3.80	4.74	4.46	4.52	4.35	4.72	4.35	4.31	4.01	4.35	4.30
Dissolved Metals												
Aluminum	mg/L	0.0448	0.0725	0.0886	0.0396	0.0656	0.0364	0.0493	0.0841	0.167	0.0426	0.0411
Antimony	mg/L	0.00413	0.00474	0.00370	0.00313	0.00282	0.00784	0.00208	0.00174	0.00164	0.00135	0.00135
Arsenic	mg/L	0.00137	0.00140	0.00125	0.00119	0.00105	0.00212	0.00086	0.00082	0.00077	0.00066	0.00061
Barium	mg/L	0.00414	0.00511	0.00489	0.00406	0.00412	0.00381	0.00424	0.00382	0.00460	0.00365	0.00350
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000270	0.000329	0.000283	0.000255	0.000256	0.000248	0.000295	0.000248	0.000265	0.000237	0.000247
Calcium	mg/L	1.92	2.76	2.38	2.28	2.33	2.35	2.48	2.07	2.27	2.33	2.25
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00344	0.00407	0.00361	0.00325	0.00332	0.00331	0.00409	0.00318	0.00349	0.00334	0.00345
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000380	0.000616	0.000657	0.000293	0.000490	0.000380	0.000585	0.000591	0.000846	0.000370	0.000385
Lithium	mg/L	0.00368	0.00387	0.00385	0.00352	0.00355	0.00361	0.00401	0.00328	0.00367	0.00417	0.00355
Magnesium	mg/L	0.413	0.552	0.502	0.476	0.464	0.547	0.504	0.422	0.475	0.458	0.464
Manganese	mg/L	1.69	2.06	1.99	1.84	1.86	1.85	1.92	1.81	1.90	1.81	1.80
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.0	<0.0	<0.0	<0.0	<0.0
Molybdenum	mg/L	0.00135	0.00161	0.00127	0.00109	0.000955	0.000914	0.000835	0.000741	0.000674	0.000619	0.000544
Nickel	mg/L	0.00164	0.00180	0.00147	0.00129	0.00127	0.00131	0.00189	0.00119	0.00133	0.00128	0.00130
Phosphorus	mg/L	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	2.28	2.40	2.20	2.16	2.05	2.09	2.07	1.93	2.07	1.96	1.92
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.11	1.47	1.40	1.19	1.24	1.23	1.25	1.10	1.31	1.11	1.09
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.0	<0.0	<0.0	<0.0	<0.0
Sodium	mg/L	0.068	0.063	0.055	0.055	0.062	0.059	0.062	0.053	0.056	0.057	0.054
Strontium	mg/L	0.00980	0.0125	0.0112	0.0107	0.0106	0.0116	0.0113	0.00936	0.0101	0.00993	0.0103
Sulfur	mg/L	1.68	1.79	1.80	1.56	1.77	1.68	1.69	1.61	1.62	1.73	1.74
Thallium	mg/L	0.000021	0.000029	0.000021	0.000022	0.000022	0.000035	0.000022	0.000022	0.000023	0.000022	0.000021
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000013	0.000017	0.000014	0.000011	0.000013	0.000055	0.000011	0.000013	0.000018	<0.0	<0.0
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.115	0.117	0.0964	0.0808	0.0830	0.0822	0.0934	0.0748	0.0767	0.0646	0.0641

Table A6-17: Results of Waste Rock Humidity Cell Test BW-ARD-338

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12
Sample ID		BW-ARD-338-0	BW-ARD-338-1	BW-ARD-338-2	BW-ARD-338-3	BW-ARD-338-4	BW-ARD-338-5	BW-ARD-338-6	BW-ARD-338-7	BW-ARD-338-8	BW-ARD-338-9	BW-ARD-338-10	BW-ARD-338-11	BW-ARD-338-12
Date Sampled		15-SEP-12	22-SEP-12	29-SEP-12	06-OCT-12	13-OCT-12	20-OCT-12	27-OCT-12	03-NOV-12	10-NOV-12	17-NOV-12	24-NOV-12	01-DEC-12	08-DEC-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	640	460	460	445	465	460	470	475	470	455	470	465	465
Conductivity	mS/cm	292	279	205	159	157	188	186	168	162	165	150	159	150
pH	units	8.41	8.09	8.20	8.33	8.19	8.22	8.10	8.15	8.12	8.16	8.18	8.15	8.05
Acidity	mg/L CaCO3	4.6	3.8	2.9	2.9	2.4	1.5	1.5	1.2	1.5	2.3	1.1	2.1	2.3
Alkalinity, Total	mg/L CaCO3	34.4	36.8	40.8	38.7	39.2	35.8	37.4	39.9	39.0	37.7	37.0	38.4	36.1
Sulfate (SO4)	mg/L	83.9	87.2	52.3	39.8	27.6	40.1	41.5	30.0	29.4	30.2	27.0	27.8	26.6
Dissolved Metals														
Aluminum	mg/L	0.0713	0.0438	0.0521	0.0687	0.0566	0.0478	0.0381	0.0451	0.0462	0.0493	0.0523	0.0485	0.0435
Antimony	mg/L	0.0458	0.0504	0.0492	0.0385	0.0386	0.0331	0.0327	0.0306	0.0314	0.0302	0.0277	0.0301	0.0261
Arsenic	mg/L	0.00283	0.00539	0.00732	0.00936	0.00930	0.00702	0.00616	0.00638	0.00632	0.00598	0.00579	0.00528	0.00513
Barium	mg/L	0.00216	0.00193	0.00135	0.000905	0.000933	0.00110	0.00112	0.00100	0.00105	0.00111	0.000899	0.00102	0.000932
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	<0.00001	0.000022	0.000024	0.000020	0.000027	0.000082	0.000115	0.000124	0.000145	0.000174	0.000144	0.000186	0.000184
Calcium	mg/L	42.9	42.6	31.7	21.3	21.8	29.1	27.0	23.2	23.6	24.0	21.3	23.8	21.9
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00018	0.00027	0.00022	0.00016	0.00016	0.00032	0.00033	0.00028	0.00029	0.00031	0.00022	0.00026	0.00023
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000054	0.000137	0.000221	0.000232	0.000367	0.00145	0.00213	0.00227	0.00254	0.00284	0.00284	0.00348	0.00329
Lithium	mg/L	0.0265	0.0240	0.0216	0.0160	0.0144	0.0153	0.0157	0.0134	0.0136	0.0144	0.0131	0.0120	0.0118
Magnesium	mg/L	0.615	0.662	0.499	0.377	0.360	0.476	0.469	0.417	0.413	0.436	0.393	0.394	0.370
Manganese	mg/L	0.0273	0.0441	0.0381	0.0269	0.0286	0.0463	0.0518	0.0493	0.0518	0.0589	0.0445	0.0523	0.0445
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00448	0.00435	0.00267	0.00167	0.00131	0.000979	0.000874	0.000773	0.000773	0.000724	0.000705	0.000673	0.000616
Nickel	mg/L	0.00160	0.00109	0.00065	<0.0005	<0.0005	0.00055	0.00056	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30
Potassium	mg/L	6.00	5.04	4.30	3.20	3.12	3.31	3.15	2.99	3.04	3.05	2.82	2.85	2.67
Selenium	mg/L	0.00035	0.00024	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	2.19	3.12	3.34	2.86	2.98	2.71	2.65	2.57	2.71	2.59	2.67	2.64	2.45
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.000013
Sodium	mg/L	13.5	12.0	9.57	7.46	6.62	6.95	7.16	6.01	5.60	5.58	5.21	5.06	4.74
Strontium	mg/L	0.241	0.225	0.183	0.125	0.127	0.160	0.157	0.138	0.130	0.137	0.127	0.137	0.124
Sulfur	mg/L	35.4	32.3	19.5	11.7	11.4	16.1	14.8	10.9	10.3	11.2	9.45	9.79	9.16
Thallium	mg/L	0.000022	0.000018	0.000017	0.000011	0.000011	0.000014	0.000013	0.000013	0.000013	0.000015	0.000012	0.000015	0.000015
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000308	0.000442	0.000461	0.000328	0.000328	0.000252	0.000233	0.000246	0.000215	0.000194	0.000157	0.000166	0.000147
Vanadium	mg/L	0.0016	0.0018	0.0022	0.0025	0.0021	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0031	<0.003

Table A6-17: Results of Waste Rock I

Week	Units	13	14	15	16	17	18	19	20	21	22	23	24	25
Sample ID		BW-ARD-338-13	BW-ARD-338-14	BW-ARD-338-15	BW-ARD-338-16	BW-ARD-338-17	BW-ARD-338-18	BW-ARD-338-19	BW-ARD-338-20	BW-ARD-338-21	BW-ARD-338-22	BW-ARD-338-23	BW-ARD-338-24	BW-ARD-338-25
Date Sampled		15-DEC-12	22-DEC-12	29-DEC-12	05-JAN-13	12-JAN-13	19-JAN-13	26-JAN-13	02-FEB-13	09-FEB-13	16-FEB-13	23-FEB-13	02-MAR-13	09-MAR-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	465	470	460	475	455	490	470	475	470	460	480	480	460
Conductivity	mS/cm	139	145	142	137	136	133	132	127	120	120	126	123	128
pH	units	8.20	8.14	8.22	8.15	8.11	8.10	8.14	8.15	8.20	8.05	8.20	8.03	8.10
Acidity	mg/L CaCO3	2.0	1.2	1.3	2.4	<1.	2.4	2.0	2.0	1.5	1.9	1.9	1.5	2.8
Alkalinity, Total	mg/L CaCO3	37.1	38.7	38.7	38.4	38.9	39.0	38.8	38.9	35.8	34.3	37.6	37.8	39.5
Sulfate (SO4)	mg/L	27.4	24.8	24.5	23.1	23.2	21.3	20.5	18.7	18.3	18.0	20.2	18.0	17.4
Dissolved Metals														
Aluminum	mg/L	0.0498	0.0472	0.0498	0.0434	0.0412	0.0458	0.0458	0.0422	0.0587	0.0595	0.0429	0.0563	0.0468
Antimony	mg/L	0.0261	0.0264	0.0254	0.0256	0.0254	0.0238	0.0231	0.0213	0.0210	0.0168	0.0202	0.0204	0.0218
Arsenic	mg/L	0.00547	0.00500	0.00464	0.00514	0.00466	0.00447	0.00481	0.00433	0.00473	0.00468	0.00444	0.00457	0.00456
Barium	mg/L	0.000921	0.000933	0.00101	0.000923	0.000928	0.000883	0.000928	0.000848	0.000914	0.000894	0.000889	0.00102	0.000961
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000180	0.000218	0.000214	0.000240	0.000227	0.000236	0.000260	0.000238	0.000196	0.000194	0.000240	0.000238	0.000266
Calcium	mg/L	21.2	22.0	20.7	20.8	20.8	19.4	19.8	19.2	18.0	17.9	18.1	19.0	20.1
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00022	0.00023	0.00021	0.00021	0.00021	0.00020	0.00020	0.00020	0.00017	0.00017	0.00018	0.00018	0.00019
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.00319	0.00347	0.00353	0.00373	0.00359	0.00370	0.00368	0.00351	0.00327	0.00260	0.00367	0.00380	0.00410
Lithium	mg/L	0.0113	0.0110	0.0111	0.0110	0.0110	0.0109	0.00929	0.00940	0.00860	0.00767	0.00911	0.00932	0.00950
Magnesium	mg/L	0.363	0.369	0.374	0.360	0.357	0.327	0.346	0.327	0.304	0.324	0.338	0.341	0.344
Manganese	mg/L	0.0456	0.0502	0.0475	0.0495	0.0465	0.0445	0.0475	0.0439	0.0394	0.0381	0.0436	0.0421	0.0426
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000622	0.000629	0.000600	0.000577	0.000649	0.000639	0.000585	0.000626	0.000581	0.000523	0.000633	0.000616	0.000628
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	2.70	2.64	2.59	2.53	2.50	2.31	2.34	2.20	2.12	2.27	2.38	2.35	2.37
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	2.41	2.48	2.37	2.36	2.37	2.14	2.11	2.11	1.97	1.93	1.80	2.05	1.97
Silver	mg/L	0.000016	0.000015	0.000018	0.000014	0.000014	0.000017	0.000016	0.000014	0.000022	0.000028	0.000017	0.000026	0.000021
Sodium	mg/L	4.43	4.37	4.29	3.98	3.94	3.74	3.66	3.45	3.44	3.32	3.46	3.42	3.30
Strontium	mg/L	0.117	0.120	0.127	0.114	0.117	0.115	0.103	0.103	0.0980	0.0864	0.107	0.106	0.113
Sulfur	mg/L	8.79	8.84	7.92	7.38	7.50	6.71	7.19	6.40	6.10	6.09	6.30	5.97	5.80
Thallium	mg/L	0.000015	0.000016	0.000015	0.000014	0.000016	0.000013	0.000014	0.000012	0.000011	0.000017	0.000014	0.000014	0.000015
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000135	0.000122	0.000117	0.000115	0.000114	0.000110	0.000103	0.000095	0.000087	0.000077	0.000091	0.000087	0.000099
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.0033	0.0032	0.0034	0.0036	0.0031	0.0033	0.0039	0.0034	<0.003	<0.003	0.0033	0.0035	0.0039

Table A6-17: Results of Waste Rock I

Week	Units	26	27	28	29	30	31	32	33	34	35	36	37
Sample ID		BW-ARD-338-26	BW-ARD-338-27	BW-ARD-338-28	BW-ARD-338-29	BW-ARD-338-30	BW-ARD-338-31	BW-ARD-338-32	BW-ARD-338-33	BW-ARD-338-34	BW-ARD-338-35	BW-ARD-338-36	BW-ARD-338-37
Date Sampled		16-MAR-13	23-MAR-13	30-MAR-13	06-APR-13	13-APR-13	20-APR-13	27-APR-13		11-MAY-13	18-MAY-13	25-MAY-13	01-JUN-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	480	460	475	470	475	470	475	445	475	455	430	430
Conductivity	mS/cm	120	123	125	113	121	119	115	97.9	116	112	109	108
pH	units	8.19	8.14	8.24	8.28	8.26	8.19	8.27	8.19	8.15	8.15	8.06	8.08
Acidity	mg/L CaCO3	2.7	2.4	1.3	1.7	1.7	1.9	7.2	2.0	8.0	8.1	2.1	2.8
Alkalinity, Total	mg/L CaCO3	36.2	39.7	38.9	33.4	38.9	37.9	36.2	28.7	32.5	29.1	27.7	26.5
Sulfate (SO4)	mg/L	16.5	17.3	18.0	16.9	17.6	15.6	17.1	16.4	20.0	19.9	19.9	16.4
Dissolved Metals													
Aluminum	mg/L	0.0555	0.0635	0.0447	0.0437	0.0550	0.0637	0.0552	0.0615	0.0563	0.0625	0.0525	0.0582
Antimony	mg/L	0.0186	0.0180	0.0181	0.0166	0.0175	0.0169	0.0169	0.0148	0.0200	0.0172	0.0171	0.0188
Arsenic	mg/L	0.00485	0.00443	0.00477	0.00544	0.00511	0.00530	0.00540	0.00780	0.00757	0.00809	0.00888	0.00896
Barium	mg/L	0.000886	0.00109	0.000875	0.000782	0.000954	0.000981	0.000950	0.000724	0.000845	0.000881	0.000774	0.000771
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000210	0.000211	0.000167	0.000125	0.000139	0.000151	0.000128	0.000078	0.000157	0.000122	0.000126	0.000109
Calcium	mg/L	18.6	19.1	19.8	17.6	19.2	18.6	18.7	14.7	18.2	17.2	17.0	16.3
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00015	0.00013	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.00338	0.00319	0.00230	0.00189	0.00212	0.00188	0.00183	0.00105	0.00219	0.00172	0.00146	0.00157
Lithium	mg/L	0.00868	0.00916	0.00902	0.00754	0.00906	0.00859	0.00839	0.00665	0.00757	0.00717	0.00712	0.00646
Magnesium	mg/L	0.318	0.342	0.312	0.289	0.321	0.320	0.296	0.236	0.280	0.280	0.260	0.253
Manganese	mg/L	0.0311	0.0210	0.0102	0.00587	0.00477	0.00460	0.00276	0.00187	0.00384	0.00238	0.00271	0.00191
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000561	0.000604	0.000792	0.00126	0.00177	0.00181	0.00190	0.00221	0.00270	0.00230	0.00231	0.00213
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	mg/L	2.29	2.42	2.29	2.25	2.15	2.28	2.23	1.88	2.08	2.01	2.03	1.93
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.91	1.93	1.97	1.70	1.84	1.81	1.77	1.55	1.74	1.72	1.68	1.64
Silver	mg/L	0.000020	0.000032	0.000020	0.000030	0.000056	0.000070	0.000062	0.000052	0.000072	0.000081	0.000069	0.000046
Sodium	mg/L	3.29	3.33	3.08	2.92	3.01	2.90	2.71	2.33	2.69	2.50	2.51	2.51
Strontium	mg/L	0.0995	0.103	0.103	0.0924	0.101	0.101	0.0986	0.0763	0.0876	0.0861	0.0822	0.0797
Sulfur	mg/L	5.87	5.68	6.00	5.43	5.85	5.77	5.38	5.38	6.69	6.87	6.57	6.57
Thallium	mg/L	0.000013	0.000015	0.000016	0.000016	0.000013	0.000014	0.000014	0.000011	0.000013	0.000012	0.000015	0.000013
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000083	0.000086	0.000089	0.000080	0.000086	0.000083	0.000078	0.000054	0.000061	0.000051	0.000040	0.000046
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Table A6-17: Results of Waste Rock I

Week	Units	38	39	40	41	42	43
Sample ID		BW-ARD-338-38	BW-ARD-338-39	BW-ARD-338-40	BW-ARD-338-41	BW-ARD-338-42	BW-ARD-338-43
Date Sampled		08-JUN-13	15-JUN-13	22-JUN-13	29-JUN-13	06-JUL-13	13-JUL-13
Total Volume In	mL	500	500	500	500	500	500
Total Volume Out	mL	425	445	430	425	445	435
Conductivity	mS/cm	99.0	107	95.6	99.7	102	104
pH	units	8.21	8.13	8.06	8.21	8.12	8.20
Acidity	mg/L CaCO3	4.4	1.5	1.5	1.4	1.6	<1.0
Alkalinity, Total	mg/L CaCO3	24.9	26.3	23.7	26.1	24.8	23.7
Sulfate (SO4)	mg/L	19.5	19.4	18.5	18.2	17.7	18.1
Dissolved Metals							
Aluminum	mg/L	0.0855	0.0591	0.0615	0.0669	0.0590	0.0678
Antimony	mg/L	0.0166	0.0160	0.0143	0.0164	0.0160	0.0159
Arsenic	mg/L	0.00963	0.00853	0.0104	0.00990	0.00928	0.00930
Barium	mg/L	0.000866	0.000808	0.000673	0.000780	0.000690	0.000806
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000080	0.000111	0.000072	0.000096	0.000084	0.000098
Calcium	mg/L	15.2	16.6	14.2	15.6	15.5	15.1
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.00151	0.00143	0.00111	0.00160	0.00127	0.00154
Lithium	mg/L	0.00639	0.00701	0.00575	0.00661	0.00631	0.00667
Magnesium	mg/L	0.236	0.254	0.210	0.238	0.228	0.232
Manganese	mg/L	0.00194	0.00222	0.00166	0.00154	0.00178	0.00231
Mercury	mg/L	<0.00001	<0.0	<0.0	<0.0	<0.0	<0.0
Molybdenum	mg/L	0.00196	0.00192	0.00177	0.00185	0.00182	0.00168
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	1.89	1.91	1.78	1.89	1.86	1.84
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.69	1.53	1.45	1.57	1.51	1.51
Silver	mg/L	0.000064	0.000053	0.000039	0.000054	0.000034	0.000040
Sodium	mg/L	2.36	2.37	2.14	2.28	2.18	2.15
Strontium	mg/L	0.0732	0.0830	0.0706	0.0796	0.0756	0.0748
Sulfur	mg/L	6.10	6.35	5.93	6.05	6.09	6.08
Thallium	mg/L	0.000012	0.000017	0.000012	0.000015	0.000015	0.000014
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000041	0.000045	0.000029	0.000037	0.000035	0.000033
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Table A6-18: Results of Waste Rock Humidity Cell Test BW-ARD-468

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Sample ID		468-0	468-1	468-2	468-3	468-4	468-5	468-6	468-7	468-8	468-9	468-10	468-11	468-12	468-13	468-14	468-15	468-16	468-17	468-18	468-19
Date Sampled		15-DEC-12	22-DEC-12	29-DEC-12	05-JAN-13	12-JAN-13	19-JAN-13	26-JAN-13	02-FEB-13	09-FEB-13	16-FEB-13	23-FEB-13	02-MAR-13	09-MAR-13	16-MAR-13	23-MAR-13	30-MAR-13	06-APR-13	13-APR-13	20-APR-13	27-APR-13
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	660	470	475	485	460	470	490	480	465	460	490	475	475	465	475	460	465	480	455	490
Conductivity	mS/cm	445	398	270	218	193	169	161	158	151	144	149	138	134	119	130	124	115	121	112	120
pH	units	7.84	7.95	8.05	7.97	7.99	7.95	8.03	7.96	8.05	7.90	8.02	7.98	8.00	8.06	8.04	8.12	8.08	8.08	8.06	8.11
Acidity	mg/L CaCO3	5.8	2.3	3.4	2.8	3.0	2.4	4.2	2.4	1.8	3.7	2.3	3.0	2.7	4.9	4.3	2.1	1.9	3.1	3.2	1.9
Alkalinity, Total	mg/L CaCO3	43.7	29.2	28.4	29.0	28.5	29.4	28.9	28.7	26.0	25.4	28.4	27.4	30.0	25.1	29.7	28.5	24.8	28.7	24.9	28.6
Sulfate (SO4)	mg/L	155	141	96.4	66.4	51.5	42.3	38.5	34.6	38.9	32.7	35.0	30.0	28.3	25.9	28.1	27.3	25.3	26.4	25.2	24.9
Dissolved Metals																					
Aluminum	mg/L	0.0350	0.0476	0.0664	0.0716	0.0830	0.0762	0.0805	0.0718	0.0713	0.0814	0.0683	0.0900	0.0676	0.0769	0.114	0.0697	0.0676	0.0790	0.106	0.102
Antimony	mg/L	0.0130	0.0237	0.0212	0.0200	0.0191	0.0162	0.0167	0.0141	0.0137	0.0131	0.0149	0.0140	0.0139	0.0121	0.0124	0.0118	0.0103	0.0103	0.00976	0.0101
Arsenic	mg/L	0.00088	0.00115	0.00118	0.00137	0.00138	0.00135	0.00138	0.00148	0.00151	0.00153	0.00141	0.00147	0.00142	0.00160	0.00126	0.00127	0.00127	0.00115	0.00128	0.00109
Barium	mg/L	0.0314	0.0229	0.0159	0.0126	0.0110	0.00884	0.00873	0.00827	0.00761	0.00735	0.00780	0.00736	0.00689	0.00559	0.00710	0.00588	0.00534	0.00576	0.00517	0.00615
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000022	0.000015	0.000014	0.000012	0.000011	0.000012	0.000010	0.000016	0.000016	0.000017	0.000020	0.000022	0.000022	0.000021	0.000027	0.000026	0.000021	0.000026	0.000026	0.000032
Calcium	mg/L	49.7	50.3	34.3	27.2	25.0	21.2	21.2	21.7	20.3	20.1	21.2	19.1	19.6	17.3	19.1	18.1	16.8	18.0	16.2	18.1
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00380	0.00076	0.00053	0.00042	0.00036	0.00036	0.00037	0.00042	0.00036	0.00033	0.00039	0.00036	0.00040	0.00029	0.00041	0.00034	0.00029	0.00036	0.00031	0.00039
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	<0.00005	<0.00005	<0.0001	<0.0001	0.000057	0.000064	0.000068	0.000080	0.000079	0.000089	0.000101	0.000157	0.000146	0.000149	0.000177	0.000113	0.000132	0.000148	0.000162	0.000220
Lithium	mg/L	0.00863	0.00712	0.00571	0.00436	0.00388	0.00356	0.00312	0.00319	0.00322	0.00256	0.00282	0.00295	0.00244	0.00197	0.00322	0.00291	0.00239	0.00282	0.00264	0.00288
Magnesium	mg/L	7.23	6.73	4.79	3.69	3.35	2.56	2.64	2.54	2.20	2.24	2.30	2.16	2.02	1.64	2.01	1.67	1.60	1.74	1.58	1.64
Manganese	mg/L	1.98	1.15	0.852	0.722	0.615	0.605	0.652	0.645	0.581	0.547	0.620	0.616	0.621	0.481	0.643	0.587	0.547	0.537	0.537	0.641
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00260	0.00322	0.00211	0.00148	0.00114	0.000832	0.000718	0.000646	0.000574	0.000544	0.000562	0.000511	0.000470	0.000439	0.000509	0.000568	0.000521	0.000536	0.000445	0.000471
Nickel	mg/L	0.00731	0.00161	0.00090	0.00065	0.00056	0.00059	0.00051	0.00053	<0.0005	<0.0005	<0.0005	<0.0005	0.00078	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30
Potassium	mg/L	18.2	13.2	9.80	7.74	6.92	5.47	5.32	4.64	4.07	3.94	4.01	3.86	3.55	2.92	3.43	3.05	2.94	2.72	2.74	2.79
Selenium	mg/L	0.00012	0.00011	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.52	2.16	1.99	1.97	1.96	1.67	1.68	1.64	1.48	1.47	1.63	1.51	1.49	1.32	1.40	1.33	1.23	1.32	1.23	1.33
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	18.4	12.1	5.68	2.80	1.76	0.987	0.670	0.449	0.306	0.237	0.204	0.157	0.130	0.098	0.109	0.095	<0.05	0.083	0.082	0.066
Strontium	mg/L	0.149	0.145	0.112	0.0825	0.0756	0.0634	0.0585	0.0583	0.0560	0.0541	0.0598	0.0557	0.0511	0.0407	0.0516	0.0472	0.0435	0.0458	0.0406	0.0487
Sulfur	mg/L	54.4	55.2	31.7	23.3	18.7	14.6	14.6	13.8	13.2	12.5	12.4	11.0	9.72	8.92	9.75	8.93	8.43	8.82	8.80	8.65
Thallium	mg/L	0.000045	0.000031	0.000023	0.000020	0.000017	0.000015	0.000015	0.000013	0.000013	0.000014	0.000015	0.000014	0.000012	0.000012	0.000014	0.000012	0.000012	0.000011	0.000012	0.000017
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.00111	0.00148	0.00124	0.00110	0.00101	0.000904	0.000841	0.000758	0.000707	0.000678	0.000727	0.000676	0.000659	0.000520	0.000593	0.000570	0.000528	0.000538	0.000433	0.000529
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Table A6-18: Results of Waste Rocl

Week	Units	20	21	22	23	24	25	26	27	28	29	30
Sample ID		468-20	468-21	468-22	468-23	468-24	468-25	468-26	468-27	468-28	468-29	468-30
Date Sampled			11-MAY-13	18-MAY-13	25-MAY-13	01-JUN-13	08-JUN-13	15-JUN-13	22-JUN-13	29-JUN-13	06-JUL-13	13-JUL-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	440	470	480	475	460	470	475	465	465	475	475
Conductivity	mS/cm	104	116	114	113	108	110	119	104	110	120	118
pH	units	7.99	8.09	8.02	8.00	8.03	8.05	8.10	7.99	8.08	8.07	8.15
Acidity	mg/L CaCO3	4.5	3.3	<1.00	2.2	2.6	3.5	2.5	2.5	2.2	2.1	1.6
Alkalinity, Total	mg/L CaCO3	20.0	26.4	22.9	24.1	21.7	23.3	25.3	20.6	24.3	24.1	24.9
Sulfate (SO4)	mg/L	24.8	26.1	24.4	23.8	20.0	25.4	26.2	24.3	24.5	26.4	26.2
Dissolved Metals												
Aluminum	mg/L	0.0962	0.0746	0.0837	0.0717	0.0849	0.0711	0.0518	0.0774	0.0849	0.0597	0.0655
Antimony	mg/L	0.00848	0.0107	0.00878	0.00868	0.00817	0.0154	0.00771	0.00642	0.00663	0.00664	0.00613
Arsenic	mg/L	0.00147	0.00130	0.00123	0.00127	0.00128	0.00296	0.00111	0.00141	0.00118	0.00110	0.00108
Barium	mg/L	0.00429	0.00477	0.00499	0.00477	0.00430	0.00423	0.00450	0.00365	0.00417	0.00398	0.00378
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000021	0.000025	0.000030	0.000029	0.000027	0.000023	0.000036	0.000029	0.000027	0.000030	0.000027
Calcium	mg/L	14.3	17.7	16.8	17.3	16.7	17.1	18.8	15.9	17.1	18.2	17.8
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00022	0.00024	0.00025	0.00024	0.00022	0.00021	0.00027	0.00018	0.00021	0.00021	0.00019
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000124	0.000169	0.000142	0.000101	0.000143	0.000117	0.000085	0.000094	0.000158	0.000107	0.000108
Lithium	mg/L	0.00211	0.00244	0.00254	0.00234	0.00240	0.00255	0.00259	0.00185	0.00228	0.00283	0.00211
Magnesium	mg/L	1.31	1.50	1.47	1.39	1.29	1.44	1.42	1.15	1.27	1.28	1.25
Manganese	mg/L	0.398	0.435	0.470	0.472	0.410	0.423	0.492	0.320	0.374	0.366	0.323
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000439	0.000479	0.000439	0.000435	0.000418	0.000470	0.000400	0.000348	0.000374	0.000373	0.000369
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00309	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	2.48	2.45	2.38	2.34	2.12	2.19	2.18	2.00	2.13	2.09	2.05
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.03	1.21	1.16	1.11	1.07	1.09	1.04	0.935	1.05	1.04	1.00
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.065	0.066	0.058	0.058	0.061	0.062	0.065	<0.05	0.053	0.053	0.052
Strontium	mg/L	0.0358	0.0412	0.0403	0.0416	0.0388	0.0424	0.0426	0.0371	0.0393	0.0397	0.0383
Sulfur	mg/L	8.90	8.82	9.10	8.64	8.89	8.74	9.20	8.32	8.42	8.91	9.38
Thallium	mg/L	0.000011	0.000012	0.000012	0.000014	0.000012	0.000033	0.000011	0.000013	0.000013	0.000012	0.000014
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000333	0.000475	0.000360	0.000375	0.000342	0.000384	0.000342	0.000265	0.000305	0.000313	0.000290
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Table A6-19: Results of Waste Rock Humidity Cell Test BW-ARD-610

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Sample ID		BW-ARD-610-0	BW-ARD-610-1	BW-ARD-610-2	BW-ARD-610-3	BW-ARD-610-4	BW-ARD-610-5	BW-ARD-610-6	BW-ARD-610-7	BW-ARD-610-8	BW-ARD-610-9	BW-ARD-610-10	BW-ARD-610-11	BW-ARD-610-12	BW-ARD-610-13
Date Sampled		15-SEP-12	22-SEP-12	29-SEP-12	06-OCT-12	13-OCT-12	20-OCT-12	27-OCT-12	03-NOV-12	10-NOV-12	17-NOV-12	24-NOV-12	01-DEC-12	08-DEC-12	15-DEC-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	640	470	475	450	465	475	450	475	465	460	465	470	470	470
Conductivity	mS/cm	115	148	140	124	120	126	153	156	151	146	143	148	148	147
pH	units	8.95	8.41	8.43	8.47	8.34	8.40	8.19	8.23	8.14	8.27	8.26	8.22	8.12	8.23
Acidity	mg/L CaCO3	1	2.1	2.2	2.9	2.0	1.5	1.6	1.1	1.5	2.2	1.4	1.4	2.2	1.9
Alkalinity, Total	mg/L CaCO3	36.0	40.4	41.1	39.9	37.9	36.9	33.6	35.6	34.1	31.9	31.3	33.5	31.2	33.7
Sulfate (SO4)	mg/L	13.5	27.4	23.8	19.9	18.1	22.9	34.1	31.6	29.4	28.1	29.0	29.0	29.8	28.0
Dissolved Metals															
Aluminum	mg/L	0.181	0.113	0.104	0.114	0.104	0.0989	0.0702	0.0794	0.0793	0.0845	0.0802	0.0768	0.0698	0.0729
Antimony	mg/L	0.0424	0.0519	0.0326	0.0258	0.0222	0.0185	0.0159	0.0142	0.0143	0.0138	0.0126	0.0134	0.0124	0.0134
Arsenic	mg/L	0.0264	0.0273	0.0320	0.0369	0.0402	0.0532	0.0560	0.0508	0.0491	0.0440	0.0418	0.0361	0.0341	0.0320
Barium	mg/L	0.00115	0.00164	0.00150	0.00143	0.00131	0.00138	0.00149	0.00179	0.00172	0.00167	0.00150	0.00167	0.00156	0.00180
Beryllium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.00001	0.000017	0.000027	0.000033	0.000037	0.000066	0.000114	0.000163	0.000186	0.000226	0.000237	0.000288	0.000276	0.000382
Calcium	mg/L	12.4	16.4	15.9	14.3	14.6	16.2	20.2	20.4	20.5	20.4	19.3	21.5	20.9	21.4
Chromium	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00012	0.00016	0.00016	0.00012	0.00013	0.00011	0.00012	0.00012	0.00013
Copper	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00095
Iron	mg/L	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	0.000069
Lithium	mg/L	0.0135	0.0167	0.0146	0.0140	0.0118	0.0122	0.0132	0.0116	0.0115	0.0116	0.0113	0.0109	0.0118	0.0101
Magnesium	mg/L	0.109	0.192	0.193	0.178	0.165	0.193	0.233	0.244	0.239	0.241	0.234	0.234	0.233	0.258
Manganese	mg/L	0.00175	0.00496	0.00412	0.00402	0.00347	0.00474	0.00590	0.00704	0.00633	0.00767	0.00654	0.00794	0.00787	0.00949
Mercury	mg/L	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00616	0.00639	0.00313	0.00191	0.00140	0.00108	0.000890	0.000739	0.000744	0.000806	0.000760	0.000765	0.000874	0.000950
Nickel	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30
Potassium	mg/L	4.83	5.98	5.63	5.06	4.79	4.86	5.19	5.59	5.32	5.18	4.98	5.07	4.97	5.13
Selenium	mg/L	0.00049	0.00033	0.00013	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	2.73	3.46	3.38	2.95	3.15	2.92	2.76	2.72	2.86	2.66	2.84	2.70	2.55	2.58
Silver	mg/L	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	8.47	10.1	8.39	7.57	6.15	5.89	6.42	5.21	4.95	4.55	4.14	3.89	3.63	3.71
Strontium	mg/L	0.0649	0.0893	0.0895	0.0895	0.0830	0.0923	0.119	0.119	0.112	0.112	0.107	0.123	0.116	0.121
Sulfur	mg/L	6.46	9.83	8.30	6.59	6.40	8.15	11.9	10.9	10.6	10.7	10.2	10.3	10.4	10.7
Thallium	mg/L	0.000029	0.000034	0.000034	0.000036	0.000033	0.000035	0.000039	0.000038	0.000041	0.000050	0.000040	0.000043	0.000044	0.000044
Tin	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000070	0.000168	0.000148	0.000140	0.000127	0.000124	0.000107	0.000097	0.000083	0.000080	0.000065	0.000069	0.000066	0.000065
Vanadium	mg/L	0.0084	0.0090	0.0090	0.0084	0.0081	0.0068	0.0050	0.0044	0.0043	0.0040	0.0038	0.0035	0.0033	0.0035
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0031	<0.003	<0.003	<0.003	<0.003	0.0042

Table A6-19: Results of Waste Rock H

Week	Units	14	15	16	17	18	19	20	21	22	23	24	25	26
Sample ID		BW-ARD-610-14	BW-ARD-610-15	BW-ARD-610-16	BW-ARD-610-17	BW-ARD-610-18	BW-ARD-610-19	BW-ARD-610-20	BW-ARD-610-21	BW-ARD-610-22	BW-ARD-610-23	BW-ARD-610-24	BW-ARD-610-25	BW-ARD-610-26
Date Sampled		22-DEC-12	29-DEC-12	05-JAN-13	12-JAN-13	19-JAN-13	26-JAN-13	02-FEB-13	09-FEB-13	16-FEB-13	23-FEB-13	02-MAR-13	09-MAR-13	16-MAR-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	490	470	470	450	480	500	475	470	465	480	475	470	480
Conductivity	mS/cm	144	142	141	147	148	142	137	129	131	142	141	147	134
pH	units	8.24	8.32	8.22	8.06	8.14	8.19	8.13	8.27	8.04	8.17	8.05	8.09	8.14
Acidity	mg/L CaCO3	1.7	<1.	2.1	8.6	2.1	1.8	1.8	1.9	1.8	1.8	1.5	1.9	2.4
Alkalinity, Total	mg/L CaCO3	34.4	34.4	35.2	36.3	37.1	35.3	33.1	29.8	30.5	33.8	32.5	35.6	29.8
Sulfate (SO4)	mg/L	28.5	28.4	28.6	30.4	30.6	28.3	26.2	26.6	26.4	31.5	28.2	29.0	27.3
Dissolved Metals														
Aluminum	mg/L	0.0700	0.0766	0.0616	0.0680	0.0580	0.0658	0.0620	0.0656	0.0729	0.0575	0.0598	0.0526	0.0594
Antimony	mg/L	0.0134	0.0122	0.0123	0.0115	0.0111	0.0107	0.00974	0.00848	0.00848	0.00929	0.00859	0.00940	0.00816
Arsenic	mg/L	0.0299	0.0283	0.0277	0.0257	0.0218	0.0225	0.0209	0.0213	0.0209	0.0190	0.0188	0.0170	0.0178
Barium	mg/L	0.00164	0.00154	0.00146	0.00169	0.00159	0.00161	0.00147	0.00134	0.00151	0.00156	0.00167	0.00174	0.00153
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000424	0.000401	0.000479	0.000480	0.000527	0.000520	0.000486	0.000402	0.000427	0.000532	0.000555	0.000617	0.000502
Calcium	mg/L	21.7	20.2	21.0	22.0	21.8	20.9	20.8	19.1	19.7	20.9	21.4	23.6	21.2
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00013	0.00013	0.00013	0.00014	0.00017	0.00014	0.00016	0.00013	0.00014	0.00015	0.00014	0.00013	<0.0001
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	<0.00005	0.000056	<0.0001	0.000058	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	0.000056	<0.00005
Lithium	mg/L	0.0118	0.0119	0.0124	0.0123	0.0121	0.0104	0.0102	0.00934	0.00955	0.0103	0.0103	0.0106	0.00935
Magnesium	mg/L	0.253	0.245	0.246	0.266	0.258	0.245	0.237	0.213	0.237	0.252	0.258	0.270	0.241
Manganese	mg/L	0.0111	0.0100	0.0123	0.0115	0.0130	0.0124	0.0122	0.00915	0.00957	0.00987	0.00896	0.00674	0.00384
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.000964	0.000982	0.00101	0.00104	0.00103	0.000961	0.00102	0.000934	0.000924	0.000932	0.000839	0.000973	0.00103
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	4.97	4.84	5.10	5.11	4.61	4.66	4.25	4.12	4.29	4.34	4.43	4.46	4.20
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	2.55	2.39	2.43	2.41	2.26	2.16	2.16	1.97	2.00	1.97	2.05	2.15	1.95
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	3.35	3.14	3.04	3.02	2.72	2.53	2.34	2.16	2.16	2.19	2.09	2.01	1.85
Strontium	mg/L	0.114	0.117	0.112	0.117	0.118	0.107	0.110	0.100	0.106	0.118	0.112	0.122	0.105
Sulfur	mg/L	10.6	9.48	9.38	10.7	9.99	10.0	9.21	9.23	9.10	10.3	10.1	10.1	9.94
Thallium	mg/L	0.000044	0.000045	0.000045	0.000044	0.000045	0.000044	0.000040	0.000040	0.000042	0.000044	0.000042	0.000047	0.000042
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000067	0.000056	0.000056	0.000058	0.000058	0.000051	0.000045	0.000038	0.000038	0.000044	0.000039	0.000042	0.000034
Vanadium	mg/L	0.0033	0.0033	0.0032	0.0029	0.0026	0.0026	0.0023	0.0024	0.0023	0.0020	0.0020	0.0019	0.0018
Zinc	mg/L	<0.003	<0.003	0.0032	0.0034	0.0040	0.0035	0.0043	<0.003	0.0036	0.0043	0.0047	0.0055	0.0043

Table A6-19: Results of Waste Rock H

Week	Units	27	28	29	30	31	32	33	34	35	36	37	38	39
Sample ID		BW-ARD-610-27	BW-ARD-610-28	BW-ARD-610-29	BW-ARD-610-30	BW-ARD-610-31	BW-ARD-610-32	BW-ARD-610-33	BW-ARD-610-34	BW-ARD-610-35	BW-ARD-610-36	BW-ARD-610-37	BW-ARD-610-38	BW-ARD-610-39
Date Sampled		23-MAR-13	30-MAR-13	06-APR-13	13-APR-13	20-APR-13	27-APR-13		11-MAY-13	18-MAY-13	25-MAY-13	01-JUN-13	08-JUN-13	15-JUN-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	465	465	470	500	465	465	450	485	455	440	435	410	450
Conductivity	mS/cm	142	145	134	142	139	133	117	128	124	125	124	123	129
pH	units	8.08	8.23	8.22	8.16	8.21	8.24	8.14	8.21	8.15	8.14	8.14	8.18	8.17
Acidity	mg/L CaCO3	2.7	1.4	1.7	2.7	2.3	6.8	1.5	1.5	7.9	3.0	1.5	3.3	1.4
Alkalinity, Total	mg/L CaCO3	32.5	32.6	28.3	31.4	29.2	32.1	22.7	27.8	24.8	21.7	20.3	21.0	21.2
Sulfate (SO4)	mg/L	29.8	34.4	31.7	32.5	29.4	28.5	27.9	27.8	30.3	26.2	24.4	29.5	32.0
Dissolved Metals														
Aluminum	mg/L	0.0656	0.0487	0.0549	0.0459	0.0599	0.0595	0.0723	0.0651	0.0701	0.0694	0.0835	0.0806	0.0629
Antimony	mg/L	0.00783	0.00794	0.00702	0.00725	0.00710	0.00698	0.00624	0.00771	0.00648	0.00622	0.00635	0.00612	0.00596
Arsenic	mg/L	0.0154	0.0139	0.0142	0.0131	0.0131	0.0131	0.0179	0.0184	0.0190	0.0206	0.0201	0.0193	0.0178
Barium	mg/L	0.00186	0.00159	0.00150	0.00161	0.00168	0.00179	0.00132	0.00148	0.00153	0.00138	0.00170	0.00154	0.00151
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000575	0.000564	0.000466	0.000538	0.000531	0.000514	0.000323	0.000416	0.000406	0.000317	0.000330	0.000293	0.000333
Calcium	mg/L	22.7	23.3	21.4	23.1	22.2	21.4	17.8	20.4	19.2	19.4	19.6	19.6	20.6
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00077
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000054	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.000052	<0.0001
Lithium	mg/L	0.00987	0.0116	0.00832	0.00993	0.00911	0.00898	0.00767	0.00854	0.00769	0.00793	0.00674	0.00752	0.00753
Magnesium	mg/L	0.267	0.262	0.234	0.262	0.265	0.240	0.201	0.222	0.213	0.201	0.202	0.197	0.212
Manganese	mg/L	0.00375	0.00266	0.00233	0.00212	0.00206	0.00221	0.00165	0.00251	0.00198	0.00156	0.00154	0.00123	0.00141
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00125	0.00122	0.00134	0.00145	0.00148	0.00153	0.00189	0.00201	0.00182	0.00193	0.00189	0.00208	0.00203
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.3
Potassium	mg/L	4.23	4.49	4.13	3.98	4.26	4.02	3.66	3.69	3.62	3.76	3.82	3.47	3.61
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	2.03	2.02	1.78	1.89	1.88	1.83	1.64	1.89	1.87	1.73	1.76	1.77	1.61
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	1.93	1.70	1.60	1.69	1.61	1.47	1.33	1.38	1.37	1.28	1.34	1.19	1.29
Strontium	mg/L	0.114	0.120	0.107	0.114	0.112	0.112	0.0886	0.101	0.0938	0.0965	0.0892	0.0949	0.0972
Sulfur	mg/L	10.9	11.1	10.1	10.9	11.4	9.94	9.76	10.2	10.5	10.7	11.7	10.9	11.2
Thallium	mg/L	0.000044	0.000044	0.000050	0.000046	0.000047	0.000045	0.000035	0.000048	0.000039	0.000047	0.000040	0.000038	0.000041
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000035	0.000035	0.000031	0.000032	0.000025	0.000022	0.000015	0.000023	0.000016	0.000016	0.000012	0.000012	0.000013
Vanadium	mg/L	0.0016	0.0016	0.0015	0.0013	0.0014	0.0013	0.0018	0.0019	0.0020	0.0021	0.0020	0.0019	0.0017
Zinc	mg/L	0.0045	0.0049	0.0039	0.0042	0.0043	0.0044	<0.003	0.0035	<0.003	<0.003	<0.003	<0.003	<0.003

Table A6-19: Results of Waste Rock H

Week	Units	40	41	42	43
Sample ID		BW-ARD-610-40	BW-ARD-610-41	BW-ARD-610-42	BW-ARD-610-43
Date Sampled		22-JUN-13	29-JUN-13	06-JUL-13	13-JUL-13
Total Volume In	mL	500	500	500	500
Total Volume Out	mL	430	425	440	425
Conductivity	mS/cm	122	1130	124	118
pH	units	8.15	8.19	8.11	8.36
Acidity	mg/L CaCO3	1.4	1.4	1.5	<1.0
Alkalinity, Total	mg/L CaCO3	20.4	22.9	21.8	21.5
Sulfate (SO4)	mg/L	<50.0	27.8	27.2	25.8
Dissolved Metals					
Aluminum	mg/L	0.0785	0.0725	0.0729	0.0780
Antimony	mg/L	0.00564	0.00624	0.00591	0.00551
Arsenic	mg/L	0.0192	0.0188	0.0181	0.0176
Barium	mg/L	0.00152	0.00147	0.00143	0.00142
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000287	0.000308	0.000298	0.000281
Calcium	mg/L	19.0	19.1	19.1	17.5
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Lithium	mg/L	0.00672	0.00745	0.00673	0.00617
Magnesium	mg/L	0.195	0.193	0.188	0.179
Manganese	mg/L	0.00129	0.00115	0.00141	0.00112
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00199	0.00217	0.00218	0.00198
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	3.55	3.64	3.49	3.32
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.60	1.72	1.64	1.50
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	1.15	1.14	1.08	1.02
Strontium	mg/L	0.0914	0.0941	0.0872	0.0815
Sulfur	mg/L	11.0	10.0	10.1	10.1
Thallium	mg/L	0.000038	0.000044	0.000042	0.000040
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	<0.00001	0.000012	0.000010	<0.00001
Vanadium	mg/L	0.0018	0.0018	0.0018	0.0018
Zinc	mg/L	<0.003	<0.003	0.0033	<0.003

Table A6-20: Results of Ore Humidity Cell Test BW-ARD2-10

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample ID		BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-
Date Sampled		09-JUN-12	16-JUN-12	23-JUN-12	30-JUN-12	07-JUL-12	14-JUL-12	21-JUL-12	28-JUL-12	04-AUG-12	11-AUG-12	18-AUG-12	24-AUG-12	01-SEP-12	08-SEP-12	15-SEP-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	615	500	400	500	490	500	490	425	475	500	500	500	495	490	460
Conductivity	mS/cm	1580	844	447	345	314	332	302	488	495	447	553	581	580	57.8	607
pH	units	3.85	4.11	4.29	4.38	4.32	4.27	4.28	3.89	3.91	3.95	3.77	3.74	3.66	3.60	3.55
Acidity	mg/L	690	367	161	105	107	115	109	177	185	158	229	240	261	241	263
Alkalinity, Total	mg/L	<2.	<2.	<2.	<2.	<2.0	<2.0	<2.0	<2.0	<2.	<2.0	<2.	<2.	<2.	<2.	<2.
Sulfate (SO4)	mg/L	906	476	184	139	141	148	130	215	219	209	247	243	262	263	251
Dissolved Metals																
Aluminum	mg/L	15.0	3.11	0.719	0.338	0.347	0.432	0.359	1.69	1.27	1.08	3.01	3.42	4.26	4.57	5.69
Antimony	mg/L	0.0066	0.0046	0.0033	0.0021	0.0018	0.00133	0.00097	0.0013	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.0383	0.0654	0.0489	0.0293	0.0366	0.0315	0.0290	0.0471	0.0348	0.0299	0.0351	0.0319	0.0313	0.0261	0.0267
Barium	mg/L	0.0104	0.0041	0.00273	0.00266	0.00352	0.00357	0.00434	0.00923	0.00776	0.00858	0.00942	0.00944	0.00847	0.00750	0.00732
Beryllium	mg/L	0.0327	0.0114	0.0040	0.0027	0.0029	0.00268	0.00234	0.0075	0.0062	0.0058	0.0104	0.0110	0.0101	0.0099	0.0095
Bismuth	mg/L	<0.025	<0.01	<0.005	<0.005	<0.005	<0.0025	<0.0025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	mg/L	<0.5	<0.2	<0.1	<0.1	<0.1	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	mg/L	0.793	0.663	0.420	0.289	0.331	0.364	0.345	0.548	0.440	0.402	0.674	0.746	0.756	0.732	0.750
Calcium	mg/L	41.4	24.7	9.28	5.83	4.35	3.82	2.97	3.58	3.08	2.63	2.51	2.01	1.64	1.38	1.16
Chromium	mg/L	<0.025	<0.01	<0.005	<0.005	<0.005	<0.0025	<0.0025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	mg/L	1.78	0.847	0.329	0.178	0.151	0.128	0.103	0.126	0.0919	0.0743	0.0790	0.0702	0.0604	0.0561	0.0509
Copper	mg/L	0.226	0.165	0.103	0.0513	0.0730	0.0815	0.0673	0.158	0.0749	0.0726	0.295	0.381	0.481	0.566	0.740
Iron	mg/L	126	29.2	7.90	6.73	4.81	4.82	4.66	14.6	29.5	25.3	14.0	13.9	13.1	13.8	11.8
Lead	mg/L	0.0688	0.0133	0.00794	0.00883	0.0148	0.0114	0.0152	0.0552	0.0456	0.0538	0.0628	0.0635	0.0542	0.0472	0.0411
Lithium	mg/L	<0.025	0.010	<0.005	<0.005	<0.005	<0.0025	<0.0025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Magnesium	mg/L	27.6	13.6	4.72	2.59	2.05	1.65	1.25	2.25	1.38	1.28	1.29	1.17	1.09	1.10	1.04
Manganese	mg/L	59.8	45.9	23.1	20.2	20.1	20.4	20.9	31.6	31.9	34.5	40.7	35.5	35.4	29.2	27.2
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	<0.0025	<0.001	<0.0005	<0.0005	<0.0005	<0.00025	<0.00025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nickel	mg/L	1.19	0.588	0.204	0.108	0.0839	0.0662	0.0503	0.0640	0.0499	0.0458	0.0443	0.0384	0.0342	0.0292	0.0257
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	3.3	1.6	1.26	1.22	1.26	1.41	1.31	1.66	1.40	1.55	1.33	1.26	1.11	0.77	0.67
Selenium	mg/L	<0.005	<0.002	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silicon	mg/L	3.34	9.23	7.32	7.84	6.40	6.85	6.52	8.29	8.95	8.64	8.85	9.12	8.89	9.33	7.89
Silver	mg/L	<0.0005	<0.0002	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00010	0.00011	<0.0001
Sodium	mg/L	3.6	2.2	0.68	<0.5	<0.5	<0.25	<0.25	1.32	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Strontium	mg/L	0.102	0.0841	0.0399	0.0300	0.0313	0.0250	0.0207	0.0349	0.0258	0.0226	0.0211	0.0176	0.0144	0.0122	0.0106
Sulfur	mg/L	341	163	74.1	54.3	49.1	51.5	46.5	72.9	76.5	70.3	88.4	92.5	95.0	92.1	97.4
Thallium	mg/L	<0.0005	0.00024	0.00018	0.00018	0.00025	0.000187	0.000188	0.00020	0.00014	0.00017	0.00016	0.00018	0.00017	0.00015	0.00017
Tin	mg/L	<0.005	<0.002	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.123	0.0497	0.0199	0.0132	0.0184	0.0183	0.0162	0.0568	0.0433	0.0419	0.0737	0.0709	0.0648	0.0577	0.0558
Vanadium	mg/L	<0.05	<0.02	<0.01	<0.01	<0.01	<0.005	<0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	229	147	70.4	46.0	47.4	50.3	45.5	75.4	57.5	56.0	89.4	98.6	99.3	90.1	92.9

Table A6-20: Results of Ore Hu

Week	Units	15	16	17	18	19	20	21	22	23	24	25
Sample ID		BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-	BW-ARD2-10-
Date Sampled		22-SEP-12	29-SEP-12	06-OCT-12	13-OCT-12	20-OCT-12	27-OCT-12	03-NOV-12	10-NOV-12	17-NOV-12	23-NOV-12	01-DEC-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	430	450	425	465	450	425	440	400	500	450	475
Conductivity	mS/cm	667	675	717	712	675	695	692	687	641	650	618
pH	units	3.49	3.50	3.45	3.39	3.43	3.36	3.33	3.33	3.36	3.33	3.34
Acidity	mg/L	296	330	287	286	274	288	291	279	268	266	250
Alkalinity, Total	mg/L	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.00	<2.00
Sulfate (SO4)	mg/L	292	291	295	283	257	282	292	273	248	266	234
Dissolved Metals												
Aluminum	mg/L	7.88	7.85	10.3	10.3	10.5	11.4	10.2	11.3	9.53	11.2	10.3
Antimony	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.002	<0.002
Arsenic	mg/L	0.0298	0.0293	0.0257	0.0270	0.0237	0.0235	0.0202	0.0217	0.0181	0.0196	0.0174
Barium	mg/L	0.0067	0.0049	0.0082	0.0056	0.0045	0.00387	0.0029	0.00313	0.00375	0.0040	0.0039
Beryllium	mg/L	0.0097	0.0077	0.0075	0.0067	0.0058	0.0055	0.0042	0.0043	0.0035	0.0034	0.0028
Bismuth	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005	<0.01	<0.005	<0.005	<0.01	<0.01
Boron	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1	<0.2	<0.1	<0.1	<0.20	<0.20
Cadmium	mg/L	0.866	0.842	0.877	0.937	0.847	0.855	0.726	0.817	0.716	0.724	0.647
Calcium	mg/L	1.09	0.955	0.891	0.817	0.695	0.637	0.572	0.586	0.620	0.569	0.504
Chromium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005	<0.01	<0.005	<0.005	<0.01	<0.01
Cobalt	mg/L	0.0579	0.0536	0.0552	0.0558	0.0493	0.0524	0.0438	0.0475	0.0394	0.0419	0.0350
Copper	mg/L	1.04	1.12	1.33	1.50	1.51	1.51	1.34	1.49	1.41	1.60	1.42
Iron	mg/L	11.9	11.3	10.6	10.8	10.1	10.8	10.7	10.8	9.67	9.37	8.11
Lead	mg/L	0.0296	0.0210	0.0300	0.0169	0.0168	0.0105	0.0073	0.00948	0.0110	0.0108	0.0108
Lithium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005	<0.01	<0.005	<0.005	<0.01	<0.01
Magnesium	mg/L	1.20	1.86	1.52	1.36	1.38	1.47	1.26	1.53	1.55	1.64	1.42
Manganese	mg/L	27.5	24.4	22.4	21.2	19.0	16.7	13.6	13.8	15.4	12.8	10.4
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	<0.001	<0.001	0.0017	<0.001	<0.001	<0.0005	<0.001	<0.0005	<0.0005	<0.001	<0.001
Nickel	mg/L	0.027	0.024	0.037	0.025	0.022	0.0212	0.016	0.0193	0.0172	0.015	0.013
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30
Potassium	mg/L	<1.	<1.	<1.	<1.	<1.	<0.5	<1.	<0.5	<0.5	<1.00	<1.00
Selenium	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.002	<0.002
Silicon	mg/L	7.05	7.98	7.13	9.13	8.93	7.67	7.67	10.0	12.8	11.4	11.1
Silver	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	0.00021	0.00021	0.00021	0.00016	0.00021	<0.0002	<0.0002
Sodium	mg/L	<1.	<3.7	<1.	<1.	<1.	<0.5	<1.	<0.5	<0.5	<1.00	<1.00
Strontium	mg/L	0.0105	0.0217	0.0089	0.0092	0.0089	0.0083	0.0068	0.0074	0.0085	0.0078	0.0097
Sulfur	mg/L	105	108	109	105	98.9	103	96.7	101	89.9	92.0	84.8
Thallium	mg/L	0.00024	<0.0002	<0.0002	<0.0002	<0.0002	0.00016	<0.0002	0.00015	0.00020	<0.0002	<0.0002
Tin	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.002	<0.002
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.0569	0.0477	0.0455	0.0394	0.0343	0.0320	0.0250	0.0283	0.0243	0.0250	0.0210
Vanadium	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.01	<0.01	<0.02	<0.02
Zinc	mg/L	105	104	108	119	106	107	90.1	104	90.9	90.8	79.9

Table A6-21: Results of Ore Humidity Cell Test BW-ARD-283

Week	Units	0	1	2	3	4	5	6	7	8	9	10	11	12
Sample ID		BW-ARD-283-0	BW-ARD-283-1	BW-ARD-283-2	BW-ARD-283-3	BW-ARD-283-4	BW-ARD-283-5	BW-ARD-283-6	BW-ARD-283-7	BW-ARD-283-8	BW-ARD-283-9	BW-ARD-283-10	BW-ARD-283-11	BW-ARD-283-12
Date Sampled		09-JUN-12	16-JUN-12	23-JUN-12	30-JUN-12	07-JUL-12	14-JUL-12	21-JUL-12	28-JUL-12	04-AUG-12	11-AUG-12	18-AUG-12	24-AUG-12	01-SEP-12
Total Volume In	mL	750	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	655	500	485	490	495	495	495	425	450	500	500	500	490
Conductivity	mS/cm	579	396	375	376	321	276	260	251	254	263	305	342	315
pH	units	5.35	4.40	4.98	4.76	4.85	4.83	4.82	4.88	4.82	4.89	4.64	4.57	4.48
Acidity	mg/L CaCO3	17.4	32.4	31.1	33.4	48.9	48.0	50.9	37.7	43.2	39.4	65.8	82.3	77.8
Alkalinity, Total	mg/L CaCO3	4.8	<2.	2.2	<2.	<2.0	<2.0	<2.0	<2.0	<2.	<2.0	<2.	<2.	<2.
Sulfate (SO4)	mg/L	235	169	152	150	133	107	102	93.2	111	112	125	143	130
Dissolved Metals														
Aluminum	mg/L	<0.025	0.106	0.065	0.095	0.064	0.067	0.066	0.057	0.054	0.029	0.070	0.124	0.134
Antimony	mg/L	0.00315	0.00264	0.00154	0.00073	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.0231	0.0405	0.0359	0.0278	0.0104	0.00651	0.00462	0.00304	0.00251	0.00255	0.00276	0.00291	0.00327
Barium	mg/L	0.0431	0.0358	0.0280	0.0242	0.0164	0.0161	0.0167	0.0161	0.0150	0.0121	0.0178	0.0242	0.0207
Beryllium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bismuth	mg/L	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Boron	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	mg/L	0.0317	0.0188	0.0222	0.0194	0.0154	0.0155	0.0152	0.0149	0.00945	0.00663	0.0145	0.0175	0.0167
Calcium	mg/L	50.0	23.2	19.7	16.1	10.9	8.94	7.55	6.56	6.53	6.24	7.19	7.61	6.58
Chromium	mg/L	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Cobalt	mg/L	0.150	0.0879	0.106	0.101	0.0831	0.0841	0.0819	0.0768	0.0548	0.0436	0.0749	0.0945	0.0906
Copper	mg/L	<0.0025	0.0046	0.0027	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Iron	mg/L	0.777	0.545	2.63	9.77	14.5	11.7	11.6	11.5	14.1	14.2	17.3	24.3	21.5
Lead	mg/L	0.00714	0.0133	0.0108	0.0116	0.00787	0.00702	0.00622	0.00528	0.00503	0.00358	0.00642	0.0101	0.00963
Lithium	mg/L	0.0111	0.0078	0.0078	0.0073	0.0059	0.0053	0.0037	0.0043	0.0035	0.0029	0.0040	0.0049	0.0046
Magnesium	mg/L	7.90	4.45	4.08	3.59	2.78	2.66	2.37	2.31	2.26	2.47	2.58	2.87	2.57
Manganese	mg/L	42.5	34.1	40.3	44.9	32.4	31.9	32.3	29.7	31.3	33.2	40.7	42.9	39.9
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00037	<0.00025	0.00036	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	<0.00025	0.00039	<0.00025	<0.00025	<0.00025
Nickel	mg/L	0.241	0.157	0.184	0.182	0.158	0.161	0.157	0.149	0.117	0.104	0.158	0.193	0.188
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	22.4	15.4	13.0	11.1	7.61	7.31	6.20	5.51	5.02	4.83	4.66	4.94	4.12
Selenium	mg/L	0.00069	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Silicon	mg/L	2.47	4.67	5.37	5.46	4.48	4.34	4.47	4.57	4.45	4.05	3.79	4.38	3.75
Silver	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Sodium	mg/L	10.4	4.74	1.90	0.91	0.47	0.32	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Strontium	mg/L	0.277	0.141	0.132	0.104	0.0739	0.0636	0.0515	0.0481	0.0426	0.0433	0.0500	0.0533	0.0453
Sulfur	mg/L	112	64.3	58.7	60.2	57.0	57.8	55.8	50.0	41.2	39.6	52.1	57.8	52.3
Thallium	mg/L	0.000081	0.000080	0.000064	0.000055	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Tin	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000215	0.000395	0.000370	0.000468	0.000377	0.000308	0.000238	0.000249	0.000214	0.000149	0.000351	0.000582	0.000694
Vanadium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	mg/L	4.59	2.67	3.51	3.65	2.68	2.48	2.23	2.10	1.49	1.37	1.93	2.37	2.23

Table A6-21: Results of Ore Humic

Week	Units	13	14	15	16	17	18	19	20	21	22	23	24	25
Sample ID		BW-ARD-283-13	BW-ARD-283-14	BW-ARD-283-15	BW-ARD-283-16	BW-ARD-283-17	BW-ARD-283-18	BW-ARD-283-19	BW-ARD-283-20	BW-ARD-283-21	BW-ARD-283-22	BW-ARD-283-23	BW-ARD-283-24	BW-ARD-283-25
Date Sampled		08-SEP-12	15-SEP-12	22-SEP-12	29-SEP-12	06-OCT-12	13-OCT-12	20-OCT-12	27-OCT-12	03-NOV-12	10-NOV-12	17-NOV-12	24-NOV-12	01-DEC-12
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	490	465	440	445	435	460	460	425	450	460	450	450	465
Conductivity	mS/cm	318	307	363	411	601	789	748	638	822	744	621	688	833
pH	units	4.42	4.39	4.28	4.15	3.90	3.73	3.70	3.69	3.42	3.38	3.49	3.41	3.22
Acidity	mg/L CaCO3	72.8	77.4	105	167	214	306	296	248	339	275	241	242	320
Alkalinity, Total	mg/L CaCO3	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.00	<2.00
Sulfate (SO4)	mg/L	130	121	155	176	274	350	311	278	347	302	249	287	340
Dissolved Metals														
Aluminum	mg/L	0.138	0.141	0.265	0.479	2.54	4.60	5.53	4.31	10.8	8.31	6.20	9.65	13.3
Antimony	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.00346	0.00462	0.00617	0.00760	0.0110	0.0149	0.0225	0.0218	0.0254	0.0250	0.0227	0.0269	0.0239
Barium	mg/L	0.0189	0.0214	0.0287	0.0305	0.0327	0.0249	0.0207	0.0173	0.0166	0.0160	0.0156	0.0205	0.0165
Beryllium	mg/L	<0.0005	<0.0005	0.00072	0.00099	0.00281	0.00427	0.00494	0.00414	0.00613	0.00467	0.00369	0.00423	0.00486
Bismuth	mg/L	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Boron	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	mg/L	0.0157	0.0181	0.0228	0.0237	0.0364	0.0607	0.140	0.171	0.478	0.357	0.242	0.342	0.433
Calcium	mg/L	6.36	6.02	7.10	7.32	9.72	10.2	8.39	7.07	6.22	5.74	5.02	5.27	6.25
Chromium	mg/L	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	0.0030
Cobalt	mg/L	0.0901	0.0866	0.103	0.0977	0.127	0.133	0.132	0.117	0.140	0.114	0.0876	0.115	0.103
Copper	mg/L	<0.0025	<0.0025	0.0044	0.0090	0.0477	0.0863	0.117	0.0920	0.240	0.179	0.129	0.189	0.249
Iron	mg/L	23.8	21.1	28.8	38.6	71.3	115	102	75.5	66.1	63.9	52.8	53.3	48.5
Lead	mg/L	0.0120	0.0124	0.0191	0.0268	0.0604	0.0944	0.113	0.0999	0.170	0.160	0.135	0.162	0.192
Lithium	mg/L	0.0044	0.0042	0.0055	<0.0025	0.0065	0.0083	0.0106	0.0095	0.0151	0.0122	0.0088	0.0109	0.0129
Magnesium	mg/L	2.64	2.34	2.63	2.68	3.71	3.49	3.38	3.14	3.47	3.02	2.50	3.73	3.46
Manganese	mg/L	36.4	35.0	37.9	39.0	52.2	53.5	49.2	41.7	40.6	33.1	30.0	37.4	27.5
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	0.00025	<0.0003	0.00031	0.00034	0.00073	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.00025	<0.00025
Nickel	mg/L	0.193	0.183	0.217	0.209	0.286	0.299	0.289	0.238	0.245	0.202	0.165	0.219	0.170
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30
Potassium	mg/L	4.06	3.64	3.97	3.46	4.13	4.32	4.62	4.04	4.62	4.34	3.44	4.61	3.85
Selenium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00058	<0.0005	<0.0005	<0.0005	<0.0005
Silicon	mg/L	3.98	3.38	3.75	4.06	4.76	6.94	6.98	5.24	7.57	8.53	7.74	8.80	11.4
Silver	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005
Sodium	mg/L	<0.25	<0.25	<0.25	0.78	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Strontium	mg/L	0.0425	0.0413	0.0483	0.0505	0.0625	0.0573	0.0505	0.0421	0.0399	0.0350	0.0296	0.0318	0.0379
Sulfur	mg/L	49.8	48.3	54.5	63.2	98.2	134	124	104	130	114	92.2	99.6	118
Thallium	mg/L	<0.0001	<0.0001	0.000053	<0.0001	0.000052	0.000068	0.000086	0.000063	0.000118	0.000135	0.000104	0.000118	0.000172
Tin	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000636	0.000696	0.00125	0.00209	0.00538	0.00815	0.00848	0.00660	0.00877	0.00651	0.00544	0.00601	0.00669
Vanadium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	mg/L	2.24	2.30	3.03	3.40	5.60	8.83	19.0	21.0	58.0	43.8	29.9	43.6	51.1

Table A6-21: Results of Ore Humic

Week	Units	26	27	28	29	30	31	32	33	34	35	36	37
Sample ID		BW-ARD-283-26	BW-ARD-283-27	BW-ARD-283-28	BW-ARD-283-29	BW-ARD-283-30	BW-ARD-283-31	BW-ARD-283-32	BW-ARD-283-33	BW-ARD-283-34	BW-ARD-283-35	BW-ARD-283-36	BW-ARD-283-37
Date Sampled		08-DEC-12	15-DEC-12	22-DEC-12	29-DEC-12	05-JAN-13	12-JAN-13	19-JAN-13	26-JAN-13	02-FEB-13	09-FEB-13	16-FEB-13	23-FEB-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	460	455	475	450	480	450	475	500	475	460	465	475
Conductivity	mS/cm	630	640	719	765	755	740	692	615	628	622	651	719
pH	units	3.37	3.32	3.21	3.14	3.09	3.11	3.13	3.20	3.22	3.24	3.21	3.18
Acidity	mg/L CaCO3	215	212	228	244	240	196	199	185	176	183	195	226
Alkalinity, Total	mg/L CaCO3	<2.00	<2.00	<2.00	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.0	<2.0
Sulfate (SO4)	mg/L	246	231	256	265	256	271	235	216	212	231	228	268
Dissolved Metals													
Aluminum	mg/L	6.73	7.47	8.61	11.9	10.1	9.45	7.51	6.40	8.04	8.64	9.52	11.7
Antimony	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.0211	0.0224	0.0183	0.0180	0.0189	0.0176	0.0347	0.0154	0.0151	0.0155	0.0160	0.0173
Barium	mg/L	0.0166	0.0169	0.0158	0.0168	0.0167	0.0170	0.0162	0.0169	0.0175	0.0166	0.0159	0.0159
Beryllium	mg/L	0.00324	0.00404	0.00386	0.00416	0.00426	0.00414	0.00395	0.00402	0.00630	0.00513	0.00559	0.00612
Bismuth	mg/L	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Boron	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	mg/L	0.222	0.232	0.267	0.309	0.281	0.279	0.232	0.231	0.284	0.292	0.324	0.377
Calcium	mg/L	4.52	4.55	4.86	5.12	4.87	4.82	4.49	3.86	4.62	4.29	4.33	4.86
Chromium	mg/L	<0.0025	<0.0025	<0.0025	0.0027	<0.0025	<0.0025	<0.0025	<0.0025	0.00137	0.00126	0.00122	0.00189
Cobalt	mg/L	0.0748	0.0787	0.0769	0.0804	0.0788	0.0781	0.0708	0.0736	0.0860	0.0918	0.101	0.111
Copper	mg/L	0.131	0.132	0.171	0.218	0.204	0.203	0.168	0.135	0.142	0.147	0.161	0.205
Iron	mg/L	41.5	36.7	32.4	25.6	26.7	25.7	23.0	20.5	11.4	8.60	7.92	7.65
Lead	mg/L	0.147	0.181	0.197	0.210	0.206	0.218	0.200	0.203	0.290	0.278	0.300	0.339
Lithium	mg/L	0.0055	0.0105	0.0108	0.0110	0.0122	0.0059	0.0081	0.0065	0.0091	0.0098	0.0071	0.0075
Magnesium	mg/L	2.43	2.58	2.64	3.01	2.85	2.80	2.35	2.30	3.62	2.77	3.15	3.46
Manganese	mg/L	25.1	24.0	21.8	22.6	21.5	19.7	18.3	17.7	22.8	19.7	20.9	22.5
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	<0.00025	<0.00025	<0.00025	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.00039	<0.0003	<0.00025	<0.00025
Nickel	mg/L	0.136	0.133	0.129	0.125	0.124	0.119	0.106	0.109	0.128	0.132	0.145	0.160
Phosphorus	mg/L	<0.30	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	3.36	3.35	3.12	3.05	3.29	3.14	2.80	2.60	3.25	2.85	2.83	3.11
Selenium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Silicon	mg/L	8.54	8.74	9.69	10.6	11.0	11.7	10.9	8.99	11.2	10.0	10.4	12.0
Silver	mg/L	<0.00005	<0.00005	0.000070	0.000067	0.000069	0.000090	0.000092	0.000115	0.000123	0.000119	0.000119	0.000132
Sodium	mg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	7.06	<0.25	<0.25	<0.25
Strontium	mg/L	0.0243	0.0287	0.0287	0.0298	0.0282	0.0262	0.0251	0.0216	0.0344	0.0219	0.0229	0.0273
Sulfur	mg/L	83.5	83.6	87.9	94.4	90.4	88.0	79.8	75.1	75.4	75.2	81.9	90.9
Thallium	mg/L	0.000128	0.000151	0.000155	0.000157	0.000315	0.000194	0.000181	0.000236	0.000207	0.000165	0.000176	0.000198
Tin	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.00473	0.00559	0.00549	0.00580	0.00559	0.00598	0.00522	0.00564	0.00822	0.00726	0.00769	0.00873
Vanadium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	mg/L	28.6	28.6	33.3	41.4	35.6	34.2	32.8	32.0	42.0	43.7	47.4	58.8

Table A6-21: Results of Ore Humic

Week	Units	38	39	40	41	42	43	44	45	46	47	48	49
Sample ID		BW-ARD-283-38	BW-ARD-283-39	BW-ARD-283-40	BW-ARD-283-41	BW-ARD-283-42	BW-ARD-283-43	BW-ARD-283-44	BW-ARD-283-45	BW-ARD-283-46	BW-ARD-283-47	BW-ARD-283-48	BW-ARD-283-49
Date Sampled		02-MAR-13	09-MAR-13	16-MAR-13	23-MAR-13	30-MAR-13	06-APR-13	13-APR-13	20-APR-13	27-APR-13	04-May-13 00:00	11-MAY-13	18-MAY-13
Total Volume In	mL	500	500	500	500	500	500	500	500	500	500	500	500
Total Volume Out	mL	475	475	470	450	475	450	465	450	445	440	475	450
Conductivity	mS/cm	672	837	727	697	783	701	780	768	796	766	797	837
pH	units	3.13	3.03	3.11	3.21	3.11	3.19	3.13	3.12	3.10	3.07	3.07	3.06
Acidity	mg/L CaCO3	209	270	238	235	245	287	300	356	360	333	320	351
Alkalinity, Total	mg/L CaCO3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
Sulfate (SO4)	mg/L	247	295	250	253	301	266	259	251	278	281	298	307
Dissolved Metals													
Aluminum	mg/L	10.6	14.8	12.1	11.9	14.8	12.5	14.8	16.5	16.4	16.1	16.8	16.6
Antimony	mg/L	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.0170	0.0136	0.0152	0.0181	0.0135	0.0150	0.0162	0.0145	0.0138	0.0136	0.0110	0.0101
Barium	mg/L	0.0144	0.0159	0.0159	0.0180	0.0156	0.0138	0.0140	0.0131	0.0131	0.0115	0.0164	0.0150
Beryllium	mg/L	0.00544	0.0058	0.0058	0.0057	0.0059	0.0055	0.0060	0.0058	0.0053	0.0050	0.0056	0.0056
Bismuth	mg/L	<0.0025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	mg/L	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium	mg/L	0.368	0.425	0.403	0.383	0.419	0.393	0.404	0.401	0.381	0.397	0.373	0.378
Calcium	mg/L	4.51	5.96	4.98	5.00	5.47	4.44	5.32	4.94	5.09	4.32	5.74	5.80
Chromium	mg/L	0.00187	0.0033	0.0018	0.0040	0.0028	0.0019	0.0025	0.0023	0.0028	0.0022	0.0032	0.0031
Cobalt	mg/L	0.107	0.117	0.121	0.119	0.125	0.120	0.125	0.132	0.126	0.128	0.126	0.133
Copper	mg/L	0.210	0.373	0.299	0.269	0.417	0.368	0.430	0.497	0.594	0.567	0.738	0.522
Iron	mg/L	5.43	5.47	3.73	3.81	2.96	2.60	3.62	2.62	3.23	3.13	1.97	1.64
Lead	mg/L	0.289	0.332	0.331	0.355	0.390	0.371	0.425	0.407	0.425	0.415	0.394	0.387
Lithium	mg/L	0.0070	0.0098	<0.005	0.0109	0.0209	0.0080	0.0055	0.0066	<0.005	0.0098	0.0078	0.0107
Magnesium	mg/L	3.19	4.01	3.44	3.33	3.66	3.16	6.27	3.60	3.58	3.35	3.99	3.96
Manganese	mg/L	19.2	18.7	18.8	17.5	18.0	15.5	16.6	16.8	17.4	14.4	15.1	15.5
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	<0.00025	0.236	<0.0005	<0.0005	<0.0005	<0.0005	0.00055	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nickel	mg/L	0.150	0.166	0.165	0.164	0.173	0.161	0.175	0.178	0.173	0.172	0.176	0.189
Phosphorus	mg/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	mg/L	2.77	3.03	3.01	3.07	2.96	2.56	3.28	2.81	2.73	2.37	2.43	2.53
Selenium	mg/L	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silicon	mg/L	11.1	14.9	12.7	12.8	14.2	12.0	14.5	13.1	12.1	12.6	15.2	14.1
Silver	mg/L	0.000132	0.00019	0.00014	0.00012	0.00022	0.00013	0.00016	0.00023	0.00703	0.00013	0.00046	0.00023
Sodium	mg/L	<0.25	0.98	0.56	6.16	<0.5	<0.5	7.69	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium	mg/L	0.0235	0.0278	0.0252	0.0256	0.0276	0.0224	0.0345	0.0232	0.0235	0.0204	0.0259	0.0258
Sulfur	mg/L	83.5	104	91.1	91.9	96.5	88.6	102	99.9	99.0	99.6	101	108
Thallium	mg/L	0.000194	0.00025	0.00023	0.00025	0.00031	0.00032	0.00033	0.00039	0.00034	0.00033	0.00032	0.00040
Tin	mg/L	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.00722	0.00817	0.00764	0.00730	0.00857	0.00776	0.00853	0.00805	0.00810	0.00774	0.00816	0.00865
Vanadium	mg/L	<0.005	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	54.6	61.6	61.6	54.9	60.3	56.5	61.5	57.7	58.0	55.8	55.2	56.0

Table A6-21: Results of Ore Humic

Week	Units	50	51
Sample ID		BW-ARD-283-50	BW-ARD-283-51
Date Sampled		25-MAY-13	01-JUN-13
Total Volume In	mL	500	500
Total Volume Out	mL	440	450
Conductivity	mS/cm	826	782
pH	units	3.02	3.05
Acidity	mg/L CaCO3	299	301
Alkalinity, Total	mg/L CaCO3	<2.00	<2.00
Sulfate (SO4)	mg/L	264	229
Dissolved Metals			
Aluminum	mg/L	17.2	16.6
Antimony	mg/L	<0.001	<0.001
Arsenic	mg/L	0.0119	0.0100
Barium	mg/L	0.0152	0.0169
Beryllium	mg/L	0.0058	0.0051
Bismuth	mg/L	<0.005	<0.005
Boron	mg/L	<0.10	<0.10
Cadmium	mg/L	0.382	0.344
Calcium	mg/L	5.82	5.54
Chromium	mg/L	0.0027	0.0028
Cobalt	mg/L	0.132	0.127
Copper	mg/L	0.559	0.534
Iron	mg/L	1.70	1.47
Lead	mg/L	0.413	0.371
Lithium	mg/L	0.0058	0.0076
Magnesium	mg/L	3.63	3.55
Manganese	mg/L	14.5	14.0
Mercury	mg/L	<0.00001	<0.00001
Molybdenum	mg/L	<0.0005	<0.0005
Nickel	mg/L	0.189	0.205
Phosphorus	mg/L	<0.30	<0.30
Potassium	mg/L	2.50	2.38
Selenium	mg/L	<0.001	<0.001
Silicon	mg/L	14.0	13.9
Silver	mg/L	0.00020	0.00017
Sodium	mg/L	<0.50	<0.50
Strontium	mg/L	0.0263	0.0243
Sulfur	mg/L	105	99.4
Thallium	mg/L	0.00044	0.00038
Tin	mg/L	<0.001	<0.001
Titanium	mg/L	<0.01	<0.01
Uranium	mg/L	0.00875	0.00763
Vanadium	mg/L	<0.01	<0.01
Zinc	mg/L	57.3	50.4

Table A6-22: Results of Modified Waste Rock Humidity Cell Test BW-ARD-566

Sample ID		BW-ARD-566-37	BW-ARD-566-38	BW-ARD-566-39	BW-ARD-566-40	BW-ARD-566-41	BW-ARD-566-42	BW-ARD-566-43	BW-ARD-566-44	BW-ARD-566-45	BW-ARD-566-46	BW-ARD-566-47	BW-ARD-566-48
Date Sampled		18-DEC-12	24-DEC-12	31-DEC-12	08-JAN-13	15-JAN-13	22-JAN-13	29-JAN-13	05-FEB-13	12-FEB-13	19-FEB-13	26-FEB-13	05-MAR-13
Total Volume In	mL	1000	<5.	<5.	500	500	500	<5.	<5.	<5.	500	500	500
Total Volume	mL	870	<5.	<5.	500	500	475	<5.	<5.	<5.	425	450	425
Conductivity	mS/cm	123			335	219	176				433	303	243
pH	units	5.24			5.01	4.98	5.06				4.88	5.00	4.98
Acidity	mg/L	7.9			25.7	16.5	12.0				44.7	28.9	24.3
Alkalinity, Total	mg/L	<2.00			<2.	<2.	<2.				2.9	<2.0	<2.0
Sulfate (SO4)	mg/L	43.6			147	84.6	68.9				201	136	105
Dissolved Metals													
Aluminum	mg/L	0.0130			0.061	0.0442	0.0307				0.152	0.0934	0.0803
Antimony	mg/L	0.00082			0.00082	0.00072	0.00065				0.00048	0.00041	0.00036
Arsenic	mg/L	0.00210			0.00336	0.00314	0.00309				0.00399	0.00231	0.00197
Barium	mg/L	0.0214			0.0665	0.0415	0.0293				0.0332	0.0250	0.0213
Beryllium	mg/L	0.00016			0.00041	0.00026	0.00024				0.00082	0.00064	0.00059
Bismuth	mg/L	<0.0005			<0.001	<0.0005	<0.0005				<0.001	<0.0005	<0.0005
Boron	mg/L	<0.01			<0.02	<0.01	<0.01				<0.02	<0.01	<0.01
Cadmium	mg/L	0.0147			0.0508	0.0306	0.0244				0.0777	0.0535	0.0405
Calcium	mg/L	12.5			44.3	25.7	19.2				54.1	38.1	25.8
Chromium	mg/L	<0.0005			<0.001	<0.0005	<0.0005				<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00386			0.0139	0.00854	0.00686				0.0232	0.0159	0.0118
Copper	mg/L	0.00067			0.0023	0.00138	0.00110				0.00291	0.00226	0.00213
Iron	mg/L	0.577			2.37	1.70	1.26				7.22	5.02	4.52
Lead	mg/L	0.000079			0.00024	0.000160	0.000118				0.00033	0.000219	0.000188
Lithium	mg/L	0.00279			0.0048	0.00378	0.00398				0.0061	0.00548	0.00534
Magnesium	mg/L	0.799			2.25	1.35	1.04				2.82	1.77	1.25
Manganese	mg/L	2.89			10.4	6.42	5.18				15.8	9.89	7.42
Mercury	mg/L	<0.00001			<0.	<0.	<0.				<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	<0.00005			<0.0001	<0.0001	<0.0001				<0.0001	<0.00005	<0.00005
Nickel	mg/L	0.00082			0.0030	0.00186	0.00149				0.0055	0.00375	0.00277
Phosphorus	mg/L	<0.30			<0.3	<0.3	<0.3				<0.3	<0.3	<0.3
Potassium	mg/L	3.31			5.64	4.40	3.85				6.32	5.16	4.35
Selenium	mg/L	<0.0001			0.00021	0.00018	<0.0001				0.00041	0.00025	0.00018
Silicon	mg/L	4.70			8.26	7.83	7.15				7.65	7.91	7.67
Silver	mg/L	<0.00001			<0.	<0.	<0.				<0.00002	<0.00001	<0.00001
Sodium	mg/L	0.322			0.75	0.611	0.486				1.03	0.746	0.609
Strontium	mg/L	0.0551			0.173	0.103	0.0789				0.172	0.119	0.0956
Sulfur	mg/L	15.9			51.5	33.5	25.6				69.6	45.9	36.1
Thallium	mg/L	0.000040			0.000068	0.000055	0.000048				0.000087	0.000066	0.000063
Tin	mg/L	<0.0001			<0.0002	<0.0001	<0.0001				<0.0002	<0.0001	<0.0001
Titanium	mg/L	<0.01			<0.01	<0.01	<0.01				<0.01	<0.01	<0.01
Uranium	mg/L	0.000131			0.000435	0.000296	0.000224				0.00110	0.000737	0.000691
Vanadium	mg/L	<0.001			<0.002	<0.001	<0.001				<0.002	<0.001	<0.001
Zinc	mg/L	2.04			7.20	4.38	3.69				11.4	8.19	6.19

mg/L

Table A6-22: Results of Modi

Sample ID		BW-ARD-566-49	BW-ARD-566-50	BW-ARD-566-51	BW-ARD-566-52	BW-ARD-566-53	BW-ARD-566-54	BW-ARD-566-55	BW-ARD-566-56	BW-ARD-566-57	BW-ARD-566-58	BW-ARD-566-59	BW-ARD-566-60
Date Sampled		12-MAR-13	19-MAR-13	26-MAR-13	02-APR-13	09-APR-13	16-APR-13	23-APR-13	30-APR-13	07-MAY-13	14-MAY-13	21-MAY-13	28-MAY-13
Total Volume In	mL	500	<5.0	<5.0	<5.0	<5.00	<5.00	500	500	500	500	500	500
Total Volume	mL	405	<5.0	<5.0	<5.0	<5.00	<5.00	400	450	470	410	455	515
Conductivity	mS/cm	223						493	372	252	203	182	185
pH	units	4.98						4.64	4.74	4.85	4.82	4.89	4.88
Acidity	mg/L	23.6						2.1	164	39.7	27.7	49.3	34.1
Alkalinity, Total	mg/L	2.1						2.1	<2.00	<2.00	<2.00	<2.00	<2.00
Sulfate (SO4)	mg/L	94.3						240	165	108	92.2	74.2	74.1
Dissolved Metals													
Aluminum	mg/L	0.0903						0.351	0.261	0.124	0.0969	0.0858	0.0867
Antimony	mg/L	0.00033						0.00027	0.00024	0.00020	0.00019	0.00019	0.00016
Arsenic	mg/L	0.00121						0.00244	0.00071	0.00059	0.00042	0.00046	0.00043
Barium	mg/L	0.0203						0.0196	0.0156	0.0136	0.0123	0.0126	0.0151
Beryllium	mg/L	0.00061						0.00155	0.00122	0.00090	0.00076	0.00062	0.00069
Bismuth	mg/L	<0.0005						<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01						<0.02	<0.02	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.0374						0.0961	0.0686	0.0436	0.0339	0.0286	0.0301
Calcium	mg/L	23.9						59.8	44.7	26.2	19.5	16.8	16.9
Chromium	mg/L	<0.0005						<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.0111						0.0328	0.0229	0.0145	0.0110	0.00957	0.00978
Copper	mg/L	0.00227						0.00388	0.00280	0.00191	0.00174	0.00161	0.00161
Iron	mg/L	4.81						17.1	14.0	9.80	7.54	6.65	6.86
Lead	mg/L	0.000191						0.00053	0.00034	0.000225	0.000189	0.000173	0.000159
Lithium	mg/L	0.00465						0.0079	0.0061	0.00522	0.00508	0.00396	0.00404
Magnesium	mg/L	1.12						2.57	1.77	1.09	0.800	0.698	0.622
Manganese	mg/L	6.76						17.7	12.5	7.86	5.79	5.38	5.53
Mercury	mg/L	<0.00001						<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L	<0.00005						<0.0001	0.00010	0.000087	<0.00005	0.000153	<0.00005
Nickel	mg/L	0.00272						0.0094	0.0072	0.00430	0.00332	0.00294	0.00298
Phosphorus	mg/L	<0.3						<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	mg/L	4.08						6.13	5.16	4.15	3.20	3.02	2.82
Selenium	mg/L	0.00016						0.00081	0.00050	0.00030	0.00022	0.00022	0.00023
Silicon	mg/L	8.01						4.28	8.93	8.55	8.18	7.66	9.26
Silver	mg/L	<0.00001						<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	0.566						1.14	0.91	0.684	0.629	0.555	0.604
Strontium	mg/L	0.0872						0.172	0.122	0.0860	0.0665	0.0625	0.0628
Sulfur	mg/L	32.2						85.6	61.1	38.2	30.1	26.3	27.2
Thallium	mg/L	0.000065						0.000089	0.000073	0.000064	0.000059	0.000051	0.000048
Tin	mg/L	<0.0001						<0.0002	<0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01						<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000755						0.00278	0.00201	0.00124	0.00106	0.000905	0.000923
Vanadium	mg/L	<0.001						<0.002	<0.002	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	5.93						14.8	10.9	6.85	5.16	4.46	4.67

mg/L

Table A6-22: Results of Modi

Sample ID		BW-ARD-566-61	BW-ARD-566-62	BW-ARD-566-63	BW-ARD-566-64	BW-ARD-566-65	BW-ARD-566-66	BW-ARD-566-67
Date Sampled		04-JUN-13	11-JUN-13	18-JUN-13	25-JUN-13	02-JUL-13	09-JUL-13	15-JUL-13
Total Volume In	mL	500	500	500	500	500	500	500
Total Volume	mL	455	455	455	470	400	500	460
Conductivity	mS/cm	153	158	148	150	154	158	165
pH	units	4.90	4.84	4.90	4.90	4.85	4.85	4.81
Acidity	mg/L	134	27.6	23.2	21.8	22.4	20.1	28.0
Alkalinity, Total	mg/L	<2.00	3.2	<2.0	<2.0	<2.0	<2.0	<2.0
Sulfate (SO4)	mg/L	67.1	64.0	58.3	61.5	60.5	61.1	63.4
Dissolved Metals								
Aluminum	mg/L	0.0746	0.0846	0.0794	0.0829	0.0925	0.0827	0.101
Antimony	mg/L	0.00015	0.00014	0.00015	0.00016	0.00013	0.00016	0.00014
Arsenic	mg/L	0.00059	0.00055	0.00063	0.00057	0.00061	0.00053	0.00059
Barium	mg/L	0.0134	0.0143	0.0132	0.0148	0.0136	0.0157	0.0163
Beryllium	mg/L	0.00064	0.00065	0.00064	0.00068	0.00066	0.00066	0.00074
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.0245	0.0256	0.0237	0.0255	0.0257	0.0255	0.0265
Calcium	mg/L	14.4	14.3	13.3	13.6	13.5	13.8	13.8
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00787	0.00813	0.00743	0.00764	0.00768	0.00733	0.00770
Copper	mg/L	0.00173	0.00174	0.00186	0.00172	0.00185	0.00177	0.00209
Iron	mg/L	5.42	6.27	5.64	5.67	6.00	5.04	5.94
Lead	mg/L	0.000141	0.000153	0.000134	0.000151	0.000149	0.000156	0.000155
Lithium	mg/L	0.00404	0.00349	0.00358	0.00338	0.00314	0.00347	0.00348
Magnesium	mg/L	0.533	0.539	0.511	0.490	0.483	0.510	0.496
Manganese	mg/L	4.39	4.62	4.10	4.47	4.41	4.45	4.76
Mercury	mg/L	<0.00001	<0.00001	<0.0	<0.0	<0.0	<0.0	<0.0
Molybdenum	mg/L	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	0.00236	0.00243	0.00224	0.00218	0.00215	0.00221	0.00230
Phosphorus	mg/L	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	2.58	2.57	2.30	2.40	2.40	2.27	2.27
Selenium	mg/L	0.00018	0.00020	0.00017	0.00017	0.00016	0.00017	0.00020
Silicon	mg/L	6.29	6.53	5.87	7.31	7.43	7.98	6.96
Silver	mg/L	<0.00001	<0.00001	<0.0	<0.0	<0.0	<0.0	<0.0
Sodium	mg/L	0.490	0.493	0.462	0.487	0.494	0.483	0.488
Strontium	mg/L	0.0504	0.0515	0.0496	0.0507	0.0495	0.0540	0.0552
Sulfur	mg/L	21.7	22.4	20.4	21.6	21.9	20.5	21.5
Thallium	mg/L	0.000045	0.000051	0.000040	0.000044	0.000045	0.000041	0.000042
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000836	0.000939	0.000863	0.000988	0.000980	0.000873	0.00110
Vanadium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	3.88	3.67	3.46	3.65	3.80	4.00	3.97

mg/L

Table A6-23: Results of Modified Waste Rock Humidity Cell Test BW-ARD-606

Sample ID		BW-ARD-606-12	BW-ARD-606-13	BW-ARD-606-14	BW-ARD-606-15	BW-ARD-606-16	BW-ARD-606-17	BW-ARD-606-18	BW-ARD-606-19	BW-ARD-606-20	BW-ARD-606-21	BW-ARD-606-22	BW-ARD-606-23
Date Sampled		08-DEC-12	15-DEC-12	22-DEC-12	29-DEC-12	05-JAN-13	12-JAN-13	19-JAN-13	26-JAN-13	02-FEB-13	09-FEB-13	16-FEB-13	23-FEB-13
Total Volume In	mL	1000	<5.00	<5.00	500	500	500	<5.	<5.	<5.	500	500	500
Total Volume Out	mL	965	<5.00	<5.00	430	470	475	<5.	<5.	<5.	410	475	475
Conductivity	mS/cm	91.3			228	144	128				212	139	120
pH	units	8.02			7.87	7.86	7.89				7.79	7.85	8.05
Acidity	mg/L CaCO3	2.4			4.1	5.5	6.7				3.1	3.2	2.3
Alkalinity, Total	mg/L CaCO3	19.2			23.7	27.2	30.5				22.9	24.9	28.6
Sulfate (SO4)	mg/L	16.2			60.5	29.6	21.6				54.8	27.8	21.8
Dissolved Metals													
Aluminum	mg/L	0.151			0.0595	0.0621	0.0862				0.0650	0.0811	0.0844
Antimony	mg/L	0.0486			0.0687	0.0741	0.0785				0.0476	0.0569	0.0662
Arsenic	mg/L	0.0349			0.0340	0.0326	0.0409				0.0353	0.0404	0.0431
Barium	mg/L	0.00127			0.00343	0.00180	0.00195				0.00322	0.00199	0.00178
Beryllium	mg/L	<0.0001			<0.0001	<0.0001	<0.0001				<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005			<0.0005	<0.0005	<0.0005				<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01			<0.01	<0.01	<0.01				<0.01	<0.01	<0.01
Cadmium	mg/L	0.000179			0.000559	0.000331	0.000347				0.000435	0.000266	0.000267
Calcium	mg/L	13.7			36.5	22.2	19.6				35.1	21.8	19.0
Chromium	mg/L	<0.0005			<0.0005	<0.0005	<0.0005				<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00027			0.00097	0.00056	0.00057				0.00063	0.00050	0.00044
Copper	mg/L	<0.0005			<0.0005	<0.0005	<0.0005				0.00055	<0.0005	<0.0005
Iron	mg/L	<0.03			<0.03	<0.03	<0.03				<0.03	<0.03	<0.03
Lead	mg/L	0.000074			<0.0001	0.000068	0.000066				<0.0001	0.000055	0.000058
Lithium	mg/L	0.00461			0.00932	0.00703	0.00666				0.00785	0.00673	0.00609
Magnesium	mg/L	0.469			1.28	0.634	0.701				1.05	0.701	0.662
Manganese	mg/L	0.105			0.282	0.164	0.170				0.160	0.118	0.125
Mercury	mg/L	<0.00001			<0.	<0.	<0.				<0.	<0.00001	<0.00001
Molybdenum	mg/L	0.00106			0.00291	0.00203	0.00175				0.00192	0.00184	0.00145
Nickel	mg/L	<0.0005			0.00052	<0.0005	<0.0005				<0.0005	0.00073	<0.0005
Phosphorus	mg/L	<0.30			<0.3	<0.3	<0.3				<0.3	<0.3	<0.3
Potassium	mg/L	2.35			3.90	2.46	2.88				3.42	2.78	2.59
Selenium	mg/L	<0.0001			<0.0001	<0.0001	<0.0001				<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.55			2.24	2.16	2.18				2.07	1.91	1.99
Silver	mg/L	<0.00001			<0.	<0.	<0.				<0.	<0.00001	<0.00001
Sodium	mg/L	0.783			1.36	0.831	0.937				1.08	0.828	0.797
Strontium	mg/L	0.0872			0.251	0.135	0.126				0.204	0.140	0.124
Sulfur	mg/L	5.62			20.8	9.80	7.39				18.9	9.59	7.22
Thallium	mg/L	0.000015			0.000026	0.000022	0.000017				0.000024	0.000017	0.000018
Tin	mg/L	<0.0001			<0.0001	<0.0001	<0.0001				<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01			<0.01	<0.01	<0.01				<0.01	<0.01	<0.01
Uranium	mg/L	0.000185			0.000308	0.000292	0.000252				0.000244	0.000229	0.000216
Vanadium	mg/L	0.0012			0.0011	<0.001	0.0013				0.0010	0.0011	0.0011
Zinc	mg/L	<0.003			0.0089	0.0061	0.0053				0.0066	0.0046	0.0043

Table A6-23: Results of Modified Was

Sample ID		BW-ARD-606-24	BW-ARD-606-25	BW-ARD-606-26	BW-ARD-606-27	BW-ARD-606-28	BW-ARD-606-29	BW-ARD-606-30	BW-ARD-606-31	BW-ARD-606-32	BW-ARD-606-33	BW-ARD-606-34	BW-ARD-606-35
Date Sampled		02-MAR-13	09-MAR-13	16-MAR-13	23-MAR-13	30-MAR-13	06-APR-13	13-APR-13	20-APR-13	27-APR-13	04-May-13	11-MAY-13	18-MAY-13
Total Volume In	mL	<5.0	<5.0	<5.0	<5.0	<5.0	500	500	500	500	500	500	500
Total Volume Out	mL	<5.0	<5.0	<5.0	<5.0	<5.0	375	500	440	480	425	510	470
Conductivity	mS/cm						212	160	124	128	113	111	105
pH	units						7.99	7.94	8.04	8.09	8.26	8.01	8.09
Acidity	mg/L CaCO3						4.7	3.4	2.9	1.8	6.3	4.1	2.4
Alkalinity, Total	mg/L CaCO3						21.3	27.0	24.7	27.6	23.2	25.9	21.4
Sulfate (SO4)	mg/L						57.9	33.4	24.8	26.0	23.9	23.8	22.8
Dissolved Metals													
Aluminum	mg/L						0.0606	0.0589	0.0797	0.0803	0.0929	0.0897	0.0976
Antimony	mg/L						0.0611	0.0599	0.0519	0.0568	0.0450	0.0587	0.0420
Arsenic	mg/L						0.0356	0.0395	0.0431	0.0413	0.0491	0.0546	0.0560
Barium	mg/L						0.00343	0.00229	0.00174	0.00195	0.00152	0.00148	0.00147
Beryllium	mg/L						<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L						<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L						<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L						0.000370	0.000275	0.000189	0.000211	0.000165	0.000171	0.000148
Calcium	mg/L						37.0	25.6	19.8	20.8	17.2	17.8	16.4
Chromium	mg/L						<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L						0.00049	0.00046	0.00035	0.00042	0.00032	0.00029	0.00027
Copper	mg/L						0.00082	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L						<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L						<0.00005	<0.00005	0.000055	0.000062	<0.00005	0.000071	<0.00005
Lithium	mg/L						0.00796	0.00818	0.00601	0.00637	0.00507	0.00489	0.00492
Magnesium	mg/L						1.05	0.819	0.622	0.634	0.537	0.533	0.511
Manganese	mg/L						0.144	0.110	0.0839	0.0899	0.0646	0.0680	0.0602
Mercury	mg/L						<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum	mg/L						0.00162	0.00174	0.00111	0.00117	0.00106	0.00108	0.00102
Nickel	mg/L						0.00052	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L						<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium	mg/L						4.13	2.93	2.45	2.52	2.27	2.16	2.07
Selenium	mg/L						<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L						2.11	2.08	1.94	1.98	1.68	1.88	1.78
Silver	mg/L						<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L						1.05	0.874	0.642	0.641	0.556	0.534	0.494
Strontium	mg/L						0.212	0.156	0.121	0.132	0.101	0.0978	0.0933
Sulfur	mg/L						20.2	12.4	9.34	8.86	8.77	7.41	7.69
Thallium	mg/L						0.000028	0.000018	0.000016	0.000016	0.000014	0.000014	0.000013
Tin	mg/L						<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L						<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L						0.000261	0.000254	0.000183	0.000203	0.000146	0.000165	0.000111
Vanadium	mg/L						<0.001	<0.001	<0.001	<0.001	<0.001	0.0011	0.0011
Zinc	mg/L						0.0048	0.0039	0.0031	0.0038	<0.003	<0.003	<0.003

Table A6-23: Results of Modified Was

Sample ID		BW-ARD-606-36	BW-ARD-606-37	BW-ARD-606-38	BW-ARD-606-39	BW-ARD-606-40	BW-ARD-606-41	BW-ARD-606-42	BW-ARD-606-43
Date Sampled		25-MAY-13	01-JUN-13	08-JUN-13	15-JUN-13	22-JUN-13	29-JUN-13	06-JUL-13	13-JUL-13
Total Volume In	mL	500	500	500	500	500	500	500	500
Total Volume Out	mL	450	450	430	450	425	465	460	440
Conductivity	mS/cm	103	96.5	96.1	98.5	92.4	97.8	98.1	93.6
pH	units	8.02	8.13	8.12	7.94	8.02	8.17	8.17	8.30
Acidity	mg/L CaCO3	2.3	1.4	1.32	2.1	2.0	2.0	2.3	1.4
Alkalinity, Total	mg/L CaCO3	21.9	18.9	19.1	19.3	19.0	22.6	21.1	20.1
Sulfate (SO4)	mg/L	20.4	19.8	21.0	20.3	20.0	20.0	18.4	18.4
Dissolved Metals									
Aluminum	mg/L	0.103	0.128	0.125	0.113	0.128	0.113	0.113	0.123
Antimony	mg/L	0.0370	0.0340	0.0323	0.0322	0.0313	0.0376	0.0357	0.0314
Arsenic	mg/L	0.0563	0.0608	0.0600	0.0572	0.0609	0.0540	0.0567	0.0554
Barium	mg/L	0.00138	0.00129	0.00134	0.00120	0.00125	0.00134	0.00124	0.00130
Beryllium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/L	0.000134	0.000086	0.000077	0.000071	0.000057	0.000065	0.000069	0.000058
Calcium	mg/L	16.4	15.3	15.9	16.3	14.7	16.3	16.0	14.4
Chromium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.00028	0.00018	0.00014	0.00011	<0.0001	<0.0001	<0.0001	<0.0001
Copper	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Iron	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Lead	mg/L	0.000053	0.000059	0.000098	<0.0001	0.000065	0.000070	0.000061	0.000063
Lithium	mg/L	0.00465	0.00423	0.00413	0.00423	0.00309	0.00389	0.00365	0.00310
Magnesium	mg/L	0.480	0.417	0.404	0.437	0.368	0.420	0.388	0.363
Manganese	mg/L	0.0487	0.0237	0.0118	0.0115	0.00572	0.00508	0.00632	0.00532
Mercury	mg/L	<0.00001	<0.00001	<0.00001	<0.0	<0.0	<0.0	<0.0	<0.0
Molybdenum	mg/L	0.00107	0.000968	0.000984	0.00103	0.00126	0.00168	0.00170	0.00157
Nickel	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Phosphorus	mg/L	<0.30	<0.30	<0.30	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	mg/L	2.00	1.87	1.82	1.86	1.75	1.86	1.81	1.69
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silicon	mg/L	1.64	1.66	1.69	1.59	1.53	1.68	1.65	1.47
Silver	mg/L	<0.00001	<0.00001	<0.00001	<0.0	<0.0	<0.0	<0.0	<0.0
Sodium	mg/L	0.485	0.442	0.401	0.420	0.364	0.377	0.359	0.327
Strontium	mg/L	0.0971	0.0886	0.0866	0.0854	0.0794	0.0899	0.0818	0.0776
Sulfur	mg/L	7.20	7.27	6.90	6.78	6.31	6.48	6.33	6.31
Thallium	mg/L	0.000016	0.000013	0.000013	0.000012	0.000011	0.000013	0.000013	0.000013
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	mg/L	0.000114	0.000096	0.000100	0.000093	0.000087	0.000117	0.000099	0.000083
Vanadium	mg/L	0.0010	0.0012	0.0010	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0031	<0.003

ANNEX 7
Metallurgical Tailings Humidity Cell Test Results

Table A7-1: Heap Leach Tails (P80-6.3mm CyanidationTail) Weekly Analysis

					P80-6.3mm Cyanidation Tail (Heap Leach)								2.02 Kg					
					Total Fe					SO_4=			Acidity, $CaCO_3$ Equivalents			Alkalinity, $CaCO_3$ Equivalents		
Week	Vol. L	Effluent pH	Redox, mV (vs Ag/AgCl)	Conductivity µS/cm[1)]	mg/l	mg/kg	Cum. mg/kg	Fe^{2}+ mg/l	Fe^{3}+ mg/l	mg/l	mg/kg	Cum. mg/kg	mg/l	mg/kg	Cum. mg/kg	mg/l	mg/kg	Cum. mg/kg
0	1.014	8.42	83	590	0.07	0.035	0.035	0.05	0.02	40.0	20.13	20.13	0	0.00	0.00	45	22.65	22.65
1	0.973	7.97	128	800	0.06	0.029	0.064	0.02	0.04	224.0	108.16	128.29	0	0.00	0.00	33	15.93	38.58
2	0.952	7.44	166	1110	0.06	0.028	0.092	0.01	0.05	510.0	240.95	369.24	0	0.00	0.00	31	14.65	53.23
3	0.940	7.45	257	1080	0.07	0.033	0.125	0.01	0.06	490.0	228.59	597.83	0	0.00	0.00	28	13.06	66.29
4	0.908	7.39	221	930	0.06	0.027	0.152	0.02	0.04	320.0	144.20	742.03	0	0.00	0.00	19	8.56	74.85
5	0.908	7.53	185	550	0.08	0.036	0.188	0.04	0.04	230.0	103.64	845.67	0	0.00	0.00	17	7.66	82.51
6	0.936	7.40	189	440	0.10	0.046	0.234	0.01	0.09	190.0	88.26	933.93	0	0.00	0.00	17	7.90	90.41
7	0.996	7.39	189	460	0.07	0.035	0.269	0.01	0.06	175.0	86.50	1020.43	0	0.00	0.00	19	9.39	99.80
8	0.946	7.37	198	310	0.09	0.042	0.311	0.01	0.08	135.0	63.38	1083.81	0	0.00	0.00	18	8.45	108.25
9	0.938	7.22	211	360	0.01	0.005	0.316	0.01	0.00	150.0	69.83	1153.64	0	0.00	0.00	12	5.59	113.84
10	0.930	7.39	271	350	0.02	0.009	0.325	0.02	0.00	125.0	57.69	1211.33	0	0.00	0.00	12	5.54	119.38
11	0.919	7.08	218	270	0.08	0.036	0.361	0.01	0.07	135.0	61.57	1272.90	7	3.19	3.19	23	10.49	129.87
12	0.911	7.16	237	310	0.02	0.009	0.370	0.01	0.01	130.0	58.77	1331.67	5	2.26	5.45	13	5.88	135.75
13	0.980	7.21	96	330	0.02	0.010	0.380	0.01	0.01	145.0	70.52	1402.19	3	1.46	6.91	9	4.38	140.13
14	0.954	7.22	154	300	0.02	0.009	0.389	0.02	0.00	135.0	63.92	1466.11	5	2.37	9.28	7	3.31	143.44
15	0.941	6.60	209	320	0.01	0.005	0.394	0.01	0.00	145.0	67.71	1533.82	3	1.40	10.68	5	2.33	145.77
16	0.947	7.56	227	420	0.00	0.000	0.394	0.00	0.00	230.0	108.09	1641.91	9	4.23	14.91	7	3.29	149.06
17	0.950	6.68	251	410	0.01	0.005	0.399	0.00	0.01	170.0	80.15	1722.06	9	4.24	19.15	5	2.36	151.42
18	0.951	6.67	257	400	0.01	0.005	0.404	0.00	0.01	175.0	82.59	1804.65	21	9.91	29.07	5	2.36	153.78
19	0.966	6.30	159	230	0.02	0.010	0.414	0.00	0.02	85.0	40.75	1845.40	17	8.15	37.22	4	1.92	155.70
20	0.915	6.91	91	310	0.09	0.041	0.455	0.02	0.07	120.0	54.49	1899.89	31	14.08	51.29	6	2.72	158.42
21	1.070	6.20	160	320	0.19	0.101	0.556	0.04	0.15	135.0	71.69	1971.58	26	13.81	65.10	4	2.12	160.54
22	0.942	6.08	125	280	0.17	0.079	0.635	0.03	0.14	115.0	53.76	2025.34	27	12.62	77.72	3	1.40	161.94
23	0.978	6.15	95	350	0.40	0.194	0.829	0.07	0.33	155.0	75.23	2100.57	40	19.41	97.13	4	1.94	163.88
24	0.978	6.24	70	380	0.65	0.315	1.144	0.11	0.54	170.0	82.51	2183.08	52	25.24	122.37	4	1.94	165.82
25	1.019	6.20	43	330	0.56	0.283	1.427	0.16	0.40	150.0	75.86	2258.94	49	24.78	147.15	4	2.02	167.84
26	1.013	6.19	120	320	0.49	0.246	1.673	0.17	0.32	145.0	72.90	2331.84	56	28.15	175.31	5	2.51	170.35
27	0.984	5.60	64	310	1.04	0.508	2.181	0.19	0.85	120.0	58.60	2390.44	49	23.93	199.24	4	1.95	172.30
28	0.987	5.03	227	320	1.24	0.607	2.788	0.19	1.05	120.0	58.78	2449.22	62	30.37	229.60	2	0.98	173.28
29	0.975	4.93	221	350	1.18	0.571	3.359	0.38	0.80	145.0	70.16	2519.38	71	34.36	263.96	1	0.48	173.76
30	0.978	4.94	231	340	1.21	0.587	3.946	0.27	0.94	150.0	72.80	2592.18	67	32.52	296.48	2	0.97	174.73
31	0.975	4.72	247	360	2.17	1.050	4.996	0.38	1.79	145.0	70.16	2662.34	69	33.39	329.87	1	0.48	175.21
32	0.945	4.71	265	320	1.47	0.689	5.685	0.18	1.29	135.0	63.31	2725.65	72	33.77	363.63	1	0.47	175.68
33	0.954	4.61	260	370	1.25	0.592	6.277	0.24	1.01	160.0	75.75	2801.40	86	40.72	404.35	1	0.47	176.15
34	1.009	4.67	249	380	1.68	0.841	7.118	0.22	1.46	160.0	80.12	2881.52	88	44.07	448.42	1	0.50	176.65
35	0.981	4.46	287	340	0.45	0.219	7.337	0.08	0.37	125.0	60.86	2942.38	77	37.49	485.90	0	0.00	176.65
36	0.984	4.47	293	360	0.48	0.234	7.571	0.12	0.36	155.0	75.69	3018.07	82	40.04	525.95	0	0.00	176.65
37	0.953	4.29	189	350	1.00	0.473	8.044	0.11	0.89	140.0	66.21	3084.28	84	39.73	565.67	0	0.00	176.65
38	0.982	4.28	311	400	0.81	0.395	8.439	0.10	0.71	195.0	95.03	3179.31	98	47.76	613.43	0	0.00	176.65
39	0.958	4.34	304	380	1.06	0.504	8.943	0.07	0.99	170.0	80.82	3260.13	98	46.59	660.03	0	0.00	176.65
40	1.006	4.25	313	440	1.51	0.754	9.697	0.16	1.35	220.0	109.84	3369.97	98	48.93	708.95	0	0.00	176.65
41	0.977	4.08	190	390	0.79	0.383	10.080	0.10	0.69	155.0	75.15	3445.12	87	42.18	751.14	0	0.00	176.65
42	0.973	4.23	327	420	1.31	0.633	10.713	0.14	1.17	190.0	91.75	3536.87	104	50.22	801.36	0	0.00	176.65
43	0.981	4.08	343	440	1.53	0.745	11.458	0.13	1.40	190.0	92.50	3629.37	96	46.74	848.09	0	0.00	176.65
44	0.977	4.03	351	420	2.27	1.101	12.559	0.20	2.07	210.0	101.82	3731.19	91	44.12	892.22	0	0.00	176.65
45	0.983	4.07	340	450	2.10	1.024	13.583	0.52	1.58	190.0	92.69	3823.88	93	45.37	937.59	0	0.00	176.65
46	0.883	4.03	348	440	1.49	0.653	14.236	0.52	0.97	195.0	85.45	3909.33	93	40.75	978.34	0	0.00	176.65
47	0.999	3.99	357	460	2.31	1.145	15.381	0.82	1.49	195.0	96.68	4006.01	99	49.08	1027.42	0	0.00	176.65
48	0.986	3.97	345	430	2.94	1.439	16.820	0.30	2.64	175.0	85.63	4091.64	93	45.51	1072.93	0	0.00	176.65
49	0.876	3.83	395	410	2.09	0.909	17.729	0.41	1.68	145.0	63.04	4154.68	92	40.00	1112.93	0	0.00	176.65
50	1.003	3.99	324	360	2.94	1.463	19.192	1.03	1.91	150.0	74.67	4229.35	84	41.81	1154.74	0	0.00	176.65
51	1.026	3.81	390	390	2.92	1.487	20.679	1.16	1.76	180.0	91.65	4321.00	91	46.34	1201.07	0	0.00	176.65
52	0.974	3.81	371	390	2.78	1.344	22.023	0.48	2.30	150.0	72.51	4393.51	79	38.19	1239.26	0	0.00	176.65
53	0.965	3.83	373	390	2.38	1.140	23.163	0.40	1.98	160.0	76.63	4470.14	94	45.02	1284.28	0	0.00	176.65
54	0.940	3.75	407	450	2.04	0.952	24.115	0.70	1.34	190.0	88.64	4558.78	100	46.65	1330.93	0	0.00	176.65
55	0.960	3.80	376	430	2.90	1.382	25.497	0.95	1.95	175.0	83.37	4642.15	100	47.64	1378.57	0	0.00	176.65
56	0.995	3.77	373	400	2.88	1.422	26.919	0.62	2.26	170.0	83.95	4726.10	80	39.50	1418.07	0	0.00	176.65
57	0.989	3.77	390	390	2.79	1.369	28.288	0.64	2.15	160.0	78.53	4804.63	83	40.74	1458.81	0	0.00	176.65
58	0.977	3.71	406	380	2.19	1.062	29.350	0.48	1.71	185.0	89.70	4894.33	90	43.64	1502.45	0	0.00	176.65
59	0.980	3.71	399	400	2.81	1.367	30.717	0.32	2.49	165.0	80.25	4974.58	91	44.26	1546.71	0	0.00	176.65
60	0.919	3.68	392	420	4.44	2.025	32.742	0.50	3.94	195.0	88.94	5063.52	101	46.06	1592.77	0	0.00	176.65
61	1.019	3.76	331	360	5.98	3.024	35.766	1.90	4.08	155.0	78.38	5141.90	87	44.00	1636.77	0	0.00	176.65
62	0.995	3.65	400	400	4.25	2.099	37.865	0.29	3.96	160.0	79.01	5220.91	96	47.40	1684.17	0	0.00	176.65
63	0.881	3.57	408	450	4.75	2.077	39.942	0.54	4.21	205.0	89.63	5310.54	113	49.41	1733.58	0	0.00	176.65
64	1.071	3.63	388	368	8.45	4.491	44.433	1.44	7.01	165.0	87.70	5398.24	95	50.49	1784.07	0	0.00	176.65
65	0.993	3.53	374	425	4.45	2.193	46.626	0.97	3.48	175.0	86.24	5484.48	107	52.73	1836.80	0	0.00	176.65
66	0.982	3.51	414	411	4.75	2.315	48.941	0.70	4.05	170.0	82.85	5567.33	108	52.63	1889.44	0	0.00	176.65
67	0.980	3.51	413	382	4.65	2.262	51.203	0.76	3.89	175.0	85.11	5652.44	106	51.55	1940.99	0	0.00	176.65
68	1.019	3.54	413	379	4.15	2.099	53.302	0.78	3.37	160.0	80.91	5733.35	104	52.59	1993.58	0	0.00	176.65
69	0.941	3.47	389	430	5.10	2.382	55.684	1.06	4.04	190.0	88.73	5822.08	117	54.64	2048.22	0	0.00	176.65
70	1.008	3.47	416	423	6.00	3.001	58.685	0.41	5.59	175.0	87.54	5909.62	121	60.53	2108.75	0	0.00	176.65
71	0.921	3.48	420	424	4.45	2.034	60.719	0.44	4.01	175.0	79.99	5989.61	113	51.65	2160.40	0	0.00	176.65
72	0.923	3.49	413	490	5.20	2.382	63.101	0.47	4.73	180.0	82.45	6072.06	121	55.43	2215.83	0	0.00	176.65
73	0.986	3.54	403	425	7.70	3.768	66.869	0.73	6.97	175.0	85.63	6157.69	114	55.78	2271.61	0	0.00	176.65
74	0.910	3.41	402	419	4.10	1.852	68.721	0.18	3.92	150.0	67.74	6225.43	118	53.29	2324.90	0	0.00	176.65
75	0.991	3.53	378	386	7.91	3.890	72.611	0.76	7.15	130.0	63.94	6289.37	122	60.00	2384.90	0	0.00	176.65
76	1.008	3.39	403	421	3.39	1.696	74.307	0.75	2.64	140.0	70.03	6359.40	108	54.03	2438.93	0	0.00	176.65
77	0.983	3.39	407	430	4.90	2.390	76.697	1.09	3.81	160.0	78.05	6437.45	125	60.98	2499.91	0	0.00	176.65
78	0.971	3.40	410	413	4.28	2.062	78.759	0.83	3.45	140.0	67.46	6504.91	122	58.79	2558.70	0	0.00	176.65
79	1.007	3.43	422	461	4.63	2.314	81.073	0.83	3.80	120.0	59.97	6564.88	122	60.97	2619.67	0	0.00	176.65
80	0.973	3.41	416	444	4.18	2.018	83.091	0.77	3.41	120.0	57.95	6622.83	122	58.91	2678.58	0	0.00	176.65
81	0.957	3.40	416	391	4.22	2.004	85.095	0.76	3.46	110.0	52.24	6675.07	117	55.57	2734.15	0	0.00	176.65

Table A7-2: Heap Leach Tails (P80-6.3mm CyanidationTail) Elements

		Elements mg/L																																
Week	pH	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide, WAD	Gallium	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Scandium	Selenium	Silicon	Silver	Sodium	Strontium	Sulfur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
0	8.42	0.1	0.026	0.029	0.016	<0.0010	<0.10	<0.10	<0.001	23	<0.0050	0.02	<0.050	0.15	<0.10	0.24	<0.0025	<0.10	1.8	0.05	<0.00010	<0.010	<0.010	<0.50	14	<0.10	<0.0050	2.8	<0.0050	62	0.12	120	<0.0010	<0.10	<0.10	<0.010	<0.010	<0.010
1	7.97	0.067	0.029	0.014	<0.010	<0.0010	<0.10	<0.10	<0.001	52	<0.0050	0.013	<0.050	0.087	<0.10	0.061	<0.0025	<0.10	5.1	0.31	<0.00010	0.014	<0.010	<0.50	18	<0.10	<0.0050	4.2	<0.0050	75	0.28	210	<0.0010	<0.10	<0.10	<0.010	<0.010	0.013
2	7.44	<0.045	0.014	<0.0050	0.014	<0.0010	<0.10	<0.10	0.0022	140	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.050	<0.0025	<0.10	11	1.7	<0.00010	<0.010	<0.010	<0.50	19	<0.10	<0.0050	2.3	<0.0050	39	0.64	160	<0.0010	<0.10	<0.10	<0.010	0.021	0.26
4	7.39	<0.045	0.01	<0.0050	0.029	<0.0010	<0.10	<0.10	0.003	100	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	5.7	1.3	<0.00010	<0.010	<0.010	<0.50	11	<0.10	<0.0050	2.2	<0.0050	9.7	0.42	130	<0.0010	<0.10	<0.10	<0.010	<0.010	0.15
8	7.37	<0.045	0.0082	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.0037	54	<0.0050	<0.010	<0.050	<0.010	<0.10	0.17	<0.0025	<0.10	2	0.98	<0.00010	<0.010	<0.010	<0.50	5.7	<0.10	<0.0050	2.8	<0.0050	1.8	0.18	100	<0.0010	<0.10	<0.10	<0.010	<0.010	0.19
12	7.16	<0.045	0.0073	<0.0050	0.025	<0.0010	<0.10	<0.10	0.0074	44	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	1.4	1.6	<0.00010	<0.010	<0.010	<0.50	4.8	<0.10	<0.0050	3.4	<0.0050	0.99	0.14	51	<0.0010	<0.10	<0.10	<0.010	<0.010	0.4
16	7.56	<0.045	0.0075	0.0089	<0.010	<0.0010	<0.10	<0.10	0.042	62	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	2	7.2	<0.00010	<0.010	<0.010	<0.50	6.1	<0.10	<0.0050	6.9	<0.0050	1.1	0.23	72	<0.0010	<0.10	<0.10	<0.0050	<0.010	4
20	6.91	<0.045	0.0051	0.012	0.014	<0.0010	<0.10	<0.10	0.12	32	<0.0050	0.033	<0.050	1	<0.10	0.094	<0.0025	<0.10	1.9	9.5	<0.00010	<0.010	0.021	<0.50	4	<0.10	<0.0050	11	<0.0050	0.53	0.18	47	<0.0010	<0.10	<0.10	<0.0050	<0.010	15
24	6.24	<0.045	<0.0025	<0.0050	0.027	<0.0010	<0.10	<0.10	0.27	32	<0.0050	0.064	<0.050	<0.010	<0.10	0.68	0.027	<0.10	2.4	12	<0.0002	<0.010	0.056	<0.50	4.4	<0.10	<0.0050	6.6	<0.0050	<0.50	0.2	56	<0.0020	<0.10	<0.10	<0.0050	<0.010	31
28	5.03	0.095	<0.0025	<0.0050	0.036	<0.0010	<0.10	<0.10	0.32	22	<0.0050	0.063	<0.050	<0.010	<0.10	2	0.089	<0.10	1.9	11	<0.00010	<0.010	0.062	<0.50	3.6	<0.10	<0.0050	6.4	<0.0050	<0.50	0.16	49	<0.0010	<0.10	<0.10	<0.0050	<0.010	37
32	4.71	0.26	<0.0025	<0.0050	0.025	0.0012	<0.10	<0.10	0.35	17	<0.0050	0.06	0.056	<0.010	<0.10	2.5	0.19	<0.10	1.7	12	<0.00010	<0.010	0.065	<0.50	3.5	<0.10	<0.0050	7.1	<0.0050	<0.50	0.12	45	0.0012	<0.10	<0.10	<0.0050	<0.010	43
36	4.47	0.53	<0.0025	0.0097	0.016	0.002	<0.10	<0.10	0.36	14	<0.0050	0.06	0.13	<0.010	<0.10	2	0.28	<0.10	1.7	18	<0.00010	<0.010	0.076	<0.50	3.1	<0.10	<0.0050	8	<0.0050	<0.50	<0.10	47	<0.0010	<0.10	<0.10	<0.0050	<0.010	47
40	4.25	1.2	<0.0025	<0.0050	0.011	0.0034	<0.10	<0.10	0.36	15	<0.0050	0.07	0.2	<0.010	<0.10	2.7	0.39	<0.10	2.2	29	<0.00010	<0.010	0.1	<0.50	3.4	<0.10	<0.0050	10	<0.0050	<0.50	<0.10	56	<0.0010	<0.10	<0.10	0.0086	<0.010	50
44	4.03	2	<0.0025	<0.0050	0.017	0.0047	<0.10	<0.10	0.27	12	<0.0050	0.061	0.26	<0.010	<0.10	2.2	0.36	<0.10	2	31	<0.00010	<0.010	0.094	<0.50	2.8	<0.10	<0.0050	9	<0.0050	<0.50	<0.10	63	<0.0010	<0.10	<0.10	0.012	<0.010	38
48	3.97	3.1	<0.0025	<0.0050	0.01	0.0062	<0.10	<0.10	0.21	12	<0.0050	0.056	0.26	0.01	<0.10	2.8	0.37	<0.10	2.2	32	<0.00010	<0.010	0.092	<0.50	3	<0.10	<0.0050	11	<0.005	<0.50	<0.10	67	<0.0010	<0.10	<0.10	0.014	<0.010	30
52	3.81	3.9	<0.0025	<0.0050	0.018	0.007	<0.10	<0.100	0.15	11	<0.0050	0.045	0.29	<0.010	<0.10	2.8	0.42	<0.10	1.8	25	<0.00010	<0.010	0.075	<0.50	2.9	<0.10	<0.0050	9.9	<0.0050	<0.50	<0.10	49	<0.0010	<0.10	<0.10	0.017	<0.010	23
56	3.77	4.2	<0.0025	<0.0050	0.011	0.0065	<0.10	<0.100	0.12	11	<0.0050	0.038	0.21	<0.010	<0.10	4.9	0.37	<0.10	1.8	22	<0.00010	<0.010	0.065	<0.50	2.8	<0.10	<0.0050	12	<0.0050	<0.50	<0.10	53	<0.0010	<0.10	<0.10	0.016	<0.010	19
60	3.68	6.6	<0.0025	<0.0050	0.014	0.0074	<0.10	<0.100	0.11	11	<0.0050	0.04	0.29	<0.050	<0.10	4.7	0.46	<0.10	2	20	<0.0002	<0.010	0.067	<0.50	3.2	<0.10	<0.0050	14	<0.0050	<0.50	<0.10	58	<0.0020	<0.10	<0.10	0.02	<0.010	19
64	3.63	5.3	<0.0025	<0.0050	0.014	0.0055	<0.10	<0.10	0.09	10	<0.0050	0.03	0.19	<0.050	<0.10	10	0.35	<0.10	1.8	15	<0.00010	<0.010	0.052	<0.50	2.9	<0.100	<0.0050	13	<0.0050	<0.50	<0.10	52	<0.0010	<0.10	<0.10	0.015	<0.010	14
68	3.54	7.8	<0.0050	<0.010	0.013	0.0059	<0.10	<0.10	0.095	8.8	<0.0050	0.032	0.3	<0.050	<0.10	4	0.43	<0.10	1.6	12	<0.0002	<0.010	0.05	<0.50	2.7	<0.100	<0.010	13	<0.0050	<0.50	<0.10	50	<0.0020	<0.10	<0.10	<0.010	<0.010	15
72	3.49	11	<0.0025	<0.0050	0.014	0.0061	<0.10	<0.10	0.12	9.9	<0.0050	0.038	0.42	<0.050	<0.10	5.9	0.45	<0.10	2.1	12	<0.00010	<0.010	0.055	<0.50	3	<0.100	<0.0050	15	<0.0050	0.51	<0.10	66	<0.0010	<0.10	<0.10	0.018	<0.010	17
76		9.2	<0.0010	0.0013	0.016	0.0052	<0.10	<0.10	0.09	9.5	<0.0050	0.029	0.32	<0.050	<0.10	4.4	0.33	<0.10	1.9	9.8	<0.0002	<0.010	0.041	<0.50	2.8	<0.100	<0.0020	16	<0.0050	<0.50	<0.10	56	<0.0005	<0.10	<0.10	0.014	<0.010	13

Table A7-3: Whole Ore Leach Tails (P80 - 150um Cyanidation Tail) Weekly Analysis

P80-150um Cyanidation Tail (Whole Ore Leach) **1.97 Kg**

					Total Fe					SO_4=			Acidity, $CaCO_3$ Equivalents			Alkalinity, $CaCO_3$ Equivalents		
Week	Vol. L	Effluent pH	Redox, mV (vs Ag/AgCl)	Conductivity µS/cm[1)]	mg/l	mg/kg	Cum. mg/kg	Fe^{2}+ mg/l	Fe^{3}+ mg/l	mg/l	mg/kg	Cum. mg/kg	mg/l	mg/kg	Cum. mg/kg	mg/l	mg/kg	Cum. mg/kg
0	0.777	7.27	92	10.0	0.06	0.024	0.024	0.03	0.03	1.0	0.40	0.40	1	0.40	0.40	7	2.77	2.77
1	0.890	7.35	137	100	0.08	0.036	0.060	0.01	0.07	18.0	8.15	8.55	2	0.91	1.30	8	3.62	6.39
2	0.808	7.03	152	110	0.07	0.029	0.089	0.01	0.06	24.0	9.86	18.41	0	0.00	1.30	7	2.88	9.27
3	0.805	6.98	221	130	0.06	0.025	0.114	0.02	0.04	25.0	10.23	28.64	0	0.00	1.30	6	2.46	11.73
4	0.895	6.61	213	110	0.10	0.046	0.160	0.03	0.07	23.0	10.47	39.11	1	0.46	1.76	4	1.82	13.55
5	0.688	7.21	186	70.0	0.07	0.024	0.184	0.01	0.06	19.0	6.65	45.76	0	0.00	1.76	6	2.10	15.65
6	0.796	6.95	188	130	0.08	0.032	0.216	0.01	0.07	47.0	19.02	64.78	2	0.81	2.57	7	2.83	18.48
7	0.664	6.98	186	80.0	0.09	0.030	0.246	0.01	0.08	23.0	7.77	72.55	1	0.34	2.90	7	2.36	20.84
8	0.846	7.01	199	120	0.10	0.043	0.289	0.01	0.09	40.0	17.21	89.76	2	0.86	3.76	6	2.58	23.42
9	0.834	7.18	223	190	0.10	0.042	0.331	0.01	0.09	67.0	28.41	118.17	1	0.42	4.19	6	2.54	25.96
10	0.863	7.28	267	180	0.13	0.057	0.388	0.01	0.12	58.0	25.45	143.62	2	0.88	5.07	7	3.07	29.03
11	0.795	7.75	236	160	0.01	0.004	0.392	0.01	0.00	72.0	29.11	172.73	2	0.81	5.87	12	4.85	33.88
12	0.861	7.52	230	250	0.01	0.004	0.396	0.00	0.01	122.0	53.41	226.14	0	0.00	5.87	20	8.76	42.64
13	0.890	7.53	168	260	0.01	0.005	0.401	0.00	0.01	120.0	54.31	280.45	1	0.45	6.33	7	3.17	45.81
14	0.821	7.74	171	180	0.01	0.004	0.405	0.01	0.00	70.0	29.22	309.67	3	1.25	7.58	7	2.92	48.73
15	0.855	6.95	230	220	0.01	0.004	0.409	0.00	0.01	100.0	43.48	353.15	2	0.87	8.45	6	2.61	51.34
16	0.797	7.38	231	190	0.00	0.000	0.409	0.00	0.00	78.0	31.61	384.76	2	0.81	9.26	6	2.43	53.77
17	0.807	6.86	260	250	0.01	0.004	0.413	0.00	0.01	104.0	42.68	427.44	0	0.00	9.26	6	2.46	56.23
18	0.890	7.32	229	280	0.00	0.000	0.413	0.00	0.00	122.0	55.21	482.65	0	0.00	9.26	6	2.72	58.95
19	0.830	7.37	156	210	0.00	0.000	0.413	0.00	0.00	104.0	43.89	526.54	2	0.84	10.10	6	2.53	61.48
20	0.800	7.30	298	210	0.01	0.004	0.417	0.01	0.00	85.0	34.58	561.12	5	2.03	12.14	7	2.85	64.33
21	0.773	7.06	124	210	0.04	0.016	0.433	0.01	0.03	60.0	23.58	584.70	4	1.57	13.71	6	2.36	66.69
22	0.861	6.61	117	270	0.01	0.004	0.437	0.00	0.01	95.0	41.59	626.29	2	0.88	14.59	5	2.19	68.88
23	0.792	7.13	71	220	0.01	0.004	0.441	0.00	0.01	90.0	36.25	662.54	2	0.81	15.39	5	2.01	70.89
24	0.842	6.77	149	240	0.01	0.004	0.445	0.00	0.01	85.0	36.39	698.93	3	1.28	16.68	5	2.14	73.03
25	0.883	6.73	171	240	0.03	0.013	0.458	0.00	0.03	85.0	38.16	737.09	3	1.35	18.02	5	2.24	75.27
26	0.874	7.37	90	250	0.01	0.004	0.462	0.00	0.01	110.0	48.89	785.98	7	3.11	21.13	8	3.56	78.83
27	0.882	6.78	56	270	0.03	0.013	0.475	0.00	0.03	95.0	42.61	828.59	0	0.00	21.13	5	2.24	81.07
28	0.810	6.91	56	170	0.02	0.008	0.483	0.00	0.02	60.0	24.71	853.30	2	0.82	21.96	4	1.65	82.72
29	0.878	6.94	33	210	0.07	0.031	0.514	0.01	0.06	80.0	35.72	889.02	2	0.89	22.85	4	1.79	84.51
30	0.822	6.37	18	230	0.02	0.008	0.522	0.00	0.02	105.0	43.89	932.91	2	0.84	23.69	4	1.67	86.18
31	0.787	6.88	56	240	0.05	0.020	0.542	0.00	0.05	105.0	42.02	974.93	2	0.80	24.49	4	1.60	87.78
32	0.850	6.94	29	210	0.04	0.017	0.559	0.01	0.03	75.0	32.42	1007.35	4	1.73	26.22	4	1.73	89.51
33	0.879	6.99	34	210	0.05	0.022	0.581	0.01	0.04	75.0	33.52	1040.87	3	1.34	27.56	5	2.23	91.74
34	0.854	7.15	31	180	0.06	0.026	0.607	0.01	0.05	65.0	28.23	1069.10	3	1.30	28.86	5	2.17	93.91
35	0.898	7.13	39	230	0.02	0.009	0.616	0.00	0.02	92.0	42.01	1111.11	3	1.37	30.23	5	2.28	96.19
36	0.858	6.99	39	220	0.02	0.009	0.625	0.00	0.02	102.0	44.50	1155.61	1	0.44	30.67	4	1.75	97.94
37	0.841	6.39	268	210	0.03	0.013	0.638	0.00	0.03	80.0	34.21	1189.82	2	0.86	31.52	4	1.71	99.65
38	0.960	6.53	252	250	0.01	0.005	0.643	0.00	0.01	130.0	63.46	1253.28	4	1.95	33.47	5	2.44	102.09
39	0.860	6.40	240	230	0.00	0.000	0.643	0.00	0.00	104.0	45.48	1298.76	3	1.31	34.79	4	1.75	103.84
40	0.893	6.51	186	280	0.03	0.014	0.657	0.00	0.03	136.0	61.76	1360.52	2	0.91	35.69	5	2.27	106.11
41	0.937	6.45	266	240	0.01	0.005	0.662	0.00	0.01	132.0	62.89	1423.41	4	1.91	37.60	4	1.91	108.02
42	0.902	6.44	202	190	0.04	0.018	0.680	0.00	0.04	98.0	44.95	1468.36	2	0.92	38.52	4	1.83	109.85
43	0.895	6.52	248	180	0.07	0.032	0.712	0.00	0.07	76.0	34.59	1502.95	3	1.37	39.88	4	1.82	111.67
44	0.891	6.29	279	160	0.06	0.027	0.739	0.01	0.05	72.0	32.62	1535.57	2	0.91	40.79	3	1.36	113.03
45	0.900	6.28	236	170	0.04	0.018	0.757	0.01	0.03	66.0	30.20	1565.77	2	0.92	41.70	4	1.83	114.86
46	0.874	6.18	295	160	0.04	0.018	0.775	0.03	0.01	65.0	28.89	1594.66	3	1.33	43.04	3	1.33	116.19
47	0.819	6.12	301	160	0.02	0.008	0.783	0.00	0.02	60.0	24.99	1619.65	3	1.25	44.28	3	1.25	117.44
48	0.980	6.44	271	250	0.04	0.020	0.803	0.01	0.03	110.0	54.82	1674.47	5	2.49	46.78	4	1.99	119.43
49	0.876	6.20	202	190	0.07	0.031	0.834	0.00	0.07	85.0	37.86	1712.33	4	1.78	48.56	3	1.34	120.77
50	0.940	6.21	213	200	0.07	0.033	0.867	0.05	0.02	75.0	35.85	1748.18	6	2.87	51.43	3	1.43	122.20
51	0.874	6.20	284	200	0.01	0.004	0.871	0.00	0.01	105.0	46.66	1794.84	6	2.67	54.09	3	1.33	123.53
52	0.864	6.02	269	200	0.01	0.004	0.875	0.00	0.01	85.0	37.34	1832.18	5	2.20	56.29	3	1.32	124.85
53	0.892	6.04	284	220	0.02	0.009	0.884	0.01	0.01	110.0	49.89	1882.07	9	4.08	60.37	3	1.36	126.21
54	0.906	6.19	221	200	0.01	0.005	0.889	0.00	0.01	90.0	41.46	1923.53	8	3.69	64.06	3	1.38	127.59
55	0.847	5.97	233	210	0.02	0.009	0.898	0.00	0.02	88.0	37.90	1961.43	11	4.74	68.80	2	0.86	128.45
56	0.832	5.97	276	230	0.05	0.021	0.919	0.01	0.04	108.0	45.69	2007.12	13	5.50	74.30	3	1.27	129.72
57	0.889	5.97	294	260	0.03	0.014	0.933	0.02	0.01	110.0	49.73	2056.85	14	6.33	80.63	2	0.90	130.62
58	0.848	6.10	196	260	0.04	0.017	0.950	0.01	0.03	142.0	61.23	2118.08	17	7.33	87.96	3	1.29	131.91
59	0.905	6.07	284	280	0.01	0.005	0.955	0.00	0.01	145.0	66.73	2184.81	20	9.20	97.16	3	1.38	133.29
60	0.869	6.04	213	210	0.05	0.022	0.977	0.02	0.03	95.0	41.98	2226.79	14	6.19	103.35	3	1.33	134.62
61	0.866	6.02	236	270	0.03	0.013	0.990	0.00	0.03	140.0	61.65	2288.44	22	9.69	113.03	3	1.32	135.94
62	0.895	6.05	226	320	0.02	0.009	0.999	0.00	0.02	155.0	70.54	2358.98	23	10.47	123.50	3	1.37	137.31
63	0.870	6.16	154	290	0.05	0.022	1.021	0.01	0.04	140.0	61.93	2420.91	20	8.85	132.35	3	1.33	138.64
64	0.954	5.86	188	308	0.04	0.019	1.040	0.03	0.01	160.0	77.62	2498.53	24	11.64	143.99	3	1.46	140.10
65	0.895	6.00	191	251	0.01	0.005	1.045	0.00	0.01	115.0	52.34	2550.87	20	9.10	153.09	2	0.91	141.01
66	0.867	5.95	156	260	0.03	0.013	1.058	0.00	0.03	120.0	52.90	2603.77	25	11.02	164.11	2	0.88	141.89
67	0.862	5.73	188	237	0.12	0.053	1.111	0.01	0.11	115.0	50.41	2654.18	21	9.21	173.32	2	0.88	142.77
68	0.945	5.84	156	335	0.16	0.077	1.188	0.04	0.12	160.0	76.88	2731.06	34	16.34	189.66	3	1.44	144.21
69	0.840	5.71	179	287	0.12	0.051	1.239	0.03	0.09	126.0	53.82	2784.88	31	13.24	202.90	2	0.85	145.06
70	0.867	5.90	150	285	0.15	0.066	1.305	0.03	0.12	128.0	56.43	2841.31	34	14.99	217.89	3	1.32	146.38
71	0.884	5.84	165	313	0.16	0.072	1.377	0.04	0.12	138.0	62.03	2903.34	36	16.18	234.07	2	0.90	147.28
72	0.973	5.75	124	260	0.54	0.267	1.644	0.12	0.42	136.0	67.29	2970.63	44	21.77	255.84	2	0.99	148.27
73	0.887	5.60	162	374	0.37	0.167	1.811	0.11	0.26	158.0	71.26	3041.89	54	24.36	280.20	3	1.35	149.62
74	0.865	5.61	134	345	0.59	0.260	2.071	0.02	0.57	156.0	68.62	3110.51	50	21.99	302.19	2	0.88	150.50
75	0.807	5.59	113	342	0.50	0.205	2.276	0.20	0.30	150.0	61.55	3172.06	51	20.93	323.12	2	0.82	151.32
76	0.814	5.30	156	406	0.83	0.344	2.620	0.07	0.76	170.0	70.37	3242.43	70	28.97	352.09	2	0.83	152.15
77	0.734	5.17	159	457	2.52	0.941	3.561	0.06	2.46	200.0	74.65	3317.08	82	30.61	382.69	2	0.75	152.90
78	0.760	5.16	173	373	3.29	1.271	4.832	<0.10	<3.29	270.0	104.34	3421.42	112	43.28	425.98	3	1.16	154.06
79	0.800	5.39	137	576	2.99	1.216	6.048	<0.10	<2.99	230.0	93.56	3514.98	116	47.19	473.17	2	0.81	154.87
80	0.845	5.24	146	437	2.32	0.997	7.045	<0.10	<2.32	180.0	77.34	3592.32	78	33.52	506.68	2	0.86	155.73
81	0.875	5.09	176	370	2.54	1.130	8.175	<0.10	<2.54	130.0	57.84	3650.16	74	32.93	539.61	2	0.89	156.62

Table A7-4: Whole Ore Leach Tails (P80-150um CyanidationTail) Elements

		Elements mg/L																																		
Week	pH	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide, WAD	Gallium	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Scandium	Selenium	Silicon	Silver	Sodium	Strontium	Sulfur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
0	7.27	0.062	<0.0025	0.0053	<0.010	<0.0010	<0.10	<0.10	<0.001	1.1	<0.0050	<0.010	<0.050	<0.010	<0.10	0.043	<0.0025	<0.10	<0.50	0.0069	<0.00010	<0.010	<0.010	<0.50	1.1	<0.10	<0.0050	0.33	<0.0050	1.3	<0.10	<1.0	<0.0010	<0.10	<0.10	<0.010	<0.010	<0.01
1	7.35	<0.045	0.0099	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	3.8	<0.0050	<0.010	<0.050	0.016	<0.10	0.033	<0.0025	<0.10	<0.50	0.0093	<0.00010	<0.010	<0.010	<0.50	1.9	<0.10	<0.0050	0.42	<0.0050	11	<0.10	16	<0.0010	<0.10	<0.10	<0.010	<0.010	<0.01
2	7.03	<0.045	0.0066	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	4.3	<0.0050	<0.010	<0.050	<0.010	<0.10	0.028	<0.0025	<0.10	<0.50	0.014	<0.00010	<0.010	<0.010	<0.50	2.2	<0.10	<0.0050	0.26	<0.0050	11	<0.10	13	<0.0010	<0.10	<0.10	<0.010	<0.010	0.012
4	6.61	<0.045	0.0028	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	4.8	<0.0050	<0.010	<0.050	<0.010	<0.10	0.022	<0.0025	<0.10	<0.50	0.022	<0.00010	<0.010	<0.010	<0.50	1.4	<0.10	<0.0050	0.14	<0.0050	7.1	<0.10	11	<0.0010	<0.10	<0.10	<0.010	<0.010	0.014
8	7.01	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	9.2	<0.0050	<0.010	<0.050	<0.010	<0.10	0.07	<0.0025	<0.10	0.76	0.07	<0.00010	<0.010	<0.010	<0.50	1.7	<0.10	<0.0050	<0.50	<0.0050	5.8	<0.10	26	<0.0010	<0.10	<0.10	<0.010	<0.010	0.02
12	7.52	<0.045	0.0029	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	30	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	1.9	0.18	<0.00010	<0.010	<0.010	<0.50	3.4	<0.10	<0.0050	0.28	<0.0050	9.7	0.13	42	<0.0010	<0.10	<0.10	<0.010	<0.010	0.027
16	7.38	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	19	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	1.7	0.2	<0.00010	<0.010	<0.010	<0.50	2.9	<0.10	<0.0050	0.24	<0.0050	7.3	<0.10	26	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.055
20	7.3	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.001	26	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	1.6	0.32	<0.00010	<0.010	<0.010	<0.50	2.8	<0.10	<0.0050	0.55	<0.0050	5.1	<0.10	30	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.057
24	6.77	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.0027	31	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	2	0.74	<0.0002	<0.010	<0.010	<0.50	3.1	<0.10	<0.0050	0.33	<0.0050	4.7	0.11	34	<0.0020	<0.10	<0.10	<0.0050	<0.010	0.12
28	6.91	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.0052	25	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	1.2	0.71	<0.00010	<0.010	<0.010	<0.50	2.4	<0.10	<0.0050	0.3	<0.0050	3.1	<0.10	23	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.24
32	6.94	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.0064	30	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.050	<0.0025	<0.10	1.2	0.71	<0.00010	<0.010	<0.010	<0.50	2.5	<0.10	<0.0050	0.25	<0.0050	2.4	<0.10	26	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.32
36	6.99	<0.045	<0.0025	0.0075	<0.010	<0.0010	<0.10	<0.10	0.0067	32	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	1.2	0.81	<0.00010	<0.010	<0.010	<0.50	2.6	<0.10	<0.0050	0.28	<0.0050	2	<0.10	29	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.34
40	6.51	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.013	42	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	1.1	1.2	<0.00010	<0.010	<0.010	<0.50	2.9	<0.10	<0.0050	0.5	<0.0050	1.5	0.1	39	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.62
44	6.29	0.26	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.012	21	<0.0050	<0.010	<0.050	0.024	<0.10	0.26	<0.0025	<0.10	0.73	1.1	<0.00010	<0.010	<0.010	<0.50	1.8	<0.10	<0.0050	0.28	<0.0050	0.88	<0.10	22	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.85
48	6.44	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.03	34	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	0.0054	<0.10	0.86	2.5	<0.00010	<0.010	<0.010	<0.50	2.5	<0.10	<0.0050	0.77	<0.005	1.1	0.1	38	<0.0010	<0.10	<0.10	<0.0050	<0.010	2.7
52	6.02	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.100	0.029	26	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	0.0032	<0.10	0.78	3.2	<0.00010	<0.010	<0.010	<0.50	2.2	<0.10	<0.0050	0.29	<0.0050	1	<0.10	26	<0.0010	<0.10	<0.10	<0.0050	<0.010	3.5
56	5.97	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.100	0.042	29	<0.0050	0.013	<0.050	<0.010	<0.10	<0.010	0.0096	<0.10	0.89	5.5	<0.00010	<0.010	0.011	<0.50	2.6	<0.10	<0.0050	0.43	<0.0050	0.97	<0.10	35	<0.0010	<0.10	<0.10	<0.0050	<0.010	7.4
60	6.04	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.100	0.032	23	<0.0050	0.013	<0.050	<0.050	<0.10	<0.010	0.012	<0.10	0.66	5.2	<0.00010	<0.010	0.014	<0.50	1.9	<0.10	<0.0050	0.61	<0.0050	0.55	<0.10	33	<0.0010	<0.10	<0.10	<0.0050	<0.010	8.7
64	5.86	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.029	36	<0.0050	0.021	<0.050	<0.050	<0.10	0.038	0.032	<0.10	1.1	11	<0.00010	<0.010	0.024	<0.50	3.1	<0.100	<0.0050	1.2	<0.0050	0.61	0.1	52	<0.0010	<0.10	<0.10	<0.0050	<0.010	16
68	5.84	<0.045	<0.0025	<0.010	<0.010	<0.0010	<0.10	<0.10	0.033	34	<0.0050	0.035	<0.050	<0.050	<0.10	0.16	0.044	<0.10	1.2	14	<0.00010	<0.010	0.047	<0.50	3.5	<0.100	<0.010	1.3	<0.0050	0.73	0.1	56	<0.0010	<0.10	<0.10	<0.0050	<0.010	24
72	5.75	<0.045	<0.0025	0.0051	<0.010	<0.0010	<0.10	<0.10	0.093	36	<0.0050	0.052	<0.050	<0.050	<0.10	0.64	0.067	<0.10	1.3	15	<0.00010	<0.010	0.07	<0.50	3	<0.100	<0.0050	1.8	<0.0050	0.58	0.11	75	<0.0010	<0.10	<0.10	<0.0050	<0.010	30
76		<0.045	<0.0010	0.0059	<0.010	<0.0010	<0.10	<0.10	0.27	30	<0.0050	0.086	<0.050	<0.050	<0.10	1.4	0.1	<0.10	1.8	22	<0.00010	<0.010	0.1	<0.50	3	<0.100	<0.0020	0.83	<0.0050	<0.50	0.1	72	<0.0010	<0.10	<0.10	<0.0050	<0.010	43

P-4257 Ro/Scav Tailings (Rougher Flotation) **1.50 Kg**

					Total Fe					SO_4=			Acidity, $CaCO_3$ Equivalents			Alkalinity, $CaCO_3$ Equivalents		
Week	Vol. L	Effluent pH	Redox, mV (vs Ag/AgCl)	Conductivity µS/cm[1]	mg/l	mg/kg	Cum. mg/kg	Fe^{2}+ mg/l	Fe^{3}+ mg/l	mg/l	mg/kg	Cum. mg/kg	mg/l	mg/kg	Cum. mg/kg	mg/l	mg/kg	Cum. mg/kg
0	0.634	6.80	160	20.0	0.07	0.030	0.030	0.03	0.04	1.0	0.42	0.42	3	1.27	1.27	6	2.54	2.54
1	0.763	7.63	166	210	0.06	0.031	0.061	0.02	0.04	56.0	28.51	28.93	0	0.00	1.27	21	10.69	13.23
2	0.735	7.40	175	210	0.04	0.020	0.081	0.02	0.02	61.0	29.92	58.85	0	0.00	1.27	18	8.83	22.06
3	0.695	7.26	235	210	0.04	0.019	0.100	0.03	0.01	61.0	28.29	87.14	0	0.00	1.27	13	6.03	28.09
4	0.663	6.70	236	80.0	0.07	0.031	0.131	0.02	0.05	19.0	8.41	95.55	4	1.77	3.04	4	1.77	29.86
5	0.543	7.19	206	90.0	0.08	0.029	0.160	0.01	0.07	52.0	18.84	114.39	2	0.73	3.76	8	2.90	32.76
6	0.531	7.26	212	160	0.10	0.035	0.195	0.01	0.09	55.0	19.49	133.88	0	0.00	3.76	12	4.25	37.01
7	0.733	7.12	210	120	0.03	0.015	0.210	0.01	0.02	34.0	16.63	150.51	0	0.00	3.76	9	4.40	41.41
8	0.653	6.83	255	80.0	0.08	0.035	0.245	0.02	0.06	24.0	10.46	160.97	2	0.87	4.64	6	2.61	44.02
9	0.528	7.10	257	120	0.02	0.007	0.252	0.01	0.01	55.0	19.38	180.35	1	0.35	4.99	7	2.47	46.49
10	0.619	7.49	260	200	0.11	0.045	0.297	0.01	0.10	59.0	24.37	204.72	0	0.00	4.99	11	4.54	51.03
11	0.647	7.66	255	120	0.01	0.004	0.301	0.01	0.00	52.0	22.45	227.17	3	1.30	6.28	9	3.89	54.92
12	0.671	7.97	217	50.0	0.01	0.004	0.305	0.00	0.01	18.0	8.06	235.23	1	0.45	6.73	8	3.58	58.50
13	0.639	7.45	214	60.0	0.01	0.004	0.309	0.00	0.01	23.0	9.81	245.04	3	1.28	8.01	6	2.56	61.06
14	0.609	7.64	191	60.0	0.01	0.004	0.313	0.01	0.00	25.0	10.16	255.20	3	1.22	9.23	6	2.44	63.50
15	0.507	6.92	281	130	0.01	0.003	0.316	0.00	0.01	57.0	19.29	274.49	0	0.00	9.23	6	2.03	65.53
16	0.622	7.42	261	200	0.00	0.000	0.316	0.00	0.00	66.0	27.40	301.89	0	0.00	9.23	8	3.32	68.85
17	0.663	6.86	233	180	0.01	0.004	0.320	0.00	0.01	70.0	30.97	332.86	0	0.00	9.23	7	3.10	71.95
18	0.622	6.76	302	120	0.00	0.000	0.320	0.00	0.00	46.0	19.09	351.95	3	1.25	10.47	6	2.49	74.44
19	0.662	6.01	248	120	0.02	0.009	0.329	0.00	0.02	62.0	27.39	379.34	5	2.21	12.68	5	2.21	76.65
20	0.440	7.69	294	100	0.01	0.003	0.332	0.00	0.01	36.0	10.57	389.91	1	0.29	12.98	7	2.06	78.71
21	0.669	7.04	147	180	0.01	0.004	0.336	0.00	0.01	80.0	35.72	425.63	1	0.45	13.42	6	2.68	81.39
22	0.715	6.77	127	120	0.01	0.005	0.341	0.00	0.01	50.0	23.86	449.49	1	0.48	13.90	5	2.39	83.78
23	0.672	7.05	150	120	0.00	0.000	0.341	0.00	0.00	54.0	24.22	473.71	1	0.45	14.35	5	2.24	86.02
24	0.670	6.92	188	120	0.00	0.000	0.341	0.00	0.00	70.0	31.30	505.01	3	1.34	15.69	5	2.24	88.26
25	0.682	6.93	186	130	0.00	0.000	0.341	0.00	0.00	50.0	22.76	527.77	3	1.37	17.05	5	2.28	90.54
26	0.646	7.40	105	130	0.01	0.004	0.345	0.00	0.01	48.0	20.69	548.46	6	2.59	19.64	7	3.02	93.56
27	0.693	6.50	159	130	0.01	0.005	0.350	0.00	0.01	44.0	20.35	568.81	3	1.39	21.03	5	2.31	95.87
28	0.675	6.64	205	110	0.01	0.005	0.355	0.00	0.01	34.0	15.32	584.13	2	0.90	21.93	4	1.80	97.67
29	0.681	6.61	175	110	0.01	0.005	0.360	0.00	0.01	36.0	16.36	600.49	2	0.91	22.84	4	1.82	99.49
30	0.685	6.45	93	140	0.01	0.005	0.365	0.01	0.00	62.0	28.34	628.83	2	0.91	23.75	4	1.83	101.32
31	0.666	6.69	172	120	0.01	0.004	0.369	0.00	0.01	48.0	21.33	650.16	2	0.89	24.64	4	1.78	103.10
32	0.673	6.80	195	130	0.01	0.004	0.373	0.00	0.01	52.0	23.35	673.51	1	0.45	25.09	5	2.25	105.35
33	0.698	6.80	168	140	0.00	0.000	0.373	0.00	0.00	50.0	23.29	696.80	3	1.40	26.49	5	2.33	107.68
34	0.697	6.97	152	140	0.00	0.000	0.373	0.00	0.00	56.0	26.05	722.85	2	0.93	27.42	5	2.33	110.01
35	0.663	6.71	158	150	0.00	0.000	0.373	0.00	0.00	52.0	23.01	745.86	4	1.77	29.19	5	2.21	112.22
36	0.671	6.69	178	150	0.00	0.000	0.373	0.00	0.00	58.0	25.97	771.83	2	0.90	30.08	4	1.79	114.01
37	0.681	6.62	252	130	0.01	0.005	0.378	0.00	0.01	45.0	20.45	792.28	4	1.82	31.90	4	1.82	115.83
38	0.740	6.60	220	140	0.00	0.000	0.378	0.00	0.00	55.0	27.16	819.44	4	1.98	33.88	5	2.47	118.30
39	0.530	6.49	242	130	0.00	0.000	0.378	0.00	0.00	54.0	19.10	838.54	4	1.42	35.29	4	1.41	119.71
40	0.819	6.75	190	180	0.00	0.000	0.378	0.00	0.00	77.0	42.08	880.62	0	0.00	35.29	5	2.73	122.44
41	0.707	6.76	250	170	0.00	0.000	0.378	0.00	0.00	106.0	50.01	930.63	2	0.94	36.24	5	2.36	124.80
42	0.681	6.72	121	150	0.01	0.005	0.383	0.00	0.01	86.0	39.08	969.71	0	0.00	36.24	6	2.73	127.53
43	0.702	6.77	255	150	0.01	0.005	0.388	0.00	0.01	60.0	28.11	997.82	3	1.41	37.64	5	2.34	129.87
44	0.664	6.66	250	150	0.00	0.000	0.388	0.00	0.00	68.0	30.13	1027.95	2	0.89	38.53	5	2.22	132.09
45	0.708	6.70	233	160	0.01	0.005	0.393	0.00	0.01	64.0	30.24	1058.19	2	0.95	39.47	5	2.36	134.45
46	0.557	6.74	247	140	0.00	0.000	0.393	0.00	0.00	65.0	24.16	1082.35	1	0.37	39.84	5	1.86	136.31
47	0.508	6.94	254	170	0.01	0.003	0.396	0.00	0.01	60.0	20.34	1102.69	2	0.68	40.52	5	1.70	138.01
48	0.949	7.06	260	150	0.01	0.006	0.402	0.00	0.01	55.0	34.83	1137.52	2	1.27	41.79	6	3.80	141.81
49	0.676	7.21	148	120	0.01	0.005	0.407	0.00	0.01	35.0	15.79	1153.31	3	1.35	43.14	5	2.26	144.07
50	0.685	6.80	174	130	0.05	0.023	0.430	0.03	0.02	50.0	22.86	1176.17	1	0.46	43.60	4	1.83	145.90
51	0.659	6.74	218	120	0.02	0.009	0.439	0.00	0.02	20.0	8.80	1184.97	1	0.44	44.04	4	1.76	147.66
52	0.664	6.45	184	90.0	0.00	0.000	0.439	0.00	0.00	34.0	15.07	1200.04	4	1.77	45.81	3	1.33	148.99
53	0.651	6.62	203	90.0	0.04	0.017	0.456	0.00	0.04	36.0	15.64	1215.68	1	0.43	46.24	3	1.30	150.29
54	0.690	7.26	172	100	0.02	0.009	0.465	0.00	0.02	40.0	18.42	1234.10	2	0.92	47.17	4	1.84	152.13
55	0.652	6.99	167	100	0.00	0.000	0.465	0.00	0.00	40.0	17.40	1251.50	2	0.87	48.04	3	1.31	153.44
56	0.702	6.81	206	90.0	0.02	0.009	0.474	0.00	0.02	39.0	18.27	1269.77	3	1.41	49.44	4	1.87	155.31
57	0.699	7.51	183	100	0.01	0.005	0.479	0.00	0.01	39.0	18.19	1287.96	4	1.87	51.31	4	1.87	157.18
58	0.713	6.49	196	90.0	0.01	0.005	0.484	0.00	0.01	44.0	20.94	1308.90	1	0.48	51.78	4	1.90	159.08
59	0.703	7.27	198	100	0.00	0.000	0.484	0.00	0.00	39.0	18.30	1327.20	2	0.94	52.72	4	1.88	160.96
60	0.556	7.22	154	90.0	0.00	0.000	0.484	0.00	0.00	40.0	14.84	1342.04	2	0.74	53.46	4	1.48	162.44
61	0.689	7.15	155	110	0.01	0.005	0.489	0.00	0.01	47.0	21.61	1363.65	4	1.84	55.30	5	2.30	164.74
62	0.608	7.50	152	100	0.00	0.000	0.489	0.00	0.00	42.0	17.04	1380.69	2	0.81	56.11	5	2.03	166.77
63	0.668	7.57	92	120	0.02	0.009	0.498	0.00	0.02	48.0	21.40	1402.09	2	0.89	57.00	5	2.23	169.00
64	0.699	6.56	225	102	0.00	0.000	0.498	0.00	0.00	43.0	20.06	1422.15	3	1.40	58.40	4	1.87	170.87
65	0.703	6.54	157	92.7	0.00	0.000	0.498	0.00	0.00	38.0	17.83	1439.98	3	1.41	59.81	3	1.41	172.28
66	0.600	6.55	201	75.4	0.01	0.004	0.502	0.00	0.01	30.0	12.01	1451.99	6	2.40	62.21	4	1.60	173.88
67	0.738	7.55	83	61.0	0.02	0.010	0.512	0.00	0.02	25.0	12.31	1464.30	3	1.48	63.69	4	1.97	175.85
68	0.654	7.45	74	54.2	0.02	0.009	0.521	0.00	0.02	21.0	9.17	1473.47	2	0.87	64.56	4	1.75	177.60
69	0.866	7.01	87	57.0	0.05	0.029	0.550	0.00	0.05	24.0	13.87	1487.34	5	2.89	67.45	4	2.31	179.91
70	0.972	7.45	74	63.3	0.02	0.013	0.563	0.01	0.01	24.0	15.57	1502.91	2	1.30	68.75	4	2.59	182.50
71	0.768	7.50	98	74.1	0.02	0.010	0.573	0.00	0.02	32.0	16.40	1519.31	4	2.05	70.80	4	2.05	184.55
72	0.700	6.24	175	83.4	0.03	0.014	0.587	0.01	0.02	26.0	12.15	1531.46	2	0.93	71.73	3	1.40	185.95
73	0.645	6.38	274	95.8	0.02	0.009	0.596	0.01	0.01	35.0	15.07	1546.53	4	1.72	73.46	3	1.29	187.24
74	0.663	7.42	54	106	0.02	0.009	0.605	0.00	0.02	38.0	16.81	1563.34	5	2.21	75.67	4	1.77	189.01
75	0.718	7.52	51	99.4	0.01	0.005	0.610	0.00	0.01	34.0	16.29	1579.63	4	1.92	77.58	4	1.92	190.93
76	0.670	7.52	297	90.0	0.00	0.000	0.610	0.00	0.00	31.0	13.86	1593.49	6	2.68	80.27	3	1.34	192.27
77	0.622	7.42	281	87.3	0.00	0.000	0.610	0.00	0.00	35.0	14.53	1608.02	4	1.66	81.93	4	1.66	193.93
78	0.717	7.59	71	106.6	<0.10	0.000	0.610	<0.10	<0.10	40.0	19.14	1627.16	8	3.83	85.76	4	1.91	195.84
79	0.632	7.72	62	81.9	<0.10	0.000	0.610	<0.10	<0.10	28.0	11.81	1638.97	4	1.69	87.44	4	1.69	197.53
80	0.677	7.33	68	75.1	<0.10	0.000	0.610	<0.10	<0.10	27.0	12.20	1651.17	3	1.36	88.80	4	1.81	199.34
81	0.692	7.46	81	76.4	<0.10	0.000	0.610	<0.10	<0.10	26.0	12.01	1663.18	5	2.31	91.11	4	1.85	201.19

Table A7-6: Rougher Flotation Tails (P-4257 Ro/Scav Tailings) Elements

		Elements mg/L																																				
Week	pH	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide, WAD	Gallium	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Scandium	Selenium	Silicon	Silver	Sodium	Strontium	Sulfur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
0	6.8	0.074	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	1.2	<0.0050	<0.010	<0.050	<0.010	<0.10	0.091	<0.0025	<0.10	<0.50	0.027	<0.00010	<0.010	<0.010	<0.50	1.9	<0.10	<0.0050	0.5	<0.0050	<0.50	<0.10	<1.0	<0.0010	<0.10	<0.10	<0.010	<0.010	<0.01
1	7.63	<0.045	0.0069	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	21	<0.0050	<0.010	<0.050	0.016	<0.10	<0.010	<0.0025	<0.10	2.6	0.17	<0.00010	0.018	<0.010	<0.50	9.1	<0.10	<0.0050	2.3	<0.0050	2.9	<0.10	24	<0.0010	<0.10	<0.10	<0.010	<0.010	<0.01
2	7.4	<0.045	0.0074	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	23	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	2.8	0.27	<0.00010	0.016	<0.010	<0.50	8.4	<0.10	<0.0050	1.1	<0.0050	2.5	<0.10	17	<0.0010	<0.10	<0.10	<0.010	<0.010	0.014
4	6.7	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	8.1	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.050	<0.0025	<0.10	0.73	0.064	<0.00010	<0.010	<0.010	<0.50	1.5	<0.10	<0.0050	0.16	<0.0050	0.63	<0.10	7.6	<0.0010	<0.10	<0.10	<0.010	<0.010	0.015
8	6.83	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	7.3	<0.0050	<0.010	<0.050	<0.010	<0.10	0.011	<0.0025	<0.10	0.68	0.14	<0.00010	<0.010	<0.010	<0.50	1.9	<0.10	<0.0050	0.21	<0.0050	<0.50	<0.10	14	<0.0010	<0.10	<0.10	<0.010	<0.010	0.026
12	7.97	<0.045	<0.0025	<0.010	<0.010	<0.0010	<0.10	<0.10	<0.001	5.7	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	0.6	0.12	<0.00010	<0.010	<0.010	<0.50	1.5	<0.10	<0.010	<0.50	<0.0050	<0.50	<0.10	6.2	<0.0010	<0.10	<0.10	<0.010	<0.010	0.022
16	7.42	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	25	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	1.9	0.51	<0.00010	<0.010	<0.010	<0.50	4.7	<0.10	<0.0050	0.52	<0.0050	0.82	<0.10	27	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.041
20	7.69	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	13	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	0.9	0.31	0.00021	<0.010	<0.010	<0.50	1.8	<0.10	<0.0050	0.35	<0.0050	<0.50	<0.10	13	0.0013	<0.10	<0.10	<0.0050	<0.010	0.034
24	6.92	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	17	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	1	0.38	<0.0002	<0.010	<0.010	<0.50	2	<0.10	<0.0050	0.23	<0.0050	<0.50	<0.10	14	<0.0020	<0.10	<0.10	<0.0050	<0.010	0.055
28	6.64	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	15	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	0.79	0.42	<0.00010	<0.010	<0.010	<0.50	1.9	<0.10	<0.0050	0.27	<0.0050	<0.50	<0.10	12	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.087
32	6.8	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.005	22	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	0.95	0.73	<0.00010	<0.010	<0.010	<0.50	2.3	<0.10	<0.0050	0.48	<0.0050	<0.50	<0.10	16	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.18
36	6.69	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.005	21	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	0.89	0.69	<0.00010	<0.010	<0.010	<0.50	2	<0.10	<0.0050	0.34	<0.0050	<0.50	<0.10	18	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.16
40	6.75	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.004	24	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	0.87	1.1	<0.00010	<0.010	<0.010	<0.50	2.6	<0.10	<0.0050	1.7	<0.0050	<0.50	<0.10	21	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.32
44	6.66	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.0038	20	<0.0050	<0.010	<0.050	<0.010	<0.10	0.014	<0.0025	<0.10	0.72	1.1	<0.00010	<0.010	<0.010	<0.50	2	<0.10	<0.0050	0.65	<0.0050	<0.50	<0.10	19	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.35
48	7.06	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.0062	21	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	0.71	1.5	<0.00010	<0.010	<0.010	<0.50	2.5	<0.10	<0.0050	1	<0.005	<0.50	<0.10	23	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.57
52	6.45	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.100	0.0038	11	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	<0.50	0.92	<0.00010	<0.010	<0.010	<0.50	1.5	<0.10	<0.0050	0.39	<0.0050	<0.50	<0.10	11	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.3
56	6.81	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.100	0.0053	12	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	<0.50	1.3	<0.00010	<0.010	<0.010	<0.50	1.4	<0.10	<0.0050	0.72	<0.0050	<0.50	<0.10	12	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.45
60	7.22	<0.045	0.027	<0.0050	0.016	<0.0010	<0.10	<0.100	0.0058	12	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	<0.0025	<0.10	<0.50	1.5	<0.00010	<0.010	<0.010	<0.50	1.6	<0.10	<0.0050	0.71	<0.0050	<0.50	<0.10	13	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.51
64	6.56	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.0085	14	<0.0050	<0.010	<0.050	<0.050	<0.10	0.021	<0.0025	<0.10	<0.50	2.2	<0.00010	<0.010	<0.010	<0.50	2.1	<0.100	<0.0050	1	<0.0050	<0.50	<0.10	14	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.79
68	7.54	<0.045	0.0029	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.0058	5.9	<0.0050	<0.010	<0.050	<0.050	<0.10	0.014	<0.0025	<0.10	<0.50	1.4	<0.00010	<0.010	<0.010	<0.50	1.3	<0.100	<0.0050	0.44	<0.0050	<0.50	<0.10	7.2	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.55
72	6.24	<0.045	<0.0025	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.0088	7.3	<0.0050	<0.010	<0.050	<0.050	<0.10	<0.010	<0.0025	<0.10	<0.50	2.3	<0.00010	<0.010	<0.010	<0.50	1.5	<0.100	<0.0050	0.76	<0.0050	<0.50	<0.10	9.2	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.96
76		<0.045	<0.0010	<0.0010	<0.010	<0.0010	<0.10	<0.10	0.014	8.9	<0.0050	<0.010	<0.050	<0.050	<0.10	0.014	<0.0025	<0.10	<0.50	3.6	<0.00010	<0.010	<0.010	<0.50	1.7	<0.100	<0.0020	0.89	<0.0050	<0.50	<0.10	12	<0.0010	<0.10	<0.10	<0.0050	<0.010	1.6

Table A7-7: Sulphide Ore Float Tails Weekly Analysis

Sulfide Master Comp. (P1, 3, 5) **2.0034 Kg**

					Total Fe					SO_4=			Acidity, $CaCO_3$ Equivalents			Alkalinity, $CaCO_3$ Equivalents		
Week	Vol. L	Effluent pH	Redox, mV (vs Ag/AgCl)	Conductivity µS/cm[1)]	mg/l	mg/kg	Cum. mg/kg	Fe^{2}+ mg/l	Fe^{3}+ mg/l	mg/l	mg/kg	Cum. mg/kg	mg/l	mg/kg	Cum. mg/kg	mg/l	mg/kg	Cum. mg/kg
0	1.308	7.79	172	300	0.01	0.007	0.007	0.00	0.01	45.0	29.38	29.38	2	1.31	1.31	32	20.89	20.89
1	0.865	7.71	190	220	0.02	0.009	0.016	0.00	0.02	45.0	19.43	48.81	0	0.00	1.31	24	10.36	31.25
2	0.991	8.13	174	220	0.02	0.010	0.026	0.00	0.02	55.0	27.21	76.02	0	0.00	1.31	26	12.86	44.11
3	0.899	7.89	169	150	0.02	0.009	0.035	0.00	0.02	6.0	2.69	78.71	0	0.00	1.31	19	8.53	52.64
4	0.843	8.01	142	150	0.01	0.004	0.039	0.00	0.01	47.0	19.78	98.49	4	1.68	2.99	21	8.84	61.48
5	0.954	8.07	167	130	0.01	0.005	0.044	0.00	0.01	40.0	19.05	117.54	0	0.00	2.99	16	7.62	69.10
6	0.918	7.95	190	150	0.02	0.009	0.053	0.00	0.02	52.0	23.83	141.37	0	0.00	2.99	16	7.33	76.43
7	0.975	7.84	169	200	0.00	0.000	0.053	0.00	0.00	65.0	31.63	173.00	0	0.00	2.99	17	8.27	84.70
8	0.893	7.99	154	190	0.03	0.013	0.066	0.00	0.03	69.0	30.76	203.76	0	0.00	2.99	14	6.24	90.94
9	0.881	7.78	166	190	0.00	0.000	0.066	0.00	0.00	65.0	28.58	232.34	0	0.00	2.99	14	6.16	97.10
10	0.905	7.68	184	160	0.00	0.000	0.066	0.00	0.00	59.0	26.65	258.99	0	0.00	2.99	13	5.87	102.97
11	0.910	7.50	223	150	0.01	0.005	0.071	0.00	0.01	53.0	24.07	283.06	0	0.00	2.99	12	5.45	108.42
12	0.901	7.41	198	150	0.00	0.000	0.071	0.00	0.00	55.0	24.74	307.80	2	0.90	3.89	12	5.40	113.82
13	0.896	7.40	221	130	0.00	0.000	0.071	0.00	0.00	48.0	21.47	329.27	0	0.00	3.89	11	4.92	118.74
14	0.900	7.40	174	150	0.00	0.000	0.071	0.00	0.00	58.0	26.06	355.33	0	0.00	3.89	12	5.39	124.13
15	0.890	7.47	202	140	0.00	0.000	0.071	0.00	0.00	47.0	20.88	376.21	0	0.00	3.89	11	4.89	129.02
16	0.942	7.47	154	140	0.02	0.009	0.080	0.00	0.02	53.0	24.92	401.13	0	0.00	3.89	11	5.17	134.19
17	0.910	7.39	230	140	0.02	0.009	0.089	0.00	0.02	48.0	21.80	422.93	0	0.00	3.89	12	5.45	139.64
18	0.910	7.27	233	130	0.00	0.000	0.089	0.00	0.00	49.0	22.26	445.19	0	0.00	3.89	11	5.00	144.64
19	0.916	7.24	228	130	0.02	0.009	0.098	0.02	0.00	44.0	20.12	465.31	0	0.00	3.89	10	4.57	149.21
20	0.869	7.40	233	130	0.01	0.004	0.102	0.00	0.01	47.0	20.39	485.70	0	0.00	3.89	11	4.77	153.98
21	0.909	7.40	244	120	0.01	0.005	0.107	0.00	0.01	40.0	18.15	503.85	0	0.00	3.89	10	4.54	158.52
22	0.970	7.38	257	130	0.03	0.015	0.122	0.00	0.03	38.0	18.40	522.25	0	0.00	3.89	11	5.33	163.85
23	0.901	7.44	167	110	0.02	0.009	0.131	0.00	0.02	37.0	16.64	538.89	1	0.45	4.34	10	4.50	168.35
24	0.912	7.37	188	90	0.04	0.018	0.149	0.03	0.01	28.0	12.75	551.64	0	0.00	4.34	10	4.55	172.90
25	1.936	7.15	207	80	0.00	0.000	0.149	0.00	0.00	30.0	28.99	580.63	1	0.97	5.30	8	7.73	180.63
27	0.862	7.04	169	170	0.04	0.017	0.166	0.00	0.04	58.0	24.96	605.59	1	0.43	5.73	8	3.44	184.07
29	0.939	7.24	186	200	0.00	0.000	0.166	0.00	0.00	72.0	33.75	639.34	1	0.47	6.20	8	3.75	187.82
31	0.944	7.32	206	200	0.02	0.009	0.175	0.00	0.02	85.0	40.05	679.39	0	0.00	6.20	8	3.77	191.59
34	0.901	7.26	173	280	0.00	0.000	0.175	0.00	0.00	110.0	49.47	728.86	1	0.45	6.65	9	4.05	195.64
37	0.917	7.32	234	260	0.03	0.014	0.189	0.00	0.03	110.0	50.35	779.21	0	0.00	6.65	7	3.20	198.84
40	0.928	7.17	188	298	0.05	0.023	0.212	0.00	0.05	114.0	52.81	832.02	3	1.39	8.04	7	3.24	202.08
45	0.882	6.75	38	333	0.20	0.088	0.300	0.01	0.19	150.0	66.04	898.06	4	1.76	9.80	5	2.20	204.28
50	0.840	6.80	74	522	1.15	0.482	0.782	0.17	0.98	250.0	104.82	1002.88	11	4.61	14.42	7	2.94	207.22
55	0.841	6.55	-46	343	1.37	0.575	1.357	0.21	1.16	110.0	46.18	1049.06	8	3.36	17.77	6	2.52	209.74

Table A7-8: Sulphide Ore Float Tails Elements

Elements mg/L

Week	pH	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide, WAD	Gallium	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Scandium	Selenium	Silicon	Silver	Sodium	Strontium	Sulfur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
0	7.79	0.069	0.039	0.029	0.011	<0.0010	<0.10	<0.10	<0.001	31	<0.0050	<0.010	<0.050	0.022	<0.10	0.049	<0.0025	<0.10	2.2	<0.0050	<0.00010	0.014	<0.010	<0.50	5	<0.10	<0.0050	2.3	<0.0050	16	0.11	32	<0.0010	<0.10	<0.10	<0.0050	<0.010	<0.01
1	7.71	0.049	0.015	0.032	<0.010	<0.0010	<0.10	0.11	<0.001	21	<0.0050	<0.010	<0.050	0.013	<0.10	0.024	<0.0025	<0.10	1.9	<0.0050	<0.00010	0.014	<0.010	<0.50	3.2	<0.10	<0.0050	2.1	<0.0050	11	<0.10	25	<0.0010	<0.10	<0.10	<0.0050	<0.010	<0.01
2	8.13	0.075	0.02	0.022	<0.010	<0.0010	<0.10	<0.10	<0.001	24	<0.0050	<0.010	<0.050	0.014	<0.10	0.04	<0.0025	<0.10	2.5	0.011	<0.00010	0.016	<0.010	<0.50	3.6	<0.10	<0.0050	2.7	<0.0050	9.4	<0.10	23	<0.0010	<0.10	<0.10	<0.0050	<0.010	<0.01
4	8.01	0.051	0.017	0.023	<0.010	<0.0010	<0.10	<0.10	<0.001	16	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.050	<0.0025	<0.10	1.5	<0.0050	<0.00010	<0.010	<0.010	<0.50	2.7	<0.10	<0.0050	2.6	<0.0050	4.4	<0.10	14	<0.0010	<0.10	<0.10	<0.0050	<0.010	<0.01
8	7.99	<0.045	<0.010	<0.050	<0.010	<0.0010	<0.10	<0.10	<0.001	28	<0.0050	<0.010	<0.050	<0.010	<0.10	0.012	<0.010	<0.10	2.5	0.026	<0.0010	<0.010	<0.010	<0.50	1.7	<0.10	<0.050	2.1	<0.0050	1.4	0.11	23	<0.010	<0.10	<0.10	<0.010	<0.010	<0.01
12	7.41	<0.045	0.008	0.0081	<0.010	<0.0010	<0.10	<0.10	<0.001	20	<0.0050	<0.010	<0.050	<0.010	<0.10	<0.010	0.0026	<0.10	1.7	0.027	<0.00010	<0.010	<0.010	<0.50	1.5	<0.10	<0.0050	1.7	<0.0050	0.96	<0.10	16	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.012
16	7.47	<0.045	0.0074	0.0074	<0.010	<0.0010	<0.10	<0.10	<0.001	19	<0.0050	<0.010	<0.050	<0.010	<0.10	0.019	<0.0025	<0.10	1.4	0.052	<0.00010	<0.010	<0.010	<0.50	1.3	<0.10	<0.0050	1.7	<0.0050	0.6	<0.10	16	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.02
20	7.4	<0.045	0.0072	<0.0050	<0.010	<0.0010	<0.10	<0.10	<0.001	18	<0.0050	<0.010	<0.050	<0.010	<0.10	0.028	<0.0025	<0.10	1.3	0.064	<0.00010	<0.010	<0.010	<0.50	1.2	<0.10	<0.0050	1.6	<0.0050	0.55	<0.10	16	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.042
24	7.37	<0.045	0.0072	0.0074	<0.010	<0.0010	<0.10	<0.10	<0.001	13	<0.0050	<0.010	<0.050	<0.010	<0.10	0.013	<0.0025	<0.10	0.99	0.039	0.00026	<0.010	<0.010	<0.50	0.94	<0.10	<0.0050	1.7	<0.0050	0.61	<0.10	10	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.012
25	7.15	<0.045	0.0039	0.0051	<0.010	<0.0010	<0.10	<0.100	<0.001	12	<0.0050	<0.010	<0.050	<0.010	<0.10	0.018	<0.0025	<0.10	0.73	0.052	<0.00010	<0.010	<0.010	<0.50	0.77	<0.10	<0.0050	1.1	<0.0050	<0.50	<0.10	11	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.033
27	7.04	<0.045	0.0054	<0.0050	<0.010	<0.0010	<0.10	<0.100	0.0016	28	<0.0050	<0.010	<0.050	<0.010	<0.10	0.052	<0.0025	<0.10	1.5	0.22	<0.00010	<0.010	<0.010	<0.50	1.4	<0.10	<0.0050	1.5	<0.0050	1.4	<0.10	25	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.29
29	7.24	<0.045	0.0055	<0.0050	<0.010	<0.0010	<0.10	<0.100	0.0013	30	<0.0050	<0.010	<0.050	<0.010	<0.10	0.032	<0.0025	<0.10	1.8	0.21	<0.00010	<0.010	<0.010	<0.50	1.3	<0.10	<0.0050	1.7	<0.0050	<0.50	0.1	27	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.12
31	7.32	<0.045	0.0059	<0.0050	<0.010	<0.0010	<0.10	<0.100	0.0013	28	<0.0050	<0.010	<0.050	<0.010	<0.10	0.012	<0.0025	<0.10	1.7	0.25	<0.00010	<0.010	<0.010	<0.50	1.3	<0.10	<0.0050	1.8	<0.0050	<0.50	0.1	29	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.14
34	7.26	<0.045	0.0056	<0.0050	<0.010	<0.0010	<0.10	<0.100	0.0023	42	<0.0050	<0.010	<0.050	<0.050	<0.10	0.014	<0.0025	<0.10	2.2	0.41	<0.00010	<0.010	<0.010	<0.50	1.7	<0.10	<0.0050	2	<0.0050	0.54	0.14	43	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.26
37	7.32	<0.045	0.0049	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.0028	42	<0.0050	<0.010	<0.050	<0.050	<0.10	0.037	<0.0025	<0.10	2.2	0.59	<0.00010	<0.010	<0.010	<0.50	1.5	<0.10	<0.0050	1.9	<0.0050	1	0.14	40	<0.0010	<0.10	<0.10	<0.0050	<0.010	0.43
40	7.17	<0.045	0.0059	<0.010	<0.010	<0.0010	<0.10	<0.10	0.0046	44	<0.0050	<0.010	<0.050	<0.050	<0.10	0.073	0.0069	<0.10	2.3	0.83	<0.0002	<0.010	<0.010	<0.50	2	<0.10	<0.010	2.1	<0.0050	0.53	0.14	46	<0.0020	<0.10	<0.10	<0.010	<0.010	0.59
45	6.75	<0.045	0.0049	<0.0050	<0.010	<0.0010	<0.10	<0.10	0.016	50	<0.0050	<0.010	<0.050	<0.050	<0.10	0.25	0.0026	<0.10	2.6	2.1	<0.00010	<0.010	<0.010	<0.50	1.9	<0.10	<0.0050	1.7	<0.0050	0.54	0.16	54	<0.0010	<0.10	<0.10	<0.0050	<0.010	2.4
50		<0.045	0.0094	<0.0050	0.01	<0.0010	<0.10	<0.10	0.03	83	<0.0050	0.015	0.19	0.17	<0.10	1.3	0.018	<0.10	4	3.6	<0.00010	<0.010	0.018	<0.50	3.3	<0.10	<0.0050	2.6	<0.0050	0.63	0.27	96	<0.0010	<0.10	<0.10	<0.0050	<0.010	4.3

Table A7-9: Transition Ore Float Tails Weekly Analysis

Transition Comp. (P7) **1.9913 Kg**

					Total Fe					SO_4=			Acidity, $CaCO_3$ Equivalents			Alkalinity, $CaCO_3$ Equivalents		
Week	Vol. L	Effluent pH	Redox, mV (vs Ag/AgCl)	Conductivity µS/cm[1)]	mg/l	mg/kg	Cum. mg/kg	Fe^{2}+ mg/l	Fe^{3}+ mg/l	mg/l	mg/kg	Cum. mg/kg	mg/l	mg/kg	Cum. mg/kg	mg/l	mg/kg	Cum. mg/kg
0	1.305	8.11	166	270	0.01	0.007	0.007	0.00	0.01	53.0	34.73	34.73	0	0.00	0.00	41	26.87	26.87
1	0.914	8.05	242	170	0.01	0.005	0.012	0.01	0.00	44.0	20.20	54.93	0	0.00	0.00	25	11.47	38.34
2	0.902	8.00	195	120	0.01	0.005	0.017	0.00	0.01	34.0	15.40	70.33	0	0.00	0.00	19	8.61	46.95
3	0.921	7.83	196	120	0.01	0.005	0.022	0.01	0.00	30.0	13.88	84.21	0	0.00	0.00	19	8.79	55.74
4	0.912	7.72	206	100	0.04	0.018	0.040	0.02	0.02	24.0	10.99	95.20	0	0.00	0.00	18	8.24	63.98
5	0.919	8.23	188	90.0	0.01	0.005	0.045	0.00	0.01	20.0	9.23	104.43	0	0.00	0.00	17	7.85	71.83
6	0.930	7.86	200	90.0	0.01	0.005	0.050	0.01	0.00	16.0	7.47	111.90	0	0.00	0.00	16	7.47	79.30
7	0.913	8.02	197	100	0.00	0.000	0.050	0.00	0.00	17.0	7.79	119.69	0	0.00	0.00	16	7.34	86.64
8	0.894	8.14	183	90.0	0.01	0.004	0.054	0.00	0.01	18.0	8.08	127.77	0	0.00	0.00	15	6.73	93.37
9	0.919	7.84	199	90.0	0.00	0.000	0.054	0.00	0.00	16.0	7.38	135.15	1	0.46	0.46	15	6.92	100.29
10	0.938	7.81	202	90.0	0.01	0.005	0.059	0.00	0.01	24.0	11.31	146.46	0	0.00	0.46	15	7.07	107.36
11	0.922	7.56	239	90.0	0.02	0.009	0.068	0.00	0.02	24.0	11.11	157.57	0	0.00	0.46	14	6.48	113.84
12	0.940	7.43	223	100	0.00	0.000	0.068	0.00	0.00	30.0	14.16	171.73	2	0.94	1.41	13	6.14	119.98
13	0.899	7.45	235	100	0.00	0.000	0.068	0.00	0.00	30.0	13.54	185.27	0	0.00	1.41	13	5.87	125.85
14	0.901	7.42	207	110	0.00	0.000	0.068	0.00	0.00	40.0	18.10	203.37	0	0.00	1.41	13	5.88	131.73
15	0.954	7.42	214	110	0.00	0.000	0.068	0.00	0.00	39.0	18.68	222.05	1	0.48	1.89	11	5.27	137.00
16	0.962	7.49	188	120	0.02	0.010	0.078	0.00	0.02	43.0	20.77	242.82	0	0.00	1.89	12	5.80	142.80
17	0.936	7.32	246	110	0.02	0.009	0.087	0.00	0.02	34.0	15.98	258.80	0	0.00	1.89	11	5.17	147.97
18	0.938	7.25	239	100	0.00	0.000	0.087	0.00	0.00	33.0	15.54	274.34	0	0.00	1.89	10	4.71	152.68
19	0.946	7.22	240	110	0.01	0.005	0.092	0.00	0.01	36.0	17.10	291.44	0	0.00	1.89	11	5.23	157.91
20	0.899	7.44	239	130	0.00	0.000	0.092	0.00	0.00	45.0	20.32	311.76	0	0.00	1.89	12	5.42	163.33
21	0.921	7.40	250	100	0.02	0.009	0.101	0.00	0.02	30.0	13.88	325.64	0	0.00	1.89	11	5.09	168.42
22	0.992	7.42	271	110	0.02	0.010	0.111	0.00	0.02	34.0	16.94	342.58	0	0.00	1.89	13	6.48	174.90
23	0.944	7.46	189	80.0	0.03	0.014	0.125	0.01	0.02	27.0	12.80	355.38	0	0.00	1.89	10	4.74	179.64
24	0.912	7.32	202	70.0	0.03	0.014	0.139	0.02	0.01	18.0	8.24	363.62	0	0.00	1.89	10	4.58	184.22
25	0.973	7.25	234	100	0.00	0.000	0.139	0.00	0.00	37.0	18.08	381.70	0	0.00	1.89	10	4.89	189.11
26	0.918	7.10	201	90.0	0.02	0.009	0.148	0.00	0.02	27.0	12.45	394.15	1	0.46	2.35	9	4.15	193.26
27	0.985	7.32	193	100	0.01	0.005	0.153	0.00	0.01	32.0	15.83	409.98	0	0.00	2.35	12	5.94	199.20
28	0.997	7.47	184	100	0.00	0.000	0.153	0.00	0.00	34.0	17.02	427.00	0	0.00	2.35	13	6.51	205.71
29	0.993	7.30	212	90.0	0.00	0.000	0.153	0.00	0.00	28.0	13.96	440.96	0	0.00	2.35	12	5.98	211.69
30	0.992	7.43	222	100	0.05	0.025	0.178	0.00	0.05	33.0	16.44	457.40	0	0.00	2.35	15	7.47	219.16
31	0.998	7.49	217	90.0	0.03	0.015	0.193	0.00	0.03	28.0	14.03	471.43	0	0.00	2.35	13	6.52	225.68
32	0.989	7.36	177	90.0	0.03	0.015	0.208	0.00	0.03	30.0	14.90	486.33	0	0.00	2.35	13	6.46	232.14
33	1.005	7.50	233	90.0	0.00	0.000	0.208	0.00	0.00	24.0	12.11	498.44	0	0.00	2.35	14	7.07	239.21
34	0.987	7.48	194	90.0	0.03	0.015	0.223	0.00	0.03	27.0	13.38	511.82	0	0.00	2.35	15	7.43	246.64
35	1.003	7.47	167	90.0	0.01	0.005	0.228	0.00	0.01	26.0	13.10	524.92	0	0.00	2.35	14	7.05	253.69
36	0.989	7.64	151	80.0	0.00	0.000	0.228	0.00	0.00	26.0	12.91	537.83	0	0.00	2.35	14	6.95	260.64
37	0.994	7.52	126	80.0	0.01	0.005	0.233	0.00	0.01	24.0	11.98	549.81	0	0.00	2.35	13	6.49	267.13
38	0.999	7.43	183	81.0	0.00	0.000	0.233	0.00	0.00	28.0	14.05	563.86	0	0.00	2.35	13	6.52	273.65
39	0.998	7.44	111	86.7	0.00	0.000	0.233	0.00	0.00	24.0	12.03	575.89	0	0.00	2.35	12	6.01	279.66
40	1.001	7.54	179	81.8	0.01	0.005	0.238	0.00	0.01	24.0	12.06	587.95	0	0.00	2.35	13	6.53	286.19
41	0.995	7.59	154	73.6	0.01	0.005	0.243	0.00	0.01	22.0	10.99	598.94	0	0.00	2.35	12	6.00	292.19
42	0.999	7.45	151	75.8	0.02	0.010	0.253	0.00	0.02	24.0	12.04	610.98	0	0.00	2.35	12	6.02	298.21
43	1.009	7.40	150	83.9	0.01	0.005	0.258	0.00	0.01	24.0	12.16	623.14	0	0.00	2.35	13	6.59	304.80
44	0.980	7.45	143	76.9	0.02	0.010	0.268	0.01	0.01	18.0	8.86	632.00	0	0.00	2.35	12	5.91	310.71
45	1.018	7.48	79	85.0	0.01	0.005	0.273	0.00	0.01	27.0	13.80	645.80	0	0.00	2.35	13	6.65	317.36
46	1.001	7.42	101	87.7	0.02	0.010	0.283	0.01	0.01	22.0	11.06	656.86	0	0.00	2.35	12	6.03	323.39
47	0.992	7.66	162	80.9	0.01	0.005	0.288	0.01	0.00	23.0	11.46	668.32	1	0.50	2.84	12	5.98	329.37
48	0.977	7.41	128	77.8	0.02	0.010	0.298	0.00	0.02	20.0	9.81	678.13	0	0.00	2.84	10	4.91	334.28
49	0.957	7.39	137	74.9	0.02	0.010	0.308	0.00	0.02	17.0	8.17	686.30	0	0.00	2.84	10	4.81	339.09
50	0.892	7.41	155	73.8	0.05	0.022	0.330	0.01	0.04	20.0	8.96	695.26	1	0.45	3.29	8	3.58	342.67
51	0.862	7.10	101	51.4	0.13	0.056	0.386	0.13	0.00	17.0	7.36	702.62	2	0.87	4.16	6	2.60	345.27
52	0.865	7.46	128	84.6	0.12	0.052	0.438	<0.10	<0.12	28.0	12.16	714.78	5	2.17	6.33	8	3.48	348.75
53	0.871	7.45	105	77.5	<0.10	0.000	0.438	<0.10	<0.10	23.0	10.06	724.84	1	0.44	6.77	7	3.06	351.81
54	0.900	7.26	101	77.9	0.19	0.086	0.524	<0.10	<0.19	24.0	10.85	735.69	2	0.90	7.67	7	3.16	354.97
55	0.937	7.19	62	62.0	<0.10	0.000	0.524	<0.10	<0.10	18.0	8.47	744.16	1	0.47	8.14	7	3.29	358.26

Table A7-10: Transition Ore Float Tails Elements

		Elements mg/L																				
Week	pH	Aluminum	Antimony	Arsenic	Barium	Cadmium	Calcium	Cobalt	Cyanide, WAD	Iron	Lead	Magnesium	Manganese	Nickel	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulfur	Tin	Zinc
0	8.11	0.074	0.013	0.056	<0.010	<0.001	16	0.013	0.058	0.026	<0.0025	1.1	<0.0050	<0.010	6.9	<0.0050	2.9	<0.0050	23	<0.10	22	<0.10	<0.01
1	8.05	<0.045	0.011	0.04	<0.010	<0.001	10	<0.010	<0.010	<0.050	<0.0025	0.87	<0.0050	<0.010	4.6	<0.0050	2.7	<0.0050	14	<0.10	17	<0.10	<0.01
2	8	0.062	0.0097	0.04	<0.010	<0.001	8.7	<0.010	<0.010	<0.050	<0.0025	0.81	<0.0050	<0.010	4.2	<0.0050	2.5	<0.0050	10	<0.10	11	<0.10	<0.01
4	7.72	0.057	0.011	0.037	<0.010	<0.001	7.7	<0.010	<0.010	0.019	<0.0025	0.78	<0.0050	<0.010	3.9	<0.0050	2.5	<0.0050	5.3	<0.10	7.3	<0.10	<0.01
8	8.14	0.048	<0.010	<0.050	<0.010	<0.001	11	<0.010	<0.010	0.026	<0.0025	1	0.0082	<0.010	2.4	<0.050	2.5	<0.0050	1.3	<0.10	5	<0.10	<0.01
12	7.43	<0.045	0.0084	0.025	0.026	<0.001	12	<0.010	<0.010	<0.010	<0.0025	1.2	0.009	<0.010	2.2	<0.0050	2.3	<0.0050	0.67	<0.10	8.8	<0.10	<0.01
16	7.49	<0.045	0.0075	0.015	<0.010	<0.001	15	<0.010	<0.010	0.013	<0.0025	1.3	0.021	<0.010	2.1	<0.0050	2.1	<0.0050	<0.50	<0.10	13	<0.10	<0.014
20	7.44	<0.045	0.0068	0.015	<0.010	<0.001	18	<0.010	<0.010	0.02	<0.0025	1.2	0.023	<0.010	1.9	<0.0050	2	<0.0050	<0.50	<0.10	15	<0.10	<0.019
24	7.32	<0.045	0.0059	0.014	<0.010	<0.001	9	<0.010	<0.010	0.011	<0.0025	0.82	0.0098	<0.010	1.3	<0.0050	1.8	<0.0050	<0.50	<0.10	6.8	<0.10	<0.01
28	7.47	<0.045	0.0073	<0.010	<0.010	<0.001	14	<0.010	<0.010	0.018	<0.0025	1.1	0.01	<0.010	1.8	<0.010	2.4	<0.0050	0.53	<0.10	10	<0.10	<0.014
32	7.36	<0.045	0.007	0.011	<0.010	<0.001	12	<0.010	<0.050	0.026	<0.0025	0.86	0.012	<0.010	1.3	<0.0050	2.2	<0.0050	0.82	<0.10	8.7	<0.10	<0.018
36	7.64	<0.045	0.0066	0.018	<0.010	<0.001	12	<0.010	<0.050	0.018	<0.0025	0.85	0.016	<0.010	1.3	<0.0050	2.7	<0.0050	0.73	<0.10	9	<0.10	0.023
40	7.54	<0.045	0.0066	0.013	<0.010	<0.001	11	<0.010	<0.050	0.016	<0.0025	0.72	0.016	<0.010	1.5	<0.0050	2.4	<0.0050	<0.50	<0.10	8.1	<0.10	<0.015
44	7.45	<0.045	0.0058	0.011	<0.010	<0.001	11	<0.010	<0.050	0.044	<0.0025	0.68	0.03	<0.010	1.2	<0.0050	2.3	<0.0050	<0.50	<0.10	7.7	<0.10	0.028
48		<0.045	0.0055	0.013	<0.010	<0.001	11	<0.010	<0.050	<0.050	<0.0025	0.68	0.021	<0.010	1.3	<0.0050	2.2	<0.0050	<0.50	<0.10	8.7	<0.10	0.028
52		<0.045	<0.0025	0.052	0.01	<0.001	33	<0.010	<0.050	<0.010	<0.0025	5.6	0.0091	<0.010	0.95	<0.0050	0.7	<0.0050	<0.50	<0.10	28	<0.10	<0.01

ANNEX 8
Waste Rock Sub-aqueous Column Test Results

Table A8-1: Sub-aqueous Waste Rock Leachate Column - BW-ARD-611

Date	Cycle No.	Volume mL		pH	Cond.	Acidity (pH 8.3)	Alkalinity	DO	Sulphate	Chloride	Fluoride	Hardness CaCO3	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		Input	Output		umhos/cm	mgCaCO3/L	mgCaCO3/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
16-Jan-13	1	360	255	7.73	113	3.9	52.9	8.17	17	2.5	0.13	24.4	0.0720	0.252	0.0257	0.00358	< 0.00002	0.00002	0.0155	0.000222	9.26	< 0.0005	0.000096	0.0023	< 0.003	0.00034	0.020	0.321	0.0198	< 0.01	0.00726	0.0008	< 0.009	4.72	< 0.00004	158	< 0.00001	9.05	0.0346	4.71	0.00002	0.00486	0.0002	0.00564	0.00121	0.017	0.00006
23-Jan-13	2	255	255	7.78	134	9.7	59.6	2.00	14	2.3	0.12	28.5	0.0463	0.274	0.0523	0.00397	< 0.00002	< 0.00001	0.0167	0.000010	10.8	< 0.0005	0.000175	< 0.0005	0.006	0.00006	0.020	0.404	0.0814	< 0.01	0.00847	0.0012	< 0.009	5.06	0.00005	151	0.00008	9.90	0.0408	10.98	0.00002	0.0409	0.0002	0.00683	0.00130	0.009	0.00008
30-Jan-13	3	255	255	7.45	136	5.3	59.0	2.55	13	2.5	0.15	33.3	0.0215	0.236	0.0534	0.00782	< 0.00002	< 0.00001	0.0210	0.000018	12.5	< 0.0005	0.000181	0.0012	0.006	0.00011	0.023	0.479	0.222	<0.01	0.00808	0.0008	< 0.009	5.83	0.00008	158	< 0.00001	12.3	0.0501	5.30	< 0.00002	0.0503	0.0001	0.00702	0.00101	0.008	0.00007
06-Feb-13	4	260	255	7.42	149	10.3	61.3	1.93	13	2.3	0.13	35.1	0.0169	0.147	0.0453	0.0178	< 0.00002	< 0.00001	0.0419	0.000003	13.2	< 0.0005	0.000158	< 0.0005	0.037	0.00005	0.023	0.489	0.335	< 0.01	0.00977	0.0007	< 0.009	5.85	< 0.00004	116	< 0.00001	12.3	0.0572	5.00	< 0.00002	0.0284	< 0.0001	0.00786	0.00082	0.006	0.00006
13-Feb-13	5	265	255	7.65	146	10.4	71.3	1.87	13	2.2	0.14	37.5	0.0149	0.0441	0.0476	0.0206	< 0.00002	< 0.00001	0.0175	< 0.000003	14.2	< 0.0005	0.000343	0.0014	0.063	0.00007	0.021	0.494	0.346	< 0.01	0.00870	0.0009	< 0.009	5.63	< 0.00004	96.7	< 0.00001	12.4	0.0574	4.02	< 0.00002	0.0338	< 0.0001	0.00804	0.00070	0.005	0.00006
20-Feb-13	6	255	255	7.59	154	7.7	82.8	2.15	12	1.9	0.13	45.3	0.0142	0.0168	0.0410	0.0228	< 0.00002	< 0.00001	0.0225	0.000007	17.3	< 0.0005	0.000291	0.0006	0.081	0.00007	0.021	0.525	0.328	< 0.01	0.00985	0.0007	< 0.009	5.75	< 0.00004	111	< 0.00001	13.0	0.0642	3.64	< 0.00002	0.0276	< 0.0001	0.00757	0.00062	0.004	0.00003
27-Feb-13	7	450	450	6.46	170	7.2	48.4	2.92	12	3.5	0.13	43.0	0.0180	0.0187	0.0539	0.0503	< 0.00002	< 0.00001	0.0204	0.000089	16.4	< 0.0005	0.000256	0.0011	0.094	0.00004	0.020	0.509	0.281	< 0.01	0.00852	0.0007	0.045	5.59	0.00008	55.9	< 0.00001	10.9	0.0591	2.84	< 0.00002	0.0425	< 0.0001	0.00692	0.00121	0.076	0.00004
06-Mar-13	8	805	805	7.02	153	7.6	83.4	7.38	5	2.0	0.12	42.7	0.0265	0.0151	0.0452	0.0254	< 0.00002	< 0.00001	0.0181	0.000054	16.3	< 0.0005	0.000325	< 0.0005	0.018	0.00017	0.020	0.490	0.218	< 0.01	0.00825	0.0006	0.168	5.75	< 0.00004	64.6	0.00002	10.4	0.0600	1.98	< 0.00002	0.0263	< 0.0001	0.00662	0.00043	0.014	0.00003
13-Mar-13	9	910	910	6.40	133	6.1	72.2	7.33	5	1.0	0.10	42.5	0.0379	0.0136	0.0350	0.0142	< 0.00002	< 0.00001	0.0159	< 0.000003	16.2	< 0.0005	0.000086	< 0.0005	0.027	0.00006	0.015	0.467	0.174	< 0.01	0.00641	0.0003	< 0.009	4.96	< 0.00004	50.3	< 0.00001	8.92	0.0564	1.47	< 0.00002	0.0189	< 0.0001	0.00584	0.00040	0.003	0.00002
20-Mar-13	10	940	940	5.98	126	9.0	68.5	7.40	4	0.9	0.08	38.1	0.0479	0.0122	0.0292	0.0123	< 0.00002	0.00001	0.0147	0.000003	14.6	< 0.0005	0.000037	< 0.0005	0.018	0.00004	0.013	0.406	0.128	< 0.01	0.00509	0.0001	< 0.009	4.44	< 0.00004	34.4	< 0.00001	8.09	0.0498	1.19	< 0.00002	0.0186	< 0.0001	0.00461	0.00007	0.002	0.00002
27-Mar-13	11	890	890	6.50	111	8.6	69.3	7.98	3	0.7	0.08	37.0	0.0439	0.0115	0.0212	0.00869	< 0.00002	0.00001	0.0107	< 0.000003	14.2	< 0.0005	0.000249	0.0006	0.009	0.00003	0.011	0.377	0.104	< 0.01	0.00380	0.0003	< 0.009	3.87	< 0.00004	27.0	< 0.00001	6.95	0.0459	1.05	< 0.00002	0.0155	< 0.0001	0.00396	0.00028	0.001	0.00001
03-Apr-13	12	935	935	7.15	106	8.8	56.9	7.39	2	0.4	0.06	38.5	0.0443	0.0147	0.0199	0.00864	< 0.00002	< 0.00001	0.0085	0.000003	14.8	< 0.0005	0.000117	0.0006	0.010	0.00011	0.010	0.385	0.0964	< 0.01	0.00307	0.0002	< 0.009	3.88	0.00037	21.2	< 0.00001	6.13	0.0481	1.13	< 0.00002	0.0133	< 0.0001	0.00317	0.00016	0.001	0.00001
10-Apr-13	13	890	890	7.10	98	5.9	56.0	7.27	3	0.3	0.06	33.8	0.0459	0.0227	0.0183	0.00621	< 0.00002	< 0.00001	0.0113	< 0.000003	13.0	< 0.0005	0.000125	< 0.0005	0.005	0.00005	0.009	0.348	0.0788	< 0.01	0.00241	0.0002	< 0.009	3.32	< 0.00004	17.1	< 0.00001	5.13	0.0425	1.15	< 0.00002	0.00993	< 0.0001	0.00267	0.00015	0.002	< 0.00001
17-Apr-13	14	845	845	6.31	94	8.0	51.1	8.05	6	0.3	0.07	32.1	0.0542	0.0437	0.0172	0.00875	< 0.00002	< 0.00001	0.0096	0.000006	12.3	< 0.0005	0.000086	< 0.0005	0.004	< 0.00002	0.008	0.330	0.0616	< 0.01	0.00187	0.0003	0.012	3.18	< 0.00004	12.9	< 0.00001	4.65	0.0412	1.35	< 0.00002	0.0152	< 0.0001	0.00234	0.00022	0.004	< 0.00001
24-Apr-13	15	870	870	6.51	89	7.7	59.4	5.45	5	0.2	0.06	31.4	0.0442	0.0743	0.0163	0.00633	< 0.00002	< 0.00001	0.0092	0.000004	12.0	< 0.0005	0.000076	< 0.0005	0.023	0.00003	0.007	0.337	0.0602	< 0.01	0.00228	0.0003	< 0.009	2.95	< 0.00004	9.32	< 0.00001	4.17	0.0405	1.51	< 0.00002	0.0187	< 0.0001	0.00220	0.00033	0.004	< 0.00001
01-May-13	16	860	860	6.50	88	7.9	48.5	7.70	7	< 0.2	< 0.06	31.1	0.0426	0.0835	0.0142	0.00464	< 0.00002	< 0.00001	0.0083	< 0.000003	11.9	< 0.0005	0.000095	0.0013	< 0.003	0.00011	0.006	0.314	0.0517	< 0.01	0.00181	0.0002	0.014	2.79	< 0.00004	8.60	< 0.00001	3.66	0.0400	1.53	< 0.00002	0.0194	< 0.0001	0.00184	0.00046	0.003	< 0.00001
08-May-13	17	1055	1055	6.15	83	8.3	46.4	7.43	10	< 0.2	< 0.06	32.5	0.0416	0.0803	0.0125	0.00426	< 0.00002	< 0.00001	0.0064	< 0.000003	12.5	< 0.0005	0.000130	< 0.0005	0.020	0.00003	0.006	0.320	0.0504	< 0.01	0.00110	0.0001	0.012	2.68	< 0.00004	6.96	< 0.00001	3.40	0.0393	1.79	< 0.00002	0.0210	< 0.0001	0.00170	0.00048	0.004	< 0.00001
15-May-13	18	940	940	6.55	73	8.2	46.4	7.78	6	< 0.2	< 0.06	32.3	0.0435	0.0701	0.0127	0.00380	< 0.00002	< 0.00001	0.0068	0.000006	12.5	< 0.0005	0.000071	< 0.0005	0.202	< 0.00002	0.007	0.293	0.0412	< 0.01	0.00093	0.0002	0.010	2.46	< 0.00004	6.53	< 0.00001	3.04	0.0360	2.04	< 0.00002	0.0199	< 0.0001	0.00159	0.00051	0.002	< 0.00001
22-May-13	19	965	965	6.32	73	8.5	41.8	4.44	9	0.4	< 0.06	30.2	0.0602	0.0665	0.0107	0.00268	< 0.00002	< 0.00001	0.0055	0.000003	11.6	< 0.0005	0.000018	< 0.0005	< 0.003	< 0.00002	0.005	0.267	0.0352	0.03	0.00082	< 0.0001	< 0.009	2.12	< 0.00004	5.21	< 0.00001	2.59	0.0332	1.81	< 0.00002	0.0169	< 0.0001	0.00128	0.00051	< 0.001	< 0.00001
29-May-13	20	1180	1180	6.41	78	8.1	41.8	5.05	5	0.4	< 0.06	30.1	0.0547	0.0544	0.0107	0.00296	< 0.00002	< 0.00001	0.0058	0.000015	11.4	< 0.0005	0.000032	0.0014	< 0.003	0.00049	0.005	0.398	0.0347	< 0.01	0.00212	0.0013	< 0.009	2.25	< 0.00004	4.67	< 0.00001	2.59	0.0352	2.06	< 0.00002	0.0159	< 0.0001	0.00123	0.00050	0.006	< 0.00001
05-Jun-13	21	1010	1010	6.23	76			5.22																																						
12-Jun-13	22	965	965	#N/A	72	16.1	43.5	5.45	6	0.3	< 0.06	25.9	0.0580	0.0458	0.0096	0.00241	< 0.00002	< 0.00001	0.0106	0.000013	10.0	< 0.0005	0.000048	0.0010	< 0.003	0.00011	0.004	0.221	0.0256	0.01	0.00054	0.0001	0.010	1.87	< 0.00004	3.57	0.00004	2.00	0.0293	1.76	< 0.00002	0.0141	< 0.0001	0.000993	0.00049	0.003	< 0.00001
19-Jun-13	23	960	960	6.67	74			5.25																																						
26-Jun-13	24	1040	1040	6.73	73	4.6	31.8	5.36	6	0.3	< 0.06	28.6	0.0579	0.0368	0.0092	0.00190	< 0.00002	< 0.00001	0.0085	0.000024	11.1	< 0.0005	0.000038	< 0.0005	0.008	0.00079	0.004	0.242	0.0277	< 0.01	0.00049	< 0.0001	0.015	1.88	< 0.00004	3.38	< 0.00001	1.87	0.0309	2.28	< 0.00002	0.0128	< 0.0001	0.000835	0.00062	0.002	< 0.00001
03-Jul-13	25	880	880	6.45	74			5.29																																						
10-Jul-13	26	905	905	6.45	70	9.0	38.1	4.71	10	0.3	< 0.06	28.9	0.0592	0.0329	0.0097	0.00250	< 0.00002	< 0.00001	0.0049	0.000048	11.2	< 0.0005	0.000185	0.0010	0.008	0.00084	0.004	0.234	0.0254	< 0.01	0.00048	0.0002	0.024	1.87	< 0.00004	2.90	< 0.00001	1.78	0.0314	2.20	< 0.00002	0.0134	< 0.0001	0.000907	0.00040	0.005	< 0.00001
17-Jul-13	27	905	905	6.27	72			5.30																																						
24-Jul-13	28	890	890	6.84				5.05																																						

Feb 27/13 Change in analytical schedule
pH values were taken in-line from Feb 27/13 onward.
Mar 6 to Apr 10/13 DO values are erroneous due to air leakage in receiving bottle.
June 12/13 start of pH and DO taken directly from column rather than sample collection bottle. pH 7.85; suspect calibration error.

Table A8-2: Sub-aqueous Waste Rock Leachate Column BW-ARD-672

Table A8-2: Sub-aqueous Waste Rock Leachate Column - BW-ARD-672

Date	Cycle No.	Volume mL		pH	Cond.	Acidity (pH 8.3)	Alkalinity	DO	Sulphate	Chloride	Fluoride	Hardness CaCO3	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		Input	Output		umhos/cm	mgCaCO3/L	mgCaCO3/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
16-Jan-13	1	290	255	6.83	277	6.5	20.7	7.49	118	3.1	0.07	66.9	0.0199	0.0109	0.0372	0.0434	0.00003	0.00001	0.0177	0.000189	21.4	< 0.0005	0.0403	0.0022	0.012	0.00043	0.013	3.28	3.41	< 0.01	0.00045	0.0554	< 0.009	13.5	0.00005	192	< 0.00001	12.9	0.188	41.8	0.00005	0.00426	0.0005	0.000174	0.00050	1.15	< 0.00001
23-Jan-13	2	255	255	7.02	297	15.0	27.5	2.10	107	2.8	0.15	67.9	0.0234	0.0079	0.0594	0.0538	0.00005	< 0.00001	0.0167	0.000034	21.6	< 0.0005	0.0435	0.0008	0.198	0.00023	0.011	3.40	3.73	< 0.01	0.00035	0.0629	< 0.009	13.1	< 0.00004	183	0.00005	12.0	0.198	37.6	0.00004	0.0480	0.0007	0.000138	0.00056	1.25	< 0.00001
30-Jan-13	3	255	255	6.76	296	10.0	23.8	1.55	118	3.2	0.06	68.3	0.0064	0.0089	0.0537	0.0593	0.00006	< 0.00001	0.0202	0.000036	21.5	< 0.0005	0.0434	0.0017	0.489	0.00046	0.013	3.55	4.00	<0.01	0.00040	0.0579	< 0.009	13.6	0.00010	194	0.00004	13.3	0.206	37.8	0.00003	0.0308	0.0003	0.000153	0.00029	1.39	< 0.00001
06-Feb-13	4	255	255	6.79	304	20.8	25.7	1.98	119	2.8	< 0.06	69.2	0.0062	0.0069	0.0462	0.0650	0.00006	< 0.00001	0.0231	0.000228	21.6	0.0007	0.0431	0.0006	0.970	0.00046	0.011	3.69	4.13	< 0.01	0.00080	0.0586	< 0.009	12.8	0.00005	137	< 0.00001	12.8	0.212	40.1	0.00003	0.0180	0.0003	0.000131	0.00039	1.12	< 0.00001
13-Feb-13	5	255	255	6.81	277	16.0	27.8	1.35	116	2.4	0.06	70.2	0.0065	0.0049	0.0389	0.0577	0.00006	< 0.00001	0.0159	0.000020	22.0	< 0.0005	0.0401	< 0.0005	1.47	0.00012	0.009	3.69	4.23	< 0.01	0.00033	0.0548	< 0.009	12.3	< 0.00004	125	0.00001	12.6	0.214	33.4	< 0.00002	0.0175	0.0002	0.000076	0.00045	0.676	< 0.00001
20-Feb-13	6	255	255	6.68	277	17.2	33.0	1.93	113	2.4	0.06	75.1	0.0071	0.0034	0.0266	0.0583	0.00006	< 0.00001	0.0197	0.000014	24.1	< 0.0005	0.0332	< 0.0005	2.02	0.00006	0.009	3.63	4.39	0.01	0.00050	0.0470	0.010	12.7	0.00004	146	< 0.00001	12.7	0.210	33.4	< 0.00002	0.0250	0.0002	0.000098	0.00011	0.156	< 0.00001
27-Feb-13	7	480	480	6.16	241	12.3	33.8	1.98	105	3.5	0.06	64.3	0.0023	0.0028	0.0258	0.0734	0.00003	< 0.00001	0.0183	0.000142	20.4	< 0.0005	0.0251	0.0007	1.62	0.00004	0.007	3.28	4.15	< 0.01	0.00041	0.0369	< 0.009	11.1	< 0.00004	74.1	< 0.00001	10.5	0.185	28.8	< 0.00002	0.0437	0.0001	0.000118	0.00012	0.065	< 0.00001
06-Mar-13	8	865	865	5.75	226	10.2	34.9	6.55	65	2.1	0.06	56.0	0.0018	0.0015	0.0168	0.0512	< 0.00002	< 0.00001	0.0158	0.000053	17.6	< 0.0005	0.0186	< 0.0005	0.407	0.00003	0.007	2.95	3.85	< 0.01	0.00043	0.0304	0.048	10.5	< 0.00004	87.5	< 0.00001	9.22	0.171	23.1	< 0.00002	0.0321	0.0001	0.000095	0.00011	0.025	< 0.00001
13-Mar-13	9	930	930	6.33	187	10.8	32.9	6.14	58	1.5	0.06	49.3	0.0011	0.0012	0.0142	0.0387	0.00002	< 0.00001	0.0148	0.000005	15.5	< 0.0005	0.0148	0.0006	1.19	0.00002	0.005	2.59	3.60	< 0.01	0.00030	0.0231	0.029	10.5	< 0.00004	70.8	< 0.00001	7.74	0.146	19.6	< 0.00002	0.0281	0.0001	0.000074	0.00011	0.016	< 0.00001
20-Mar-13	10	1000	1000	5.50	160	11.0	35.9	6.65	39	1.1	0.06	40.7	0.0030	0.0008	0.0108	0.0308	< 0.00002	< 0.00001	0.0135	< 0.000003	12.7	< 0.0005	0.0120	< 0.0005	0.427	< 0.00002	0.004	2.16	2.96	< 0.01	0.00026	0.0190	< 0.009	9.39	< 0.00004	54.9	< 0.00001	6.66	0.121	14.6	< 0.00002	0.0215	< 0.0001	0.000047	< 0.00003	0.010	< 0.00001
27-Mar-13	11	935	935	6.02	142	11.3	35.5	6.93	35	0.8	< 0.06	38.5	0.0024	0.0007	0.0065	0.0269	< 0.00002	< 0.00001	0.0102	0.000011	12.1	< 0.0005	0.00896	0.0006	0.170	< 0.00002	0.003	2.01	2.76	< 0.01	0.00034	0.0139	< 0.009	8.37	< 0.00004	40.6	< 0.00001	5.85	0.114	12.3	< 0.00002	0.0190	< 0.0001	0.000030	0.00008	0.007	< 0.00001
03-Apr-13	12	990	990	6.28	126	11.7	35.8	6.46	29	0.6	< 0.06	33.9	0.0018	0.0006	0.0034	0.0246	< 0.00002	< 0.00001	0.0083	0.000006	10.7	< 0.0005	0.00710	< 0.0005	0.371	0.00006	0.003	1.77	2.63	< 0.01	0.00021	0.0111	< 0.009	7.93	0.00042	29.4	< 0.00001	4.55	0.101	9.56	< 0.00002	0.0146	< 0.0001	0.000032	0.00006	0.012	< 0.00001
10-Apr-13	13	905	905	6.45	111	7.7	33.2	6.50	27	0.5	0.06	29.5	0.0011	0.0007	0.0030	0.0208	< 0.00002	< 0.00001	0.0096	0.000006	9.14	< 0.0005	0.00543	< 0.0005	0.398	#N/A	0.003	1.61	2.40	< 0.01	0.00034	0.0093	< 0.009	7.29	< 0.00004	26.0	< 0.00001	3.90	0.0913	8.04	< 0.00002	0.00970	< 0.0001	0.000026	< 0.00003	0.012	< 0.00001
17-Apr-13	14	905	905	5.93	103	10.2	35.2	6.27	23	0.4	0.06	26.4	0.0021	0.0008	0.0029	0.0206	< 0.00002	< 0.00001	0.0101	0.000004	8.11	< 0.0005	0.00519	< 0.0005	0.103	< 0.00002	0.003	1.50	2.16	0.01	0.00024	0.0079	0.011	6.95	< 0.00004	19.9	< 0.00001	3.38	0.0821	6.75	< 0.00002	0.00651	< 0.0001	0.000020	< 0.00003	0.013	< 0.00001
24-Apr-13	15	950	950	6.19	95	5.7	29.4	6.45	18	0.3	0.06	25.1	0.0015	0.0006	0.0028	0.0188	< 0.00002	< 0.00001	0.0084	0.000005	7.64	< 0.0005	0.00444	< 0.0005	0.014	0.00005	0.003	1.46	2.17	< 0.01	0.00033	0.0068	0.012	6.58	< 0.00004	13.9	< 0.00001	2.91	0.0788	6.07	< 0.00002	0.00763	< 0.0001	0.000037	0.00007	0.013	< 0.00001
01-May-13	16	890	890	6.34	89	9.9	35.4	7.09	17	0.2	0.06	23.3	0.0023	0.0007	0.0028	0.0136	< 0.00002	< 0.00001	0.0076	< 0.000003	7.20	< 0.0005	0.00385	0.0011	0.057	0.00027	0.002	1.30	2.04	< 0.01	0.00050	0.0051	0.012	6.26	< 0.00004	12.9	< 0.00001	2.41	0.0746	4.92	< 0.00002	0.00619	< 0.0001	0.000028	0.00013	0.010	< 0.00001
08-May-13	17	1035	1035	5.85	80	8.8	35.3	7.31	19	< 0.2	< 0.06	23.7	0.0018	0.0009	0.0025	0.0155	< 0.00002	< 0.00001	0.0062	< 0.000003	7.37	< 0.0005	0.00315	< 0.0005	0.031	< 0.00002	0.002	1.29	2.10	< 0.01	0.00019	0.0043	< 0.009	6.02	< 0.00004	10.4	< 0.00001	2.12	0.0702	4.56	< 0.00002	0.00845	< 0.0001	0.000025	0.00003	0.018	< 0.00001
15-May-13	18	915	915	6.44	70	9.7	33.5	6.56	11	< 0.2	< 0.06	23.3	0.0029	0.0008	0.0030	0.0151	< 0.00002	< 0.00001	0.0089	0.000003	7.26	< 0.0005	0.00293	< 0.0005	0.131	< 0.00002	0.003	1.26	2.05	< 0.01	0.00018	0.0041	< 0.009	5.85	< 0.00004	10.1	< 0.00001	1.89	0.0662	4.29	< 0.00002	0.0163	< 0.0001	0.000014	0.00004	0.018	< 0.00001
22-May-13	19	945	945	6.51	69	8.9	32.1	2.85	11	< 0.2	0.06	20.4	0.0018	0.0007	0.0025	0.0137	< 0.00002	< 0.00001	0.0052	< 0.000003	6.35	< 0.0005	0.00248	< 0.0005	0.018	< 0.00002	0.002	1.11	1.91	0.02	0.00019	0.0036	< 0.009	4.92	< 0.00004	7.89	< 0.00001	1.53	0.0590	3.48	< 0.00002	0.0201	< 0.0001	0.000010	0.00006	0.020	< 0.00001
29-May-13	20	1155	1155	6.24	71	10.0	31.5	4.10	9	< 0.2	< 0.06	20.2	0.0020	0.0007	0.0027	0.0139	< 0.00002	< 0.00001	0.0048	0.000017	6.16	< 0.0005	0.00228	0.0006	0.144	< 0.00002	0.002	1.16	2.06	< 0.01	0.00061	0.0340	< 0.009	5.31	0.00011	7.24	< 0.00001	1.49	0.0617	3.44	< 0.00002	0.0249	< 0.0001	0.000017	0.00003	0.028	< 0.00001
05-Jun-13	21	920	920	6.65	68			3.02																																						
12-Jun-13	22	955	955	#N/A	64	15.8	32.6	4.26	8	0.3	0.06	17.2	0.0011	0.0010	0.0026	0.0129	< 0.00002	< 0.00001	0.0046	< 0.000003	5.35	< 0.0005	0.00201	< 0.0005	0.053	0.00006	0.002	0.929	1.79	< 0.01	0.00012	0.0034	< 0.009	4.59	< 0.00004	5.44	0.00001	1.04	0.0510	2.51	< 0.00002	0.0192	< 0.0001	0.000013	< 0.00003	0.029	< 0.00001
19-Jun-13	23	935	935	6.30	65			5.35																																						
26-Jun-13	24	895	895	6.00	64	5.6	24.3	5.20	8	< 0.2	0.06	18.6	0.0015	0.0010	0.0027	0.0127	< 0.00002	< 0.00001	0.0089	< 0.000003	5.79	< 0.0005	0.00173	< 0.0005	0.103	0.00062	0.002	1.01	2.05	< 0.01	0.00011	0.0025	< 0.009	4.52	< 0.00004	5.07	< 0.00001	0.96	0.0554	2.94	< 0.00002	0.0137	< 0.0001	0.000018	< 0.00003	0.032	< 0.00001
03-Jul-13	25	895	895	5.73	65			4.73																																						
10-Jul-13	26	885	885	5.29	60	9.4	28.4	5.50	12	0.2	0.06	18.0	0.0030	0.0009	0.0027	0.0122	< 0.00002	< 0.00001	0.0046	0.000004	5.62	< 0.0005	0.00170	0.0006	0.142	0.00256	0.002	0.962	2.10	< 0.01	0.00008	0.0023	< 0.009	4.32	< 0.00004	4.23	< 0.00001	0.83	0.0533	2.71	< 0.00002	0.0156	< 0.0001	0.000014	< 0.00003	0.042	< 0.00001
17-Jul-13	27	925	925	5.62	61			5.40																																						
24-Jul-13	28	910	910	6.42				4.27																																						

Feb 27/13 Change in analytical schedule
pH values were taken in-line from Feb 27/13 onward.
Mar 6 to Apr 10/13 DO values are erroneous due to air leakage in receiving bottle.
June 12/13 start of pH and DO taken directly from column rather than sample collection bottle. pH 7.26 suspect calibration error.

ANNEX 9
Field Bin Test Results

Table A9-1: Waste Rock Field Bin Test Results - BW-ARD2-9

Sample ID		ARD2-9	BW-ARD2-9	BW-ARD2-9	BW-ARD2-9	BW-ARD2-9	BW-ARD-2-9	BW-ARD-2-9	ARD-2-9	BW-ARD2-9
Week		1	7	12	16	20	25	60	65	69
Date Analyzed		01/04/2012	15/05/2012	17/07/2013	16/07/2012	13/08/2012	17/09/2012	15/05/2013 0:00	19/06/2013 0:00	2013-07-17
Volume (Field)	L	8.3	1.9	3.1	1.3	1.8	0.5	1.8	8.5	2.5
pH @ 25°C BC-D	pH units	4.2	4.52	4.29	4.31	3.92	3.94	4.68	4.5	4.18
Conductivity @ 25°C	µS/cm	1190	423	626.00	645	633	971	0.185	297	355
T-Dissolved Solids180°C	mg/L	1208	360	548	580	548	920	5	144	76
Total Suspended Solids @105°C	mg/L	5	20	10	9	29	273	124	2	6
Acidity as CaCO3	mg/L	473	80	160	113	143	206	34	50	94
Alkalinity as CaCO3	mg/L	1.0000	1.0000	1	1.0000	1.0000	1.0000	1	1	1
Sulphate	mg/L	781	257	276	307	406	54.9	66.1	118	140
Nitrate-N	mg/L	0.056	0.059	0.109	0.179	0.151	0.171	0.096	0.063	0.017
Nitrite-N	mg/L	0.003	0.08	0.004	0.006	0.0030	0.0030	0.003	0.003	0.003
Total Metals										
Aluminum	mg/L	34.2	2.8	3.65	2.25	5.44	10.5	1.23	2.93	4.11
Antimony	mg/L	0.00211	0.00134	0.00156	0.00169	0.00182	0.00796	0.00036	0.00035	0.00027
Arsenic	mg/L	0.0046	0.0041	0.0072	0.0078	0.0065	0.0333	0.002	0.0015	0.0027
Barium	mg/L	0.0114	0.0158	0.0143	0.0141	0.0136	0.0435	0.0211	0.00698	0.00803
Beryllium	mg/L	0.0124	0.0028	0.004	0.0024	0.0058	0.0041	0.0008	0.0018	0.0024
Boron	mg/L	0.053	0.001	0.007	0.013	0.034	0.017	0.001	0.005	0.006
Cadmium	mg/L	2.13	0.547	0.859	0.454	0.451	0.75	0.135	0.185	0.195
Calcium	mg/L	30.6	14	15.1	12.9	11.7	16.9	2.2	3.8	4.1
Chromium	mg/L	0.0017	0.0003	0.0003	0.0005	0.0007	0.0093	0.0003	0.0003	0.0003
Cobalt	mg/L	3.46	0.596	0.672	0.495	0.397	0.521	0.0556	0.0708	0.0626
Copper	mg/L	0.188	0.0457	0.0891	0.0705	0.0793	0.134	0.0237	0.0382	0.0561
Iron	mg/L	10.7	1.57	3.98	4.57	12.1	19.1	1.54	5.95	4.01
Lead	mg/L	0.537	1.34	1.58	1.47	1.66	3.26	3.28	2.2	2.76
Lithium	mg/L	0.064	0.039	0.03	0.026	0.03	0.02	0.005	0.006	0.009
Magnesium	mg/L	33.2	7.3	8.94	9.72	8.19	15.4	2.04	3.08	3.86
Manganese	mg/L	106	40.9	76.4	103	85	200	26.4	42.7	59
Mercury	mg/L	0.00001	0.00001	0.000007	0.0000	0.0000	0.000016	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.0022	0.00122	0.00257	0.00251	0.00207	0.00546	0.00036	0.00047	0.00055
Nickel	mg/L	2.82	0.537	0.741	0.618	0.529	0.761	0.102	0.14	0.136
Phosphorus	mg/L	0.02000	0.02000	0.02	0.0200	0.0200	0.23	0.01	0.01	0.01
Potassium	mg/L	1	1.2	1.5	1.5	1.9	4.2	0.5	0.7	0.7
Selenium	mg/L	0.0011	0.00060	0.0007	0.0007	0.0008	0.0013	0.0001	0.0002	0.0003
Silicon	mg/L	1.65	2.46	9.28	7.65	21.7	19.5	2.19	3.52	4.15
Silver	mg/L	0.0001	0.00005	0.00012	0.00044	0.00047	0.00328	0.00005	0.00007	0.00012
Sodium	mg/L	1.1	0.50000	0.5	0.5000	0.5000	0.5000	0.5	0.5	0.5
Strontium	mg/L	0.065	0.0805	0.0742	0.0571	0.0517	0.0444	0.0175	0.0141	0.0144
Thallium	mg/L	0.00005	0.00009	0.00021	0.00024	0.00018	0.00028	0.00023	0.00025	0.00019
Tin	mg/L	0.00010	0.00010	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium	mg/L	0.0017	0.0003	0.0018	0.0027	0.0059	0.043	0.001	0.0006	0.0005
Uranium	mg/L	0.0215	0.00279	0.00476	0.00343	0.00936	0.00785	0.0008	0.00253	0.00255
Vanadium	mg/L	0.00010	0.00010	0.0001	0.0007	0.0009	0.0137	0.00005	0.00005	0.00005
Zinc	mg/L	131	29.3	51.8	47.9	38.1	60.7	7.49	11.4	9.87
T-Hardness as CaCO3	mg/L	213	65.1	74.6	72.1	62.9	106	13.8	22.1	26
Dissolved Metals										
Aluminum	mg/L	33.7	2.49	3.65	1.64	4.49	5.56	1.12	2.93	3.36
Antimony	mg/L	0.00211	0.00127	0.00141	0.0012	0.00082	0.00051	0.00032	0.00029	0.00015
Arsenic	mg/L	0.0043	0.0036	0.0064	0.0056	0.0037	0.0083	0.0018	0.0015	0.0024
Barium	mg/L	0.0114	0.0156	0.0129	0.0128	0.0104	0.00717	0.0211	0.00698	0.00803
Beryllium	mg/L	0.01	0.0028	0.0038	0.0024	0.0045	0.0039	0.0008	0.0018	0.0022
Boron	mg/L	0.052	0.00100	0.006	0.012	0.028	0.012	0.001	0.005	0.006
Cadmium	mg/L	2.13	0.547	0.799	0.454	0.374	0.75	0.135	0.181	0.195
Calcium	mg/L	30.6	13.9	15.1	12.8	10.8	16.9	2.2	3.8	4.1
Chromium	mg/L	0.0017	0.00030	0.0003	0.0005	0.0003	0.0003	0.0003	0.0003	0.0003
Cobalt	mg/L	3.46	0.596	0.629	0.486	0.397	0.521	0.0556	0.07	0.0626
Copper	mg/L	0.174	0.0451	0.0872	0.0675	0.0742	0.0902	0.0237	0.0382	0.0561
Iron	mg/L	10.7	1.39	3.6	3.73	10.5	7.25	1.34	5.95	4.01
Lead	mg/L	0.537	1.29	1.48	1.2	1.23	1.58	3.28	2.02	2.66
Lithium	mg/L	0.06	0.037	0.028	0.026	0.026	0.017	0.005	0.006	0.006
Magnesium	mg/L	33.2	7.05	8.39	9.72	8.14	14.9	2.04	3.08	3.86
Manganese	mg/L	106	36	76.4	85	82.9	200	26.4	42.1	57.2
Mercury	mg/L	0.00001	0.00001	0.000005	0.0000	0.0000	0.0000	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.00248	0.00122	0.0024	0.00251	0.00207	0.00546	0.00031	0.00028	0.00055
Nickel	mg/L	2.82	0.523	0.741	0.617	0.517	0.761	0.102	0.14	0.136
Phosphorus	mg/L	0.01000	0.01000	0.01	0.0100	0.0100	0.0100	0.01	0.01	0.01
Potassium	mg/L	1	1.2	1.6	1.3	1.9	1.2	0.5	0.7	0.7
Selenium	mg/L	0.0009	0.00060	0.0006	0.0007	0.0006	0.0011	0.0001	0.0002	0.0002
Silicon	mg/L	1.58	2.46	7.75	5.94	19.3	13.2	2.15	3.52	4.15
Silver	mg/L	0.0001	0.00005	0.00006	0.00007	0.0001	0.0001	0.00005	0.00005	0.00005
Sodium	mg/L	1.1	0.50000	0.5	0.5000	0.5000	0.5000	0.5	0.5	0.5
Strontium	mg/L	0.065	0.0805	0.0708	0.0571	0.0459	0.0329	0.0175	0.0141	0.0144
Thallium	mg/L	0.00005	0.00007	0.00016	0.00024	0.00015	0.00007	0.00019	0.00011	0.00019
Tin	mg/L	0.00010	0.00010	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium	mg/L	0.00020	0.00020	0.0004	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Uranium	mg/L	0.02150	0.00137	0.00476	0.00343	0.00733	0.00767	0.0008	0.00253	0.00255
Vanadium	mg/L	0.00005	0.00005	0.00005	0.0001	0.0001	0.0001	0.00005	0.00005	0.00005
Zinc	mg/L	116	28.5	51.8	47.4	38.1	60.7	7.49	11.4	9.87
D-Hardness as CaCO3	mg/L	213	63.7	72.2	71.9	60.4	104	13.8	22.1	26

Table A9-2: Waste Rock Field Bin Test Results - BW-ARD-037

Sample ID		BW-ARD-037_Dup	BW-ARD-037_DUP	BW-ARD-037_DUP	BW-ARD-037_DUP	BW-ARD-037	BW-ARD-037	BW-ARD-037 DUP	ARD-037	BW-ARD-037_Dup
Week		1	7	12	16	20	25	60	65	69
Date Analyzed		01/04/2012	15/05/2012	17/07/2013	16/07/2012	13/08/2012	17/09/2012	15/05/2013	19/06/2013	2013/07/17
Volume (Field)	L	5.4	1.1	3.8	1.6	2.0	0.9	1.8	9.0	3.0
pH @ 25°C BC-D	pH units	6.05	6.49	6.28	5.9	5.09	5.07	5.78	5.21	5.82
Conductivity @ 25°C	µS/cm	377	138	140.00	144	122	225	47	100	97
T-Dissolved Solids180°C	mg/L	284	132	108	76	64	196	36	88	64
Total Suspended Solids @105°C	mg/L	7	16	95	24	20	470	3	2	4
Acidity as CaCO3	mg/L	62	17	15	19	29	56	16	28	37
Alkalinity as CaCO3	mg/L	1	3	2	2	1	1	2	1	1
Sulphate	mg/L	163	64	44.9	46.1	42.8	81.9	15.4	36.4	36
Nitrate-N	mg/L	0.133	0.124	0.169	0.0050	0.156	0.239	0.069	0.059	0.044
Nitrite-N	mg/L	0.025	0.231	0.011	0.01	0.003	0.0030	<0.003	0.003	0.003
Total Metals										
Aluminum	mg/L	0.128	0.37	2.41	1.71	0.716	13.1	0.102	0.222	0.19
Antimony	mg/L	0.00161	0.00189	0.00307	0.00331	0.00247	0.00554	0.00104	0.00117	0.00132
Arsenic	mg/L	0.0067	0.0071	0.0116	0.0119	0.0074	0.0263	0.0057	0.0044	0.002
Barium	mg/L	0.0284	0.0307	0.0357	0.0302	0.0236	0.099	0.00704	0.02	0.016
Beryllium	mg/L	0.00010	0.00010	0.0002	0.0002	0.0002	0.0009	<0.0001	0.0002	0.0002
Boron	mg/L	0.008	0.006	0.011	0.012	0.019	0.013	<0.001	0.007	0.003
Cadmium	mg/L	0.0224	0.0122	0.0241	0.0275	0.0258	0.0805	0.0189	0.0523	0.0511
Calcium	mg/L	12.6	3.2	3.3	3.5	2.8	5.3	0.7	1.5	1.3
Chromium	mg/L	0.0004	0.0004	0.0017	0.0018	0.0007	0.0175	<0.0003	0.0003	0.0003
Cobalt	mg/L	0.289	0.0751	0.0885	0.109	0.0816	0.23	0.0387	0.103	0.0977
Copper	mg/L	0.0058	0.002	0.0042	0.0029	0.0069	0.0246	0.0009	0.0027	0.003
Iron	mg/L	0.169	0.722	3.86	2.5	1.17	21.5	0.131	0.288	0.21
Lead	mg/L	0.0253	0.0365	0.125	0.107	0.14	0.584	0.0362	0.215	0.242
Lithium	mg/L	0.048	0.023	0.019	0.019	0.014	0.029	0.003	0.003	0.004
Magnesium	mg/L	11.5	2.94	3.46	3.4	2.37	8.09	0.57	1.13	0.92
Manganese	mg/L	11.4	2.82	3	3.41	2.31	6.05	0.635	1.43	1.2
Mercury	mg/L	0.00001	0.00001	0.000005	0.0000	0.000005	0.000006	<0.000005	0.000005	0.000005
Molybdenum	mg/L	0.00042	0.00022	0.00052	0.00043	0.00023	0.00086	<0.00005	0.00005	0.00005
Nickel	mg/L	0.538	0.151	0.167	0.179	0.128	0.357	0.0591	0.167	0.18
Phosphorus	mg/L	0.02000	0.02	0.06	0.03	0.03	0.28	<0.01	0.01	0.01
Potassium	mg/L	28.2	12.7	12.5	11.4	9.6	17.9	2.3	3.5	3.2
Selenium	mg/L	0.00060	0.00060	0.0006	0.0006	0.0006	0.0006	<0.0001	0.0001	0.0001
Silicon	mg/L	1.56	1.66	8.35	6.46	8.32	23.6	1.44	2.71	2.61
Silver	mg/L	0.00005	0.00005	0.00019	0.0001	0.00005	0.00131	<0.00005	0.00005	0.00005
Sodium	mg/L	2	0.50000	0.5	0.5000	0.5	0.5000	<0.5	0.5	0.5
Strontium	mg/L	0.0676	0.0238	0.0276	0.03	0.0249	0.0512	0.00494	0.011	0.00795
Thallium	mg/L	0.00005	0.00007	0.00018	0.00016	0.00008	0.0008	<0.00005	0.00006	0.00006
Tin	mg/L	0.00010	0.00010	0.0001	0.0001	0.0001	0.0001	<0.0001	0.0001	0.0001
Titanium	mg/L	0.006	0.017	0.114	0.0685	0.03	0.703	0.0036	0.0072	0.0062
Uranium	mg/L	0.00005	0.00005	0.00015	0.0001	0.00013	0.00084	<0.00005	0.00008	0.00005
Vanadium	mg/L	0.00010	0.0005	0.0051	0.0033	0.0013	0.0313	<0.00005	0.00005	0.00005
Zinc	mg/L	38.4	8.24	9.84	11.7	9.45	31.2	5.22	16.5	15.9
T-Hardness as CaCO3	mg/L	79	20.1	22.4	22.8	16.7	46.6	<6.0	8.5	6.9
Dissolved Metals										
Aluminum	mg/L	0.005	0.003	0.012	0.003	0.078	0.2	0.002	0.059	0.018
Antimony	mg/L	0.00149	0.00189	0.00218	0.00261	0.00247	0.00224	0.00104	0.00058	0.00128
Arsenic	mg/L	0.0065	0.0063	0.0092	0.0096	0.006	0.0054	0.0057	0.0034	0.0016
Barium	mg/L	0.0226	0.0252	0.0168	0.0196	0.0226	0.0276	0.00704	0.02	0.0153
Beryllium	mg/L	0.00010	0.00010	0.0001	0.0001	0.0001	0.0003	<0.0001	0.0001	0.0002
Boron	mg/L	0.007	0.003	0.01	0.01	0.019	0.008	<0.001	0.007	0.003
Cadmium	mg/L	0.0224	0.0115	0.021	0.0275	0.0258	0.0805	0.0189	0.0523	0.0511
Calcium	mg/L	12.6	3.1	3.3	3.4	2.8	5.3	0.7	1.4	1.3
Chromium	mg/L	0.00030	0.00030	0.0004	0.0004	0.0003	0.0003	<0.0003	0.0003	0.0003
Cobalt	mg/L	0.289	0.0728	0.0869	0.105	0.0801	0.23	0.0387	0.101	0.0977
Copper	mg/L	0.0041	0.0007	0.0001	0.0004	0.0052	0.0056	0.0009	0.0027	0.0027
Iron	mg/L	0.0021	0.0003	0.0077	0.0044	0.164	0.467	0.0058	0.0623	0.0481
Lead	mg/L	0.0196	0.0108	0.0143	0.0288	0.113	0.345	0.03	0.208	0.228
Lithium	mg/L	0.047	0.02	0.015	0.018	0.014	0.014	0.003	0.002	0.003
Magnesium	mg/L	11.4	2.56	2.86	3.05	2.21	4.38	0.57	1.09	0.91
Manganese	mg/L	10.7	2.45	2.85	2.7	2.17	5.26	0.635	1.43	1.2
Mercury	mg/L	0.00001	0.00001	0.000005	0.0000	0.000005	0.0000	<0.000005	0.000005	0.000005
Molybdenum	mg/L	0.00062	0.00022	0.00052	0.00043	0.00023	0.00022	<0.00005	0.00005	0.00005
Nickel	mg/L	0.538	0.145	0.167	0.174	0.122	0.357	0.0591	0.166	0.18
Phosphorus	mg/L	0.01000	0.01000	0.01	0.0100	0.01	0.0100	<0.01	0.01	0.01
Potassium	mg/L	26	12.1	11	10.7	9.6	9.2	2.3	3.5	3.2
Selenium	mg/L	0.00060	0.00060	0.0006	0.0006	0.0006	0.0006	<0.0001	0.0001	0.0001
Silicon	mg/L	1.19	1.3	4.38	3.65	7.37	5.37	1.26	2.49	2.48
Silver	mg/L	0.00005	0.00005	0.00005	0.0001	0.00005	0.0001	<0.00005	0.00005	0.00005
Sodium	mg/L	2	0.50000	0.5	0.5000	0.5	0.5000	<0.5	0.5	0.5
Strontium	mg/L	0.0676	0.0224	0.0238	0.0283	0.0249	0.0403	0.00494	0.0108	0.00795
Thallium	mg/L	0.00005	0.00005	0.00005	0.00008	0.00008	0.0001	<0.00005	0.00005	0.00005
Tin	mg/L	0.00010	0.00010	0.0001	0.0001	0.0001	0.0001	<0.0001	0.0001	0.0001
Titanium	mg/L	0.00020	0.00020	0.0002	0.0002	0.0002	0.0002	<0.0002	0.0002	0.0003
Uranium	mg/L	0.00005	0.00005	0.00005	0.0001	0.00008	0.00019	<0.00005	0.00007	0.00005
Vanadium	mg/L	0.00005	0.00005	0.00005	0.0001	0.00005	0.0001	<0.00005	0.00005	0.00005
Zinc	mg/L	34.3	8.03	9.84	11.4	9.45	31.2	5.22	15	15.9
D-Hardness as CaCO3	mg/L	78.6	18.2	20	21	16.1	31.2	<6.0	8.1	6.9

Table A9-3: Waste Rock Field Bin Test Results - BW-ARD-537

Sample ID		BW-ARD-537_Dup	BW-ARD-537_DUP	BW-ARD-537_DUP	BW-ARD-537_DUP	BW-ARD-537	BW-ARD-537
Week		1	7	12	16	20	25
Date Analyzed		01/04/2012	15/05/2012	17/07/2013	16/07/2012	13/08/2012	17/09/2012
Volume (Field)	L	7.3	2.6	3.2	1.6	1.8	0.9
pH @ 25°C BC-D	pH units	7.62	7.84	7.84	7.86	7.87	7.78
Conductivity @ 25°C	µS/cm	216	171	234.00	205.00	188	200
T-Dissolved Solids180°C	mg/L	148	148	100	124.00	136	224
Total Suspended Solids @105°C	mg/L	9	36	102	64.00	10	97
Acidity as CaCO3	mg/L	-3	-22	-25	-38	-20	-26
Alkalinity as CaCO3	mg/L	34	51	50	52	51	42
Sulphate	mg/L	65.2	28.4	54.3	49.7	37.6	55.3
Nitrate-N	mg/L	0.105	0.114	0.133	0.044	0.044	0.055
Nitrite-N	mg/L	0.102	0.025	0.024	0.011	0.012	0.004
Total Metals							
Aluminum	mg/L	0.694	0.71	3.09	2.61	1.12	8.14
Antimony	mg/L	0.0404	0.0448	0.0419	0.0479	0.0668	0.0348
Arsenic	mg/L	0.009	0.0152	0.025	0.0264	0.0322	0.0328
Barium	mg/L	0.0239	0.00692	0.0223	0.0159	0.00806	0.0523
Beryllium	mg/L	0.0001	0.0001	0.0002	0.0003	0.0001	0.0008
Boron	mg/L	0.012	0.007	0.011	0.016	0.027	0.02
Cadmium	mg/L	0.000181	0.000055	0.000251	0.000164	0.000115	0.000427
Calcium	mg/L	33.9	23.3	31.5	30	28.9	31.7
Chromium	mg/L	0.0006	0.0004	0.0017	0.0025	0.0008	0.0077
Cobalt	mg/L	0.00044	0.00024	0.00142	0.00155	0.00077	0.00365
Copper	mg/L	0.0062	0.0006	0.0025	0.0029	0.0017	0.0062
Iron	mg/L	0.0005	0.343	2.75	2.87	1.13	7.49
Lead	mg/L	0.00089	0.00129	0.00123	0.00228	0.0012	0.00603
Lithium	mg/L	0.006	0.005	0.007	0.007	0.006	0.01
Magnesium	mg/L	1.47	1.06	1.76	1.71	1.38	2.69
Manganese	mg/L	0.206	0.168	0.382	0.363	0.25	0.622
Mercury	mg/L	0.000008	0.000005	0.000005	0.0000	0.0000	0.000009
Molybdenum	mg/L	0.0115	0.0101	0.0103	0.00808	0.0068	0.0055
Nickel	mg/L	0.00156	0.00062	0.00283	0.00351	0.00162	0.00825
Phosphorus	mg/L	0.03	<0.02	0.08	0.06	0.05	0.14
Potassium	mg/L	8	8.5	10.5	10.3	10.2	12.1
Selenium	mg/L	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Silicon	mg/L	2.45	3.32	7.5	6.92	11.3	17.3
Silver	mg/L	0.0001	0.0001	0.00005	0.0001	0.0001	0.0001
Sodium	mg/L	4.4	2.8	2.2	2	2.1	1.6
Strontium	mg/L	0.107	0.078	0.109	0.0996	0.0964	0.102
Thallium	mg/L	0.00005	0.00009	0.00026	0.00029	0.00012	0.00078
Tin	mg/L	0.00010	0.0019	0.0001	0.0001	0.0001	0.0001
Titanium	mg/L	0.0138	0.0099	0.075	0.0634	0.0261	0.173
Uranium	mg/L	0.002	0.00124	0.00253	0.00209	0.00234	0.00278
Vanadium	mg/L	0.0015	0.0016	0.0065	0.0067	0.0039	0.0162
Zinc	mg/L	0.0314	0.008	0.0416	0.0349	0.0181	0.0863
T-Hardness as CaCO3	mg/L	90.7	62.5	85.8	82.1	77.8	90.3
Dissolved Metals							
Aluminum	mg/L	0.016	0.015	0.012	0.028	0.037	0.042
Antimony	mg/L	0.0404	0.048	0.0419	0.0479	0.0668	0.0348
Arsenic	mg/L	0.0086	0.0144	0.0188	0.0217	0.0301	0.021
Barium	mg/L	0.0181	0.00329	0.00415	0.00426	0.00412	0.00389
Beryllium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Boron	mg/L	0.01	0.004	0.009	0.015	0.027	0.015
Cadmium	mg/L	0.000078	0.00002	0.000049	0.0000	0.000049	0.000047
Calcium	mg/L	33.2	21.1	29.2	28.6	28.9	31.7
Chromium	mg/L	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Cobalt	mg/L	0.00028	0.00019	0.00013	0.00005	0.00013	0.00011
Copper	mg/L	0.003	0.0004	0.0001	0.0005	0.0005	0.0003
Iron	mg/L	0.00010	0.00010	0.0012	0.0057	0.0079	0.0067
Lead	mg/L	0.00005	0.00005	0.00005	0.0001	0.0001	0.0001
Lithium	mg/L	0.005	0.005	0.004	0.005	0.006	0.004
Magnesium	mg/L	1.42	0.94	1.17	1.23	1.21	1.29
Manganese	mg/L	0.189	0.152	0.203	0.19	0.177	0.258
Mercury	mg/L	0.000008	0.000005	0.000005	0.0000	0.0000	0.0000
Molybdenum	mg/L	0.0115	0.00888	0.009	0.00805	0.00652	0.00532
Nickel	mg/L	0.00111	0.0006	0.00039	0.00016	0.00031	0.00026
Phosphorus	mg/L	0.02	0.01	0.01	0.0100	0.0100	0.0100
Potassium	mg/L	7.3	7.9	8.1	9.2	10.2	7.5
Selenium	mg/L	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Silicon	mg/L	1.24	3.32	2.58	3.07	9.6	8.7
Silver	mg/L	0.00005	0.00005	0.00005	0.0001	0.0001	0.0001
Sodium	mg/L	4.4	2.8	2	2	2.1	1.4
Strontium	mg/L	0.107	0.074	0.0975	0.0984	0.0964	0.0938
Thallium	mg/L	0.00005	0.00005	0.00005	0.00007	0.00006	0.0001
Tin	mg/L	0.00010	0.00010	0.0001	0.0001	0.0001	0.0001
Titanium	mg/L	0.00020	0.00020	0.0002	0.0002	0.0006	0.0006
Uranium	mg/L	0.00192	0.00117	0.00248	0.00209	0.0021	0.00232
Vanadium	mg/L	0.00037	0.00081	0.00091	0.00145	0.00213	0.00134
Zinc	mg/L	0.0206	0.0031	0.0053	0.0047	0.0059	0.0014
D-Hardness as CaCO3	mg/L	88.8	56.6	77.7	76.5	77.1	84.6

Table A9-4: Waste Rock Field Bin Test Results - BW-ARD-176

Sample ID		BW-ARD-176_Dup	BW-ARD-176_DUP	BW-ARD-176_DUP	BW-ARD-176_DUP	BW-ARD-176	BW-ARD-176
Week		1	7	12	16	20	25
Date Analyzed		01/04/2012	15/05/2012	17/07/2013	16/07/2012	8/13/2012	9/17/2012
Volume (Field)	L	7.0	1.6	3.2	1.6	2.0	0.9
pH @ 25°C BC-D	pH units	7.63	7.84	7.82	7.71	7.8	7.75
Conductivity @ 25°C	µS/cm	154	135	179.00	231	182	250
T-Dissolved Solids180°C	mg/L	76	72	128.00	132	108	184
Total Suspended Solids @105°C	mg/L	11	2	34.00	50	8	504
Acidity as CaCO3	mg/L	-5	-14	-26.00	-32	-13	-23
Alkalinity as CaCO3	mg/L	29	47	50.00	45	45	51
Sulphate	mg/L	33.7	15.3	27.00	67.5	39.8	75.6
Nitrate-N	mg/L	0.103	0.078	0.13	0.0050	0.073	0.144
Nitrite-N	mg/L	0.024	0.015	0.00	0.01	0.005	0.0030
Total Metals							
Aluminum	mg/L	0.693	0.467	1.12	2.85	0.329	25.3
Antimony	mg/L	0.0643	0.0641	0.0568	0.0541	0.0519	0.0276
Arsenic	mg/L	0.004	0.0044	0.0069	0.0057	0.0059	0.0079
Barium	mg/L	0.0236	0.00789	0.0115	0.0227	0.0077	0.182
Beryllium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0007
Boron	mg/L	0.005	0.002	0.006	0.011	0.018	0.012
Cadmium	mg/L	0.000191	0.000591	0.000716	0.00141	0.000722	0.00723
Calcium	mg/L	18	14.7	21.3	31.3	26.6	44.6
Chromium	mg/L	0.0006	0.0004	0.0003	0.0034	0.0003	0.0318
Cobalt	mg/L	0.00044	0.00034	0.00075	0.00153	0.0006	0.0114
Copper	mg/L	0.0026	0.0012	0.0008	0.0028	0.0031	0.0179
Iron	mg/L	0.0007	0.5	1.34	3.24	0.294	28.4
Lead	mg/L	0.0005	0.00112	0.00123	0.00377	0.00094	0.0255
Lithium	mg/L	0.015	0.013	0.013	0.018	0.012	0.041
Magnesium	mg/L	1.42	1.15	1.63	2.93	1.4	13.6
Manganese	mg/L	0.11	0.105	0.186	0.309	0.16	1.46
Mercury	mg/L	0.000008	0.000005	0.000005	0.0000	0.0000	0.000007
Molybdenum	mg/L	0.00335	0.00205	0.00261	0.00243	0.00197	0.00296
Nickel	mg/L	0.00122	0.00061	0.00112	0.00317	0.00114	0.0235
Phosphorus	mg/L	0.04	0.03	0.04	0.09	0.0200	0.59
Potassium	mg/L	9.6	9.4	10.1	12.4	9.3	24.6
Selenium	mg/L	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Silicon	mg/L	1.78	1.42	3.48	6.86	8.67	41.3
Silver	mg/L	0.00005	0.00005	0.00005	0.0001	0.0001	0.0001
Sodium	mg/L	5.2	3.8	3.2	3.6	2.6	2.6
Strontium	mg/L	0.154	0.133	0.185	0.263	0.199	0.312
Thallium	mg/L	0.00005	0.00005	0.00005	0.0001	0.0001	0.00072
Tin	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Titanium	mg/L	0.0479	0.0297	0.0837	0.21	0.0176	1.86
Uranium	mg/L	0.00005	0.00005	0.00009	0.00013	0.00013	0.00027
Vanadium	mg/L	0.0021	0.0017	0.0036	0.0085	0.002	0.0693
Zinc	mg/L	0.0216	0.0638	0.0791	0.147	0.0535	0.88
T-Hardness as CaCO3	mg/L	50.9	41.6	60	90.3	72.2	167
Dissolved Metals							
Aluminum	mg/L	0.06	0.034	0.029	0.052	0.057	0.05
Antimony	mg/L	0.0643	0.0715	0.0568	0.0541	0.0519	0.0276
Arsenic	mg/L	0.0037	0.0041	0.0067	0.0051	0.0056	0.0051
Barium	mg/L	0.0177	0.00354	0.00334	0.00491	0.00427	0.0044
Beryllium	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Boron	mg/L	0.003	<0.001	0.005	0.01	0.018	0.01
Cadmium	mg/L	0.000118	0.000058	0.000214	0.000265	0.000623	0.000988
Calcium	mg/L	17.9	14.7	20.6	29.4	26.6	40.1
Chromium	mg/L	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Cobalt	mg/L	0.00023	0.00015	0.00015	0.0001	0.00041	0.00014
Copper	mg/L	0.0019	0.0008	0.0001	0.0006	0.0017	0.0005
Iron	mg/L	0.0004	0.0017	0.0044	0.0045	0.019	0.0116
Lead	mg/L	0.00005	0.00005	0.00005	0.0001	0.00017	0.0001
Lithium	mg/L	0.014	0.012	0.011	0.016	0.012	0.012
Magnesium	mg/L	1.18	0.91	1.12	1.7	1.29	1.67
Manganese	mg/L	0.0833	0.0802	0.117	0.16	0.143	0.248
Mercury	mg/L	0.000008	0.000005	0.000005	0.0000	0.0000	0.0000
Molybdenum	mg/L	0.00325	0.00178	0.00245	0.00235	0.00182	0.00249
Nickel	mg/L	0.00081	0.00033	0.00024	0.00017	0.00073	0.00025
Phosphorus	mg/L	0.03	0.01	0.01	0.0100	0.0100	0.0100
Potassium	mg/L	8.6	8.9	8.8	11.1	9.3	8.3
Selenium	mg/L	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Silicon	mg/L	0.58	0.76	1.73	2	7.8	5
Silver	mg/L	0.00005	0.00005	0.00005	0.0001	0.0001	0.0001
Sodium	mg/L	5.3	3.8	3.1	3.6	2.6	2
Strontium	mg/L	0.154	0.133	0.168	0.253	0.199	0.255
Thallium	mg/L	0.00005	0.00005	0.00005	0.0001	0.0001	0.0001
Tin	mg/L	0.00010	0.00010	0.0001	0.0001	0.0001	0.0001
Titanium	mg/L	0.00020	0.00020	0.0002	0.0003	0.0013	0.0009
Uranium	mg/L	0.00005	0.00005	0.00009	0.00013	0.00012	0.00015
Vanadium	mg/L	0.00038	0.00064	0.00079	0.00117	0.00147	0.00094
Zinc	mg/L	0.0078	0.0103	0.0106	0.0082	0.0402	0.0098
D-Hardness as CaCO3	mg/L	49.5	40.4	56.1	80.4	71.7	107

Table A9-5: Waste Rock Field Bin Test Results - BW-ARD-606

Sample ID		BW-606	ARD-606	BW-ARD-606
Week		1	6	10
Date Analyzed		15/05/2013	19/06/2013	17/07/2013
Volume (Field)	L	1.4	8.3	2.8
pH @ 25°C BC-D	pH units	7.63	7.56	7.67
Conductivity @ 25°C	µS/cm	0.135	104	122
T-Dissolved Solids180°C	mg/L	100	60	84
Total Suspended Solids @105°C	mg/L	46	5	2
Acidity as CaCO3	mg/L	-57	-34	-35
Alkalinity as CaCO3	mg/L	68	41	44
Sulphate	mg/L	6.3	8	11.7
Nitrate-N	mg/L	0.039	0.047	0.034
Nitrite-N	mg/L	<0.003	<0.003	0.003
Total Metals				
Aluminum	mg/L	0.925	0.193	0.19
Antimony	mg/L	0.192	0.107	0.123
Arsenic	mg/L	0.0099	0.013	0.0197
Barium	mg/L	0.0138	0.00457	0.00422
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.001	0.005	0.004
Cadmium	mg/L	0.000168	0.000116	0.000324
Calcium	mg/L	25	18.7	20
Chromium	mg/L	0.0004	<0.0003	<0.0003
Cobalt	mg/L	0.00044	0.00027	0.00026
Copper	mg/L	0.0012	0.0013	0.0001
Iron	mg/L	0.612	0.108	0.0805
Lead	mg/L	0.00152	0.00068	0.0006
Lithium	mg/L	0.008	0.006	0.009
Magnesium	mg/L	1.07	0.79	0.83
Manganese	mg/L	0.156	0.109	0.136
Mercury	mg/L	<0.000005	<0.000005	<0.000005
Molybdenum	mg/L	0.00167	0.00099	0.00074
Nickel	mg/L	0.00237	0.00081	<0.00005
Phosphorus	mg/L	0.03	<0.01	<0.01
Potassium	mg/L	4.2	3.5	3.3
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silicon	mg/L	3.63	1.98	2.24
Silver	mg/L	<0.00005	<0.00005	<0.00005
Sodium	mg/L	3	2	1.4
Strontium	mg/L	0.216	0.13	0.144
Thallium	mg/L	0.00005	<0.00005	<0.00005
Tin	mg/L	0.0013	0.0005	0.0002
Titanium	mg/L	0.0189	0.0037	0.003
Uranium	mg/L	0.00119	0.00097	0.00077
Vanadium	mg/L	0.00187	0.00041	0.00122
Zinc	mg/L	0.019	0.0107	0.0389
T-Hardness as CaCO3	mg/L	66.8	49.9	53.4
Dissolved Metals				
Aluminum	mg/L	0.049	0.056	0.065
Antimony	mg/L	0.192	0.106	0.123
Arsenic	mg/L	0.0099	0.013	0.0197
Barium	mg/L	0.00487	0.00367	0.00383
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	<0.001	0.005	0.004
Cadmium	mg/L	<0.000015	0.000103	0.000319
Calcium	mg/L	21.6	18.7	20
Chromium	mg/L	<0.0003	<0.0003	<0.0003
Cobalt	mg/L	0.00017	0.00017	0.00022
Copper	mg/L	0.0004	<0.0001	<0.0001
Iron	mg/L	0.0059	0.0094	0.017
Lead	mg/L	<0.00005	0.00007	0.0002
Lithium	mg/L	0.008	0.006	0.006
Magnesium	mg/L	0.98	0.79	0.83
Manganese	mg/L	0.099	0.105	0.136
Mercury	mg/L	<0.000005	<0.000005	<0.000005
Molybdenum	mg/L	0.00167	0.00098	0.00074
Nickel	mg/L	0.00128	0.00066	<0.00005
Phosphorus	mg/L	<0.01	<0.01	<0.01
Potassium	mg/L	3.8	3.5	3.3
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silicon	mg/L	2.92	1.72	2.24
Silver	mg/L	<0.00005	<0.00005	<0.00005
Sodium	mg/L	2.9	2	1.4
Strontium	mg/L	0.21	0.127	0.144
Thallium	mg/L	<0.00005	<0.00005	<0.00005
Tin	mg/L	0.0005	0.0005	<0.0001
Titanium	mg/L	0.0003	0.0004	0.0005
Uranium	mg/L	0.00024	0.00097	0.00077
Vanadium	mg/L	0.00037	0.00041	0.00082
Zinc	mg/L	0.0088	0.0107	0.0389
D-Hardness as CaCO3	mg/L	58	49.9	53.4

Table A9-6: Waste Rock Field Bin Test Results - BW-ARD-610

Sample ID		BW-ARD-610	ARD-610	BW-ARD-610
Week		1	6	10
Date Analyzed		15/05/2013	19/06/2013	17/07/2013
Volume (Field)	L	0.6	8.5	2.4
pH @ 25°C BC-D	pH units	8.07	7.75	7.81
Conductivity @ 25°C	µS/cm	0.213	114	148
T-Dissolved Solids180°C	mg/L	168	80	120
Total Suspended Solids @105°C	mg/L	23	3	15
Acidity as CaCO3	mg/L	-98	-38	-49
Alkalinity as CaCO3	mg/L	104	48	56
Sulphate	mg/L	10.3	6.6	13.3
Nitrate-N	mg/L	0.033	0.049	<0.005
Nitrite-N	mg/L	<0.003	0.003	<0.003
Total Metals				
Aluminum	mg/L	0.308	0.195	0.592
Antimony	mg/L	0.0694	0.0199	0.0261
Arsenic	mg/L	0.018	0.0127	0.0181
Barium	mg/L	0.00968	0.0041	0.006
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	0.003	0.003	0.002
Cadmium	mg/L	0.000069	0.000062	0.000133
Calcium	mg/L	30.2	19.6	23.4
Chromium	mg/L	<0.0003	<0.0003	0.0006
Cobalt	mg/L	0.00042	0.00022	0.00047
Copper	mg/L	0.0017	<0.0001	0.0002
Iron	mg/L	0.323	0.178	0.588
Lead	mg/L	0.00041	0.00025	0.00071
Lithium	mg/L	0.02	0.009	0.015
Magnesium	mg/L	0.55	<0.5	<0.5
Manganese	mg/L	0.067	0.0106	0.0335
Mercury	mg/L	<0.000005	<0.000005	<0.000005
Molybdenum	mg/L	0.00127	0.00068	0.00074
Nickel	mg/L	0.00192	0.00067	<0.00005
Phosphorus	mg/L	0.04	0.01	0.03
Potassium	mg/L	7.8	3.7	4.4
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silicon	mg/L	5.98	2.26	3.29
Silver	mg/L	<0.00005	<0.00005	<0.00005
Sodium	mg/L	11.3	4.1	3.9
Strontium	mg/L	0.204	0.0997	0.124
Thallium	mg/L	<0.00005	<0.00005	0.00007
Tin	mg/L	0.0014	0.0003	<0.0001
Titanium	mg/L	0.0165	0.0121	0.041
Uranium	mg/L	0.00034	0.00016	0.00014
Vanadium	mg/L	0.00457	0.00199	0.00496
Zinc	mg/L	0.0089	0.0045	0.0101
T-Hardness as CaCO3	mg/L	77.6	49.8	60.4
Dissolved Metals				
Aluminum	mg/L	0.027	0.038	0.043
Antimony	mg/L	0.0694	0.0197	0.0261
Arsenic	mg/L	0.018	0.0127	0.0181
Barium	mg/L	0.00678	0.00314	0.00338
Beryllium	mg/L	<0.0001	<0.0001	<0.0001
Boron	mg/L	0.003	0.003	0.002
Cadmium	mg/L	<0.000015	0.000042	0.000056
Calcium	mg/L	30.2	19.6	23.4
Chromium	mg/L	<0.0003	<0.0003	<0.0003
Cobalt	mg/L	0.00027	0.00012	0.00009
Copper	mg/L	0.0015	<0.0001	<0.0001
Iron	mg/L	0.0123	0.008	0.005
Lead	mg/L	0.00006	<0.00005	0.00007
Lithium	mg/L	0.02	0.009	0.01
Magnesium	mg/L	<0.5	<0.5	<0.5
Manganese	mg/L	0.0528	0.0034	0.00343
Mercury	mg/L	<0.000005	<0.000005	<0.000005
Molybdenum	mg/L	0.00127	0.00068	0.00074
Nickel	mg/L	0.00174	0.00062	<0.00005
Phosphorus	mg/L	0.03	<0.01	0.01
Potassium	mg/L	7.8	3.7	4.4
Selenium	mg/L	<0.0001	<0.0001	<0.0001
Silicon	mg/L	5.98	1.97	2.63
Silver	mg/L	<0.00005	<0.00005	<0.00005
Sodium	mg/L	11.1	4.1	3.9
Strontium	mg/L	0.204	0.0977	0.124
Thallium	mg/L	<0.00005	<0.00005	<0.00005
Tin	mg/L	0.0014	0.0003	<0.0001
Titanium	mg/L	0.0006	0.0006	0.0003
Uranium	mg/L	0.00034	0.00016	0.00014
Vanadium	mg/L	0.00391	0.00199	0.00274
Zinc	mg/L	0.0083	0.0033	0.0049
D-Hardness as CaCO3	mg/L	77.2	49.6	59.5

ANNEX 10
EGi 2013. Specialized ARD Testing of Samples from the Blackwater Gold Project, BC, Canada

TO:	AMEC Environment and Infrastructure
ATTENTION:	Ezra Kulczycki and Keith Ferguson
FROM:	Stuart Miller and Ai Binh Tran
DATE:	21 January 2013
REFERENCE:	3004/1035
SUBJECT:	Specialised ARD testing of samples from the Blackwater Gold Project, BC, Canada.

This memorandum presents the results of test work conducted on samples from the Blackwater Gold Project. Acid-base and single additional net acid generation (NAG) test results were emailed to EGi in September 2012 and advice was provided on a selection of samples to undergo sequential NAG, kinetic NAG, acid buffering characteristic curve (ABCC) and sulphide oxidation chamber (SOC) testing. A total of 11 samples were received by EGi, 10 samples were received in September 2012 and one sample (BW-ARD 037) was received in December 2012. Sample BW-ARD037 underwent humidity cell testing in Canada prior to delivery to EGi.

Samples underwent the following testing procedures:

- Sequential NAG: Samples BW-ARD 651, BW-ARD 652, BW-ARD 653 and BW-ARD 695;
- Kinetic NAG: Samples BW-ARD 608, BW-ARD 671, BW-ARD 672, BW-ARD 650, BW-ARD 619 and BW-ARD 655;
- ABCC: All samples except BW-ARD 037;
- SOC: Sample BW-ARD 037.

The results are presented in the following sections.

Acid Forming Characteristics and Elemental Composition[1]

The acid-base and NAG test results[2] are presented in Table 1 and show that the samples had total S contents ranging from 0.45 to 1.29%S and acid neutralising capacity (ANC) values ranging from 6 to 33 kg H_2SO_4/t. The samples had net acid producing potential (NAPP) values ranging from -11 to 20 kg H_2SO_4/t, with five samples being NAPP negative and five samples being NAPP positive. Net acid generation (NAG) testing confirmed that five samples were potentially acid forming (PAF), three were non-acid forming (NAF) and two samples had an uncertain (UC) classification. Sample ARD classification are presented on Table 1.

Table 2 presents multi-element composition and Table 3 presents the geochemical abundance indices (GAI) for the samples. The elemental compositions are compared against median soil concentrations to provide an indication of those elements that are elevated above background levels (expressed as a GAI). The enrichment ranges for the GAI are as follows:

Little or No Enrichment	GAI=0	< 3 times median soil
Minor Enrichment	GAI=1	3 to < 6 times median soil
	GAI=2	6 to < 12 times median soil
Significant Enrichment	GAI=3	12 to < 24 times median soil
	GAI=4	24 to < 48 times median soil
	GAI=5	48 to < 96 times median soil
	GAI=6	≥ 96 times median soil

As a general rule, a GAI of 3 or above is considered significant and such enrichment may warrant further examination.

The results show that Ag, As, Bi, Cd, Cs, Pb, S, Sb, Tl and Zn are significantly enriched (GAI ≥ 3) in at least one of the samples and Be, Co, Cu, In, Mg, Mn, Mo and P are slightly enriched (GAI=1 or 2) in at least one of the samples. Ag, As, Cd, S and Zn are significantly enriched in more than 5 of the samples. The remainder of the elements were either at concentrations similar to or less than the median soil abundance.

Acid Buffering Characteristic Curve (ABCC)

An acid buffering characteristic curve (ABCC) is produced by slow titration of a sample with acid, and provides an indication of the relative reactivity of the measured ANC. The acid buffering of a sample to pH 4 can be used as an estimate of the proportion of readily available ANC. Calcite, dolomite, ferroan dolomite and siderite standard curves are used

[1] Note that discussion of acid-forming characteristics and elemental composition in this section is for all samples, except sample BW-ARD 037. Sample BW-ARD 037 is discussed in a separate section.

[2] Acid-base and NAG testing was conducted by ALS Environmental in Burnaby, British Columbia, Canada and results emailed to EGi by AMEC.

for reference. Calcite and dolomite readily dissolve in acid and exhibit strongly buffered pH curves in the ABCC test, rapidly dropping once the ANC value is reached. Siderite provides very poor acid buffering, exhibiting a steep pH curve in the ABCC test. Ferroan dolomite is between siderite and dolomite in acid buffering availability. All samples, except BW-ARD 037, underwent ABCC testing and the results are presented in Figures 1 to 6.

Figure 1 presents the ABCC plot of sample BW-ARD 608, which has an ANC of 6 kg H_2SO_4/t. The pH decreases from the beginning of the test and the curve plots between the dolomite and ferroan dolomite standard curve, suggesting that the ANC of this sample is dominated by dolomitic minerals. The ABCC curve suggests that most of the measured ANC, although low, will be readily available and reactive.

Figure 2 presents the ABCC plot of BW-ARD 619, BW-ARD 671 and BW-ARD 672, which all had ANC values of 10 kg H_2SO_4/t. The pH curve for the samples plot between the dolomite and ferroan dolomite standard curves for samples BW-ARD 619 and BW-ARD 671 and close to the ferroan dolomite standard curve for sample BW-ARD 672. The results suggest that the ANC of the three samples is dominated by dolomite and/or ferroan dolomite. All of the measured ANC was readily available for samples BW-ARD 619, BW-ARD 671 and about 60% of the measured ANC was readily available in sample BW-ARD 672.

Figure 3 is the ABCC plot of sample BW-ARD 655, which has an ANC of 15 kg H_2SO_4/t. The results suggest that all of the measured ANC is readily available and that the ANC of the sample is dominated by dolomite, although minor calcite may also be present.

The ABCC plot for sample BW-ARD 650 is presented in Figure 4. The sample has an ANC of 20 kg H_2SO_4/t and results show that the pH curve exhibits a pH plateau above pH 8 up to about 8 kg H_2SO_4/t. The curve initially follows the calcite standard before dropping to the dolomite standard. The ANC of the sample is dominated by these carbonate minerals and the results indicate that all the measured ANC of this sample is readily available.

Figure 5 presents the ABCC plot for samples BW-ARD 651 and BW-ARD 653, which had ANC values of 24 and 26 kg H_2SO_4/t respectively. The pH curve for both samples exhibits a plateau above pH 7, before decreasing. The results indicate that all of the measured ANC of these samples is readily available and that the ANC of the samples is dominated by calcite and dolomite.

Figure 6 presents the ABCC plot of samples BW-ARD 652 and BW-ARD 695, which had ANC values of 33 and 31 kg H_2SO_4/t, respectively. The pH curve for the samples exhibits strong pH buffering above pH 7 up to about 15 and 20 kg H_2SO_4/t, respectively. The curves plot between the calcite and dolomite standard curves suggesting that the ANC is dominated by these carbonate minerals. All of the measured ANC for sample BW-ARD 652 and about 80% of the measured ANC of sample BW-ARD 695 is readily available.

The ABCC test results indicate that in all but one of the samples (BW-ARD 672) about 80 to 100% of the measured ANC is readily available and that the ANC is dominated by carbonate minerals such as calcite and dolomite.

Sequential Net Acid Generation (NAG)

When testing samples with sulphide sulphur contents greater than about 1%S, it is possible that oxidation may not go to completion in the single addition NAG test. Sequential NAG testing overcomes this limitation to an extent through successive additions of peroxide to the same sample.

Four samples were selected for sequential NAG testing and the results are presented in Table 4. Although these samples contain less than 1%S, two were classified as UC (BW-ARD 651 and BW-ARD 695) and two were NAF with ANC/MPA values of 1.3 and 1.5, respectively (BW-ARD 652 and BW-ARD653).

The samples underwent four sequential NAG stages and the results show that samples BW-ARD 651 and BW-ARD 695 produced NAGpH values of 4.4 in the first stage, but then the NAGpH increased to above 5 in Stage 2 and above 6 in Stage 4. Based on the NAG results and the ABCC tests, these two samples are classified as PAF but with only a low acid generating capacity of less than 5 kg H_2SO_4/t (i.e., PAF-LC). Both these samples had ANC/MPA values of 1.1.

The other two samples BW-ARD 652 and BW-ARD 653 did not acidify in the four stages and are confirmed as being NAF. These samples had ANC/MPA values of 1.5 and 1.3, respectively.

These results indicate that an ANC/MPA value of 1.3 is likely to provide a good factor of safety for prevention of ARD from materials represented by the samples provided.

Kinetic Net Acid Generation (NAG)

The kinetic NAG procedure was used to gain an insight into the reactivity of sulphides and likely lag times to onset of low pH conditions. Whilst kinetic NAG testing is not a replacement for column leach tests, the pH and temperature profiles obtained by the accelerated procedure provide a qualitative estimate of the lag period[3] to the extent that acidification of PAF rock is likely to occur rapidly (weeks to months), within the short term (many months to one or two years), or medium to long term (many years). Five (5) PAF samples and one NAF sample were selected for kinetic NAG testing and the results are presented in Figures 7 to 12.

[3] The lag times provided in this report should be used as a guide only and are based on correlations previously derived by EGi from comparison of kinetic NAG profiles with results from real time testing of the same materials (*e.g.* leach column tests) and field observations across a wide range of rock types at actual mine sites.

Figure 10 presents the kinetic NAG plot of NAF sample BW-ARD 655 and shows that the pH remained alkaline throughout the testing period with no apparent temperature increase.

The kinetic NAG plot of the five PAF samples (Figures 7, 8, 9, 11 and 12) show that the pH slowly decreases by about 1 to 1.5 pH units throughout the testing period but no sample decreased below pH 4.5 and there were no temperature spikes. The results suggest that materials represented by these samples will have a long lag period of at least 2 years and possible more than 5 years before onset of acid conditions, if continuously exposed to atmospheric conditions.

Sample BW-ARD 037

Sample BW-ARD 037 underwent humidity cell testing in Canada prior to delivery to EGi for measurement of the oxygen consumption rate. The post humidity cell acid-base test results and multi-element assays of the sample were emailed to EGi in January 2013 and are presented in Tables 5 and 6, respectively. The sample has a residual total S content of 0.51%S, ANC of 11 kg H_2SO_4/t, positive NAPP of 5 kg H_2SO_4/t and a NAGpH of 3.1, indicating that it was PAF, but most likely still within the lag phase based on the residual ANC of 11 kg H_2SO_4/t.

Table 6 presents multi-element composition and geochemical abundance indices (GAI) for sample BW-ARD 037. The results show that Ag, Bi, Cd, Pb and Zn are significantly enriched (GAI $\geq$ 3) and As, Be, Cs, Mn, Mo, S, Sb and Tl are slightly enriched (GAI=1 or 2) in the sample. The remainder of the elements were at concentrations similar to or less than the median soil abundance.

The oxidation rate of a material (the rate at which it consumes oxygen through the process of sulphide oxidation) can be determined using the sulphide oxidation chamber (SOC). The SOC is a perspex chamber into which a test sample is placed and the chamber is sealed. A fixed volume of air is slowly pumped through the sample in a closed loop. The oxygen concentration within the chamber is then monitored over time. The rate of decrease in the oxygen concentration is used to calculate the oxidation rate of the material based on various parameters including the sample mass and the air volume within the chamber.

As only 400 g of sample was provided for SOC testing, the sample was loaded into a column by placing approximately 1.6 kg of inert sand at the base of the column, overlain by the 400 g of sample. The sulphide oxidation chamber (SOC) measurement was taken over a period of 2 weeks due to the low amount of oxygen that was being consumed during the test.

The oxygen content of the SOC decreased from 20.8% to 20.3% indicating that a total of about 0.5% O_2 was consumed over the two week period. The calculated oxidation rate (OR) based on the cumulative oxygen consumed is 1.0×10^{-8} kg O_2/m^3/sec. This is based on an assumed particle density of 2.7 g/cm^3 (for volcaniclastic material from the

continental crust) and an approximate sample depth in the column of 1.2 cm (not including the inert sand sample).

Although sample BW-ARD 037 did not undergo kinetic NAG testing, the low IOR calculated from the SOC test further confirms that the sulphides within the samples tested are only slowly reactive.

Summary

AMEC Environmental and Infrastructure provided a total of 11 samples for detailed geochemical analysis. Samples were selected for ABCC, sequential NAG, kinetic NAG and SOC testing. All results from acid-base accounting, NAG testing and multi-element assays on solids, which are reported in this memorandum were conducted by ALS Environmental in Burnaby, British Columbia in Canada. The results were emailed to EGi in September 2012 and January 2013.

The results indicate that three of the samples are non-acid forming (NAF), five samples are potentially acid forming (PAF) and two samples are uncertain but likely to be PAF with only a low capacity to generate acid, i.e, UC (PAF-LC).

The ABCC test results indicate that in all but one of the samples (BW-ARD 672) about 80 to 100% of the measured ANC is readily available and that the ANC is dominated by carbonate minerals such as calcite and dolomite.

Kinetic NAG testing suggested that PAF materials represented by the samples would have a long lag of at least 2 and possibly more than 5 years before onset of low pH conditions if left continually exposed to atmospheric conditions. Furthermore, the results suggest that the sulphide content of the samples is only slowly reactive.

Oxidation rate testing of the post humidity cell sample indicated only a low oxidation rate of 1.0×10^{-8} kg $O_2/m^3/sec$. Although there is some uncertainty with this test due to the limited amount of sample provided, the result is consistent with the kinetic NAG tests indicating that an ANC/MPA value of 1.3 is likely to provide a good factor of safety for prevention of ARD from materials represented by the samples provided.

Table 1: Acid forming characteristics of samples from Blackwater.

Sample No.	ACID-BASE ANALYSIS					NAG TEST			ARD Classification
	Total S (%)	MPA	ANC	NAPP	ANC/MPA Ratio	NAGpH	NAG(4.5)	NAG(7.0)	
		(kg H2SO4/t)					(kg H2SO4/t)		
BW-ARD 608	0.71	22	6	16	0.3	3.1	7	16	PAF
BW-ARD 619	0.46	14	10	4	0.7	3.5	3	8	PAF
BW-ARD 650	1.29	39	20	20	0.5	3.1	11	22	PAF
BW-ARD 651	0.73	22	24	-2	1.1	4.4	0	5	UC (PAF-LC)
BW-ARD 652	0.74	23	33	-11	1.5	9.1	0	0	NAF
BW-ARD 653	0.66	20	26	-6	1.3	9.9	0	0	NAF
BW-ARD 655	0.45	14	15	-1	1.1	4.6	0	3	NAF
BW-ARD 671	0.81	25	10	15	0.4	3.2	6	17	PAF
BW-ARD 672	0.69	21	10	11	0.5	3.5	4	13	PAF
BW-ARD 695	0.94	29	31	-3	1.1	3.9	1	4	UC (PAF-LC)

KEY

MPA = Maximum Potential Acidity

ANC = Acid Neutralising Capacity

NAPP = Net Acid Producing Potential

NAG = Net Acid Generation

NAF = Non-Acid Forming

PAF = Potentially Acid Forming

PAF-LC = Potentially Acid Forming Low Capacity (< 5 kg H_2SO_4/t)

UC = Uncertain

Table 2: Multi-element composition of selected samples from Blackwater (mg/kg except where shown).

Element	Detection Limit	BW-ARD 608	BW-ARD 619	BW-ARD 650	BW-ARD 651	BW-ARD 652	BW-ARD 653	BW-ARD 655	BW-ARD 671	BW-ARD 672	BW-ARD-695
Ag	0.01	1.83	0.47	0.9	1.09	0.57	0.69	2.09	7.25	2.25	0.35
Al	0.01%	2.23%	3.27%	3.01%	4.87%	5.27%	2.56%	2.03%	3.38%	4.10%	4.70%
As	0.2	32.3	301	120	27.5	57.7	501	77.5	35.8	59.2	30.1
B	10	10	10	10	10	10	10	10	10	10	10
Ba	10	130	70	30	80	80	40	70	110	110	80
Be	0.05	1.04	1.39	1.14	0.87	1.21	1.02	0.85	1.3	1.5	1.15
Bi	0.01	1.38	0.42	2.46	4.67	2.32	1.51	1.77	0.44	1.52	0.36
Ca	0.01%	0.28%	0.66%	1.49%	2.15%	2.76%	1.59%	0.73%	0.51%	0.89%	2.62%
Cd	0.02	9.23	1.47	8.87	15.35	13.15	5.59	10.2	13.3	13	8.03
Ce	0.01	16.9	33	24.5	29.9	35.2	34.1	18.25	22.6	20.9	24
Co	0.1	7.4	13.8	21.7	18.5	16.8	16.9	8.9	19.8	16.1	19.3
Cr	1	20	29	41	49	55	37	12	34	40	63
Cs	0.05	23.1	50.8	14.85	25.2	23.9	12.45	11.85	21.2	19.35	25.7
Cu	0.2	82.5	29.5	152	145	129.5	63.3	86.4	89.2	98.1	107
Fe	0.01%	4.18%	4.98%	4.13%	4.78%	4.78%	3.69%	2.51%	5.30%	5.58%	4.48%
Ga	0.05	5.41	9.05	10.55	18.25	18.3	10.2	6.11	9.07	12.15	14.85
Ge	0.05	0.06	0.1	0.09	0.22	0.19	0.1	0.05	0.08	0.08	0.14
Hf	0.01	0.42	0.11	0.06	0.07	0.06	0.15	0.26	0.12	0.11	0.07
Hg	0.005	0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01
In	0.005	**2.97**	0.027	0.116	0.363	0.353	0.122	0.082	0.184	0.677	0.138
K	0.01%	1.27%	1.60%	0.87%	1.69%	1.46%	0.81%	0.80%	1.87%	1.65%	1.21%
La	0.5	8	14.5	11.1	13.8	16.4	16.4	9.2	9.5	8.7	11
Li	0.2	38.2	46	34.2	35.6	40.8	23.6	26.8	49.8	49.4	43.9
Mg	0.01%	0.46%	0.78%	0.76%	1.39%	1.55%	0.56%	0.54%	1.13%	1.21%	1.04%
Mn	5	2270	2690	871	2480	1920	2100	1700	5370	4900	1110
Mo	0.05	2.19	1.48	3.7	2.18	2	2.35	3.5	2.25	2.47	1.88
Na	0.01%	0.03%	0.06%	0.14%	0.42%	0.32%	0.05%	0.03%	0.03%	0.07%	0.35%
Nb	0.1	0.31	0.31	0.31	0.26	0.21	0.2	0.33	0.22	0.21	0.36
Ni	0.2	12.2	21.7	26.4	26.9	28.6	26.1	11.7	28.5	25.9	28
P	10	620	1400	1650	1700	1730	1370	670	1530	1480	1800
Pb	0.5	10	14.4	16.8	24.5	16.4	46.2	444	1140	195.5	12.1
Rb	0.1	83.9	159	57.6	87.6	89	48.9	54.2	90.9	81.9	82.6
S	0.01%	0.74%	0.51%	1.32%	0.75%	0.79%	0.71%	0.49%	0.92%	0.79%	1.09%
Sb	0.05	5.2	11.55	4.86	1.08	1.57	9.28	6.64	**23.9**	8.71	1.99
Sc	0.1	2.1	4.3	7.8	10.1	11.8	6.4	2.8	5	7.1	9.9
Se	1	0.5	0.4	0.4	**0.7**	**0.7**	0.3	0.2	0.2	0.2	0.5
Sn	0.2	0.8	0.6	0.5	1.2	1.2	0.9	0.5	1.4	1.2	0.6
Sr	0.2	19.8	28.6	79.6	208	233	85.9	25.7	25	45.3	195.5
Ta	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Th	0.2	6.9	4.5	3.6	3.1	3.4	4.4	5.2	4.1	3.9	2.7
Ti	0.005%	0.15%	0.22%	0.15%	0.29%	0.23%	0.13%	0.10%	0.26%	0.25%	0.25%
Tl	0.02	1.58	2.97	1.27	1.47	1.65	1.08	1.17	1.88	1.95	1.75
U	0.1	1.81	0.94	0.39	0.37	0.4	0.74	1.07	0.74	0.57	0.29
V	1	30	72	88	119	126	74	25	64	90	125
W	0.1	0.41	0.17	0.39	0.9	0.51	0.14	0.21	0.67	0.45	0.38
Y	0.1	5.57	7.78	7.84	8.32	9.8	7.67	4.82	6.43	5.85	6.49
Zn	2	2110	853	814	1810	1380	694	1300	3250	2520	754
Zr	0.5	14.9	5	1.9	2.2	1.8	5	9.9	5.6	4.5	2.8

< element at or below analytical detection limit.

Table 3: Geochemical abundance indeices (GAI) for selected samples from Blackwater.

Element	Median Soil Abundance*	BW-ARD 608	BW-ARD 619	BW-ARD 650	BW-ARD 651	BW-ARD 652	BW-ARD 653	BW-ARD 655	BW-ARD 671	BW-ARD 672	BW-ARD-695
Ag	0.05	**5**	**3**	**4**	**4**	**3**	**3**	**5**	**7**	**5**	2
Al	7.1%	-	-	-	-	-	-	-	-	-	-
As	6	2	**5**	**4**	2	**3**	**6**	**3**	2	**3**	2
B	20	-	-	-	-	-	-	-	-	-	-
Ba	500	-	-	-	-	-	-	-	-	-	-
Be	0.3	1	2	1	1	1	1	1	2	2	1
Bi	0.2	2	-	**3**	**4**	**3**	2	**3**	1	2	-
Ca	1.5%	-	-	-	-	-	-	-	-	-	-
Cd	0.35	**4**	1	**4**	**5**	**5**	**3**	**4**	**5**	**5**	**4**
Ce	50	-	-	-	-	-	-	-	-	-	-
Co	8	-	-	1	1	-	-	-	1	-	1
Cr	70	-	-	-	-	-	-	-	-	-	-
Cs	4	2	**3**	1	2	2	1	1	2	2	2
Cu	30	1	-	2	2	2	-	1	1	1	1
Fe	4.0%	-	-	-	-	-	-	-	-	-	-
Ga	20	-	-	-	-	-	-	-	-	-	-
Ge	1	-	-	-	-	-	-	-	-	-	-
Hf	6	-	-	-	-	-	-	-	-	-	-
Hg	0.06	-	-	-	-	-	-	-	-	-	-
In	1	1	-	-	-	-	-	-	-	-	-
K	1.4%	-	-	-	-	-	-	-	-	-	-
La	40	-	-	-	-	-	-	-	-	-	-
Li	25	-	-	-	-	-	-	-	-	-	-
Mg	0.5%	-	-	-	1	1	-	-	1	1	-
Mn	1000	1	1	-	1	-	-	-	2	2	-
Mo	1.2	-	-	1	-	-	-	1	-	-	-
Na	0.5%	-	-	-	-	-	-	-	-	-	-
Nb	10	-	-	-	-	-	-	-	-	-	-
Ni	50	-	-	-	-	-	-	-	-	-	-
P	800	-	-	-	1	1	-	-	-	-	1
Pb	35	-	-	-	-	-	-	**3**	**4**	2	-
Rb	150	-	-	-	-	-	-	-	-	-	-
S	0.07%	**3**	2	**4**	**3**	**3**	**3**	2	**3**	**3**	**3**
Sb	1	2	**3**	2	-	-	**3**	2	**4**	**3**	-
Sc	7	-	-	-	-	-	-	-	-	-	-
Se	0.4	-	-	-	-	-	-	-	-	-	-
Sn	4	-	-	-	-	-	-	-	-	-	-
Sr	250	-	-	-	-	-	-	-	-	-	-
Ta	2	-	-	-	-	-	-	-	-	-	-
Th	9	-	-	-	-	-	-	-	-	-	-
Ti	0.50%	-	-	-	-	-	-	-	-	-	-
Tl	0.2	2	**3**	2	2	2	2	2	**3**	**3**	**3**
U	2	-	-	-	-	-	-	-	-	-	-
V	90	-	-	-	-	-	-	-	-	-	-
W	1.5	-	-	-	-	-	-	-	-	-	-
Y	40	-	-	-	-	-	-	-	-	-	-
Zn	90	**4**	**3**	**3**	**4**	**3**	2	**3**	**5**	**4**	2
Zr	400	-	-	-	-	-	-	-	-	-	-

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements.

Table 4: Sequential NAG test results

Site Code	Total S (%)	ANC	NAPP	STAGE 1			STAGE 2			STAGE 3			STAGE 4			Total Seq. NAG to pH 4.5	Total Seq. NAG to pH 7.0
		(kg H_2SO_4/t)		NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	(kg H_2SO_4/t)	
BW-ARD 651	0.73	24	-2	4.4	0.1	3	5.5	0	0	6.0	0	0	6.2	0	0	0.1	3
BW-ARD 652	0.74	33	-11	7.8	0	0	6.2	0	0	6.9	0	0	7.1	0	0	0	0
BW-ARD 653	0.66	26	-6	7.6	0	0	5.6	0	0	6.3	0	0	6.9	0	0	0	0
BW-ARD 695	0.94	31	-3	4.4	0.2	3	5.2	0	0	5.8	0	0	6.5	0	0	0.2	2.6

Table 5: Acid forming characteristics of of sample BW-ARD 037 - Post Humidity Cell testing.

Sample No.	ACID-BASE ANALYSIS					NAG TEST			ARD Classification
	Total S (%)	MPA	ANC	NAPP	ANC/MPA Ratio	NAGpH	NAG(4.5)	NAG(7.0)	
		(kg H2SO4/t)					(kg H2SO4/t)		
BW-ARD 037	0.51	16	11	5	0.7	3.1	2	8	PAF

KEY

MPA = Maximum Potential Acidity

ANC = Acid Neutralising Capacity

NAPP = Net Acid Producing Potential

NAG = Net Acid Generation

PAF = Potentially Acid Forming

Table 6: Multi-element composition (mg/kg except where shown) and geochemical abundace indices (GAI) of sample BW-ARD 037.

Element	Detection Limit	BW-ARD 037	Element	Median Soil Abundance*	BW-ARD 037
Ag	0.01	2.86	Ag	0.05	**5**
Al	0.01%	2.52%	Al	7.1%	-
As	0.2	27	As	6	2
B	10	10.00	B	20	-
Ba	10	70.00	Ba	500	-
Be	0.05	0.68	Be	0.3	1
Bi	0.01	3.1	Bi	0.2	**3**
Ca	0.01%	0.21%	Ca	1.5%	-
Cd	0.02	23.5	Cd	0.35	**5**
Ce	0.01	19.35	Ce	50	-
Co	0.1	13.70	Co	8	-
Cr	1	32.00	Cr	70	-
Cs	0.05	19.25	Cs	4	2
Cu	0.2	56.10	Cu	30	-
Fe	0.01%	4.5%	Fe	4.0%	-
Ga	0.05	7.34	Ga	20	-
Ge	0.05	0.08	Ge	1	-
Hf	0.01	0.22	Hf	6	-
Hg	0.005	0.01	Hg	0.06	-
In	0.005	0.57	In	1	-
K	0.01%	1.32%	K	1.4%	-
La	0.5	9.10	La	40	-
Li	0.2	32.80	Li	25	-
Mg	0.01%	0.80%	Mg	0.5%	-
Mn	5	4130	Mn	1000	1
Mo	0.05	3.18	Mo	1.2	1
Na	0.01%	0.02%	Na	0.5%	-
Nb	0.1	0.23	Nb	10	-
Ni	0.2	30.30	Ni	50	-
P	10	930	P	800	-
Pb	0.5	771	Pb	35	**4**
Rb	0.1	62.30	Rb	150	-
S	0.01%	0.55%	S	0.07%	2
Sb	0.05	7.12	Sb	1	2
Sc	0.1	3.80	Sc	7	-
Se	1	0.50	Se	0.4	-
Sn	0.2	0.70	Sn	4	-
Sr	0.2	32.80	Sr	250	-
Ta	0.05	0.01	Ta	2	-
Th	0.2	3.70	Th	9	-
Ti	0.005%	0.21%	Ti	0.50%	-
Tl	0.02	1.33	Tl	0.2	2
U	0.1	0.91	U	2	-
V	1	57.00	V	90	-
W	0.1	0.60	W	1.5	-
Y	0.1	6.48	Y	40	-
Zn	2	4690	Zn	90	**5**
Zr	0.5	8.6	Zr	400	-

< element at or below analytical detection limit.

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements.

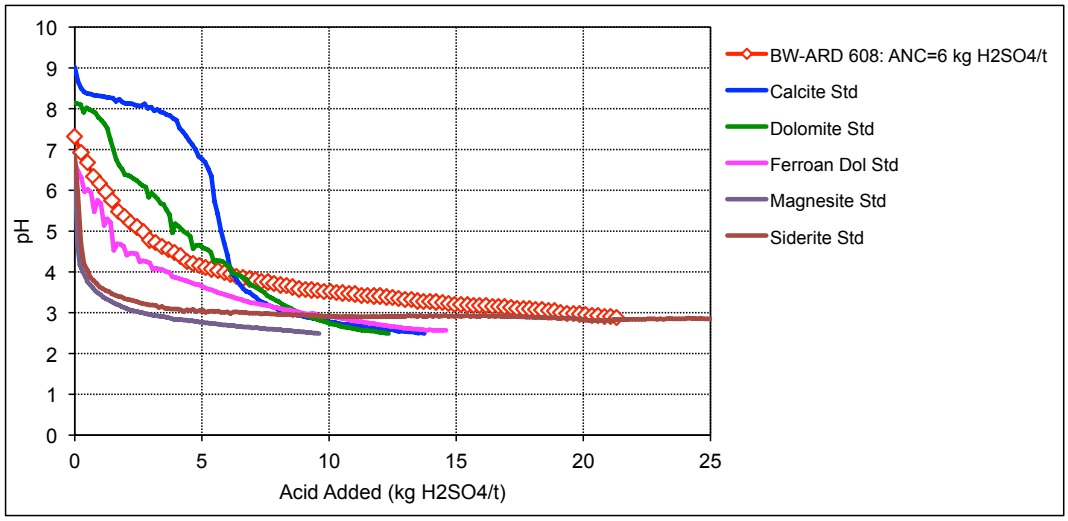


Figure 1: ABCC profile of sample BW-ARD 608 with an ANC value of 6 kg H_2SO_4/t. Carbonate standard curves are included for reference.

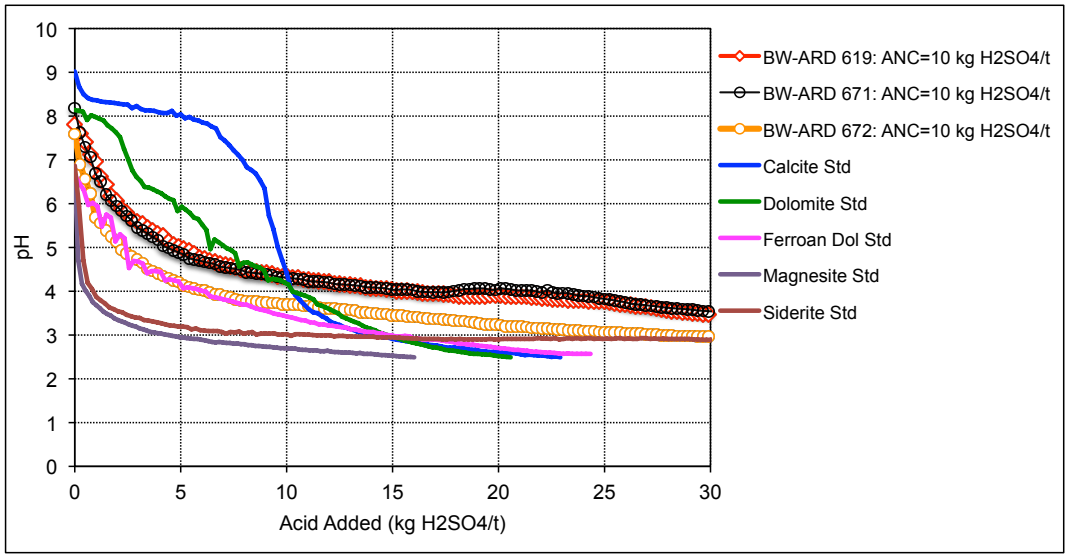


Figure 2: ABCC profile of samples BW-ARD 619, BW-ARD 671 and BW-ARD 672 with an ANC value of 10 kg H_2SO_4/t. Carbonate standard curves are included for reference.

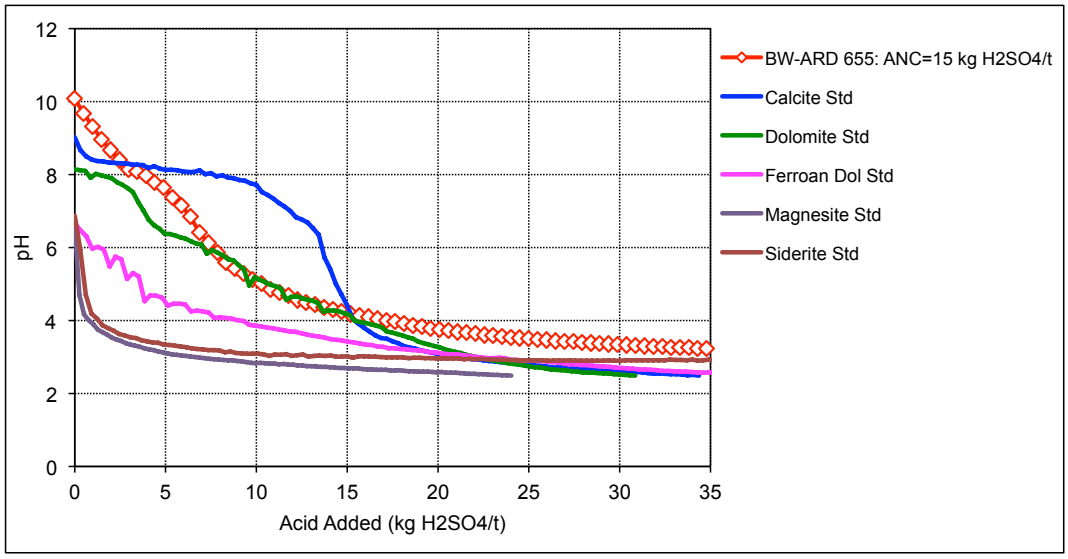


Figure 3: ABCC profile of sample BW-ARD 655 with an ANC value of 15 kg H_2SO_4/t. Carbonate standard curves are included for reference.

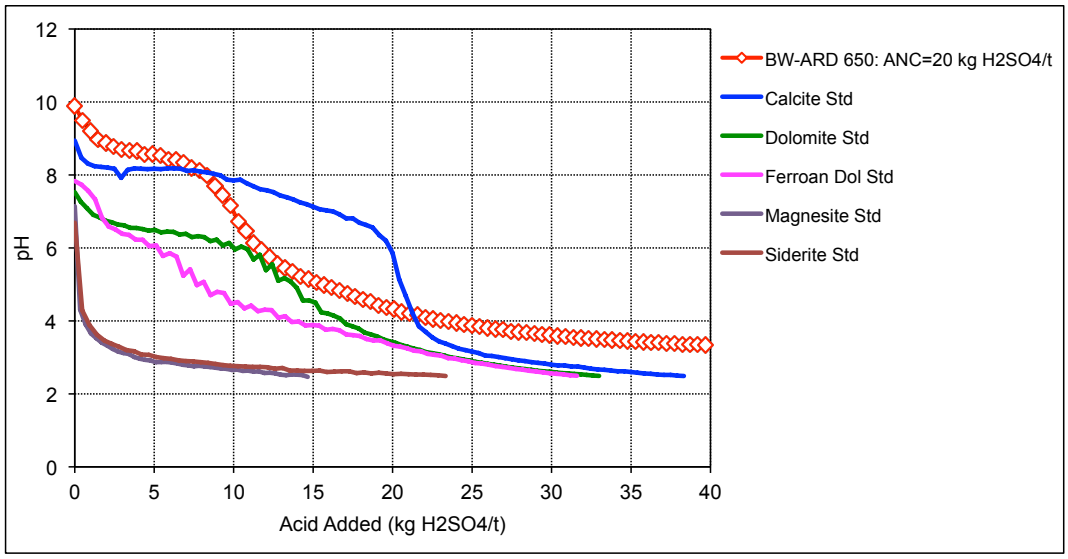


Figure 4: ABCC profile of sample BW-ARD 650 with an ANC value of 20 kg H_2SO_4/t. Carbonate standard curves are included for reference.

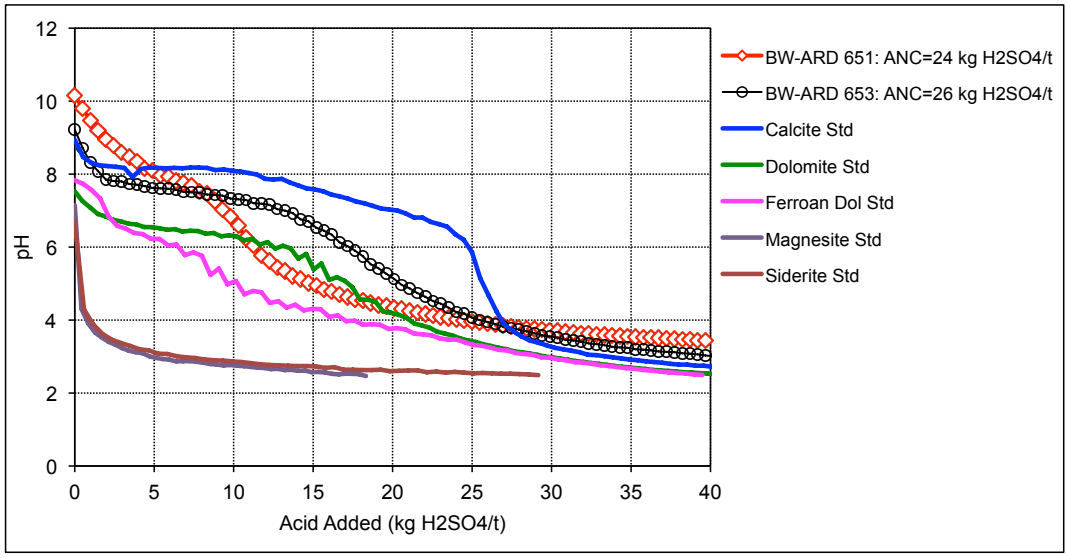


Figure 5: ABCC profile of sample BW-ARD 651 and BW-ARD 653 with an ANC value close to 25 kg H_2SO_4/t. Carbonate standard curves are included for reference.

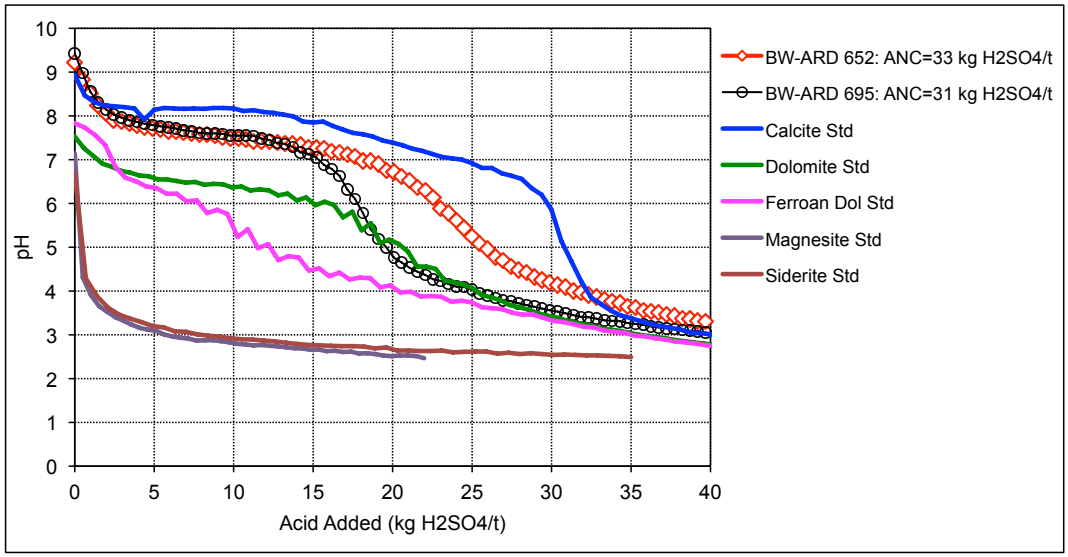
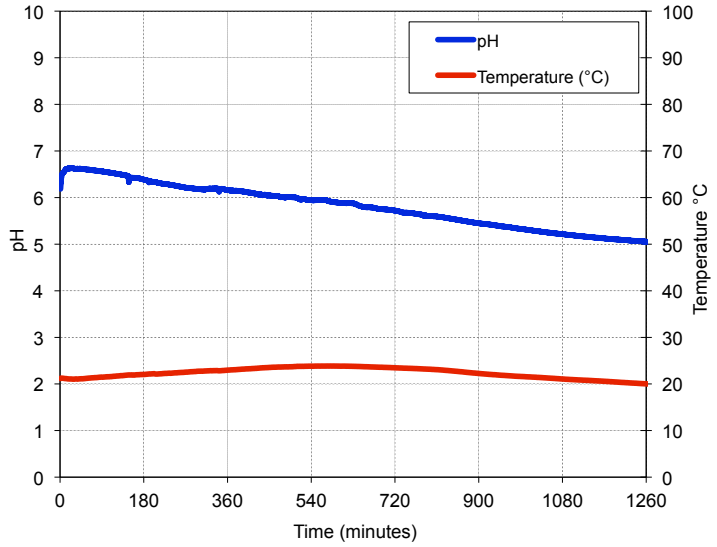


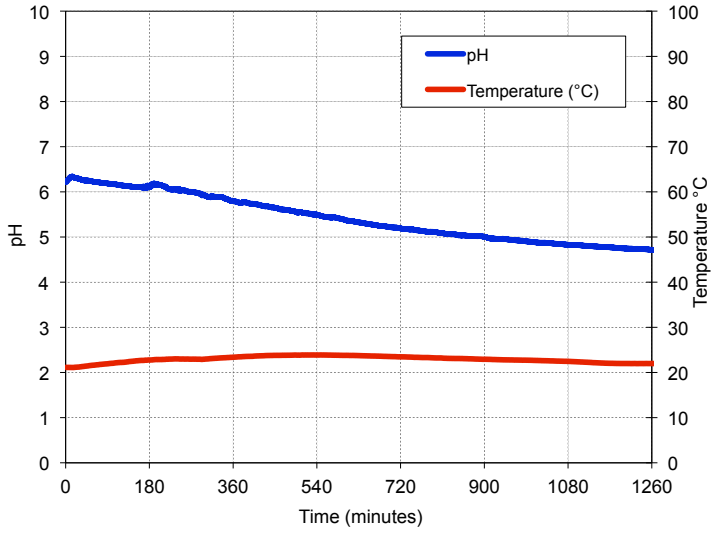
Figure 6: ABCC profile of sample BW-ARD 652 and BW-ARD 695 with an ANC value close to 30 kg H_2SO_4/t. Carbonate standard curves are included for reference.



Sample Characteristics

Total %S	= 0.71
ANC (kg H_2SO_4/t)	= 6
NAPP (kg H_2SO_4/t)	= 16
NAGpH	= 3.1
$NAG_{(pH4.5)}$ (kg H_2SO_4/t)	= 7
$NAG_{(pH7.0)}$ (kg H_2SO_4/t)	= 16

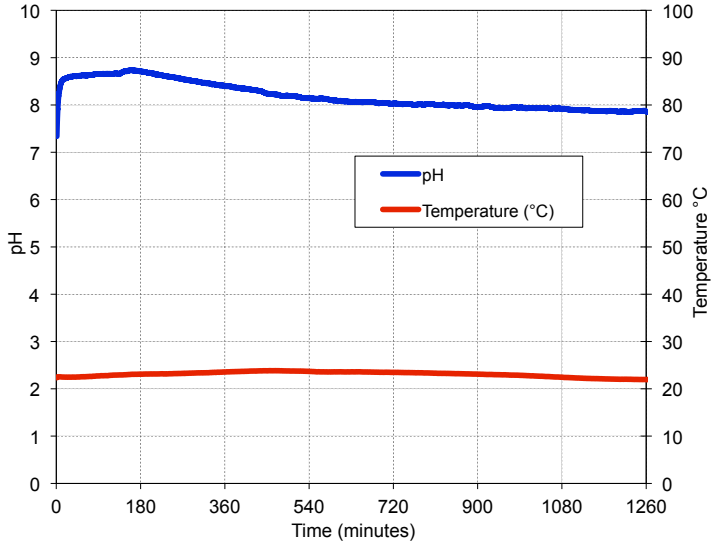
Figure 7: Kinetic NAG plot of sample BW-ARD 608.



Sample Characteristics

Total %S	= 0.46
ANC (kg H_2SO_4/t)	= 10
NAPP (kg H_2SO_4/t)	= 4
NAGpH	= 3.5
$NAG_{(pH4.5)}$ (kg H_2SO_4/t)	= 3
$NAG_{(pH7.0)}$ (kg H_2SO_4/t)	= 8

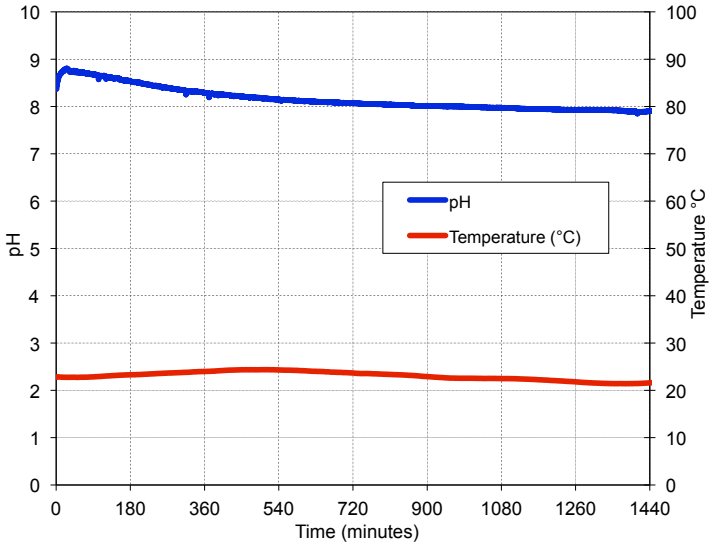
Figure 8: Kinetic NAG plot of sample BW-ARD 619.



Sample Characteristics

Total %S	= 1.29
ANC (kg H_2SO_4/t)	= 20
NAPP (kg H_2SO_4/t)	= 20
NAGpH	= 3.1
$NAG_{(pH4.5)}$ (kg H_2SO_4/t)	= 11
$NAG_{(pH7.0)}$ (kg H_2SO_4/t)	= 22

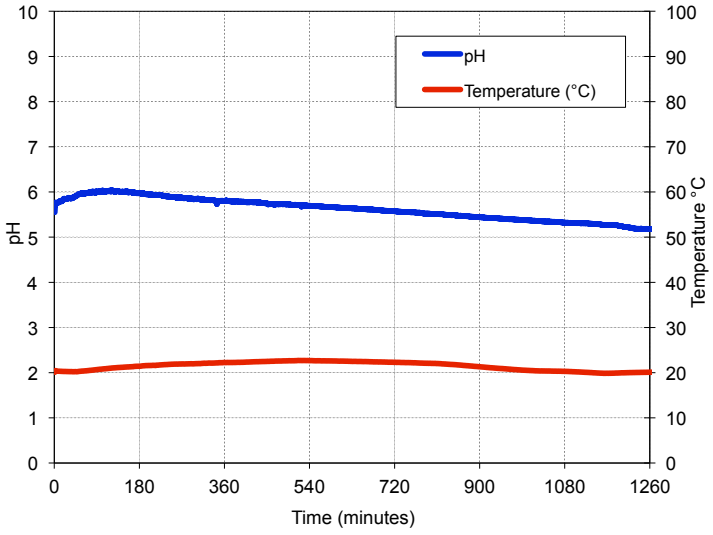
Figure 9: Kinetic NAG plot of sample BW-ARD 650.



Sample Characteristics

Total %S	= 0.45
ANC (kg H_2SO_4/t)	= 15
NAPP (kg H_2SO_4/t)	= -1
NAGpH	= 4.6

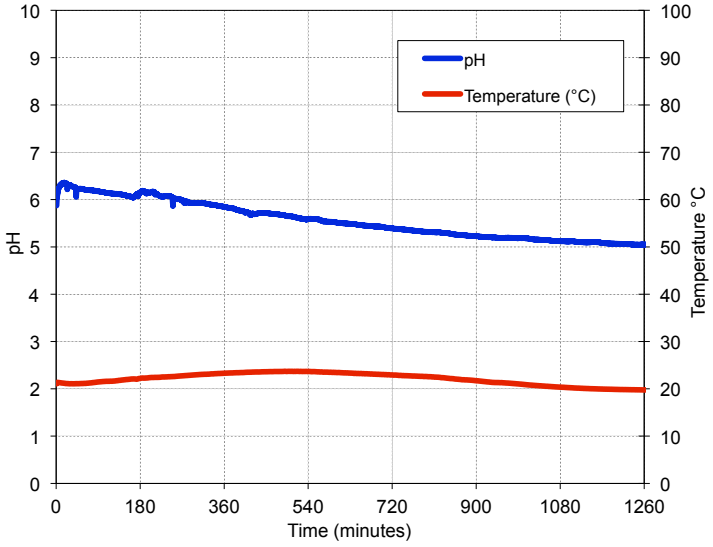
Figure 10: Kinetic NAG plot of sample BW-ARD 655.



Sample Characteristics

Total %S	= 0.81
ANC (kg H_2SO_4/t)	= 10
NAPP (kg H_2SO_4/t)	= 15
NAGpH	= 3.2
$NAG_{(pH4.5)}$ (kg H_2SO_4/t)	= 6
$NAG_{(pH7.0)}$ (kg H_2SO_4/t)	= 17

Figure 11: Kinetic NAG plot of sample BW-ARD 671.



Sample Characteristics

Total %S	= 0.69
ANC (kg H_2SO_4/t)	= 10
NAPP (kg H_2SO_4/t)	= 11
NAGpH	= 3.5
$NAG_{(pH4.5)}$ (kg H_2SO_4/t)	= 4
$NAG_{(pH7.0)}$ (kg H_2SO_4/t)	= 13

Figure 12: Kinetic NAG plot of sample BW-ARD 672.

ANNEX 11
pH Neutralization Test Results

Table A11-1: pH Neutralization Testing Summary

Sample	Description
BW-ARD-037	Leachate from PAG 1 WR humidity cell
BW-ARD-509/288	Mixed leachate from PAG 1 and PAG 2 WR humidity cells
BW-ARD-283/288	Mixed leachate from Ore and PAG 2 WR humidity cells
BW-ARD-509	Leachate from PAG 1 WR humidity cell
BW-ARD-283 UF	Leachate from Ore humidity cell
BW-ARD-283	Leachate from Ore humidity cell
BW-ARD2-9	Leachate from PAG 1 WR humidity cell

Table A11-2: pH Neutralization Test Results

Sample ID		BW-ARD2-9 (initial)	BW-ARD2-9-PH8	BW-ARD2-9-PH9	BW-ARD2-9-PH10	BW-ARD-037 (initial)	BW-ARD-037-PH8	BW-ARD-037-PH9	BW-ARD-037-PH10	BW-ARD-283 (initial)	BW-ARD-283-PH7	BW-ARD-283-PH8	BW-ARD-283-PH9	BW-ARD-283-PH10	BW-ARD-283-PH11	BW-ARD-509 (initial)	BW-ARD-509-PH7	BW-ARD-509-PH8	BW-ARD-509-PH9	BW-ARD-509-PH10	BW-ARD-509-PH11	BW-ARD-283/288 (initial)	BW-ARD-283/288-PH7	BW-ARD-283/288-PH8	BW-ARD-283/288-PH9	BW-ARD-283/288-PH10	BW-ARD-283/288-PH11	BW-ARD-509/288 (initial)	BW-ARD-509/288-PH7	BW-ARD-509/288-PH8	BW-ARD-509/288-PH9	BW-ARD-509/288-PH10	BW-ARD-509/288-PH11	BW-ARD-283 UF (initial)	BW-ARD-283 UF-PH7	BW-ARD-283 UF-PH11
Total Volume In	mL	100.0	8.0	9.1	10.1	100.0	5.0	6.4	6.6	75	11.0	13.2	14.5	16.5	19.6	75	4.00	4.30	4.50	5.60	9.60	75	3.20	4.00	4.10	4.50	8.10	75	1.10	1.40	1.50	2.00	5.30	100	10.9	25.5
pH	Units	2.4	7.1	8.6	9.7	5.9	6.8	7.0	9.0	3.3	6.4	6.9	7.2	7.8	10.3	4.3	6.7	7.0	7.3	8.9	10.8	4.0	6.7	7.1	7.4	8.1	9.9	5.1	6.6	7.2	7.4	8.7	10.6	3.4	6.2	10.5
Dissolved Metals																																				
Aluminum	(mg/L)	33.5	0.612	3.16	4.08	0.027	0.005	0.0069	0.0204	10.2	0.025	0.018	0.0787	0.402	2.61	1.38	0.0167	0.0333	0.131	0.156	0.604	1.80	0.0159	0.0166	0.194	0.341	0.967	0.258	0.0075	0.0379	0.0433	0.119	0.200	7.86	0.005	2.62
Antimony	(mg/L)	0.0019	0.000	0.000	0.000	0.00069	0.00018	0.00029	0.00043	0.0005	0.0005	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00095	0.00047	0.00031	0.00045	0.00060	0.00066	0.00093	0.00067	0.00084	0.00079	0.00092	0.00086	0.0005	0.0005	0.0001
Arsenic	(mg/L)	0.0014	0.000	0.000	0.000	0.00021	0.000	0.000	0.000	0.0210	0.00072	0.00035	0.00029	0.00012	0.00037	0.00043	0.0001	0.0001	0.0001	0.0001	0.0001	0.00502	0.00041	0.00016	0.00038	0.00016	0.00021	0.00031	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0211	0.0005	0.0001
Barium	(mg/L)	0.00295	0.00416	0.00287	0.00295	0.0250	0.0261	0.0224	0.0230	0.0172	0.0153	0.0128	0.0118	0.00591	0.00322	0.0410	0.0258	0.0245	0.0223	0.0115	0.00813	0.0154	0.0155	0.0149	0.0137	0.0115	0.00769	0.0209	0.0211	0.0211	0.0205	0.0179	0.0133	0.0165	0.0143	0.00466
Beryllium	(mg/L)	0.0021	0.000	0.000	0.000	0.00024	0.000	0.000	0.000	0.00431	0.0005	0.0002	0.0001	0.0001	0.0001	0.00578	0.0001	0.0001	0.00036	0.0001	0.0001	0.00086	0.0001	0.0001	0.0001	0.0001	0.0001	0.00115	0.0001	0.0001	0.0001	0.0001	0.0001	0.00402	0.0005	0.0001
Bismuth	(mg/L)	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0025	0.0025	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0025	0.0025	0.0005
Boron	(mg/L)	0.100	0.020	0.020	0.020	0.020	0.010	0.010	0.010	0.05	0.05	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05	0.05	0.01
Cadmium	(mg/L)	0.471	0.00677	0.000735	0.000101	0.0854	0.0305	0.0158	0.00235	0.299	0.178	0.0626	0.0157	0.00205	0.00302	0.00616	0.000278	0.000127	0.000408	0.00001	0.00001	0.0756	0.0283	0.0135	0.00681	0.000982	0.000205	0.0173	0.0127	0.00226	0.00223	0.000211	0.00001	0.268	0.179	0.000017
Calcium	(mg/L)	10.2	340	369	372	0.464	11.1	13.6	13.3	5.22	72.0	85.5	92.4	96.8	103	2.24	26.8	29.8	31.6	33.9	46.6	2.27	23.5	26.2	30.4	31.8	36.1	1.63	7.74	10.8	11.3	14.2	24.9	4.83	69.6	99.7
Chromium	(mg/L)	0.0435	0.0019	0.0023	0.0022	0.001	0.001	0.001	0.001	0.0025	0.0025	0.001	0.0005	0.0005	0.00084	0.0005	0.0005	0.0005	0.0005	0.0005	0.00055	0.001	0.0005	0.0005	0.0005	0.0005	0.00051	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00192	0.0005	0.00069
Cobalt	(mg/L)	0.167	0.00050	0.000	0.000	0.0351	0.0227	0.00891	0.00177	0.0857	0.0558	0.0111	0.00234	0.00012	0.00083	0.0348	0.00524	0.00223	0.00352	0.00017	0.0001	0.0291	0.00727	0.00181	0.00261	0.00060	0.0001	0.0191	0.0166	0.00687	0.00522	0.00109	0.0001	0.0907	0.0588	0.0001
Copper	(mg/L)	0.883	0.001	0.001	0.0013	0.0112	0.00120	0.00072	0.00069	0.194	0.0025	0.001	0.0005	0.00248	0.00185	0.0179	0.0005	0.0005	0.00121	0.0005	0.0005	0.0463	0.0005	0.0005	0.00143	0.0005	0.0005	0.00500	0.0005	0.0005	0.0005	0.0005	0.0005	0.149	0.001	0.0005
Iron	(mg/L)	118	0.030	0.030	0.030	0.304	0.030	0.030	0.030	36.1	0.074	0.03	0.034	0.03	0.369	21.6	0.042	0.03	1.30	0.03	0.03	8.78	0.03	0.03	0.337	0.03	0.03	3.93	0.03	0.03	0.136	0.03	0.03	48.1	0.065	0.03
Lead	(mg/L)	0.124	0.000	0.000	0.000	2.37	0.0917	0.0262	0.0624	0.196	0.00025	0.0001	0.000159	0.00005	0.00178	0.0165	0.00005	0.00005	0.00105	0.00005	0.00005	0.115	0.000053	0.00005	0.00430	0.00005	0.000240	0.0910	0.000334	0.000338	0.00330	0.000094	0.00005	0.151	0.00025	0.00005
Lithium	(mg/L)	0.0270	0.0409	0.0369	0.0360	0.0014	0.00149	0.00165	0.00170	0.0108	0.0074	0.0078	0.00971	0.00817	0.00720	0.0116	0.0114	0.0103	0.0112	0.0104	0.0102	0.0016	0.00332	0.00316	0.00262	0.00313	0.00324	0.00337	0.00304	0.00323	0.00303	0.00354	0.00299	0.0090	0.0083	0.00792
Magnesium	(mg/L)	12.0	8.68	3.84	1.14	0.257	0.250	0.320	0.236	2.91	2.66	2.38	2.31	1.97	0.259	0.716	0.639	0.691	0.699	0.618	0.357	0.851	0.846	0.822	0.834	0.786	0.294	0.408	0.423	0.416	0.411	0.409	0.291	2.74	2.49	0.135
Manganese	(mg/L)	37.0	1.44	0.0157	0.00545	0.646	0.465	0.243	0.0121	23.6	20.0	14.3	6.95	0.109	0.225	8.56	4.81	3.34	2.42	0.9653	0.000607	6.07	5.31	3.06	0.904	0.0360	0.0141	2.61	2.54	1.69	0.915	0.0303	0.000468	28.9	24.4	0.000640
Mercury	(mg/L)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	(mg/L)	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00025	0.00028	0.00013	0.000141	0.00005	0.00005	0.000086	0.000056	0.000051	0.00005	0.00005	0.00005	0.0001	0.000055	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00025	0.00025	0.00005
Nickel	(mg/L)	0.415	0.0010	0.001	0.001	0.0557	0.0321	0.0115	0.00261	0.142	0.0715	0.0120	0.00293	0.0005	0.00150	0.0434	0.00763	0.00420	0.00511	0.0005	0.0005	0.0445	0.00806	0.00156	0.00328	0.00063	0.0005	0.0238	0.0196	0.00681	0.00518	0.00091	0.0005	0.163	0.0859	0.0005
Phosphorus	(mg/L)	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Potassium	(mg/L)	0.500	0.40	0.20	0.14	3.09	3.41	3.09	3.13	4.39	4.42	3.76	4.18	4.26	4.37	5.16	4.92	4.54	4.64	4.70	5.11	2.11	2.85	5.64	2.60	2.31	2.96	2.45	2.96	2.85	2.36	2.49	3.37	3.49	5.56	4.32
Selenium	(mg/L)	0.001	0.000	0.000	0.000	0.000	0.000	0.00011	0.00011	0.0005	0.0005	0.0002	0.00010	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0005	0.0005	0.0001
Silicon	(mg/L)	23.2	0.676	0.442	0.507	1.94	0.423	0.477	0.428	9.88	3.03	1.52	0.849	0.462	0.658	7.53	3.12	2.60	2.81	2.20	2.52	2.97	1.26	1.07	0.761	0.522	0.657	2.38	1.68	1.31	1.29	1.13	1.23	7.71	2.94	0.487
Silver	(mg/L)	0.00300	0.000042	0.000024	0.000	0.000	0.000011	0.000015	0.000014	0.00005	0.00005	0.00002	0.000015	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00002	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00005	0.00005	0.00001
Sodium	(mg/L)	0.500	0.11	0.13	0.100	0.050	0.050	0.050	0.25	2.29	0.1	0.104	0.135	0.110	0.099	0.096	0.131	0.137	0.079	0.098	0.12	0.113	0.141	0.137	0.086	0.095	0.089	0.109	0.089	0.083	0.088	0.082	0.25	0.05	0.212
Strontium	(mg/L)	0.206	0.311	0.312	0.329	0.00666	0.0108	0.0128	0.0114	0.0312	0.0523	0.0601	0.0618	0.0636	0.0651	0.0104	0.0209	0.0192	0.0210	0.0214	0.0271	0.0156	0.0249	0.0251	0.0253	0.0263	0.0320	0.0114	0.0138	0.0153	0.0147	0.0167	0.0229	0.0303	0.0533	0.0631
Sulfur	(mg/L)	314	283	295	291	9.99	9.71	11.3	9.50	94.8	79.5	76.7	77.1	75.5	71.9	26.8	26.1	26.0	25.9	25.2	24.4	24.4	23.1	23.2	23.7	23.8	22.9	9.48	9.27	9.03	9.10	8.95	8.44	93.0	80.4	68.5
Thallium	(mg/L)	0.000	0.000	0.000	0.000	0.000290	0.000087	0.000084	0.000094	0.000162	0.000152	0.000110	0.000115	0.000082	0.000061	0.000180	0.000148	0.000132	0.000121	0.000083	0.000080	0.000050	0.000036	0.000033	0.000032	0.000033	0.000028	0.000054	0.000042	0.000041	0.000040	0.000039	0.000033	0.000112	0.000094	0.000061
Tin	(mg/L)	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.0005	0.0005	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0005	0.0005	0.0001
Titanium	(mg/L)	0.010	0.019	0.019	0.019	0.010	0.010	0.010	0.010	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Uranium	(mg/L)	0.00674	0.000053	0.000038	0.000	0.000124	0.000	0.000	0.000015	0.00609	0.000056	0.00002	0.000036	0.000029	0.000072	0.0132	0.000133	0.000172	0.00112	0.000292	0.000017	0.00129	0.00001	0.00001	0.000061	0.000031	0.000037	0.00270	0.000058	0.000099	0.000168	0.000221	0.000094	0.00546	0.00005	0.000016
Vanadium	(mg/L)	0.010	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.005	0.005	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.005	0.001
Zinc	(mg/L)	63.7	0.0478	0.0109	0.006	14.7	0.837	0.373	0.367	36.8	13.3	0.893	0.161	0.0157	0.367	1.72	0.0269	0.0099	0.101	0.003	0.003	11.0	0.803	0.384	0.571	0.0539	0.0285	4.44	2.62	0.293	0.362	0.0439	0.0253	33.1	14.2	0.003

ANNEX 12
Predicted Drainage Quality Modelling Results

Table A12-1 Predicted Drainage Quality Modeling Results - Low Grade Ore Stockpile

Year	Acidity (mg CaCO3/L)	Alkalinity (mg CaCO3/L)	Sulfate (mg/L)	Al (mg/L)	Sb (mg/L)	As (mg/L)	Ba (mg/L)	Be (mg/L)	Bi (mg/L)	B (mg/L)	Cd (mg/L)	Ca (mg/L)	Cr (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Hg (mg/L)	Mo (mg/L)	Ni (mg/L)	P (mg/L)	K (mg/L)	Se (mg/L)	Si (mg/L)	Ag (mg/L)	Na (mg/L)	Sr (mg/L)	S (mg/L)	Tl (mg/L)	Sn (mg/L)	Ti (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
Pre-prod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yr 1	2547	20	2532	105	0.010	0.18	0.09	0.04	0.05	1.0	5.2	28	0.05	0.7	8.5	157	1.4	0.08	23	174	0.0001	0.04	0.9	3.0	19	0.010	101	0.0025	8.1	0.18	909	0.002	0.010	0.10	0.16	0.10	668
Yr 2	2059	16	2047	85	0.008	0.15	0.08	0.03	0.04	0.8	4.2	22	0.04	0.6	6.9	127	1.1	0.06	19	141	0.0001	0.03	0.7	2.4	15	0.008	82	0.002	6.6	0.14	735	0.002	0.008	0.08	0.13	0.08	540
Yr 3	3340	26	3321	137	0.014	0.24	0.12	0.06	0.07	1.4	6.8	36	0.06	0.9	11.2	206	1.8	0.10	30	229	0.0001	0.05	1.2	4.0	25	0.014	133	0.003	10.7	0.23	1192	0.003	0.014	0.13	0.21	0.14	876
Yr 4	2632	21	2617	108	0.011	0.19	0.10	0.04	0.05	1.1	5.3	29	0.05	0.7	8.8	162	1.4	0.08	24	180	0.0001	0.04	0.9	3.1	19	0.011	105	0.003	8.4	0.18	940	0.002	0.011	0.10	0.16	0.11	690
Yr 5	2038	16	2026	84	0.008	0.15	0.08	0.03	0.04	0.8	4.1	22	0.04	0.6	6.8	126	1.1	0.06	18	139	0.0001	0.03	0.7	2.4	15	0.008	81	0.002	6.5	0.14	727	0.002	0.008	0.08	0.13	0.08	534
Yr 6	1663	13	1653	68	0.007	0.12	0.06	0.03	0.03	0.7	3.4	18	0.03	0.5	5.6	102	0.9	0.05	15	114	0.0001	0.03	0.6	2.0	12	0.007	66	0.002	5.3	0.12	594	0.001	0.007	0.07	0.10	0.07	436
Yr 7	1387	11	1379	57	0.006	0.10	0.05	0.02	0.03	0.6	2.8	15	0.03	0.4	4.6	85	0.7	0.04	12	95	0.0001	0.02	0.5	1.6	10	0.006	55	0.001	4.4	0.10	495	0.001	0.006	0.05	0.09	0.06	364
Yr 8	1653	13	1643	68	0.007	0.12	0.06	0.03	0.03	0.7	3.3	18	0.03	0.5	5.5	102	0.9	0.05	15	113	0.0001	0.03	0.6	2.0	12	0.007	66	0.002	5.3	0.11	590	0.001	0.007	0.07	0.10	0.07	433
Yr 9	1613	13	1603	66	0.007	0.12	0.06	0.03	0.03	0.7	3.3	18	0.03	0.5	5.4	99	0.9	0.05	15	110	0.0001	0.03	0.6	1.9	12	0.007	64	0.002	5.2	0.11	576	0.001	0.007	0.06	0.10	0.07	423
Yr 10	1994	16	1983	82	0.008	0.14	0.07	0.03	0.04	0.8	4.0	22	0.04	0.6	6.7	123	1.1	0.06	18	136	0.0001	0.03	0.7	2.4	15	0.008	79	0.002	6.4	0.14	712	0.002	0.008	0.08	0.12	0.08	523
Yr 11	2095	17	2082	86	0.009	0.15	0.08	0.04	0.04	0.9	4.2	23	0.04	0.6	7.0	129	1.1	0.07	19	143	0.0001	0.03	0.7	2.5	15	0.009	83	0.002	6.7	0.14	748	0.002	0.009	0.08	0.13	0.09	549
Yr 12	2227	18	2214	92	0.009	0.16	0.08	0.04	0.05	0.9	4.5	24	0.04	0.6	7.5	137	1.2	0.07	20	152	0.0001	0.04	0.8	2.6	16	0.009	88	0.002	7.1	0.15	795	0.002	0.009	0.09	0.14	0.09	584
Yr 13	2438	19	2423	100	0.010	0.18	0.09	0.04	0.05	1.0	4.9	27	0.04	0.7	8.2	150	1.3	0.08	22	167	0.0001	0.04	0.8	2.9	18	0.010	97	0.002	7.8	0.17	870	0.002	0.010	0.10	0.15	0.10	639
Yr 14	3120	25	3101	128	0.013	0.22	0.12	0.05	0.06	1.3	6.3	34	0.06	0.9	10.5	192	1.7	0.10	28	213	0.0001	0.05	1.1	3.7	23	0.013	124	0.003	10.0	0.22	1114	0.002	0.013	0.12	0.20	0.13	818
Yr 15	2911	23	2894	120	0.012	0.21	0.11	0.05	0.06	1.2	5.9	32	0.05	0.8	9.8	179	1.6	0.09	26	199	0.0001	0.05	1.0	3.4	21	0.012	116	0.003	9.3	0.20	1039	0.002	0.012	0.11	0.18	0.12	763
Yr 16	2442	19	2427	100	0.010	0.18	0.09	0.04	0.05	1.0	4.9	27	0.05	0.7	8.2	151	1.3	0.08	22	167	0.0001	0.04	0.8	2.9	18	0.010	97	0.002	7.8	0.17	871	0.002	0.010	0.10	0.15	0.10	640

Table A12-2 Predicted Drainage Quality Modelling Results - Temporary Ore Stockpile

Year	Month	Acidity (mg/L)	Alkalinity (mg/L)	Sulfate (mg/L)	Al (mg/L)	Sb (mg/L)	As (mg/L)	Ba (mg/L)	Be (mg/L)	Bi (mg/L)	B (mg/L)	Cd (mg/L)	Ca (mg/L)	Cr (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Hg (mg/L)	Mo (mg/L)	Ni (mg/L)	P (mg/L)	K (mg/L)	Se (mg/L)	Si (mg/L)	Ag (mg/L)	Na (mg/L)	Sr (mg/L)	S (mg/L)	Tl (mg/L)	Sn (mg/L)	Ti (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
Pre-prod.	January	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	February	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	April	558	7.9	946	8	0.0093	0.12	0.060	0.020	0.022	0.44	0.9	74	0.022	1.36	0.2	75	0.06	0.032	26.3	124	0.000033	0.002	1.1	1.00	27.5	0.0045	18	0.00044	9.6	0.360	366	0.0006	0.0044	0.033	0.08	0.044	193
	May	117	1.7	198	1.6	0.0019	0.02	0.013	0.004	0.005	0.09	0.2	15.5	0.005	0.28	0.0	16	0.01	0.007	5.5	26	0.000007	0.000	0.2	0.21	5.8	0.0009	3.8	0.00009	2.0	0.075	77	0.0001	0.0009	0.007	0.02	0.009	40
	June	99	1.4	167	1.3	0.0016	0.02	0.011	0.004	0.004	0.08	0.2	13.0	0.004	0.24	0.0	13.2	0.01	0.006	4.6	21.9	0.000006	0.000	0.2	0.18	4.9	0.0008	3.2	0.00008	1.7	0.064	64.6	0.0001	0.0008	0.006	0.01	0.008	34.1
	July	146	2.1	247	2.0	0.0024	0.03	0.016	0.005	0.006	0.11	0.2	19.3	0.006	0.36	0.1	19	0.02	0.008	6.9	32	0.000009	0.001	0.3	0.26	7.2	0.0012	4.8	0.00011	2.5	0.094	95	0.0002	0.0011	0.009	0.02	0.011	50
	August	171	2.4	290	2.3	0.0029	0.04	0.018	0.006	0.007	0.13	0.3	22.6	0.007	0.42	0.1	23	0.02	0.010	8.1	38	0.000010	0.001	0.3	0.31	8.4	0.0014	5.6	0.00013	3.0	0.110	112	0.0002	0.0013	0.010	0.02	0.013	59
	September	211	3.0	357	3	0.0035	0.04	0.023	0.008	0.008	0.17	0.3	27.9	0.008	0.51	0.1	28	0.02	0.012	9.9	47	0.000013	0.001	0.4	0.38	10.4	0.0017	7	0.00017	3.6	0.136	138	0.0002	0.0017	0.013	0.03	0.017	73
	October	357	5.1	606	5	0.0060	0.07	0.038	0.013	0.014	0.28	0.6	47	0.014	0.87	0.1	48	0.04	0.020	16.8	80	0.000021	0.001	0.7	0.64	17.6	0.0029	12	0.00028	6.2	0.230	234	0.0004	0.0028	0.021	0.05	0.028	124
	November	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	December	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Year 1	January	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	February	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	April	3156	45	5352	43	0.05	0.66	0.339	0.116	0.124	2.49	5.0	417	0.124	7.69	1.2	422	0.33	0.179	148.5	702	0.000188	0.013	6.2	5.65	155.7	0.0253	103	0.00249	54.5	2.034	2068	0.0033	0.0249	0.188	0.46	0.249	1093
	May	425	6.0	720	6	0.0071	0.09	0.046	0.016	0.017	0.33	0.7	56	0.017	1.03	0.2	57	0.04	0.024	20.0	94	0.000025	0.002	0.8	0.76	20.9	0.0034	14	0.00033	7.3	0.274	278	0.0004	0.0033	0.025	0.06	0.033	147
	June	247	3.5	419	3	0.0041	0.05	0.026	0.009	0.010	0.19	0.4	32.7	0.010	0.60	0.1	33	0.03	0.014	11.6	55	0.000015	0.001	0.5	0.44	12.2	0.0020	8	0.00019	4.3	0.159	162	0.0003	0.0019	0.015	0.04	0.019	86
	July	276	3.9	468	4	0.0046	0.06	0.030	0.010	0.011	0.22	0.4	36.5	0.011	0.67	0.1	37	0.03	0.016	13.0	61	0.000016	0.001	0.5	0.49	13.6	0.0022	9	0.00022	4.8	0.178	181	0.0003	0.0022	0.016	0.04	0.022	96
	August	255	3.6	432	3	0.0043	0.05	0.027	0.009	0.010	0.20	0.4	33.7	0.010	0.62	0.1	34	0.03	0.014	12.0	57	0.000015	0.001	0.5	0.46	12.6	0.0020	8	0.00020	4.4	0.164	167	0.0003	0.0020	0.015	0.04	0.020	88
	September	251	3.5	425	3	0.0042	0.05	0.027	0.009	0.010	0.20	0.4	33.1	0.010	0.61	0.1	33	0.03	0.014	11.8	56	0.000015	0.001	0.5	0.45	12.4	0.0020	8	0.00020	4.3	0.161	164	0.0003	0.0020	0.015	0.04	0.020	87
	October	341	4.8	578	5	0.0057	0.07	0.037	0.012	0.013	0.27	0.5	45	0.013	0.83	0.1	46	0.04	0.019	16.0	76	0.000020	0.001	0.7	0.61	16.8	0.0027	11	0.00027	5.9	0.220	223	0.0004	0.0027	0.020	0.05	0.027	118
	November	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	December	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Year 2	January	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	February	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	April	751	10.6	1273	10	0.0125	0.16	0.081	0.027	0.030	0.59	1.2	99	0.030	1.83	0.3	100	0.08	0.04	35.3	167	0.000045	0.003	1.5	1.34	37.0	0.006	25	0.00059	13.0	0.484	492	0.0008	0.0059	0.045	0.11	0.059	260
	May	195	2.8	331	3	0.0033	0.04	0.021	0.007	0.008	0.15	0.3	25.8	0.008	0.48	0.1	26	0.02	0.01	9.2	43	0.000012	0.001	0.4	0.35	9.6	0.002	6	0.00015	3.4	0.126	128	0.0002	0.0015	0.012	0.03	0.015	68
	June	148	2.1	251	2	0.0025	0.03	0.016	0.005	0.006	0.12	0.2	19.6	0.006	0.36	0.1	20	0.02	0.01	7.0	33	0.000009	0.001	0.3	0.26	7.3	0.001	4.8	0.00012	2.6	0.095	97	0.0002	0.0012	0.009	0.02	0.012	51
	July	188	2.7	318	3	0.0031	0.04	0.020	0.007	0.007	0.15	0.3	24.8	0.007	0.46	0.1	25	0.02	0.01	8.8	42	0.000011	0.001	0.4	0.34	9.3	0.002	6.1	0.00015	3.2	0.121	123	0.0002	0.0015	0.011	0.03	0.015	65
	August	191	2.7	325	3	0.0032	0.04	0.021	0.007	0.008	0.15	0.3	25.3	0.008	0.47	0.1	26	0.02	0.01	9.0	43	0.000011	0.001	0.4	0.34	9.4	0.002	6	0.00015	3.3	0.123	125	0.0002	0.0015	0.011	0.03	0.015	66
	September	208	2.9	352	3	0.0035	0.04	0.022	0.008	0.008	0.16	0.3	27.5	0.008	0.51	0.1	28	0.02	0.01	9.8	46	0.000012	0.001	0.4	0.37	10.2	0.002	7	0.00016	3.6	0.134	136	0.0002	0.0016	0.012	0.03	0.016	72
	October	315	4.5	534	4	0.0053	0.07	0.034	0.012	0.012	0.25	0.5	42	0.012	0.77	0.1	42	0.03	0.02	14.8	70	0.000019	0.001	0.6	0.56	15.5	0.003	10	0.00025	5.4	0.203	206	0.0003	0.0025	0.019	0.05	0.025	109
	November	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	December	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Year 3	January	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	February	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	April	751	10.6	1273	10	0.0125	0.16	0.081	0.027	0.030	0.59	1.2	99	0.030	1.83	0.3	100	0.08	0.04	35.3	167	0.000045	0.003	1.5	1.34	37.0	0.006	25	0.00059	13.0	0.484	492	0.0008	0.0059	0.045	0.11	0.059	260
	May	195	2.8	331	3	0.0033	0.04	0.021	0.007	0.008	0.15	0.3	25.8	0.008	0.48	0.1	26	0.02	0.01	9.2	43	0.000012	0.001	0.4	0.35	9.6	0.002	6	0.00015	3.4	0.126	128	0.0002	0.0015	0.012	0.03	0.015	68
	June	148	2.1	251	2	0.0025	0.03	0.016	0.005	0.006	0.12	0.2	19.6	0.006	0.36	0.1	20	0.02	0.01	7.0	33	0.000009	0.001	0.3	0.26	7.3	0.001	4.8	0.00012	2.6	0.095	97	0.0002	0.0012	0.009	0.02	0.012	51
	July	188	2.7	318	3	0.0031	0.04	0.020	0.007	0.007	0.15	0.3	24.8	0.007	0.46	0.1	25	0.02	0.01	8.8	42	0.000011	0.001	0.4	0.34	9.3	0.002	6.1	0.00015	3.2	0.121	123	0.0002	0.0015	0.011	0.03	0.015	65
	August	191	2.7	325	3	0.0032	0.04	0.021	0.007	0.008	0.15	0.3	25.3	0.008	0.47	0.1	26	0.02	0.01	9.0	43	0.000011	0.001	0.4	0.34	9.4	0.002	6	0.00015	3.3	0.123	125	0.0002	0.0015	0.011	0.03	0.015	66
	September	208	2.9	352	3	0.0035	0.04	0.022	0.008	0.008	0.16	0.3	27.5	0.008	0.51	0.1	28	0.02	0.01	9.8	46	0.000012	0.001	0.4	0.37	10.2	0.002	7	0.00016	3.6	0.134	136	0.0002	0.0016	0.012	0.03	0.016	72
	October	315	4.5	534	4	0.0053	0.07	0.034	0.012	0.012	0.25	0.5	42	0.012	0.77	0.1	42	0.03	0.02	14.8	70	0.000019	0.001	0.6	0.56	15.5	0.003	10	0.00025	5.4	0.203	206	0.0003	0.0025	0.019	0.05	0.025	109
	November	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	December	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Year 4	January	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	February	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	April	751	10.6	1273	10	0.0125	0.16	0.081	0.027	0.030	0.59	1.2	99	0.030	1.83	0.3	100	0.08	0.04	35.3	167	0.000045	0.003	1.5	1.34	37.0	0.006	25	0.00059	13.0	0.484	492	0.0008	0.0059	0.045	0.11	0.059	260
	May	195	2.8	331	3	0.0033	0.04	0.021	0.007	0.008	0.15	0.3	25.8	0.008	0.48	0.1	26	0.02	0.01	9.2	43	0.000012	0.001	0.4	0.35	9.6	0.002	6	0.00015	3.4	0.126	128	0.0002	0.0015	0.012	0.03	0.015	68
	June	148	2.1	251	2	0.0025	0.03	0.016	0.005	0.006	0.12	0.2	19.6	0.006	0.36	0.1	20	0.02	0.01	7.0	33	0.000009	0.001	0.3	0.26	7.3	0.001	4.8	0.00012	2.6	0.095	97	0.0002	0.0012	0.009	0.02	0.012	51
	July	188	2.7	318	3	0.0031	0.04	0.020	0.007	0.007	0.15	0.3	24.8	0.007	0.46	0.1	25	0.02	0.01	8.8	42	0.000011	0.001	0.4	0.34	9.3	0.002	6.1	0.00015	3.2	0.121	123	0.0002	0.0015	0.011	0.03	0.015	65
	August	191	2.7	325	3	0.0032	0.04	0.021	0.007	0.008	0.15	0.3	25.3	0.008	0.47	0.1	26	0.02	0.01	9.0	43	0.000011	0.001	0.4	0.34	9.4	0.002	6	0.00015	3.3	0.123	125	0.0002	0.0015	0.011	0.03	0.015	66
	September	208	2.9	352	3	0.0035	0.04	0.022	0.008	0.008	0.16	0.3	27.5	0.008	0.51	0.1	28	0.02	0.01	9.8	46	0.000012	0.001	0.4	0.37	10.2	0.002	7	0.00016	3.6	0.134	136	0.0002	0.0016	0.012	0.03	0.016	72
	October	315	4.5	534	4	0.0053	0.07	0.034	0.012	0.012	0.25	0.5	42	0.012	0.77	0.1	42	0.03	0.02	14.8	70	0.000019	0.001	0.6	0.56	15.5	0.003	10	0.00025	5.4	0.203	206	0.0003	0.0025	0.019	0.05	0.025	109
	November	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	December	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Year 5	January	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	February	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	April	743	10.5	1260	10	0.0124	0.16	0.080	0.027	0.029	0.59	1.2	98	0.029	1.81	0.3	99	0.08	0.04	35.0	165	0.000044	0.003	1.5	1.33	36.7	0.006	24	0.00059	12.8	0.479	487	0.0008	0.0059	0.044	0.11	0.059	257
	May	193	2.7	328	3	0.0032	0.04	0.021	0.007	0.008	0.15	0.3	25.5	0.008	0.47	0.1	26	0.02	0.01	9.1	43	0.000012	0.001	0.4	0.35	9.5	0.002	6	0.00015	3.3	0.125	127	0.0002	0.0015	0.012	0.03	0.015	67
	June	146	2.1	248	2	0.0024	0.03	0.016	0.005	0.006	0.12	0.2	19.3	0.006	0.36	0.1	20	0.02	0.01	6.9	33	0.000009	0.001	0.3	0.26	7.2	0.001	4.8	0.00012	2.5	0.094	96	0.0002	0.0012	0.009	0.02	0.012	51
	July	186	2.6	315	3	0.0031	0.04	0.020	0.007	0.007	0.15	0.3	24.6	0.007	0.45	0.1	25	0.02	0.01	8.7	41	0.000011	0.001	0.4	0.33	9.2	0.001	6.1	0.00015	3.2	0.120	122	0.0002	0.0015	0.011	0.03	0.015	64
	August	189	2.7	321	3	0.0032	0.04	0.020	0.007	0.007	0.15	0.3	25.0	0.007	0.46	0.1	25	0.02	0.01	8.9	42	0.000011	0.001	0.4	0.34	9.3	0.002	6.2	0.00015	3.3	0.122	124	0.0002	0.0015	0.011	0.03	0.015	66
	September	206	2.9	348	3	0.0034	0.04	0.022	0.008	0.008	0.16	0.3	27.2	0.008	0.50	0.1	27	0.02	0.01	9.7	46	0.000012	0.001	0.4	0.37	10.1	0.002	7	0.00016	3.6	0.132	135	0.0002	0.0016	0.012	0.03	0.016	71
	October	312	4.4	528	4	0.0052	0.07	0.033	0.011	0.012	0.25	0.5	41	0.012	0.76	0.1	42	0.03	0.02	14.7	69	0.000019	0.001	0.6	0.56	15.4	0.002	10	0.00025	5.4	0.201	204	0.0003	0.0025	0.019	0.05	0.025	108
	November	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	December	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Year 6	January	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	February	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	April	743	10.5	1260	10	0.0124	0.16	0.080	0.027	0.029	0.59	1.2	98	0.029	1.81	0.3	99	0.08	0.04	35.0	165	0.000044	0.003	1.5	1.33	36.7	0.006	24	0.00059	12.8	0.479	487	0.0008	0.0059	0.044	0.11	0.059	257
	May	193	2.7	328	3	0.0032	0.04	0.021	0.007	0.008	0.15	0.3	25.5	0.008	0.47	0.1	26	0.02	0.01	9.1	43	0.000012	0.001	0.4	0.35	9.5	0.002	6	0.00015	3.3	0.125	127	0.0002	0.0015	0.012	0.03	0.015	67
	June	146	2.1	248	2	0.0024	0.03	0.016	0.005	0.006	0.12	0.2	19.3	0.006	0.36	0.1	20	0.02	0.01	6.9	33	0.000009	0.001	0.3	0.26	7.2	0.001	4.8	0.00012	2.5	0.094	96	0.0002	0.0012	0.009	0.02	0.012	51
	July	186	2.6	315	3	0.0031	0.04	0.020	0.007	0.007	0.15	0.3	24.6	0.007	0.45	0.1	25	0.02	0.01	8.7	41	0.000011	0.001	0.4	0.33	9.2	0.001	6.1	0.00015	3.2	0.120	122	0.0002	0.0015	0.011	0.03	0.015	64
	August	189	2.7	321	3	0.0032	0.04	0.020	0.007	0.007	0.15	0.3	25.0	0.007	0.46	0.1	25	0.02	0.01	8.9	42	0.000011	0.001	0.4	0.34	9.3	0.002	6.2	0.00015	3.3	0.122	124	0.0002	0.0015	0.011	0.03	0.015	66
	September	206	2.9	348	3	0.0034	0.04	0.022	0.008	0.008	0.16	0.3	27.2	0.008	0.50	0.1	27	0.02	0.01	9.7	46	0.000012	0.001	0.4	0.37	10.1	0.002	7	0.00016	3.6	0.132	135	0.0002	0.0016	0.012	0.03	0.016	71
	October	312	4.4	528	4	0.0052	0.07	0.033	0.011	0.012	0.25	0.5	41	0.012	0.76	0.1	42	0.03	0.02	14.7	69	0.000019	0.001	0.6	0.56	15.4	0.002	10	0.00025	5.4	0.201	204	0.0003	0.0025	0.019	0.05	0.025	108
	November	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	December	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Year 7	January	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	February	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	April	751	10.6	1273	10	0.0125	0.16	0.081	0.027	0.030	0.59	1.2	99	0.030	1.83	0.3	100	0.08	0.04	35.3	167	0.000045	0.003	1.5	1.34	37.0	0.006	25	0.00059	13.0	0.484	492	0.0008	0.0059	0.045	0.11	0.059	260
	May	195	2.8	331	3	0.0033	0.04	0.021	0.007	0.008	0.15	0.3	25.8	0.008	0.48	0.1	26	0.02	0.01	9.2	43	0.000012	0.001	0.4	0.35	9.6	0.002	6	0.00015	3.4	0.126	128	0.0002	0.0015	0.012	0.03	0.015	68
	June	148	2.1	251	2	0.0025	0.03	0.016	0.005	0.006	0.12	0.2	19.6	0.006	0.36	0.1	20	0.02	0.01	7.0	33	0.000009	0.001	0.3	0.26	7.3	0.001	4.8	0.00012	2.6	0.095	97	0.0002	0.0012	0.009	0.02	0.012	51
	July	188	2.7	318	3	0.0031	0.04	0.020	0.007	0.007	0.15	0.3	24.8	0.007	0.46	0.1	25	0.02	0.01	8.8	42	0.000011	0.001	0.4	0.34	9.3	0.002	6.1	0.00015	3.2	0.121	123	0.0002	0.0015	0.011	0.03	0.015	65
	August	191	2.7	325	3	0.0032	0.04	0.021	0.007	0.008	0.15	0.3	25.3	0.008	0.47	0.1	26	0.02	0.01	9.0	43	0.000011	0.001	0.4	0.34	9.4	0.002	6	0.00015	3.3	0.123	125	0.0002	0.0015	0.011	0.03	0.015	66
	September	208	2.9	352	3	0.0035	0.04	0.022	0.008	0.008	0.16	0.3	27.5	0.008	0.51	0.1	28	0.02	0.01	9.8	46	0.000012	0.001	0.4	0.37	10.2	0.002	7	0.00016	3.6	0.134	136	0.0002	0.0016	0.012	0.03	0.016	72
	October	315	4.5	534	4	0.0053	0.07	0.034	0.012	0.012	0.25	0.5	42	0.012	0.77	0.1	42	0.03	0.02	14.8	70	0.000019	0.001	0.6	0.56	15.5	0.003	10	0.00025	5.4	0.203	206	0.0003	0.0025	0.019	0.05	0.025	109
	November	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	December	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Year 8	January	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	February	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	March	-	-	-	-	-	-	-

Table A12-3 Predicted Drainage Quality Modeling Results - East & West Dump

Year	Acidity (mg/L)	Alkalinity (mg/L)	Sulfate (mg/L)	Al (mg/L)	Sb (mg/L)	As (mg/L)	Ba (mg/L)	Be (mg/L)	Bi (mg/L)	B (mg/L)	Cd (mg/L)	Ca (mg/L)	Cr (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Hg (mg/L)	Mo (mg/L)	Ni (mg/L)	P (mg/L)	K (mg/L)	Se (mg/L)	Si (mg/L)	Ag (mg/L)	Na (mg/L)	Sr (mg/L)	S (mg/L)	Tl (mg/L)	Sn (mg/L)	Ti (mg/L)	U (mg/L)	V (mg/L)	Zn (mg/L)
Pre-prod	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yr 1	3.4	54	29	0.13	0.02	0.0117	0.01	0.0002	0.001	0.01	0.0002	26.6	0.001	0.000	0.001	0.08	0.001	0.01	2.0	0.2	0.00002	0.001	0.0007	0.33	3.9	0.001	5.6	0.00005	3.9	0.13	10.2	0.00006	0.0002	0.011	0.0004	0.002	0.005
Yr 2	7.3	99	69	0.23	0.04	0.028	0.011	0.00032	0.0016	0.026	0.0005	55.7	0.0015	0.0006	0.0015	0.12	0.0026	0.020	3.1	0.5	0.00003	0.0026	0.0015	0.8	9.0	0.0006	8.0	0.00007	7.0	0.3	24.3	0.00009	0.0003	0.026	0.0007	0.004	0.010
Yr 3	11	138	105	0.31	0.06	0.043	0.014	0.00044	0.0022	0.040	0.0008	81.7	0.0021	0.0008	0.0021	0.15	0.0039	0.030	4.0	0.8	0.00004	0.0038	0.0022	1.2	13.5	0.0007	10.1	0.00009	9.8	0.4	36.9	0.00012	0.0004	0.040	0.0010	0.006	0.014
Yr 4	8.2	110	78	0.25	0.04	0.032	0.012	0.00035	0.0018	0.030	0.0006	62.8	0.0017	0.0006	0.0016	0.13	0.0029	0.023	3.4	0.6	0.00003	0.0029	0.0017	0.9	10.2	0.0007	8.8	0.00008	7.8	0.3	27.6	0.00010	0.0004	0.030	0.0008	0.005	0.011
Yr 5	7.7	103	73	0.24	0.04	0.029	0.011	0.00033	0.0016	0.028	0.0006	58.4	0.0015	0.0006	0.0015	0.12	0.0027	0.021	3.2	0.5	0.00003	0.0027	0.0016	0.8	9.4	0.0006	8.3	0.00007	7.3	0.3	25.6	0.00009	0.0003	0.028	0.0007	0.004	0.010
Yr 6	9.2	120	89	0.27	0.05	0.036	0.013	0.00038	0.0019	0.034	0.0007	70.1	0.0018	0.0007	0.0018	0.13	0.0033	0.026	3.5	0.7	0.00004	0.0033	0.0019	1.0	11.5	0.0006	9.0	0.00008	8.5	0.3	31.4	0.00010	0.0004	0.034	0.0009	0.005	0.012
Yr 7	8.3	110	79	0.25	0.04	0.032	0.012	0.00035	0.0018	0.030	0.0006	63.1	0.0017	0.0006	0.0016	0.13	0.0029	0.023	3.4	0.6	0.00003	0.0030	0.0017	0.9	10.3	0.0006	8.7	0.00008	7.8	0.3	27.8	0.00010	0.0004	0.030	0.0008	0.005	0.011
Yr 8	7.4	101	70	0.23	0.04	0.028	0.011	0.00032	0.0016	0.027	0.0005	56.9	0.0015	0.0006	0.0015	0.12	0.0026	0.020	3.1	0.5	0.00003	0.0027	0.0015	0.8	9.2	0.0006	8.2	0.00007	7.2	0.3	24.8	0.00009	0.0003	0.027	0.0007	0.004	0.010
Yr 9	8.8	115	85	0.26	0.05	0.034	0.012	0.00037	0.0018	0.032	0.0007	67.0	0.0018	0.0007	0.0017	0.13	0.0032	0.025	3.4	0.6	0.00004	0.0031	0.0018	1.0	11.0	0.0006	8.7	0.00008	8.2	0.3	29.9	0.00010	0.0004	0.032	0.0008	0.005	0.012
Yr 10	11.2	142	109	0.32	0.06	0.044	0.015	0.00046	0.0023	0.042	0.0008	84.7	0.0022	0.0009	0.0022	0.15	0.0041	0.032	4.1	0.8	0.00004	0.004	0.002	1.2	14.1	0.0007	10.1	0.0001	10.0	0.4	38.5	0.00012	0.0005	0.04	0.001	0.006	0.015
Yr 11	10.3	134	100	0.30	0.05	0.041	0.014	0.00043	0.0021	0.038	0.0008	78.4	0.0020	0.0008	0.0020	0.15	0.0037	0.029	4.0	0.7	0.000041	0.0037	0.0021	1.1	12.9	0.0007	10.0	0.00009	9.5	0.4	35.2	0.00012	0.0004	0.04	0.0010	0.006	0.014
Yr 12	9.5	125	92	0.28	0.05	0.037	0.014	0.00040	0.0020	0.035	0.0007	72.5	0.0019	0.0007	0.0019	0.14	0.0034	0.027	3.7	0.7	0.000038	0.0034	0.0020	1.0	11.8	0.0007	9.6	0.00009	8.9	0.3	32.2	0.00011	0.0004	0.03	0.0009	0.005	0.013
Yr 13	8.9	118	85	0.27	0.05	0.035	0.013	0.00038	0.0019	0.033	0.0007	67.9	0.0018	0.0007	0.0018	0.13	0.0032	0.025	3.6	0.6	0.000036	0.0032	0.0019	1.0	11.1	0.0007	9.2	0.00008	8.4	0.3	30.1	0.00011	0.0004	0.03	0.0009	0.005	0.012
Yr 14	8.3	111	79	0.25	0.04	0.032	0.012	0.00035	0.0018	0.030	0.0006	63.1	0.0017	0.0006	0.0016	0.13	0.0029	0.023	3.4	0.6	0.000034	0.0030	0.0017	0.9	10.2	0.0007	8.8	0.00008	7.9	0.3	27.8	0.00010	0.0004	0.03	0.0008	0.005	0.011
Yr 15	7.7	104	73	0.24	0.04	0.030	0.012	0.00033	0.0017	0.028	0.0006	59.1	0.0016	0.0006	0.0015	0.12	0.0027	0.021	3.2	0.5	0.000032	0.0028	0.0016	0.8	9.5	0.0006	8.4	0.00007	7.4	0.3	25.9	0.00009	0.0003	0.03	0.0008	0.004	0.010
Yr 16	7.3	98	69	0.23	0.04	0.028	0.011	0.00032	0.0016	0.026	0.0005	55.5	0.0015	0.0005	0.0015	0.12	0.0026	0.020	3.1	0.5	0.000030	0.0026	0.0015	0.8	8.9	0.0006	8.0	0.00007	7.0	0.3	24.2	0.000090	0.0003	0.03	0.0007	0.004	0.010
Yr 17	6.9	93	65	0.22	0.04	0.026	0.011	0.00030	0.0015	0.025	0.0005	52.4	0.0014	0.0005	0.0014	0.11	0.0024	0.019	2.9	0.5	0.000028	0.0025	0.0014	0.7	8.4	0.0006	7.7	0.00007	6.7	0.2	22.7	0.000086	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 1	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 2	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 3	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 4	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 5	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 6	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 7	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 8	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 9	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 10	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 11	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 12	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 13	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 14	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 15	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 16	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 17	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 18	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 19	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 20	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 21	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 22	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 23	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 24	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 25	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 26	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 27	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 28	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 29	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 30	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 31	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009
Closure Yr 32	6.6	91	62	0.21	0.03	0.025	0.010	0.00029	0.0015	0.024	0.0005	50.8	0.0013	0.0005	0.0013	0.11	0.0023	0.018	2.9	0.5	0.000027	0.0024	0.0014	0.7	8.1	0.0006	7.5	0.00007	6.5	0.2	22.0	0.000084	0.0003	0.02	0.0007	0.004	0.009

Table A12-4 Predicted Drainage Quality Modeling Results - Waste Rock in the Tailings Storage Facility

Year	Acidity (mg/L) Total	Alkalinity (mg/L) Total	Sulfate (mg/L) Total	Al (mg/L) Total	Sb (mg/L) Total	As (mg/L) Total	Ba (mg/L) Total	Be (mg/L) Total	Bi (mg/L) Total	B (mg/L) Total	Cd (mg/L) Total	Ca (mg/L) Total	Cr (mg/L) Total	Co (mg/L) Total	Cu (mg/L) Total	Fe (mg/L) Total	Pb (mg/L) Total	Li (mg/L) Total	Mg (mg/L) Total	Mn (mg/L) Total	Hg (mg/L) Total	Mo (mg/L) Total	Ni (mg/L) Total	P (mg/L) Total	K (mg/L) Total	Se (mg/L) Total	S (mg/L) Total	Ag (mg/L) Total	Na (mg/L) Total	Sr (mg/L) Total	S (mg/L) Total	Tl (mg/L) Total	Sn (mg/L) Total	Ti (mg/L) Total	U (mg/L) Total	V (mg/L) Total	Zn (mg/L) Total
Pre-prod	0.8	2.7	3.9	0.025	0.006	0.0023	0.0012	0.000026	0.00013	0.00257	0.00045	2.0	0.00013	0.00038	0.00014	0.011	0.0007	0.0019	0.16	0.19	0.0000026	0.00041	0.00034	0.08	1.1	0.000026	1.5	0.0000026	0.40	0.012	1.5	0.000009	0.000026	0.0026	0.00006	0.00030	0.022
Yr 1	0.8	2.7	3.9	0.025	0.006	0.0023	0.0012	0.000026	0.00013	0.00257	0.00045	2.0	0.00013	0.00038	0.00014	0.011	0.0007	0.0019	0.16	0.19	0.0000026	0.00041	0.00034	0.08	1.1	0.000026	1.5	0.0000026	0.40	0.012	1.5	0.000009	0.000026	0.0026	0.00006	0.00030	0.022
Yr 2	0.8	2.7	3.9	0.025	0.006	0.0023	0.0012	0.000026	0.00013	0.00257	0.00045	2.0	0.00013	0.00038	0.00014	0.011	0.0007	0.0019	0.16	0.19	0.0000026	0.00041	0.00034	0.08	1.1	0.000026	1.5	0.0000026	0.40	0.012	1.5	0.000009	0.000026	0.0026	0.00006	0.00030	0.022
Yr 3	10.5	1.4	13.9	0.27	0.0019	0.0012	0.0027	0.00021	0.0003	0.006	0.014	1.2	0.00044	0.013	0.012	0.8	0.12	0.0018	0.29	1.2	0.0000019	0.00016	0.022	0.054	1.2	0.00007	5.0	0.000011	0.13	0.007	5.0	0.000052	0.00006	0.0018	0.0004	0.0007	2.6
Yr 4	14.3	1.4	18.1	0.35	0.0018	0.0012	0.003	0.00023	0.0004	0.008	0.019	1.3	0.0006	0.018	0.013	1.0	0.17	0.0022	0.38	1.6	0.0000021	0.00014	0.031	0.06	1.4	0.00009	6.5	0.000015	0.13	0.008	6.5	0.00007	0.00008	0.0021	0.0004	0.0008	3.6
Yr 5	12.2	2.0	16.6	0.29	0.0025	0.0014	0.003	0.00022	0.0004	0.007	0.016	1.7	0.0005	0.016	0.011	0.9	0.15	0.0023	0.36	1.4	0.0000023	0.00018	0.027	0.07	1.5	0.00008	6.0	0.000013	0.16	0.010	6.0	0.00006	0.00007	0.0023	0.0004	0.0008	3.0
Yr 6	14.9	1.5	18.9	0.37	0.0018	0.0012	0.003	0.00023	0.0004	0.008	0.020	1.3	0.0006	0.019	0.013	1.0	0.18	0.0023	0.40	1.7	0.0000021	0.00014	0.033	0.06	1.4	0.00009	6.7	0.000016	0.12	0.008	6.7	0.00007	0.00008	0.0021	0.0004	0.0009	3.7
Yr 7	14.6	1.5	18.3	0.36	0.0022	0.0014	0.003	0.00021	0.0004	0.008	0.020	1.3	0.0006	0.018	0.012	1.0	0.18	0.0023	0.40	1.6	0.0000022	0.00016	0.032	0.07	1.4	0.00009	6.6	0.000016	0.16	0.009	6.6	0.00007	0.00008	0.0022	0.0004	0.0008	3.6
Yr 8	14.3	1.3	17.8	0.36	0.0018	0.0012	0.003	0.00022	0.0004	0.008	0.020	1.1	0.0006	0.018	0.013	1.0	0.17	0.0021	0.38	1.6	0.0000020	0.00014	0.031	0.06	1.3	0.00009	6.4	0.000015	0.13	0.008	6.4	0.00007	0.00008	0.0020	0.0004	0.0008	3.6
Yr 9	10.7	1.7	14.2	0.27	0.0029	0.0015	0.0026	0.00016	0.0003	0.007	0.014	1.4	0.0005	0.013	0.010	0.7	0.13	0.0021	0.32	1.2	0.0000022	0.00021	0.023	0.06	1.2	0.00007	5.1	0.000012	0.19	0.009	5.1	0.00005	0.00007	0.0021	0.0003	0.0007	2.6
Yr 10	12.4	1.4	15.7	0.31	0.0022	0.0013	0.0026	0.00018	0.0004	0.007	0.017	1.2	0.0005	0.015	0.012	0.8	0.14	0.0020	0.34	1.3	0.0000020	0.00017	0.026	0.06	1.2	0.00008	5.6	0.000014	0.15	0.008	5.6	0.00006	0.00007	0.0020	0.0003	0.0007	3.1
Yr 11	14.9	0.9	17.9	0.38	0.0012	0.0011	0.0029	0.00021	0.0004	0.008	0.021	0.9	0.0006	0.018	0.015	1.0	0.17	0.0019	0.37	1.6	0.0000018	0.00012	0.031	0.053	1.1	0.00009	6.4	0.000016	0.10	0.006	6.4	0.00007	0.00008	0.0018	0.0004	0.0008	3.7
Yr 12	16.0	0.8	19.1	0.41	0.0011	0.0011	0.003	0.00022	0.0004	0.008	0.022	0.8	0.0007	0.019	0.015	1.0	0.19	0.0020	0.39	1.7	0.0000019	0.00011	0.034	0.055	1.2	0.00009	6.8	0.000017	0.10	0.006	6.8	0.00007	0.00009	0.0018	0.0004	0.0009	4.0
Yr 13	0.8	2.7	3.9	0.025	0.006	0.0023	0.0012	0.000026	0.00013	0.0026	0.00045	2.0	0.00013	0.00038	0.00014	0.011	0.0007	0.0019	0.16	0.19	0.0000026	0.00041	0.00034	0.08	1.1	0.000026	1.5	0.0000026	0.40	0.012	1.5	0.000009	0.000026	0.0026	0.00006	0.00030	0.022

Table A12-5 Predicted Water Quality Modeling Results - Pit Lake

Condition	Year	pH	Alkalinity mg/L CaCO3	Acidity mg/L CaCO3	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Aluminum mg/L	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Bismuth mg/L	Boron mg/L	Cadmium mg/L	Calcium mg/L	Chromium mg/L	Cobalt mg/L	Copper mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Mercury mg/L	Molybdenum mg/L	Nickel mg/L	Phosphorus mg/L	Potassium mg/L	Selenium mg/L	Silicon mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Thallium mg/L	Tin mg/L	Titanium mg/L	Uranium mg/L	Vanadium mg/L	Zinc mg/L	Nitrate mg/L	Nitrite mg/L	Total Cyanide mg/L	WAD Cyanide mg/L
Dewatering to TSF Pond C	Yr -2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0	0	0.0000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Yr -1		31.5	0	1.6	0.787	0.104	0.09	0.0001	0.0004	0.0061	0.00010	0.0000	0.0010	0.0000	8.6	0.0003	0.0000	0.0003	0.066	0.0008	0.0010	1.700	0.002	0.000007	0.0004	0.0002	0.010	0.504	0.0006	5.47	0.00005	2.397	0.059	0.00005	0.00010	0.0011	0.0002	0.0002	0.003	0.016	0.0038	0.007	0.005
	Yr 1	7.4	34.5	0.1	2.7	0.773	0.107	0.10	0.0001	0.0023	0.0070	0.00010	0.0001	0.0022	0.0001	9.1	0.0003	0.0002	0.0004	0.072	0.0005	0.0010	1.754	0.046	0.000006	0.0019	0.0006	0.040	0.578	0.0008	5.72	0.00004	3.334	0.064	0.00005	0.00011	0.0022	0.0002	0.0003	0.024	0.014	0.0034	0.006	0.005
	Yr 2	7.1	38.1	0.0	3.8	0.746	0.112	0.11	0.0001	0.0050	0.0081	0.00010	0.0001	0.0039	0.0001	9.7	0.0003	0.0002	0.0004	0.067	0.0006	0.0009	1.812	0.086	0.000005	0.0041	0.0009	0.082	0.654	0.0004	6.02	0.00004	4.650	0.072	0.00004	0.00013	0.0038	0.0003	0.0004	0.012	0.012	0.0028	0.006	0.005
	Yr 3	7.0	40.2	0.1	4.5	0.723	0.113	0.12	0.0001	0.0067	0.0088	0.00010	0.0002	0.0050	0.0001	10.1	0.0003	0.0003	0.0004	0.067	0.0006	0.0008	1.836	0.116	0.000004	0.0054	0.0011	0.108	0.703	0.0004	6.17	0.00003	5.447	0.076	0.00003	0.00014	0.0047	0.0004	0.0005	0.014	0.011	0.0024	0.006	0.005
	Yr 4	6.9	41.6	0.1	5.1	0.706	0.114	0.12	0.0001	0.0078	0.0093	0.00009	0.0002	0.0057	0.0001	10.3	0.0002	0.0003	0.0004	0.068	0.0010	0.0008	1.849	0.139	0.000003	0.0063	0.0014	0.125	0.738	0.0009	6.26	0.00003	5.984	0.079	0.00003	0.00014	0.0054	0.0004	0.0006	0.021	0.009	0.0021	0.005	0.004
	Yr 5	6.9	42.2	0.1	5.5	0.686	0.114	0.12	0.0001	0.0086	0.0096	0.00009	0.0003	0.0063	0.0002	10.4	0.0002	0.0004	0.0005	0.070	0.0016	0.0008	1.844	0.158	0.000003	0.0070	0.0016	0.138	0.762	0.0003	6.27	0.00002	6.351	0.080	0.00002	0.00015	0.0059	0.0005	0.0006	0.032	0.009	0.0019	0.005	0.004
	Yr 6	6.9	42.9	0.2	5.8	0.674	0.114	0.12	0.0001	0.0093	0.0098	0.00009	0.0003	0.0067	0.0002	10.5	0.0003	0.0005	0.0005	0.071	0.0019	0.0007	1.846	0.172	0.000002	0.0075	0.0017	0.148	0.783	0.0003	6.31	0.00002	6.638	0.082	0.00002	0.00015	0.0062	0.0005	0.0006	0.039	0.008	0.0018	0.005	0.004
	Yr 7	6.9	43.4	0.3	6.2	0.665	0.114	0.13	0.0002	0.0098	0.0100	0.00009	0.0003	0.0070	0.0004	10.6	0.0002	0.0006	0.0006	0.076	0.0030	0.0007	1.850	0.190	0.000002	0.0078	0.0020	0.156	0.801	0.0002	6.34	0.00002	6.863	0.083	0.00002	0.00015	0.0065	0.0005	0.0007	0.061	0.007	0.0016	0.005	0.004
	Yr 8	6.8	43.8	0.4	6.5	0.657	0.114	0.13	0.0002	0.0102	0.0101	0.00009	0.0003	0.0073	0.0005	10.6	0.0002	0.0008	0.0007	0.083	0.0045	0.0007	1.852	0.210	0.000002	0.0082	0.0023	0.162	0.821	0.0002	6.36	0.00002	7.042	0.083	0.00002	0.00015	0.0068	0.0005	0.0007	0.089	0.007	0.0015	0.005	0.004
	Yr 9	6.8	44.0	0.4	6.7	0.647	0.114	0.13	0.0002	0.0105	0.0102	0.00009	0.0003	0.0075	0.0006	10.6	0.0002	0.0008	0.0007	0.086	0.0052	0.0007	1.845	0.221	0.000002	0.0084	0.0025	0.168	0.832	0.0002	6.35	0.00002	7.179	0.084	0.00002	0.00016	0.0069	0.0005	0.0007	0.102	0.007	0.0014	0.005	0.004
	Yr 10	6.8	44.1	0.5	6.9	0.637	0.113	0.14	0.0002	0.0108	0.0103	0.00009	0.0003	0.0078	0.0007	10.6	0.0002	0.0010	0.0008	0.090	0.0063	0.0007	1.839	0.235	0.000001	0.0086	0.0027	0.172	0.843	0.0013	6.34	0.00002	7.291	0.084	0.00002	0.00016	0.0071	0.0005	0.0007	0.123	0.006	0.0013	0.004	0.004
	Yr 11	6.8	44.2	0.6	7.1	0.631	0.113	0.14	0.0002	0.0110	0.0104	0.00009	0.0004	0.0079	0.0008	10.6	0.0003	0.0010	0.0008	0.093	0.0069	0.0007	1.837	0.244	0.000001	0.0088	0.0028	0.176	0.849	0.0002	6.34	0.00002	7.391	0.085	0.00002	0.00016	0.0072	0.0005	0.0007	0.134	0.006	0.0013	0.004	0.004
Operation - Pit Dewatering to Mill	Yr 12	6.8	44.4	0.7	7.2	0.626	0.113	0.14	0.0002	0.0112	0.0105	0.00009	0.0004	0.0081	0.0009	10.7	0.0002	0.0011	0.0009	0.098	0.0079	0.0007	1.835	0.256	0.000001	0.0090	0.0031	0.179	0.858	0.0002	6.34	0.00001	7.477	0.085	0.00002	0.00016	0.0073	0.0005	0.0008	0.155	0.006	0.0012	0.004	0.004
	Yr 13	6.8	44.4	0.8	7.4	0.620	0.113	0.15	0.0002	0.0114	0.0105	0.00009	0.0004	0.0083	0.0011	10.7	0.0002	0.0013	0.0010	0.106	0.0096	0.0007	1.834	0.273	0.000001	0.0091	0.0034	0.182	0.868	0.0002	6.34	0.00001	7.549	0.085	0.00002	0.00016	0.0074	0.0006	0.0008	0.187	0.005	0.0012	0.004	0.004
	Yr 14	6.8	44.6	0.9	7.6	0.622	0.104	0.12	0.0002	0.0114	0.0106	0.00010	0.0004	0.0084	0.0013	10.7	0.0001	0.0015	0.0011	0.117	0.0116	0.0007	1.844	0.290	0.000008	0.0091	0.0038	0.183	0.882	0.0002	6.37	0.00001	7.581	0.085	0.00002	0.00016	0.0075	0.0006	0.0008	0.226	0.005	0.0011	0.004	0.004
	Yr 15	6.7	44.6	0.9	7.6	0.624	0.113	0.12	0.0002	0.0114	0.0106	0.00010	0.0004	0.0083	0.0013	10.7	0.0001	0.0015	0.0011	0.117	0.0117	0.0007	1.845	0.290	0.000008	0.0091	0.0038	0.182	0.881	0.0002	6.37	0.00001	7.548	0.085	0.00002	0.00016	0.0075	0.0006	0.0008	0.227	0.005	0.0012	0.004	0.004
	Yr 16	6.7	44.3	0.9	7.6	0.622	0.116	0.12	0.0002	0.0113	0.0105	0.00010	0.0004	0.0083	0.0013	10.6	0.0001	0.0015	0.0011	0.117	0.0117	0.0007	1.838	0.288	0.000008	0.0090	0.0037	0.181	0.877	0.0002	6.34	0.00001	7.493	0.085	0.00002	0.00016	0.0074	0.0006	0.0008	0.227	0.005	0.0012	0.004	0.004
	Yr 17	7.2	46.2	0.9	114.8	1.825	0.106	0.12	0.0094	0.0121	0.0120	0.00009	0.0003	0.0105	0.0012	20.0	0.0001	0.0072	0.0030	0.203	0.0107	0.0013	1.835	0.263	0.000009	0.0151	0.0035	0.164	7.775	0.0002	5.90	0.00002	57.149	0.102	0.00003	0.00130	0.0067	0.0009	0.0007	0.207	0.059	0.0281	0.378	0.007
	Yr 18	7.8	55.3	0.5	570.2	6.935	0.062	0.14	0.0482	0.0160	0.0184	0.00006	0.0002	0.0200	0.0008	59.8	0.0004	0.0313	0.0109	0.571	0.0062	0.0037	1.857	0.163	0.000014	0.0411	0.0027	0.098	37.075	0.0006	4.14	0.00004	268.148	0.175	0.00010	0.00612	0.0040	0.0021	0.0005	0.119	0.286	0.1422	1.965	0.021
	Yr 19	8.1	58.2	0.4	713.8	8.548	0.048	0.14	0.0662	0.0173	0.0204	0.00005	0.0002	0.0230	0.0008	72.4	0.0004	0.0389	0.0134	0.687	0.0048	0.0045	1.868	0.131	0.000015	0.0493	0.0025	0.077	46.317	0.0007	3.60	0.00003	334.696	0.198	0.00013	0.00765	0.0031	0.0025	0.0006	0.090	0.358	0.1782	2.466	0.025
	Yr 20	8.1	59.8	0.3	786.1	9.361	0.041	0.15	0.0667	0.0179	0.0215	0.00005	0.0002	0.0245	0.0006	78.8	0.0005	0.0427	0.0147	0.745	0.0040	0.0048	1.875	0.114	0.000016	0.0534	0.0023	0.067	50.973	0.0007	3.33	0.00005	368.223	0.210	0.00014	0.00841	0.0027	0.0027	0.0004	0.075	0.394	0.1963	2.718	0.028
	Yr 21	8.1	60.7	0.3	830.9	9.865	0.036	0.15	0.0705	0.0183	0.0221	0.00004	0.0002	0.0254	0.0005	82.7	0.0005	0.0451	0.0154	0.781	0.0035	0.0051	1.881	0.104	0.000016	0.0560	0.0023	0.060	53.853	0.0008	3.17	0.00005	388.963	0.217	0.00014	0.00889	0.0024	0.0029	0.0003	0.065	0.416	0.2075	2.874	0.029
	Yr 22	8.1	61.4	0.2	862.1	10.217	0.033	0.15	0.0732	0.0186	0.0225	0.00004	0.0002	0.0261	0.0005	85.5	0.0005	0.0468	0.0160	0.806	0.0031	0.0052	1.886	0.096	0.000017	0.0578	0.0022	0.056	55.860	0.0008	3.06	0.00005	403.416	0.222	0.00015	0.00922	0.0023	0.0030	0.0003	0.058	0.432	0.2154	2.983	0.030
	Yr 23	8.1	61.9	0.2	885.6	10.483	0.031	0.15	0.0752	0.0188	0.0229	0.00004	0.0001	0.0265	0.0005	87.6	0.0005	0.0480	0.0164	0.825	0.0029	0.0054	1.890	0.091	0.000017	0.0591	0.0021	0.052	57.375	0.0008	2.98	0.00006	414.324	0.226	0.00015	0.00947	0.0021	0.0030	0.0003	0.053	0.443	0.2213	3.065	0.031
	Yr 24	8.1	62.3	0.2	904.3	10.695	0.029	0.15	0.0768	0.0189	0.0232	0.00004	0.0001	0.0269	0.0005	89.2	0.0005	0.0490	0.0167	0.840	0.0026	0.0055	1.894	0.086	0.000017	0.0602	0.0021	0.050	58.581	0.0008	2.92	0.00006	423.000	0.229	0.00016	0.00967	0.0020	0.0031	0.0003	0.048	0.453	0.2260	3.130	0.031
	Yr 25	8.1	62.7	0.2	919.9	10.871	0.027	0.15	0.0781	0.0190	0.0234	0.00004	0.0001	0.0273	0.0004	90.6	0.0005	0.0498	0.0170	0.852	0.0024	0.0055	1.897	0.082	0.000017	0.0611	0.0021	0.047	59.584	0.0008	2.86	0.00006	430.223	0.232	0.00016	0.00983	0.0019	0.0031	0.0003	0.044	0.460	0.2299	3.184	0.032
	Yr 26	8.1	63.0	0.2	933.3	11.023	0.026	0.15	0.0792	0.0192	0.0236	0.00004	0.0001	0.0275	0.0004	91.8	0.0005	0.0505	0.0172	0.863	0.0023	0.0056	1.901	0.079	0.000017	0.0618	0.0020	0.045	60.447	0.0008	2.82	0.00006	436.434	0.234	0.00016	0.00997	0.0018	0.0032	0.0003	0.041	0.467	0.2333	3.231	0.032
	Yr 27	8.2	63.3	0.2	945.1	11.157	0.025	0.15	0.0803	0.0192	0.0237	0.00004	0.0001	0.0278	0.0004	92.8	0.0005	0.0511	0.0174	0.872	0.0021	0.0057	1.904	0.076	0.000018	0.0625	0.0020	0.043	61.209	0.0008	2.78	0.00006	441.916	0.236	0.00016	0.01010	0.0017	0.0032	0.0003	0.038	0.473	0.2362	3.272	0.032
	Yr 28	8.2	63.5	0.1	955.8	11.278	0.024	0.15	0.0812	0.0193	0.0239	0.00004	0.0001	0.0280	0.0004	93.8	0.0005	0.0517	0.0176	0.881	0.0020	0.0057	1.907	0.073	0.000018	0.0631	0.0020	0.042	61.897	0.0008	2.75	0.00006	446.871	0.238	0.00016	0.01021	0.0017	0.0032	0.0003	0.036	0.478	0.2389	3.309	0.033
	Yr 29	8.2	63.8	0.1	965.6	11.389	0.023	0.15	0.0820	0.0194	0.0240	0.00004	0.0001	0.0282	0.0004	94.6	0.0005	0.0522	0.0178	0.889	0.0019	0.0058	1.909	0.071	0.000018	0.0637	0.0020	0.040	62.525	0.0009	2.72	0.00006	451.392	0.239	0.00017	0.01032	0.0016	0.0033	0.0003	0.034	0.483	0.2414	3.343	0.033
Closure - No pit discharge	Yr 30	8.2	64.0	0.1	974.7	11.492	0.022	0.15	0.0828	0.0195	0.0242	0.00004	0.0001	0.0284	0.0004	95.4	0.0006	0.0527	0.0179	0.896	0.0018	0.0058	1.912	0.069	0.000018	0.0642	0.0019	0.039	63.109	0.0009	2.69	0.00006	455.587	0.241	0.00017	0.01041	0.0016	0.0033	0.0003	0.032	0.488	0.2436	3.375	0.033
	Yr 31	8.2	64.2	0.1	983.2	11.589	0.021	0.15	0.0835	0.0195	0.0243	0.00004	0.0001	0.0285	0.0004	96.2	0.0006	0.0531	0.0181	0.903	0.0017	0.0059	1.915	0.067	0.000018	0.0647	0.0019	0.037	63.658	0.0009	2.66	0.00006	459.543	0.242	0.00017	0.01050	0.0015	0.0033	0.0003	0.030	0.492	0.2458	3.405	0.034
	Yr 32	8.2	64.3	0.1	987.7	11.641	0.030	0.15	0.0839	0.0196	0.0244	0.00004	0.0001	0.0286	0.0004	96.6	0.0006	0.0534	0.0182	0.907	0.0017	0.0059	1.917	0.065	0.000018	0.0649	0.0019	0.036	63.948	0.0009	2.65	0.00006	461.622	0.243	0.00017	0.01055	0.0015	0.0033	0.0003	0.029	0.494	0.2469	3.420	0.034
	Yr 33	8.2	64.3	0.1	984.3	11.605	0.132	0.15	0.0836	0.0195	0.0243	0.00004	0.0001	0.0285	0.0004	96.3	0.0006	0.0532	0.0181	0.904	0.0017	0.0059	1.921	0.065	0.000018	0.0647	0.0019	0.037	63.732	0.0009	2.68	0.00006	460.055	0.242	0.00017	0.01052	0.0015	0.0033	0.0003	0.029	0.493	0.2461	3.409	0.034
	Yr 34	8.2	64.3	0.1	981.4	11.575	0.233	0.15	0.0834	0.0195	0.0243	0.00004	0.0001	0.0285	0.0004	96.1	0.0006	0.0530	0.0181	0.902	0.0017	0.0059	1.925	0.065	0.000018	0.0645	0.0019	0.037	63.548	0.0009	2.70	0.00006	458.723	0.242	0.00017	0.01049	0.0015	0.0033	0.0003	0.030	0.491	0.2454	3.399	0.034
	Yr 35	8.2	64.3	0.1	978.9	11.549	0.334	0.15	0.0831	0.0194	0.0243	0.00004	0.0001	0.0284	0.0004	95.9	0.0006	0.0529	0.0180	0.900	0.0017	0.0059	1.928	0.065	0.000018	0.0643	0.0019	0.037	63.382	0.0009	2.72	0.00006	457.518	0.242	0.00017	0.01046	0.0015	0.0033	0.0003	0.030	0.490	0.2448	3.390	0.034
	Yr 36	8.2	64.2	0.1	976.3	11.522	0.434	0.15	0.0829	0.0194	0.0242	0.00004	0.0001	0.0283	0.0004	95.7	0.0006	0.0528	0.0180	0.898	0.0017	0.0059	1.931	0.065	0.000018	0.0642	0.0019	0.037	63.217	0.0009	2.74	0.00006	456.317	0.241	0.00017	0.01043	0.0015	0.0033	0.0003	0.030	0.489	0.2441	3.381	0.033
	Yr 37	8.2	64.2	0.1	973.7	11.495	0.535	0.15	0.0827	0.0193	0.0242	0.00004	0.0001	0.0283	0.0004	95.4	0.0006	0.0526	0.0179	0.896	0.0017	0.0059	1.935	0.065	0.000018	0.0640	0.0019	0.037	63.051	0.0009	2.76	0.00006	455.118	0.241	0.00017	0.01040	0.0015	0.0033	0.0003	0.030	0.488	0.2435	3.372	0.033
	Yr 38	8.2	64.2	0.1	971.1	11.469	0.635	0.15	0.0825	0.0193	0.0242	0.00004	0.0001	0.0282	0.0004	95.2	0.0006	0.0525	0.0179	0.894	0.0017	0.0058	1.938	0.065	0.000018	0.0638	0.0019	0.036	62.887	0.0009	2.78	0.00006	453.923	0.241	0.00017	0.01038	0.0015	0.0033	0.0003	0.030	0.486	0.2429	3.363	0.033
	Yr 39	8.2	64.2	0.1	968.6	11.442	0.735	0.15	0.0823	0.0192	0.0241	0.00004	0.0001	0.0281	0.0004	95.0	0.0006	0.0524	0.0178	0.892	0.0017	0.0058	1.942	0.065	0.000018	0.0637	0.0019	0.036	62.723	0.0009	2.80	0.00006	452.731	0.240	0.00017	0.01035	0.0015	0.0033	0.0003	0.030	0.485	0.2422	3.354	0.033
	Yr 40	8.2	64.2	0.1	966.0	11.416	0.834	0.15	0.0820	0.0192	0.0241	0.00004	0.0001	0.0281	0.0004	94.8	0.0006	0.0522	0.0178	0.890	0.0017	0.0058	1.945	0.065	0.000018	0.0635	0.0019	0.036	62.559	0.0009	2.82	0.00006	451.542	0.240	0.00017	0.01032	0.0015	0.0033	0.0003	0.030	0.484	0.2416	3.345	0.033
	Yr 41	8.2	64.2	0.1	963.5	11.389	0.934	0.15	0.0818	0.0191	0.0241	0.00004	0.0001	0.0280	0.0004	94.6	0.0006	0.0521	0.0177	0.888	0.0017	0.0058	1.948	0.065	0.000018	0.0633	0.0019	0.036	62.396	0.0009	2.84	0.00006	450.356	0.240	0.00017	0.01030	0.0015	0.0032	0.0003	0.031	0.483	0.2410	3.336	0.033
	Yr 42	8.2	64.2	0.1	960.9	11.363	1.033	0.15	0.0816	0.0191	0.0240	0.00004	0.0001	0.0279	0.0004	94.4	0.0006	0.0519	0.0177	0.886	0.0017	0.0058	1.952	0.065	0.000018	0.0632	0.0019	0.036	62.233	0.0009	2.86	0.00006	449.173	0.239	0.00017	0.01027	0.0015	0.0032	0.0003	0.031	0.481	0.2404	3.328	0.033
	Yr 43	8.2	64.2	0.1	958.4	11.337	1.132	0.15	0.0814	0.0190	0.0240	0.00004	0.0001	0.0279	0.0004	94.2	0.0006	0.0518	0.0176	0.884	0.0017	0.0058	1.955	0.065	0.000018	0.0630	0.0019	0.036	62.070	0.0009	2.88	0.00006	447.993	0.239	0.00017	0.01024	0.0015	0.0032	0.0003	0.031	0.480	0.2397	3.319	0.033
	Yr 44	8.2	64.1	0.1	955.8	11.311	1.231	0.15	0.0812	0.0190	0.0240	0.00004	0.0001	0.0278	0.0004	94.0	0.0006	0.0517	0.0176	0.882	0.0017	0.0058	1.958	0.065	0.000018	0.0628	0.0019	0.036	61.908	0.0009	2.90	0.00006	446.817	0.239	0.00017	0.01022	0.0015	0.0032	0.0003	0.031	0.479	0.2391	3.310	0.033
	Yr 45	8.2	64.1	0.1	953.3	11.285	1.329	0.15	0.0810	0.0189	0.0239	0.00004	0.0001	0.0277	0.0004	93.8	0.0006	0.0515	0.0176	0.880	0.0017	0.0058	1.961	0.065	0.000018	0.0627	0.0019	0.036	61.747	0.0009	2.92	0.00006	445.644	0.238	0.00017	0.01019	0.0015	0.0032	0.0003	0.031	0.478	0.2385	3.301	0.033
	Yr 46	8.2	64.1	0.1	950.8	11.259	1.427	0.15	0.0808	0.0189	0.0239	0.00004	0.0001	0.0276	0.0004	93.6	0.0006	0.0514	0.0175	0.878	0.0018	0.0058	1.965	0.065	0.000018	0.0625	0.0019	0.036	61.586	0.0009	2.94	0.00006	444.474	0.238	0.00017	0.01016	0.0015	0.0032	0.0003	0.031	0.476	0.2379	3.293	0.033
	Yr 47	8.2	64.1	0.1	948.3	11.233	1.493	0.16	0.0805	0.0188	0.0239	0.00004	0.0001	0.0276	0.0004	93.4	0.0006	0.0513	0.0175	0.876	0.0018	0.0058	1.968	0.065	0.000018	0.0624	0.0019	0.036	61.425	0.0009	2.96	0.00006	443.306	0.238	0.00017	0.01014	0.0015	0.0032	0.0003	0.031	0.475	0.2373	3.284	0.033
	Yr 48	8.2	64.1	0.1	945.8	11.207	1.490	0.16	0.0803	0.0188	0.0238	0.00004	0.0001	0.0275	0.0004	93.2	0.0006	0.0511	0.0174	0.875	0.0018	0.0057	1.971	0.065	0.000018	0.0622	0.0019	0.036	61.264	0.0009	2.98	0.00006	442.142	0.237	0.00017	0.01011	0.0015	0.0032	0.0003	0.031	0.474	0.2366	3.275	0.033
	Yr 49	8.2	64.1	0.1	943.3	11.181	1.486	0.16	0.0801	0.0187	0.0238	0.00004	0.0001	0.0274	0.0004	93.0	0.0006	0.0510	0.0174	0.873	0.0018	0.0057	1.975	0.065	0.000018	0.0620	0.0019	0.036	61.105	0.0009	3.00	0.00006	440.982	0.237	0.00017	0.01008	0.0015	0.0032	0.0003	0.032	0.473	0.2360	3.266	0.033
	Yr 50	8.2	64.1	0.1	940.8	11.155	1.483	0.16	0.0799	0.0187	0.0238	0.00004	0.0001	0.0274	0.0004	92.7	0.0006	0.0509	0.0173	0.871	0.0018	0.0057	1.978	0.065	0.000018	0.0619	0.0019	0.036	60.945	0.0009	3.02	0.00006	439.824	0.237	0.00017	0.01006	0.0015	0.0032	0.0003	0.032	0.471	0.2354	3.258	0.033
	Yr 51	8.2	64.1	0.1	938.3	11.129	1.480	0.16	0.0797	0.0186	0.0237	0.00004	0.0001	0.0273	0.0004	92.5	0.0006	0.0507	0.0173	0.869	0.0018	0.0057	1.981	0.064	0.000018	0.0617	0.0019	0.036	60.786	0.0009	3.04	0.00006	438.669	0.236	0.00017	0.01003	0.0015	0.0032	0.0003	0.032	0.470	0.2348	3.249	0.033
	Yr 52	8.2	64.0	0.1	935.9

Table 1. Base Case - Perfect Segregation (mg/L)

	Acidity	Alkalinity	Sulphate	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn
Year 1	0.80	25.23	1.27	0.07640	0.00004	0.00030	0.00489	0.00008	0.00040	0.00080	0.00001	6.853	0.00026	0.00002	0.00022	0.05263	0.00005	0.00080	1.35973	0.00184	0.00001	0.00035	0.00013	0.00832	0.40296	0.00048	4.37387	0.00004	1.91733	0.04680	0.400	0.00004	0.00008	0.00091	0.00014	0.00014	0.00206
Year 2	1.55	31.67	13.40	0.10394	0.00138	0.00414	0.00493	0.00012	0.00061	0.00570	0.00014	13.905	0.00048	0.00007	0.00045	0.06247	0.00007	0.00291	1.29041	0.00209	0.00001	0.00110	0.00037	0.15685	1.66590	0.00048	4.39705	0.00004	1.92344	0.07347	4.412	0.00005	0.00012	0.00580	0.00014	0.00062	0.00336
Year 3	2.89	42.12	35.86	0.15051	0.00385	0.01127	0.00472	0.00020	0.00098	0.01476	0.00037	26.596	0.00088	0.00016	0.00086	0.07758	0.00010	0.00678	1.07924	0.00245	0.00002	0.00245	0.00080	0.43241	3.98879	0.00046	4.17526	0.00004	1.81868	0.12020	11.844	0.00008	0.00020	0.01483	0.00011	0.00151	0.00564
Year 4	2.72	44.42	30.64	0.15384	0.00326	0.00959	0.00571	0.00019	0.00096	0.01271	0.00031	24.826	0.00083	0.00014	0.00080	0.08399	0.00010	0.00599	1.39123	0.00272	0.00002	0.00219	0.00072	0.36705	3.50161	0.00056	5.06768	0.00005	2.21171	0.11781	10.115	0.00008	0.00019	0.01281	0.00014	0.00132	0.00548
Year 5	2.79	38.57	35.87	0.13989	0.00387	0.01129	0.00402	0.00018	0.00092	0.01472	0.00037	25.718	0.00085	0.00015	0.00083	0.07011	0.00010	0.00670	0.88117	0.00219	0.00002	0.00241	0.00078	0.43361	3.95083	0.00039	3.54211	0.00003	1.54107	0.11385	11.851	0.00007	0.00018	0.01478	0.00009	0.00150	0.00536
Year 6	3.97	50.61	53.90	0.18821	0.00584	0.01699	0.00458	0.00025	0.00127	0.02204	0.00055	36.814	0.00120	0.00023	0.00119	0.08991	0.00013	0.00989	0.91507	0.00275	0.00002	0.00354	0.00114	0.65371	5.85560	0.00044	4.01455	0.00004	1.74218	0.15790	17.814	0.00010	0.00025	0.02209	0.00009	0.00223	0.00748
Year 7	3.32	39.90	46.55	0.15113	0.00506	0.01469	0.00320	0.00021	0.00104	0.01899	0.00048	30.842	0.00100	0.00019	0.00099	0.06965	0.00011	0.00845	0.57839	0.00210	0.00002	0.00302	0.00097	0.56561	5.01442	0.00031	2.78937	0.00003	1.20745	0.12953	15.386	0.00008	0.00021	0.01901	0.00006	0.00191	0.00616
Year 8	3.42	50.24	42.28	0.17919	0.00454	0.01328	0.00569	0.00023	0.00116	0.01741	0.00043	31.501	0.00104	0.00018	0.00101	0.09268	0.00012	0.00801	1.30476	0.00294	0.00002	0.00290	0.00094	0.50962	4.70902	0.00055	5.02604	0.00005	2.18956	0.14275	13.964	0.00009	0.00023	0.01750	0.00013	0.00179	0.00669
Year 9	3.82	44.53	54.52	0.17041	0.00594	0.01721	0.00330	0.00024	0.00118	0.02221	0.00056	35.576	0.00115	0.00022	0.00115	0.07695	0.00012	0.00985	0.55473	0.00229	0.00002	0.00351	0.00113	0.66313	5.84899	0.00032	2.87465	0.00003	1.24217	0.14777	18.023	0.00009	0.00024	0.02223	0.00005	0.00223	0.00704
Year 10	5.47	60.84	79.99	0.23660	0.00873	0.02528	0.00396	0.00033	0.00167	0.03254	0.00082	51.080	0.00165	0.00033	0.00165	0.10346	0.00017	0.01434	0.56396	0.00304	0.00003	0.00510	0.00164	0.97431	8.53247	0.00038	3.41850	0.00004	1.47211	0.20876	26.448	0.00012	0.00033	0.03255	0.00005	0.00326	0.00997
Year 11	5.58	66.36	78.78	0.25229	0.00857	0.02487	0.00518	0.00035	0.00174	0.03212	0.00081	51.911	0.00169	0.00033	0.00167	0.11542	0.00018	0.01427	0.91366	0.00346	0.00003	0.00509	0.00164	0.95769	8.47446	0.00050	4.51237	0.00005	1.95213	0.21714	26.043	0.00013	0.00035	0.03216	0.00009	0.00323	0.01033
Year 12	5.12	61.38	71.92	0.23271	0.00782	0.02270	0.00488	0.00032	0.00160	0.02933	0.00074	47.587	0.00155	0.00030	0.00153	0.10705	0.00016	0.01305	0.87879	0.00322	0.00003	0.00466	0.00150	0.87399	7.74477	0.00047	4.26222	0.00004	1.84474	0.19966	23.773	0.00012	0.00032	0.02937	0.00008	0.00296	0.00949
Year 13	5.22	72.40	67.00	0.26237	0.00723	0.02108	0.00758	0.00035	0.00173	0.02750	0.00069	48.124	0.00159	0.00029	0.00155	0.13172	0.00018	0.01252	1.66615	0.00412	0.00003	0.00451	0.00146	0.80975	7.38305	0.00074	6.68083	0.00007	2.90685	0.21329	22.135	0.00013	0.00035	0.02761	0.00017	0.00281	0.01004
Year 14	4.90	69.36	62.13	0.24996	0.00669	0.01954	0.00747	0.00033	0.00164	0.02553	0.00064	45.181	0.00149	0.00027	0.00146	0.12682	0.00017	0.01166	1.66887	0.00399	0.00003	0.00421	0.00137	0.75025	6.87109	0.00073	6.59123	0.00006	2.86919	0.20178	20.524	0.00013	0.00033	0.02564	0.00017	0.00261	0.00948
Year 15	4.62	66.31	57.91	0.23794	0.00623	0.01820	0.00729	0.00031	0.00155	0.02382	0.00060	42.526	0.00141	0.00025	0.00137	0.12168	0.00016	0.01091	1.64746	0.00384	0.00003	0.00394	0.00128	0.69886	6.42301	0.00071	6.43762	0.00006	2.80325	0.19104	19.130	0.00012	0.00031	0.02393	0.00017	0.00244	0.00897
Year 16	4.37	63.64	54.23	0.22745	0.00583	0.01704	0.00713	0.00030	0.00148	0.02232	0.00056	40.209	0.00133	0.00024	0.00129	0.11720	0.00015	0.01025	1.62877	0.00371	0.00003	0.00371	0.00121	0.65400	6.03200	0.00070	6.30358	0.00006	2.74571	0.18167	17.914	0.00012	0.00030	0.02243	0.00017	0.00229	0.00852
Year 17	4.25	64.45	51.17	0.22781	0.00548	0.01606	0.00761	0.00029	0.00146	0.02111	0.00053	39.036	0.00130	0.00022	0.00126	0.11985	0.00015	0.00978	1.78237	0.00382	0.00003	0.00355	0.00116	0.61576	5.73993	0.00074	6.73292	0.00007	2.93498	0.17932	16.898	0.00012	0.00029	0.02123	0.00018	0.00218	0.00839
Year 18	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 19	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 20	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 21	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 22	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 23	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 24	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 25	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 26	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 27	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 28	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 29	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 30	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 31	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Year 32	4.14	63.24	49.50	0.22303	0.00530	0.01553	0.00754	0.00029	0.00143	0.02043	0.00051	37.982	0.00126	0.00022	0.00122	0.11780	0.00015	0.00948	1.77386	0.00376	0.00003	0.00344	0.00112	0.59535	5.56192	0.00074	6.67189	0.00006	2.90879	0.17505	16.345	0.00011	0.00029	0.02055	0.00018	0.00211	0.00818
Seepage to Creek 661@ Year 400	0.20697	3.16199	2.47481	0.01115	0.00026	0.00078	0.00038	0.00001	0.00007	0.00102	0.00003	1.89908	0.00006	0.00001	0.00006	0.00589	0.00001	0.00047	0.08869	0.00019	0.00000	0.00017	0.00006	0.02977	0.27810	0.00004	0.33359	0.00000	0.14544	0.00875	0.81723	0.00001	0.00001	0.00103	0.00001	0.00011	0.00041

Table 2. 1% Imperfect Segregation (mg/L)

	Acidity	Alkalinity	Sulphate	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn
Year 1	0.80	25.23	1.27	0.07640	0.00004	0.00030	0.00489	0.00008	0.00040	0.00080	0.00001	6.853	0.00026	0.00002	0.00022	0.05263	0.00005	0.00080	1.35973	0.00184	0.00001	0.00035	0.00013	0.00832	0.40296	0.00048	4.37387	0.00004	1.91733	0.04680	0.400	0.00004	0.00008	0.00091	0.00014	0.00014	0.00206
Year 2	1.63	31.69	13.46	0.10906	0.00145	0.00412	0.00497	0.00012	0.00061	0.00576	0.00020	13.906	0.00048	0.00010	0.00051	0.06291	0.00138	0.00292	1.29419	0.00711	0.00001	0.00109	0.00042	0.15832	1.66752	0.00048	4.41369	0.00004	1.92451	0.07343	4.436	0.00005	0.00012	0.00585	0.00014	0.00063	0.01380
Year 3	3.11	42.17	36.03	0.16514	0.00406	0.01122	0.00484	0.00020	0.00098	0.01492	0.00055	26.599	0.00089	0.00026	0.00104	0.07885	0.00386	0.00680	1.09003	0.01681	0.00002	0.00245	0.00095	0.43661	3.99341	0.00046	4.22282	0.00004	1.82173	0.12007	11.914	0.00008	0.00020	0.01497	0.00012	0.00153	0.03550
Year 4	2.90	44.46	30.79	0.16616	0.00343	0.00955	0.00581	0.00020	0.00097	0.01285	0.00047	24.828	0.00084	0.00023	0.00095	0.08506	0.00327	0.00601	1.40031	0.01480	0.00002	0.00219	0.00085	0.37059	3.50551	0.00056	5.10773	0.00005	2.21428	0.11771	10.174	0.00008	0.00019	0.01293	0.00015	0.00134	0.03062
Year 5	3.01	38.62	36.04	0.15460	0.00408	0.01124	0.00414	0.00019	0.00093	0.01488	0.00055	25.720	0.00086	0.00026	0.00101	0.07139	0.00388	0.00672	0.89202	0.01663	0.00002	0.00241	0.00094	0.43783	3.95549	0.00039	3.58994	0.00004	1.54413	0.11372	11.921	0.00007	0.00019	0.01492	0.00010	0.00152	0.03539
Year 6	4.31	50.68	54.16	0.21047	0.00616	0.01692	0.00475	0.00026	0.00128	0.02228	0.00083	36.818	0.00122	0.00038	0.00147	0.09185	0.00585	0.00993	0.93149	0.02460	0.00002	0.00354	0.00138	0.66011	5.86265	0.00045	4.08694	0.00004	1.74682	0.15771	17.920	0.00010	0.00026	0.02230	0.00010	0.00226	0.05293
Year 7	3.61	39.96	46.77	0.17043	0.00534	0.01463	0.00335	0.00021	0.00105	0.01920	0.00072	30.845	0.00102	0.00033	0.00124	0.07132	0.00507	0.00848	0.59264	0.02104	0.00002	0.00301	0.00117	0.57115	5.02054	0.00031	2.85215	0.00003	1.21147	0.12937	15.478	0.00008	0.00021	0.01920	0.00006	0.00194	0.04558
Year 8	3.69	50.29	42.48	0.19642	0.00479	0.01323	0.00582	0.00024	0.00117	0.01760	0.00065	31.504	0.00106	0.00031	0.00123	0.09418	0.00455	0.00804	1.31748	0.01984	0.00002	0.00289	0.00112	0.51457	4.71448	0.00056	5.08207	0.00005	2.19315	0.14260	14.046	0.00009	0.00023	0.01766	0.00014	0.00181	0.04187
Year 9	4.16	44.60	54.78	0.19307	0.00626	0.01714	0.00349	0.00024	0.00120	0.02246	0.00084	35.580	0.00117	0.00038	0.00143	0.07891	0.00595	0.00989	0.57144	0.02453	0.00002	0.00350	0.00136	0.66964	5.85616	0.00032	2.94833	0.00003	1.24689	0.14757	18.131	0.00009	0.00024	0.02245	0.00006	0.00226	0.05331
Year 10	5.98	60.95	80.38	0.26994	0.00920	0.02517	0.00422	0.00034	0.00169	0.03290	0.00124	51.086	0.00167	0.00056	0.00207	0.10636	0.00874	0.01440	0.58857	0.03576	0.00003	0.00509	0.00198	0.98389	8.54303	0.00038	3.52694	0.00004	1.47906	0.20848	26.607	0.00012	0.00034	0.03287	0.00007	0.00330	0.07806
Year 11	6.08	66.46	79.17	0.28499	0.00904	0.02476	0.00544	0.00036	0.00176	0.03248	0.00122	51.917	0.00171	0.00056	0.00209	0.11826	0.00858	0.01433	0.93779	0.03555	0.00003	0.00508	0.00198	0.96708	8.48481	0.00050	4.61871	0.00005	1.95894	0.21686	26.199	0.00013	0.00035	0.03248	0.00010	0.00327	0.07710
Year 12	5.57	61.47	72.27	0.26254	0.00825	0.02260	0.00512	0.00033	0.00162	0.02966	0.00111	47.592	0.00157	0.00051	0.00191	0.10964	0.00783	0.01310	0.90080	0.03250	0.00003	0.00465	0.00181	0.88256	7.75421	0.00048	4.35924	0.00005	1.85096	0.19941	23.915	0.00012	0.00032	0.02966	0.00010	0.00299	0.07041
Year 13	5.63	72.49	67.32	0.28983	0.00761	0.02099	0.00780	0.00035	0.00174	0.02780	0.00103	48.129	0.00160	0.00048	0.00190	0.13410	0.00724	0.01257	1.68641	0.03107	0.00003	0.00450	0.00175	0.81763	7.39174	0.00074	6.77013	0.00007	2.91257	0.21306	22.265	0.00014	0.00035	0.02787	0.00018	0.00284	0.06611
Year 14	5.29	69.45	62.43	0.27538	0.00705	0.01945	0.00767	0.00033	0.00165	0.02581	0.00095	45.185	0.00151	0.00045	0.00177	0.12903	0.00671	0.01170	1.68762	0.02893	0.00003	0.00420	0.00163	0.75755	6.87913	0.00073	6.67389	0.00007	2.87449	0.20156	20.645	0.00013	0.00033	0.02588	0.00018	0.00264	0.06138
Year 15	4.98	66.38	58.19	0.26160	0.00657	0.01813	0.00748	0.00032	0.00156	0.02407	0.00089	42.530	0.00142	0.00042	0.00167	0.12373	0.00624	0.01095	1.66491	0.02705	0.00003	0.00393	0.00153	0.70565	6.43050	0.00071	6.51456	0.00006	2.80818	0.19084	19.243	0.00012	0.00031	0.02415	0.00018	0.00247	0.05727
Year 16	4.70	63.71	54.49	0.24957	0.00614	0.01697	0.00731	0.00030	0.00149	0.02256	0.00083	40.213	0.00135	0.00039	0.00157	0.11912	0.00584	0.01029	1.64509	0.02542	0.00003	0.00370	0.00144	0.66036	6.03900	0.00070	6.37551	0.00006	2.75032	0.18149	18.019	0.00012	0.00030	0.02264	0.00018	0.00232	0.05369
Year 17	4.57	64.52	51.41	0.24858	0.00578	0.01599	0.00777	0.00030	0.00147	0.02134	0.00078	39.040	0.00131	0.00037	0.00152	0.12165	0.00549	0.00981	1.79770	0.02421	0.00003	0.00354	0.00137	0.62173	5.74651	0.00074	6.80048	0.00007	2.93931	0.17914	16.997	0.00012	0.00029	0.02143	0.00019	0.00220	0.05081
Year 18	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 19	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 20	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 21	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 22	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 23	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 24	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 25	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 26	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 27	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 28	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 29	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 30	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 31	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Year 32	4.44	63.30	49.73	0.24311	0.00558	0.01546	0.00770	0.00029	0.00144	0.02065	0.00076	37.985	0.00128	0.00036	0.00147	0.11955	0.00531	0.00951	1.78867	0.02346	0.00003	0.00344	0.00133	0.60111	5.56827	0.00074	6.73718	0.00007	2.91297	0.17488	16.440	0.00012	0.00029	0.02075	0.00019	0.00213	0.04917
Seepage to Creek 661@ Year 400	0.22218	3.16522	2.48659	0.01216	0.00028	0.00077	0.00038	0.00001	0.00007	0.00103	0.00004	1.89925	0.00006	0.00002	0.00007	0.00598	0.00027	0.00048	0.08943	0.00117	0.00000	0.00017	0.00007	0.03006	0.27841	0.00004	0.33686	0.00000	0.14565	0.00874	0.82200	0.00001	0.00001	0.00104	0.00001	0.00011	0.00246

Table 3. 3.3% Imperfect Segregation (mg/L)

	Acidity	Alkalinity	Sulphate	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn
Year 1	0.80	25.23	1.27	0.07640	0.00004	0.00030	0.00489	0.00008	0.00040	0.00080	0.00001	6.853	0.00026	0.00002	0.00022	0.05263	0.00005	0.00080	1.35973	0.00184	0.00001	0.00035	0.00013	0.00832	0.40296	0.00048	4.37387	0.00004	1.91733	0.04680	0.400	0.00004	0.00008	0.00091	0.00014	0.00014	0.00206
Year 2	1.80	31.72	13.59	0.12083	0.00161	0.00409	0.00507	0.00013	0.00062	0.00588	0.00035	13.908	0.00049	0.00019	0.00066	0.06393	0.00441	0.00294	1.30287	0.01866	0.00001	0.00109	0.00054	0.16170	1.67124	0.00049	4.45195	0.00004	1.92696	0.07333	4.492	0.00005	0.00012	0.00596	0.00014	0.00064	0.03783
Year 3	3.62	42.27	36.43	0.19878	0.00454	0.01111	0.00511	0.00021	0.00100	0.01528	0.00097	26.605	0.00091	0.00050	0.00146	0.08177	0.01251	0.00686	1.11484	0.04982	0.00002	0.00244	0.00130	0.44627	4.00406	0.00047	4.33221	0.00004	1.82874	0.11979	12.074	0.00008	0.00020	0.01529	0.00013	0.00157	0.10418
Year 4	3.33	44.55	31.12	0.19448	0.00383	0.00946	0.00604	0.00021	0.00099	0.01315	0.00082	24.833	0.00086	0.00043	0.00131	0.08752	0.01055	0.00606	1.42121	0.04260	0.00002	0.00218	0.00114	0.37872	3.51447	0.00056	5.19983	0.00005	2.22018	0.11747	10.309	0.00008	0.00020	0.01320	0.00016	0.00137	0.08846
Year 5	3.52	38.72	36.44	0.18843	0.00456	0.01113	0.00441	0.00020	0.00095	0.01525	0.00097	25.726	0.00088	0.00050	0.00144	0.07433	0.01257	0.00678	0.91698	0.04982	0.00002	0.00240	0.00129	0.44755	3.96620	0.00040	3.69995	0.00004	1.55118	0.11344	12.082	0.00007	0.00019	0.01524	0.00011	0.00156	0.10446
Year 6	5.08	50.84	54.76	0.26167	0.00688	0.01675	0.00516	0.00028	0.00131	0.02284	0.00147	36.827	0.00125	0.00075	0.00211	0.09629	0.01902	0.01002	0.96927	0.07484	0.00003	0.00352	0.00191	0.67481	5.87885	0.00045	4.25344	0.00004	1.75749	0.15728	18.164	0.00010	0.00026	0.02279	0.00012	0.00231	0.15747
Year 7	4.28	40.10	47.29	0.21484	0.00596	0.01448	0.00370	0.00023	0.00107	0.01968	0.00127	30.853	0.00105	0.00064	0.00180	0.07518	0.01648	0.00856	0.62539	0.06461	0.00002	0.00299	0.00163	0.58391	5.03459	0.00032	2.99654	0.00003	1.22073	0.12899	15.689	0.00008	0.00021	0.01962	0.00009	0.00198	0.13624
Year 8	4.29	50.42	42.94	0.23605	0.00535	0.01310	0.00614	0.00025	0.00119	0.01803	0.00114	31.511	0.00108	0.00059	0.00173	0.09762	0.01474	0.00811	1.34671	0.05873	0.00002	0.00288	0.00153	0.52596	4.72702	0.00056	5.21093	0.00005	2.20141	0.14227	14.234	0.00010	0.00024	0.01804	0.00016	0.00185	0.12279
Year 9	4.95	44.77	55.40	0.24519	0.00700	0.01697	0.00390	0.00026	0.00123	0.02302	0.00149	35.589	0.00120	0.00075	0.00209	0.08344	0.01934	0.00998	0.60990	0.07568	0.00002	0.00348	0.00190	0.68461	5.87266	0.00033	3.11782	0.00003	1.25776	0.14714	18.379	0.00009	0.00025	0.02295	0.00009	0.00232	0.15972
Year 10	7.14	61.20	81.28	0.34664	0.01029	0.02492	0.00483	0.00037	0.00173	0.03373	0.00219	51.100	0.00173	0.00110	0.00303	0.11302	0.02846	0.01454	0.64515	0.11102	0.00003	0.00506	0.00278	1.00592	8.56730	0.00039	3.77635	0.00004	1.49504	0.20783	26.972	0.00013	0.00035	0.03360	0.00010	0.00338	0.23466
Year 11	7.22	66.70	80.05	0.36021	0.01010	0.02452	0.00604	0.00038	0.00180	0.03329	0.00215	51.930	0.00176	0.00109	0.00303	0.12479	0.02792	0.01447	0.99328	0.10936	0.00004	0.00506	0.00276	0.98869	8.50862	0.00051	4.86330	0.00005	1.97462	0.21623	26.556	0.00013	0.00036	0.03320	0.00014	0.00336	0.23068
Year 12	6.61	61.69	73.07	0.33116	0.00922	0.02238	0.00567	0.00035	0.00166	0.03040	0.00196	47.604	0.00161	0.00099	0.00277	0.11560	0.02547	0.01323	0.95142	0.09983	0.00003	0.00462	0.00252	0.90227	7.77593	0.00048	4.58238	0.00005	1.86527	0.19883	24.241	0.00012	0.00033	0.03031	0.00013	0.00307	0.21052
Year 13	6.59	72.69	68.06	0.35300	0.00851	0.02079	0.00830	0.00037	0.00178	0.02849	0.00181	48.140	0.00165	0.00093	0.00269	0.13959	0.02348	0.01268	1.73301	0.09305	0.00003	0.00448	0.00240	0.83578	7.41174	0.00075	6.97553	0.00007	2.92574	0.21253	22.566	0.00014	0.00036	0.02848	0.00021	0.00291	0.19508
Year 14	6.17	69.63	63.11	0.33385	0.00788	0.01927	0.00814	0.00035	0.00168	0.02644	0.00168	45.196	0.00155	0.00086	0.00251	0.13410	0.02174	0.01181	1.73076	0.08630	0.00003	0.00418	0.00224	0.77434	6.89764	0.00074	6.86400	0.00007	2.88667	0.20107	20.924	0.00013	0.00034	0.02644	0.00021	0.00271	0.18075
Year 15	5.80	66.56	58.83	0.31601	0.00734	0.01795	0.00791	0.00033	0.00159	0.02467	0.00156	42.539	0.00146	0.00080	0.00235	0.12846	0.02023	0.01105	1.70505	0.08045	0.00003	0.00391	0.00209	0.72128	6.44772	0.00072	6.69150	0.00007	2.81952	0.19038	19.502	0.00013	0.00032	0.02467	0.00020	0.00253	0.16838
Year 16	5.48	63.87	55.09	0.30045	0.00686	0.01680	0.00772	0.00032	0.00152	0.02312	0.00146	40.222	0.00138	0.00075	0.00221	0.12353	0.01892	0.01038	1.68262	0.07534	0.00003	0.00368	0.00196	0.67497	6.05510	0.00070	6.54096	0.00006	2.76093	0.18106	18.261	0.00012	0.00030	0.02313	0.00020	0.00237	0.15757
Year 17	5.29	64.68	51.98	0.29637	0.00645	0.01584	0.00815	0.00031	0.00150	0.02186	0.00138	39.048	0.00134	0.00071	0.00212	0.12580	0.01778	0.00990	1.83295	0.07110	0.00003	0.00352	0.00187	0.63546	5.76163	0.00075	6.95586	0.00007	2.94927	0.17874	17.225	0.00012	0.00030	0.02189	0.00022	0.00225	0.14837
Year 18	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 19	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 20	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 21	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 22	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 23	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 24	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 25	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 26	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 27	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 28	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 29	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 30	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 31	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Year 32	5.14	63.45	50.27	0.28928	0.00624	0.01532	0.00806	0.00031	0.00146	0.02115	0.00133	37.993	0.00131	0.00069	0.00206	0.12355	0.01718	0.00960	1.82274	0.06878	0.00003	0.00342	0.00181	0.61437	5.58289	0.00074	6.88733	0.00007	2.92260	0.17449	16.660	0.00012	0.00029	0.02119	0.00021	0.00218	0.14345
Seepage to Creek 661@ Year 400	0.25718	3.17265	2.51369	0.01446	0.00031	0.00077	0.00040	0.00002	0.00007	0.00106	0.00007	1.89966	0.00007	0.00003	0.00010	0.00618	0.00086	0.00048	0.09114	0.00344	0.00000	0.00017	0.00009	0.03072	0.27914	0.00004	0.34437	0.00000	0.14613	0.00872	0.83299	0.00001	0.00001	0.00106	0.00001	0.00011	0.00717

ANNEX 13
Lorax Environmental Conceptual TSF Model and Metal Sorption Potential of Natural Substrates Underlying the Blackwater TSF

newgold

Blackwater Gold Project: Conceptual Model for Contaminant Transport and Behaviour in Tailings Storage Facility

Report prepared for:
New Gold Inc.
Suite 1800, Two Bentall Centre 555 Burrard Street
Vancouver, B.C., V7X 1M9

Report prepared by:
Lorax Environmental Services
2289 Burrard St.
Vancouver, B.C., V6J 3H9

November 25, 2013

FINAL

LORAX ENVIRONMENTAL

Executive Summary

newgold

Executive Summary

Tailings and a majority of waste rock (potentially acid generating and metal leaching fraction) from the Blackwater mine will be stored subaqueously in the proposed Blackwater tailings storage facility (TSF). There will be no discharge of TSF supernatant during the 17 year operating and early stages (18 years) closure periods. The majority of the seepage from the TSF will be collected and recycled during these periods but about 2 L/s of unreceovered seepage might discharge to the environment. Therefore, seepage management is a focus of water and waste management planning. In order to provide insight into the origin, behaviour and fate of mine-related contaminants associated with the TSF, a qualitative conceptual model was developed that links contaminant sources, seepage pathways, attenuation processes, water management and contingency planning.

Potential contaminant sources associated with the TSF include those associated with the tailings supernatant as well as those associated with neutral-pH metal leaching that may occur post-deposition (pH- and/or redox-controlled dissolution of metal-bearing tailings and waste rock components). In contrast, metal leaching associated with ARD is less relevant given that the TSF will be engineered to ensure that the reactive (transition/sulfide) tailings materials remain saturated below the final water table elevation where oxygen transfer will be severely limited.

During operations, the quality of porewaters within the TSF and corresponding seepage waters will be largely governed by the composition of tailings supernatant. However, the supernatant signature will be altered within the pond environment due to the breakdown of cyanide compounds, metal removal following degradation of metal-cyanide complexes, and re-carbonation from the atmosphere. The degradation of cyanide and cyanate will also contribute to elevated ammonia levels within the pond environment during operations. From the pond system, waters will migrate downward through the saturated tailings and waste rock mass. Within suboxic zones of the saturated tailings and waste rock, the reductive dissolution of redox-sensitive phases (*e.g.*, secondary Fe oxides that form in the mill/treatment process) will result in an increase in dissolved Fe in porewaters. This mechanism may also promote increases in the concentration of other elements (*e.g.*, Zn, Cu and Cd) that show associations with Fe oxides.

Mineralogical and sequential extraction data for the sulfide tailings suggest that Zn and Cd occur dominantly as primary and secondary sulfide minerals, with minor to negligible amounts associated with reducible phases (*e.g.,* Fe oxides). In contrast, the transition/oxide zone materials are characterized by a mixed mineral assemblage containing both oxidizable and reducible Cd and Zn phases. In this regard, the

oxide/transition materials have a greater potential for redox- and pH-driven dissolution of metal-bearing components. Overall, however, the generally low abundance of redox-sensitive phases (*e.g.*, Fe oxides) identified in tailings and waste rock samples suggest that reductive dissolution processes will not have a profound effect on the concentration of trace elements in porewaters (*e.g.*, Cd, Zn). Given the low abundance of soluble Cd-Zn phases associated with the tailings, the potential relevance of pH-dependent dissolution processes is predicted to be low, and less significant in comparison to redox-related mechanisms.

At the base of the impoundment where tailings and waste rock are in contact with remnant vegetation and organic soils, there is an increased potential for sulfate reduction and the precipitation of secondary metal sulfides. The introduction of suboxic waters from the TSF into the underlying groundwater system may result in the development of a suboxic plume in the natural aquifer. This seepage plume may be characterized by elevated concentrations of Fe, Mn, ammonia and possibly trace metals in comparison to background conditions. The results of adsorption testwork indicate that the substrates underlying the TSF afford significant potential for the attenuation of Cd and Zn. This imparts an element of conservatism into water quality predictions that do not account for trace element removal along seepage pathways.

A suite of mitigation measures have been developed by New Gold and their consultants to minimize both the volume and contamination of the seepage through impoundment design (maintenance of permanent saturation), water management (seepage cutoff, interception, collection and pumpback), active (SO_2/air treatment) and passive treatment (wetlands). These features, as well as contingency measures (passive and active treatment), are discussed with respect to both operations and closure. Overall, the mitigation and contingency framework will provide for multiple levels of control with regards to the potential for downstream impacts.

Table of Contents

newgold

Table of Contents

EXECUTIVE SUMMARY i

TABLE OF CONTENTS iii

1. BACKGROUND AND OBJECTIVES

2. POTENTIAL CONTAMINANT SOURCES
   - 2.1 TAILINGS SUPERNATANT 2-1
   - 2.2 TAILINGS AND WASTE ROCK SOLID PHASE GEOCHEMISTRY 2-7
     - **2.2.1** WASTE ROCK 2-8
     - **2.2.2** TAILINGS 2-9
     - **2.2.3** POST-DEPOSITIONAL REMOBILIZATION 2-14
       - 2.2.3.1 REDOX-RELATED PROCESSES 2-14
       - 2.2.3.2 pH-RELATED PROCESSES 2-18
       - 2.2.3.3 SULFIDE OXIDATION 2-19
   - 2.3 DAM AND COVER CONSTRUCTION MATERIALS 2-19
   - 2.4 LOW GRADE STOCKPILE DRAINAGE 2-21

3. POTENTIAL ATTENUATION PROCESSES
   - 3.1 ATTENUATION PROCESSES WITHIN THE TSF POND 3-1
   - 3.2 ATTENUATION WITHIN TAILINGS AND WASTE ROCK POREWATERS 3-1
   - 3.3 SORPTION WITHIN NATURAL SUBSTRATES 3-3
   - 3.4 ENGINEERED WETLANDS 3-4

4. CONTAMINANT BEHAVIOUR ALONG SEEPAGE PATHWAYS
   - 4.1 OPERATIONS 4-1
   - 4.2 POST CLOSURE 4-6

5. CONTINGENCY MEASURES, MONITORING AND CONFIRMATORY TESTWORK
   - 5.1 CONTINGENCY MEASURES 5-1
   - 5.2 MONITORING 5-3
   - 5.3 CONFIRMATORY TESTWORK 5-4

REFERENCES R-1

APPENDIX A: BLACKWATER GOLD PROJECT – MINERALOGICAL CHARACTERIZATION OF WASTE ROCK AND TAILINGS

LIST OF FIGURES

FIGURE 2-1 CYANIDE CYCLING MECHANISMS (FROM SMITH AND MUDDER, 1991). 2-4

FIGURE 2-2 CHANGES IN PH AND CONCENTRATION OF TOTAL CN, WAD-CN, CNO, CNS, AMMONIA-N AND TOTAL AND DISSOLVED TRACE ELEMENTS (CD, CU, FE AND ZN) IN DECANTED TAILINGS SUPERNATANT IN RESPONSE TO 39-DAY AGEING EXPERIMENT. TAILINGS POREWATER DATA (AFTER 39 DAYS OF AGEING) ARE PRESENTED FOR COMPARISON. 2-5

FIGURE 2-3 SOLUBILITY OF VARIOUS METAL HYDROXIDES (FROM VACHON *ET AL.*, 1987). 2-6

FIGURE 2-4 SEQUENTIAL EXTRACTION DATA FOR ORE SAMPLES BY OXIDATION FACIES (OXIDE, TRANSITION AND SULFIDE) FOR ZN (ABOVE) AND CD (BELOW). 2-12

FIGURE 2-5 SEQUENTIAL EXTRACTION DATA FOR TAILINGS SAMPLES BY OXIDATION FACIES (TRANSITION AND SULFIDE) FOR ZN AND CD. 2-13

FIGURE 2-6 COLUMN EFFLUENT TIME SERIES DATA FOR SATURATED WASTE ROCK (PAG1 AND PAG2) FOR CONDUCTIVITY, PH, SULFATE AND HARDNESS. CYLCES ARE AT WEEKLY TIME STEPS. 2-16

FIGURE 2-7 COLUMN EFFLUENT TIME SERIES DATA FOR SATURATED WASTE ROCK (PAG1 AND PAG2) FOR DISSOLVED OXYGEN, IRON, MANGANESE, CADMIUM, COPPER, ZINC COBALT AND ARSENIC. CYLCES ARE AT WEEKLY TIME STEPS. 2-17

FIGURE 2-8 TONNAGE PRODUDCTION OF OXIDE ORE AS A FUNCTION OF MINE LIFE (YEAR 0-10) SHOWING TIME-DEPENDENT ORE PROPERTIES WITH RESPECT NET POTENTIAL RATIO (NPR), CADMIUM CONTENT AND ZINC CONTENT. 2-20

FIGURE 4-1 CONCEPTUAL MODEL FOR CONTAMINANT TRANSPORT AND BEHAVIOUR IN TAILINGS STORAGE FACILITY (OPERATIONS YEAR 6) 4-2

FIGURE 4-2 CONCEPTUAL MODEL FOR CONTAMINANT TRANSPORT AND BEHAVIOUR IN TAILINGS STORAGE FACILITY (POST CLOSURE) 4-3

LIST OF TABLES

TABLE 1-1 TYPES AND SOURCES OF INFORMATION USED IN THE DEVELOPMENT OF THE CONCEPTUAL BEHAVIOR AND TRANSPORT MODEL FOR THE BLACKWATER TAILINGS STORAGE FACILITY. 1-3

TABLE 2-1 TAILINGS SUPERNATANT COMPOSITION (TAILINGS SLURRY DECANT) FOR TRANSITION AND SULFIDE TAILINGS BASED ON MEDIAN VALUES FOLLOWING SO_2/AIR TREATMENT. 2-2

TABLE 2-2 SAMPLES SELECTED FOR MINERALOGICAL CHARACTERIZATION OF WASTE ROCK AND TAILINGS 2-8

TABLE 2-3 STATIC TEST DATA (MEDIAN VALUES) FOR OXIDE, TRANSITION AND SULFIDE ORE SAMPLES. 2-10

TABLE 2-4 SEQUENTIAL EXTRACTION STEPS USED FOR ANALYSIS OF OXIDE, TRANSITION AND SULFIDE ORES. 2-10

TABLE 3-1 OXIDATION/REDUCTION REACTIONS AS A FUNCTION OF REDOX POTENTIAL AND ENERGY YIELD. PARAMETERS MEASURED IN SOLUTION TO INFER REDOX CONDITIONS ARE HIGHLIGHTED IN BOLD. 3-2

1. Background and Objectives

newgold

1. Background and Objectives

Tailings and a majority of waste rock from the Blackwater mine will be stored sub-aqueously in the proposed Blackwater tailings storage facility (TSF). Of the tailings portion, sulfide tailings (~80% of the total) will dominate the tailings inventory, with transition (~18%) and oxide (~2%) fractions making up lower proportions. Sulfide tailings are potentially acid generating (PAG) with a median NPR <0.1 and relatively low sulfur (median of 1.1%). Similarly, waste rock will comprise primarily PAG materials (PAG 1 and PAG 2) with less high zinc metal leaching (ML) (NAG 3) and non-acid generating, low metal leaching (NAG4 and NAG5) waste rock as described by AMEC (2013). Subaqueous disposal of PAG tailings and PAG/ML waste rock within the TSF is a fundamental strategy to inhibit sulfide mineral oxidation, thereby minimizing loadings of metals, sulfate and acidity to surface and seepage flow paths. The management of seepage from the TSF is a central component of water and waste management planning at the Blackwater Project. In this regard, a suite of mitigation measures have been developed by New Gold and their consultants to minimize both the volume and contamination of the seepage through impoundment design (maintenance of permanent saturation), water management (seepage cutoff, interception, collection and pumpback), active (SO_2/air treatment) and passive treatment (wetlands) (as documented in the Application for an Environmental Assessment Certificate – New Gold, 2014). There will be no discharge of TSF supernatant during the 17 year operating and early stages (18 years) closure periods. The majority of the seepage from the TSF will be collected and recycled during these periods but about 2 L/s of unreceovered seepage might discharge to the environment.

The input of tailings process water in conjunction with neutral-pH metal leaching processes will contribute to some contamination of seepage waters that exit the TSF. For example, water quality degradation will occur in association with elevated metal concentrations in mill process waters, which will dominate porewater composition during operations. Furthermore, some degree of metal leaching will persist in the closure and post-closure period due to post-depositional reactions involving pH- and/or redox-sensitive secondary phases that may be generated within the mill circuit, as part of effluent treatment, or via waste rock/tailings weathering prior to submergence.

In order to provide insight into the origin, behaviour and fate of mine-related contaminants associated with the Blackwater TSF, a qualitative conceptual model was developed that links contaminant sources, seepage pathways, attenuation processes, water management and contingency planning. Specific objectives of this memorandum included the following:

- To delineate the biogeochemical processes governing the behaviour of tailings and PAG waste rock in permanently saturated settings;
- To describe the transport and behavior of contaminants along seepage pathways within the TSF and subsurface materials (underlying TSF and downstream);
- To assess the relative importance of the various biogeochemical processes contributing to porewater and seepage quality evolution; and
- To provide information in support of TSF water management and contingency planning.

To achieve these objectives, several sources of information were considered as outlined in Table 1-1. Data sources include the results of tailings supernatant testwork, tailings and waste rock geochemical evaluations, kinetic testwork (saturated column experiments), seepage transport modelling, and testwork in support of contaminant attenuation (*e.g.,* adsorption testwork). Data are presented in this memorandum and in the Application for an Environmental Assessment Certificate (New Gold, 2014).

In the following sections, the conceptual model for contaminant transport and behaviour is discussed with respect to contaminant sources, attenuation processes, and contaminant transport and behaviour. These concepts are then coupled to the temporal evolution of the TSF (operations to closure and post-closure) as it relates to water management, passive treatment and contingency planning.

Table 1-1:
Types and sources of information used in the development of the conceptual behavior and transport model for the Blackwater Tailings Storage Facility.

Information Type	Sub-Type	Source of Information
Ore processing	n/a	Preliminary Economic Assessment/Feasibility Study
Tailings supernatant chemistry	SO_2/air treatment testwork	New Gold, unpublished data
	Ageing testwork	New Gold, unpublished data
	Neutralization testwork	New Gold, unpublished data
	PAG waste rock acid production /neutralization water quality model	AMEC (2013)
	Tailings Supernatant Ageing Experiments	New Gold, unpublished data
Tailings and waste rock solid phase geochemistry	Whole rock analysis	AMEC (2013)
	Acid base accounting	AMEC (2013)
	Sequential extractions	AMEC (2013)
	Shake flask extractions	AMEC (2013)
	Mineralogy	Lorax (2013a)
	Humidity Cells	AMEC (2013)
Saturated waste rock column testwork	n/a	AMEC (2013)
Seepage transport model	n/a	Knight Piesold (2013)
Groundwater quality	n/a	New Gold (2014)
PAG acidic water neutralization experiments	n/a	AMEC, unpublished data
Adsorption testwork	n/a	Lorax (2013b)
Passive Treatment Alternatives	n/a	Lorax (2013c,d)

n/a = not applicable

2. Potential Contaminant Sources

newgold

2. Potential Contaminant Sources

Potential contaminant sources associated with the Blackwater TSF include those associated with the tailings supernatant as well as those associated with post-depositional processes that result in the dissolution of metal-bearing tailings and waste rock components. Each of these are described in turn below. Additional loadings to the TSF will be realized from the discharge of drainage from the Low Grade Stockpile (LGS), coarse ore stockpile and open pit, although the loadings from these sources will be low as any acid, metal laden water will be neutralized with lime as required prior to discharge to the TSF.

2.1 Tailings Supernatant

Ore processing at the Blackwater Project will involve grinding, cyanidation and tailings slurry treatment with SO_2/air. Within the cyanidation circuit, solution pH will be maintained at pH>10.5. In these basic cyanide conditions, trace elements of environmental interest (*e.g.*, Cd, Cu and Zn) can be expected to form soluble CN complexes as well as secondary hydroxide precipitates (Devuyst *et al.*, 1989). Upon SO_2/air treatment, which includes the addition of lime and $CuSO_4$ (catalyst), pH will decrease to values between 8<pH<9 prior to final discharge to the TSF. Within the SO_2/air circuit, free and weak-acid-dissociable (WAD) CN are oxidized, while a large proportion of Fe-cyanide precipitates from solution as copper-ferro-cyanide complexes. A portion of the trace metal inventory can also be expected to be removed from solution via precipitation as metal hydroxide phases. These secondary phases that form within the mill circuit represent a potential source of labile metals following deposition in the TSF.

The results of tailings supernatant testwork (post SO_2/air) are summarized in Table 2-1, which provides water quality results for tailings slurry decant water. The results show basic pH solutions for both transition and sulfide tailings, with the major ion inventory being dominated by SO_4, Na, Ca, K and Mg. In these solutions, SO_4 originates from the addition of SO_2 in the treatment process and the dissolution of sulfur-bearing ore components, while Na originates from NaCN reagent addition in support of cyanidation. In both the transition and sulfide tailings, WAD CN remains below detection limits, indicating that the total CN inventory is dominated by stronger Fe-cyanide complexes. The tailings supernatant also shows elevated levels of ammonia (1.7 to 6 mg/L) which is a product of cyanide and cyanate hydrolysis.

Table 2-1:
Tailings supernatant composition (tailings slurry decant) for transition and sulfide tailings based on median values following SO_2/air treatment.

Parameter		Transition		Sulphide	
General					
pH units		8.51		9.02	
Conductivity µS/cm		2490		2340	
Acidity mg/L as CaCO3		*2*		*2*	
Alkalinity mg/L as CaCO3		65		67	
Major Ions (mg/L)					
SO_4 mg/L		890		900	
Ca		142		110	
Mg		2.64		2.19	
Na		396		446	
K		74.4		91.2	
Cyanide and Nitrogen Species (mg/L)					
CN-Total mg/L		0.43		0.49	
CN-WAD		*0.01*		*0.01*	
CNO		110		91	
CNS		73		64	
NO_2 as N		*0.3*		*0.3*	
NO_3 as N		*0.6*		*0.6*	
NH_3+NH_4 as N		2.30		1.70	
Trace Elements (mg/L)		**Transition**		**Sulphide**	
		Dissolved	Total	Dissolved	Total
	Hg	0.00001	0.00002	0.00001	0.00002
	Al	0.16	0.24	0.16	0.51
	As	0.010	0.031	0.008	0.024
	Cd	0.00361	0.00540	0.00026	0.00028
	Co	0.055	0.066	0.047	0.069
	Cr	*0.0005*	0.0005	*0.0005*	0.0028
	Cu	1.29	2.51	3.92	7.51
	Fe	0.05	1.19	0.24	2.40
	Mn	0.159	0.039	0.075	0.031
	Mo	0.0639	0.0571	0.0689	0.0691
	Ni	0.0864	0.0087	0.0295	0.0538
	P	0.040	0.048	0.021	0.121
	Pb	0.0050	0.0223	0.0008	0.0085
	Sb	0.059	0.082	0.106	0.152
	Se	0.002	0.002	0.002	0.006
	Zn	0.013	0.035	0.034	0.074

[1] median values (n=3)
[2] median values (n=7)
Shaded cells show measurements for which the dissolved concentration exceeds the total value

In general, total and dissolved metal concentrations are low, reflecting the low solubility of most trace elements within the SO_2/air treatment system, with only Cu and Fe being present at mg/L levels in both the transition and sulfide decants. Copper levels are typically high immediately after SO_2/air treatment but will reduce rapidly due to "post reaction" in the TSF (discussed with respect to ageing tests below). Overall, metal concentrations are generally higher in the sulfide tailings decant in comparison to the transition tailings. Exceptions to this include As, Cd and Pb, which show higher values in the transition solutions. For several elements, the dissolved value is higher than the corresponding total value for the transition (Mn and Ni) and sulfide (Mn) tailings decants, indicating analytical error or contamination (Table 2-1).

Comparison of the dissolved and total metal fractions in the tailings supernatant indicates that some metals are preferentially associated with fine-grained particulates or colloidal materials, including Al, As, Cr, Fe, Pb, Se and Zn (Table 2-1). Such fine-grained materials represent non-filterable components in the tailings slurry decant that may include secondary phases formed within the mill/treatment system. Metals in the sulfide tailings supernatant show particulate proportions ranging from 48% (Cu), 54% (Zn) to 90% (Fe). In contrast Cd (5%) shows a lower proportion of colloidal/particulate species. The abundance of Fe associated with the fine particulate fraction suggests that this component is associated with amorphous Fe oxyhydroxides, which may provide a sorptive sink for other metals showing particulate associations (*e.g.*, Zn, Cu). These phases would be predicted to represent a labile source of metals following deposition in the pond environment through redox-controlled dissolution mechanisms.

In the final effluent, metal-cyanide complexation will play a dominant role in maintaining trace metals in solution, including Fe, and to a lesser degree Cd, Cu and Zn. In particular, CN forms strong complexes with Fe (*e.g.*, $Fe(CN)_6^{4-}$) that can remain stable even under mildly acidic conditions. Cd, Cu and Zn also form soluble cyanide complexes, such as $Cd(CN)_4^{2-}$, $Cu(CN)_3^{2-}$ and $Zn(CN)_4^{2-}$. These latter species represent weaker metal-cyanide complexes that readily dissociate to produce free cyanide under mildly acidic (pH 4 to 6) conditions (Ghosh *et al.*, 2006). Such complexes comprise the WAD cyanide component in mine-related effluents and are readily removed in the SO_2/air treatment process and through natural degradation in the TSF. Given their dissociative nature, and their potential toxicity, WAD CN compounds are often regulated as part of national frameworks for cyanide use (Environment Australia, 1998).

Within the pond environment, cyanide will degrade through several mechanisms, including volatilization of HCN, photodegradation of metal-CN complexes, biological oxidation and adsorption processes (Smith and Mudder, 1991; Figure 2-1). Within tailings porewaters, cyanide may be further degraded through oxidation and hydrolysis

reactions, as well as precipitation of insoluble mixed ferri/ferro cyanides in suboxic porewaters (Jambor *et al.,* 2009). The degradation of cyanide will liberate dissolved Fe and other trace elements to solution, which will then become available for sorption processes (*e.g.,* adsorption to tailings solids, precipitation of secondary Fe oxides). Such processes will result in the removal of metals from solution. The liberation of Fe, for example, will result in the precipitation of Fe hydroxides. Zn and Cu (and to a lesser degree Cd) can be expected to co-precipitate with Fe, resulting in the partial removal of these elements from solution.

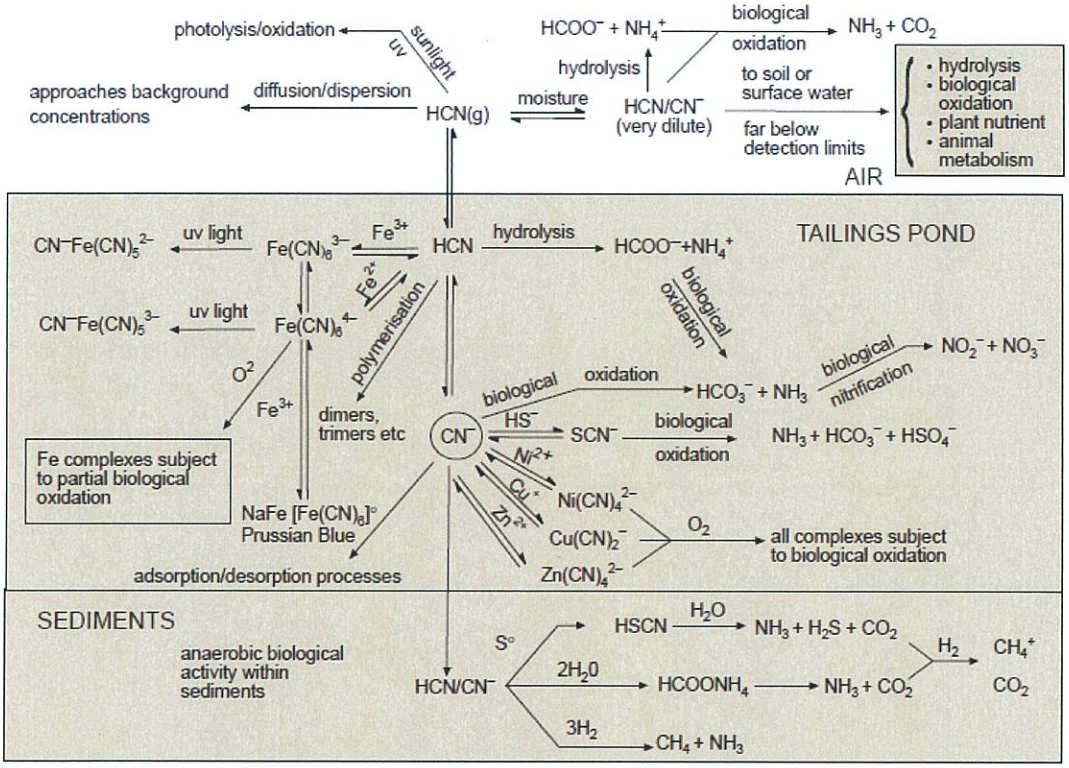


Figure 2-1: Cyanide cycling mechanisms (from Smith and Mudder, 1991).

Some insight into reaction mechanisms within the pond environment can be garnered from ageing tests which involved exposing tailings supernatant (overlying solid tailings) to atmospheric conditions for one month while monitoring changes in chemistry over time (at day 0, 1, 4, 7, 28 and 39) (Figure 2-2) (New Gold, unpublished data). Total and dissolved Fe and Cu show pronounced decreases during the 39 day ageing process (Figure 2-2). The concentration decreases occur commensurately with a reduction in Total-CN from 8.2 to 0.8 mg/L (Figure 2-2). Solution pH remained relatively unchanged over the course of the experiment (7.7<pH<8.3) suggesting that the decreases in Fe and Cu may be attributed to the degradation of CN-metal complexes, followed by removal from solution via adsorption/precipitation reactions.

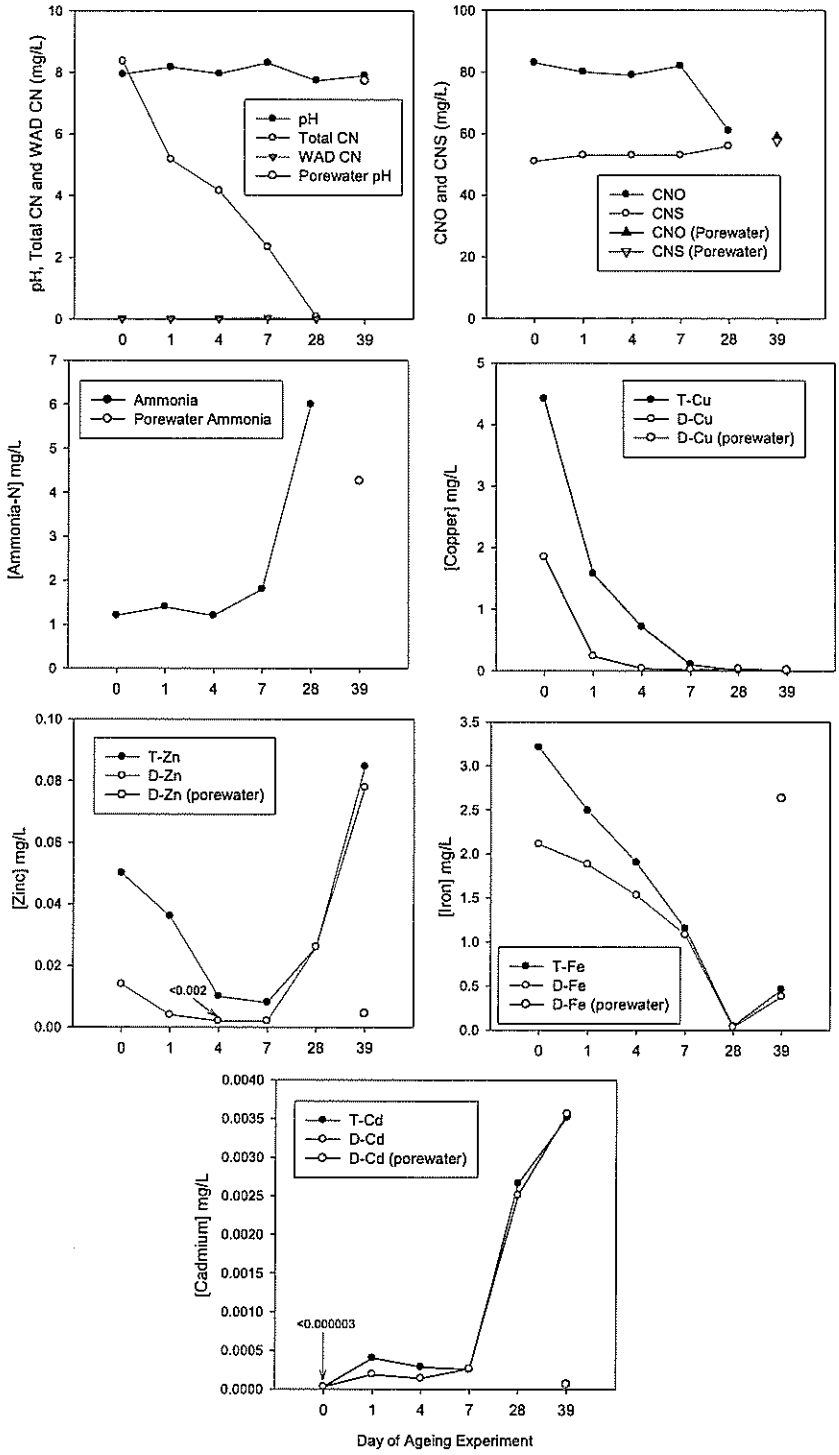


Figure 2-2: Changes in pH and concentration of total CN, WAD-CN, CNO, CNS, ammonia-N and total and dissolved trace elements (Cd, Cu, Fe and Zn) in decanted tailings supernatant in response to 39-day ageing experiment. Tailings porewater data (after 39 days of ageing) are presented for comparison.

In contrast to Fe and Cu, the concentration of Cd shows a general increase in concentration over the entire 39-day ageing period, with peak values (0.0035 mg/L) observed on Day 39 (Figure 2-2). The increase in Cd concentration may represent a kinetic effect associated with the dissolution of cadmium hydroxide [$Cd(OH)_2$], which could be expected to form at high pH during ore processing. Inspection of metal hydroxide solubility curves indicates that Cd hydroxide is predicted to form at pH>10 (Figure 2-3), conditions that are achieved in the cyanidation circuit. Upon pH depression following SO_2/air treatment (8<pH<9), the solubility of $Cd(OH)_2$ would be expected to increase, resulting in the addition of dissolved Cd to solution. In contrast, Cu-hydroxide phases are less soluble, and would be predicted to remain relatively stable at the final pH of the ageing experiments (Figure 2-3). A further factor relevant to Cd is its weaker interaction with Fe and Mn oxides in comparison to Cu and Zn (McCorkle and Klinkhammer, 1991). In this regard, Cd released into solution is less likely to reprecipitate with secondary Fe hydroxides.

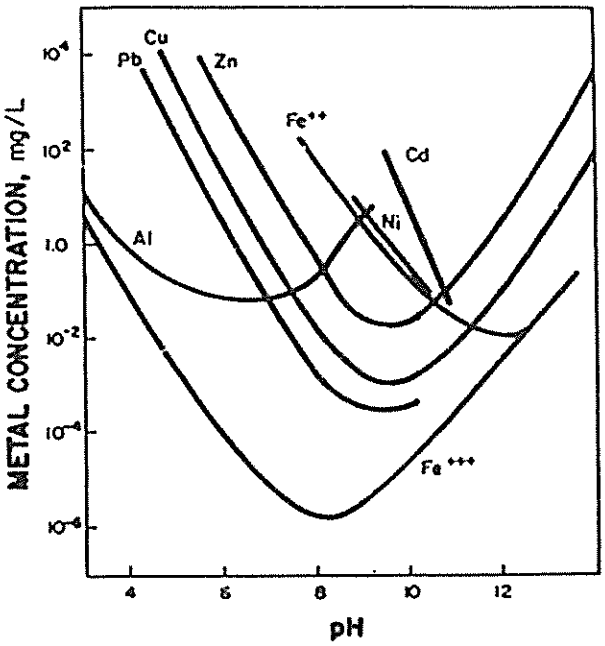


Figure 2-3: Solubility of various metal hydroxides (from Vachon *et al.*, 1987).

Zinc shows a similar pattern of removal over the first 7 days of the experiment as observed for Cu and Fe, following which concentrations increase in a similar fashion to Cd (Figure 2-2). A rationale to explain the time series distribution of Zn is not clear, but may reflect a combination of metal-cyanide complex degradation as well as dissolution of secondary phases formed during mill processing.

Ammonia-N shows a progressive rise in concentration over the ageing experiment, with values increasing from 1.2 to 6 mg/L (Figure 2-2). This increase can be attributed to the degradation of cyanide and cyanate (CNO^-), both of which show decreases in concentration over time. Conversely, thiocyanate (CNS) values remain relatively invariant over the course of the ageing experiment (Figure 2-2).

As part of the ageing experiments, porewaters were extracted from the tailings materials on Day 39 and analyzed for a suite of parameters. This was achieved by first removing standing water overlying the tailings solids. The remaining solids were then slurried and the interstitial waster removed by vacuum filtration on a Whatman #3 filter (6 micron pore size). Although this method will not ensure the absence of oxidation artifacts (*i.e.*, oxidation of suboxic porewaters), the data nonetheless provide a useful comparison to supernatant values. Comparison of supernatant and porewater composition shows considerably lower concentrations of Zn and Cd in porewaters (Figure 2-2). Such observations may reflect decreased solubility of these metals under conditions of suboxia. Indeed, Fe shows elevated values in porewater (2.7 mg/L), possibly reflecting Fe oxide dissolution within suboxic porewaters.

2.2 Tailings and Waste Rock Solid Phase Geochemistry

Mineral composition (*i.e.*, metal-phase associations) and the nature of the depositional environment (*e.g.* degree of saturation, pH, Eh, *etc.*) will govern the amount and rate of metal release from tailings and waste rock in a given setting. It is known that Cd and Zn have relatively similar geochemical characteristics, with Cd commonly found in the same primary mineral phases as Zn. However, the relative redistribution and leaching behaviour of these metals during weathering is poorly constrained. In order to shed light on the major host minerals of Zn and Cd in waste materials associated with the Blackwater Project, detailed mineralogical analysis was conducted on five waste rock samples and two tailings samples using optical and scanning electron microscopy (SEM) (Table 2-2)

The mineralogy results were analyzed in conjunction with sequential extraction data to identify phases susceptible to chemical instability within the TSF. Mineralogy data are discussed in detail in the report "*Blackwater Gold Project: Mineralogical Characterization of Waste Rock & Tailings*" (Lorax, 2013a), which is provided in Appendix A. The main conclusions from this report are summarized for waste rock and tailings in the following sections.

Table 2-2:
Samples Selected for Mineralogical Characterization of Waste Rock and Tailings

Sample ID	Waste type	Descriptor	Oxidation Facies
BW-ARD2-10	Waste Rock PAG1	NPR < 1.0 (PAG)	Sulfide
BW-ARD-510	Waste Rock PAG2	1.0 < NPR < 2.0 (PAG)	Sulfide
BW-ARD-648	Waste Rock NAG3	NPR>2.0, Zn>1000 ppm (NAG)	Sulfide
BW-ARD-473	Waste Rock NAG3	NPR>2.0, Zn>1000 ppm (NAG)	Transition
BW-ARD-468	Waste Rock NAG4	NPR>2.0, 600 ppm<Zn<1000 ppm (NAG)	Sulfide
CND 1-5	Tailings	PAG	Sulfide
CND 2-4	Tailings	PAG	Sulfide

2.2.1 Waste Rock

Waste rock from the Blackwater deposit is composed of varitextured, felsic volcanic and sub-volcanic rock in which igneous textures are largely overprinted by strong hydrothermal alteration that led to partial or full recrystallization of a quartz-feldpar matrix, as well as replacement by dominantly sericite-biotite assemblages. Generally, sphalerite (ZnS) has a higher modal abundance in samples with high solid-phase Zn content (BW-ARD2-10; BW-ARD-648) except for NAG transition zone sample BW-ARD-473 which is relatively low in sphalerite despite containing >3000 ppm Zn. In the assemblages rich in sphalerite, this mineral may form relatively large, weakly weathered, anhedral to subhedral aggregates while in the remaining samples sphalerite is anhedral, disseminated and fine (<30μm). Pyrite may occur as fine-to medium grained, equant grains or as oriented networks of microfracture-fill with corroded grain boundaries. The latter texture is commonly associated with Fe-staining and is interpreted to be at least partially weathered. Patches and alteration rims containing secondary Fe hydroxide were identified in all samples; however, these phases make up less than 2% of the overall mineral assemblages.

Waste rock thin sections were studied in backscattered electron mode to identify different mineralogical compositions. Areas of interest marked during petrographic observation were then further examined by energy dispersive X-ray spectroscopy (EDX) including elemental mapping, and line and spot analyses to provide qualitative insight into mineral chemistry. EDX results show that Zn was incorporated almost exclusively into sulfide minerals, with sphalerite being the primary host. In waste rock samples with lower Zn and sphalerite contents, minor amounts of Zn and Cd were also detected in pyrite. Sample BW-ARD-473 (transition zone NAG3) stands out from this trend by observations of Mn-Fe-carbonates and Fe hydroxides/sulfates that, in several cases, displayed detectable amounts of both Zn and Cd. In two of the studied areas, pure CdS (potentially

greenockite) was also discovered by elemental mapping within this sample, both times associated with larger grains of polymetallic sulfide. These findings can be explained by the somewhat different geochemical regimes commonly found in transition *versus* sulfide facies, leading to precipitation of hydroxides and, if Eh is sufficiently low, the re-precipitation of poorly crystalline sulfides. The stability of Zn- and Cd-bearing phases in the transition zone sample is difficult to assess; however, the potential for metal remobilization must be considered relevant under anoxic conditions due to the dissolution of reducible phases and/or pH-driven carbonate leaching. *Vice-versa*, waste rock from the sulfide zone (main oxidation facies) has a mineral assemblage that is expected to be stable under sub-aqueous conditions. Naturally, storage under atmospheric conditions would lead to sulfide oxidation accompanied by metal release and possible acid generation.

2.2.2 Tailings

The studied tailings samples generally show the same gangue mineralogy as waste rock units. However, fragment assemblages were generally too fine-grained to accurately determine modal abundances. Sulfide minerals identified in both tailings samples include disseminated sphalerite, pyrite and arsenopyrite (Appendix A). Secondary Fe-precipitates are relatively rare, but where observed these phases occur as semi-opaque blebs with orange-brown translucent rims partly or completely replacing pyrite. These phases are generally more abundant in tailings sample CND 1-5 originating from the transition zone, indicating these materials are more susceptible to the release of co-precipitated and sorbed metals under reducing conditions.

Cd and Zn distribution patterns seen during SEM analysis are comparable to those in waste rock with Cd apparently residing in a wider variety of non-sphalerite phases (*e.g.*, sulfates and arsenopyrite), while Zn is largely restricted to sphalerite. It should be noted that interpretations were partly made based on elemental EDX-maps which have a relatively high visual detection limit for trace element species. Therefore, a more scattered appearance may in part be a result of a lack of resolution within the different illustrations. This analytical limitation hinders the interpretation of the Cd data.

Oxide tailings were not examined as part of the mineralogical analysis, although oxide ore samples were available. Oxide ores are characterized by lower metal concentrations than their sulfide counter parts with respect to most trace elements including Cd, Cu and Zn (Table 2-3). In contrast, transition zone tailings show variably lower or similar metal contents compared to sulfide materials. However, based on their weathering features, the oxide and transition ores are predicted to contain a higher proportion of redox- and pH-sensitive solid phases. This assumption was investigated through analysis of

sequential extraction data for oxide, transition and sulfide ores as well as the two transition and sulfide tailings samples that were also studied mineralogically (CND 1-5 and CND 2-4, respectively).

Table 2-3:
Static test data (median values) for oxide, transition and sulfide ore samples.

Parameter	Unit	Oxide	Transition	Sulfide
Total S	%	0.09	0.55	1.10
NPR	-	0.27	0.11	0.06
As	ppm	155	161	189
Cd	ppm	10	27	25
Cu	ppm	73	103	113
Fe	%	1.59	2.53	2.67
Pb	ppm	1328	658	145
Zn	ppm	417	1985	3403

Sequential extraction analysis is a laboratory method designed to assess the solid-phase associations of certain metals by selectively leaching mineral groups or surfaces (Tessier *et al.,* 1979). Table 2-4 provides an overview of the various extraction steps. It should be noted that, while sequential extraction methods provide an elegant tool to gain insight into relative elemental distributions, the quantitative benefit of this approach is disputed as certain phases may be only partially leached or leached in multiple extraction steps (*e.g.,* Peltier *et al.,* 2005).

Table 2-4:
Sequential extraction steps used for analysis of oxide, transition and sulfide ores.

Extraction Step	Phases Leached	Comments
1	Readily dissolved phases	
2	Exchangeable and adsorbed metals	
3	Easily reducible phases and iron/manganese oxides	amorphous and poorly crystalline sulfides may be dissolved in this step
4	Carbonate minerals	
5	Organic matter	most crystalline sulfides are dissolved in this step
6	Residual phases	refractory sulfides may still be present

Figure 2-4 presents the sequential extraction results according to the different oxidation facies for Zn and Cd in ore samples. In all transition and sulfide zone samples, Zn primarily resides in "*organic bound metals*" (Step 4). Primary sulfide phases are also expected to be leached in this analytical step (Tessier *et al.*, 1979) suggesting that this sulfide mineral class represents the major host in this facies, consistent with observations from SEM analysis. "*Residual metals*" (Step 5) and "*easily reducible metals and iron oxides*" (Step 3) released comparable amounts of Zn and represent the second largest source for this element. It was found, however, that poorly crystalline sulfides may be subject to dissolution in analytical Step 3 as well, making it difficult to distinguish between "real" Fe hydroxides and amorphous secondary sulfide phases (Peltier *et al.*, 2005).

Interpretation of the sequential extraction data is further complicated when interpreting transition zone analytical results, given that re-precipitated sulfides may be present in this unit. Indeed, the relative amount of Zn leached during Step 3 is somewhat larger than in sulfide waste rock. The same trend is more pronounced when looking at the distribution of Cd (Figure 2-4). For two of the three transition zone samples, 50% or more of the Cd budget was extracted from "*easily reducible metals and iron oxides*" with the second largest portion leached in Step 3, likely from primary sulfide minerals. The partitioning of cadmium in the sulfide facies is comparable to that of Zn, with sphalerite likely being the dominant host phase for Cd.

The "*residual metals*" fraction (Step 6) is also relevant with respect to Cd and Zn (Figure 2-4). During this step, the samples are treated with highly aggressive acid (HF-$HClO_4$) capable of dissolving silicate minerals as well as the most weathering-resistant sulfides. Appreciable amounts of both Cd and Zn were found in this fraction, even though SEM analysis did not show these metals fractionating into silicate phases. It may therefore be inferred that refractory pyrite (*e.g.*, coarse grained, euhedral aggregates) is responsible for the extraction of Zn and Cd in this step. The presence of Zn and Cd in readily soluble phases (*e.g.*, amorphous aggregates or loose bonds) (Step 1), weakly exchangeable fractions (Step 2), or in carbonate minerals (Step 4), is minor to negligible in the tested ore samples.

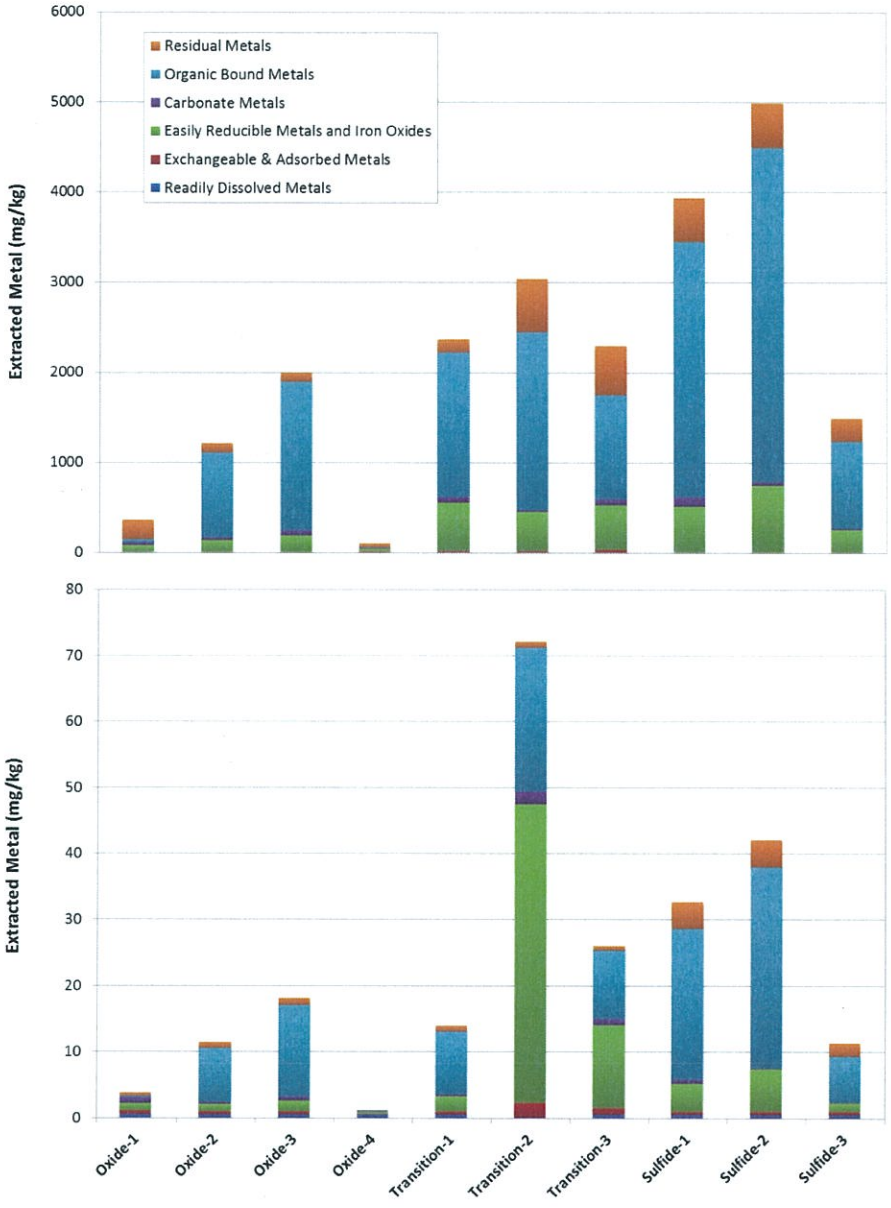


Figure 2-4: Sequential extraction data for ore samples by oxidation facies (oxide, transition and sulfide) for Zn (above) and Cd (below).

Sequential extraction results of the two tailings samples are consistent with the results of the mineralogical analysis and ore sequential extractions. The data show that, as for the studied ore samples, Zn has a relatively higher abundance in "*organic bound metals*" (Step 4) in sulfide tailings in comparison to transition materials (Figure 2-5). The differences in mineralogical speciation between transition and sulfide zone are much

more pronounced for Cd. While sphalerite appears to be the primary host for Cd in the sulfide tailings (Step 4), considerable amounts of Cd were leached during every extraction step but Step 1 (*"readily dissolved metals"*) (Figure 2-5). In contrast to the sequential extraction data for ore samples, Cd was also leached during extraction Step 2 (*"exchangeable and adsorbed metals")* from both tailings samples. This observation hints at the mobilization and adsorption of Cd onto the surfaces of secondary phases formed during ore processing, therefore increasing the potential of Cd release in response to changing Eh- or pH-conditions.

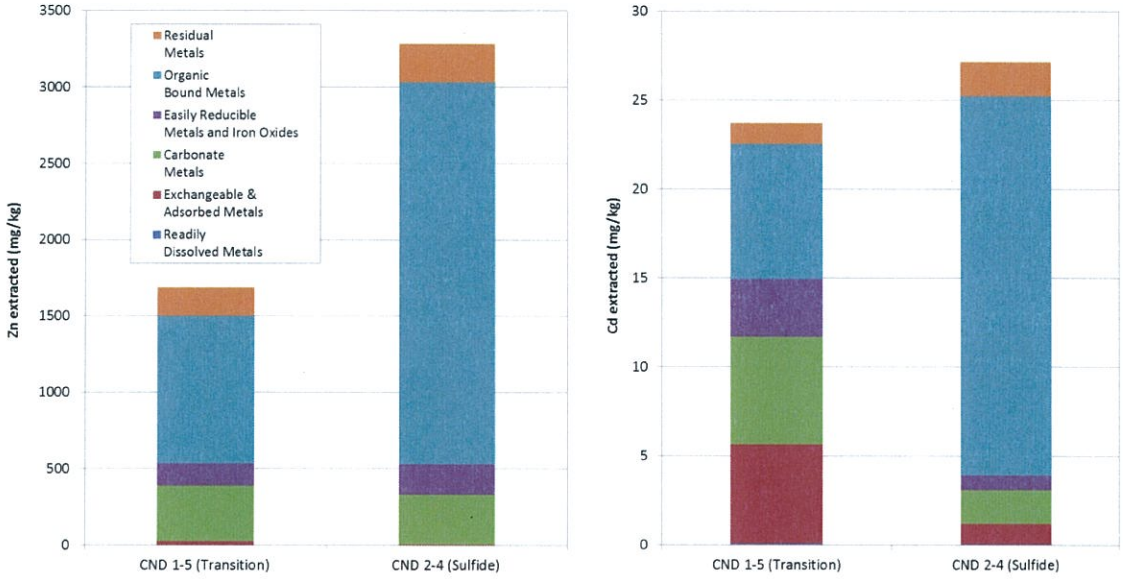


Figure 2-5: Sequential extraction data for tailings samples by oxidation facies (transition and sulfide) for Zn and Cd.

Overall the, results of the sequential extraction analyses are in accordance with the mineralogical data, suggesting that in the sulfide facies, Zn and Cd are primarily present in primary and secondary sulfide minerals with minor to negligible amounts being leachable from reducible phases. Therefore, material from this zone can generally be considered chemically stable under sub-aqueous deposition. For transition/oxide zone materials, however, a mixed mineral assemblage containing both oxidizable and reducible Cd and Zn host phases is evident. The presence of Zn- and Cd-bearing carbonates determined using EDX-analysis may also suggest an additional pH-sensitivity of this material. Collectively, the results demonstrate that the oxide/transition materials have a greater potential for redox- and pH-driven dissolution of metal-bearing components. This trend is more evident for Cd than Zn. In this regard, the de-stabilization of labile secondary phases formed during ore processing may be an additional source of Cd and minor Zn following tailings deposition.

2.2.3 Post-Depositional Remobilization

During the operational period, the composition of tailings and waste rock porewaters, as well as seepage quality, will be largely governed by the quality of the tailings supernatant. Following cessation of the tailing discharge, however, post-depositional reactions will exert a dominant influence on porewater composition and corresponding seepage quality. Such post-depositional (diagenetic) processes will become relevant within the operational period, and increase in importance following mine closure.

The basis for the potential chemical instability of solid phases in the saturated conditions of the TSF relates to contrasting solution conditions of the mill and TSF environments. Specifically, the final storage conditions for tailings materials (circum-neutral pH, low redox potential) will differ markedly from the conditions of ore processing (basic pH, oxidizing redox potentials). In this regard, both redox- and pH-dependent mechanism can promote enhanced chemical instability in tailings impoundments (Martin *et al.*, 2003a). These factors are examined in the sections below.

2.2.3.1 Redox-Related Processes

Redox processes relevant to the remobilization of mine-related contaminants relate to reductive dissolution reactions involving Fe oxides, and to a lesser degree Mn-oxides. Such phases will be introduced to the TSF from multiple sources, including:

- Secondary Fe/Mn oxides that form within the mill environment (*e.g.*, formed during SO_2/air treatment process);
- Secondary Fe/Mn oxides that form within the TSF pond (*e.g*, Fe oxide formation association with cyanide breakdown, weathering of subaerially exposed waste rock and tailings, and introduction of LGS neutralization products); and
- Sulfide oxidation products associated with the primary ore mineralogy (as illustrated by the presence of Fe hydroxide in association with pyrite).

Of these, secondary phases that form within the mill environment are predicted to be most relevant, given their fine-grained nature, amorphous character, and susceptibility to dissolution. Secondary Fe oxides that form in both natural and mine-impacted systems are typically poorly crystalline or amorphous, and exhibit considerable variability due to the incorporation of structural and adsorbed impurities within the Fe oxide matrix (Bigham *et al.*, 1990). Accordingly, such phases can be considered to be more labile than their crystalline counterparts.

In aerobic environments within the TSF (*e.g.*, pond water column and shallow porewaters), Fe/Mn oxide phases will be expected to be chemically stable at circum-neutral pH. However, upon burial and the development of suboxia within the porewater

environment, such phases can be expected to become chemically unstable. Specifically, suboxic conditions (as defined by onset to Fe^{3+} reduction) are predicted to develop within the permanently saturated tailings given the fine-grained nature of the tailings, long hydraulic retention times within tailings porewaters, and oxygen demand imposed by the oxidation of organics introduced in the milling process (*e.g.*, flocculants added in the tailings thickener) and TSF pond (algal/bacterial production). Under conditions of suboxia, the reductive dissolution of Fe and Mn phases will result in the release of dissolved Fe^{2+} and Mn^{2+} to solution, along with adsorbed and co-precipitated trace elements (Cu, Zn and to a lesser degree Cd).

In order to assess the relative importance of reductive dissolution mechanisms with regards to the potential for metal remobilization, several information sources were examined including mineralogy, sequential extraction data, and the results of saturated column testwork for waste rock. As described in Section 2.2 (Tailings and Waste Rock Solid Phase Geochemistry), Fe and Mn oxide phases were not detected in abundance in the tailings and waste rock mineralogical analysis at the spatial resolution of SEM (micron scale). However, such phases are present and will be predicted to be chemically unstable. In particular, transition materials host a mixed mineral assemblage containing both oxidizable and reducible Cd and Zn host phases. These materials can be expected to show a greater potential for redox-driven dissolution of metal-bearing components.

Data for saturated column testwork were also examined to assess the relative importance of redox-related mechanisms. Such experiments were conducted to assess the chemical stability of waste rock materials in permanently saturated settings, and to evaluate the potential for metal remobilization and attenuation under suboxic conditions. To date, saturated column testwork has been initiated for waste rock samples (PAG1 and PAG2), but not for tailings. Tailings based experiments will commence in the fall of 2013 to coincide with the availability of pilot-scale tailings materials.

With regards to the waste rock saturated column experiments, data were available for 27 weekly cycles at the time of writing. Data for major ion proxies (conductivity, sulfate and hardness) show generally decreasing values over time, illustrating the progressive flushing of the tailings supernatant and soluble constituents (Figure 2-6). PAG1 waste rock materials show predictably higher sulfate, conductivity and hardness values, reflecting a higher initial inventory of soluble weathering products.

Data for redox-sensitive parameters, including dissolved oxygen (DO), Fe and Mn, were examined to assess the evolution of redox conditions within the columns (Figure 2-7). The profiles for DO show a high degree of consistency between the PAG1 and PAG2 columns, which cannot be easily explained. Specifically, large fluctuations are mirrored

in both columns with values exhibiting dramatic minima between Cycles 2 through 7, implying DO consumption followed by re-introduction of oxygen to the column systems. Despite the questionable origin of the DO profiles, the data are consistent with the Fe time series. In both columns, peaks in dissolved Fe are observed in cycles 5 through 7 which are coincident with the DO minima. Since the kinetics of Fe^{2+} oxidation are rapid in the presence of molecular oxygen, the presence of elevated Fe at neutral pH typically precludes the presence of DO (Stumm and Morgan, 1981). Accordingly, the presence of dissolved Fe is a robust indicator of suboxia, and suggests that the Fe peak results from the reductive dissolution of Fe oxides. Dissolved Mn shows the same pattern as observed for Fe, further supporting the tenet that Cycles 5-7 represent a period of enhanced suboxia.

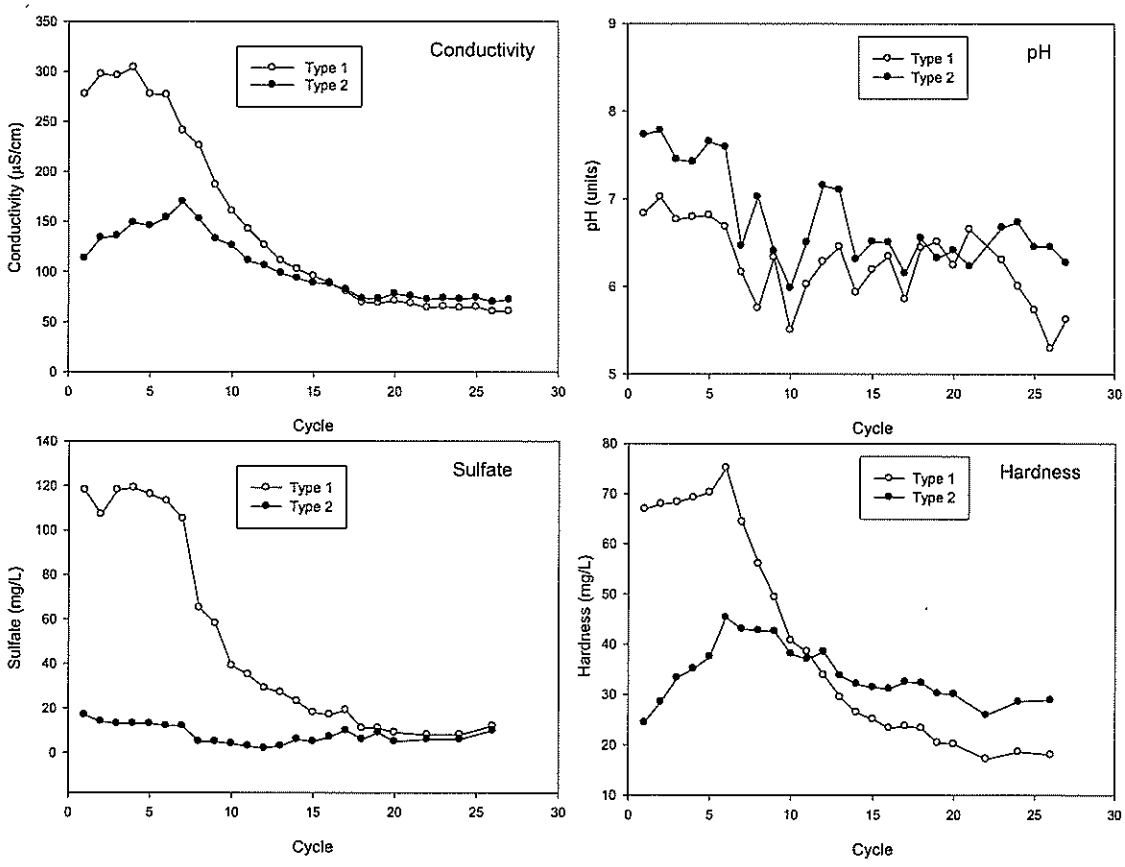


Figure 2-6: Column effluent time series data for saturated waste rock (PAG1 and PAG2) for conductivity, pH, sulfate and hardness. Cylces are at weekly time steps.

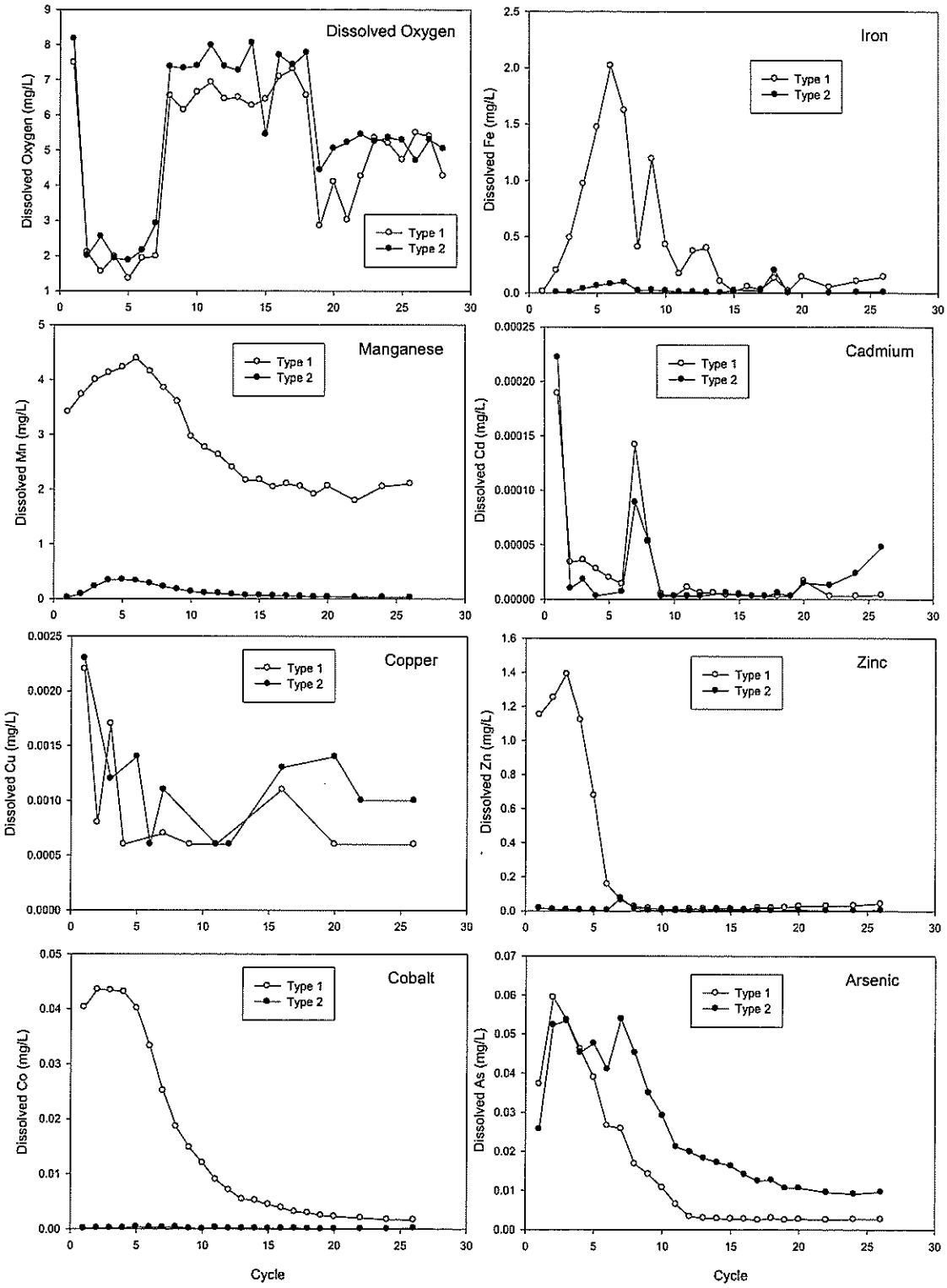


Figure 2-7: Column effluent time series data for saturated waste rock (PAG1 and PAG2) for dissolved oxygen, iron, manganese, cadmium, copper, zinc cobalt and arsenic. Cylces are at weekly time steps.

Based on the considerations above, the data for Cycles 5 through 7 were examined in detail to assess how other trace elements respond to Fe- and Mn-oxide dissolution. In the PAG2 column effluent, dissolved Cd and to a lesser extent As and Zn, show maxima at week 7 consistent with the period of Fe enrichment (Figure 2-7). These data suggest possible remobilization associated with the reductive dissolution of Fe oxides. In the PAG1 column, dissolved Cd also shows a concentration maximum at week 7. However, for the other elements of interest (Cu, Zn, Co and As), peaks coincident with Fe are not observed. Rather, the profiles show progressive decreases over time, more consistent with a flushing mechanism as observed for sulfate (Figure 2-7).

Overall, the data for the saturated column experiments do not reveal evidence of pronounced trace element remobilization from saturated waste rock associated with reductive dissolution processes. Given the conditions of ore processing, tailings are predicted to host a higher abundance of redox sensitive phases in comparison to waste rock. At the spatial resolution of the SEM, however, such phases were sparse in tailings samples. In this regard, it can be postulated that reductive dissolution mechanisms will not have a significant influence on the chemical stability of tailings solids with regards to the mobility of Cd and Zn. As outlined above, such assumptions will be verified through the initiation of saturated tailings column testwork in the fall of 2013.

2.2.3.2 pH-Related Processes

Within the mill, process stream pH will be maintained at pH 10 to 11 with lime addition during the cyanidation process. Effluent pH will decrease upon SO_2/air treatment (to pH 8-8.5) and further decrease somewhat in the TSF environment due to inputs of slightly acidic meteoric water and interaction with atmospheric CO_2 (operating pH of TSF estimated to be about pH 8). Given the marked differences in pH between the cyanide circuit and the TSF, there is the potential for pH-dependent dissolution of secondary metal-bearing phases that form within the mill environment (Martin *et al.*, 2003a). Such phases may include secondary metal hydroxides or carbonates. Indeed, the ageing experiment data highlight the potential for Cd and Zn remobilization at final pH of the ageing experiments (8.0<pH<8.3) (Figure 2-2). At the lower pH values predicted for the TSF (circum-neutral), other phases including $Zn(OH)_2$ and $Cu(OH)_2$ may also become destabilized.

Given the predicted low abundance of soluble phases within the TSF, the potential relevance of pH-dependent dissolution processes is predicted to be low, and less significant in comparison to redox-related mechanisms. However, as outlined in Section 2.2.2 (Tailings Solid Phase Geochemistry), transition/oxide zone materials are predicted to host a higher proportion of pH-sensitive phases (*e.g.*, Zn- and Cd-bearing carbonates).

Accordingly, such materials show a greater potential for the pH-driven dissolution of metal-bearing components.

2.2.3.3 Sulfide Oxidation

The TSF at the Blackwater Project will be carefully managed to minimize the subaerial exposure of both PAG waste rock and tailings. All PAG waste rock deposited in the TSF will be submerged within one year of placement, while frequent rotation of tailings spigotting locations will greatly minimize exposure times for PAG tailings beaches. Despite these measures, there is the potential during operations for localized development of acidic drainages within the TSF associated with the oxidation of PAG materials. Humidity cell data for waste rock, for example, demonstrate that the onset to acidic conditions in the laboratory may be <1 year (AMEC, 2013). Given the fine grain-size distribution of the tailings, their relatively-low permeability, tendency to support tension-based saturation, and spigotting practices, oxidation mechanisms will have less relevance to PAG tailings.

During operations, abundant pH buffering capacity will be afforded by the tailings supernatant and therefore any localized acidic drainages within the PAG waste rock will be effectively neutralized. In this regard, porewater pH is expected to remain neutral to slightly alkaline (to pH 8) throughout the TSF pond and porewater environment. At closure, all PAG materials (waste rock and tailings) will be submerged below the final water table elevation, thus mitigating the potential for acid generation.

2.3 Dam and Cover Construction Materials

Waste rock materials (limited NAG4 (about 3%) & NAG5 waste rock) will be incorporated into the dam shell along with overburden/till. NAG4 & 5 waste materials are characterized by very low sulfur content (median S of 0.20 and 0.15% respectively) and relatively abundant NP, contributing to high NPR values (median NPR of 5.6 and 7.9 for NAG4 and NAG5 respectively). Accordingly, sulfide oxidation has minor relevance to the dam materials. The NAG4 & 5 waste rock also exhibit relatively low Zn and Cd content, demonstrating a low overall metal-leaching potential. Such conclusions are consistent with humidity cell testwork which show relatively-low leaching rates from NAG4 & 5 waste rock (AMEC, 2013). Overall, the neutral-pH drainages associated with the NAG4 & 5 waste materials used for dam construction are not predicted to contribute significant metal loadings to runoff or seepage pathways.

As part of the reclamation planning for C Cell, oxide tailings will be used to cover the beaches comprising transition and sulfide tailings. The use of oxide tailings as cover material will peak in Year 3, which corresponds to the peak production period of oxide

ore (Figure 2-8). In terms of oxide ore composition, Year 3 also coincides with more favourable solid-phase characteristics of oxide ore with respect to NPR, Zn content and Cd content (Figure 2-8). In this manner, the timing of oxide tailings placement will serve to minimize the potential for metal leaching from oxide cover materials.

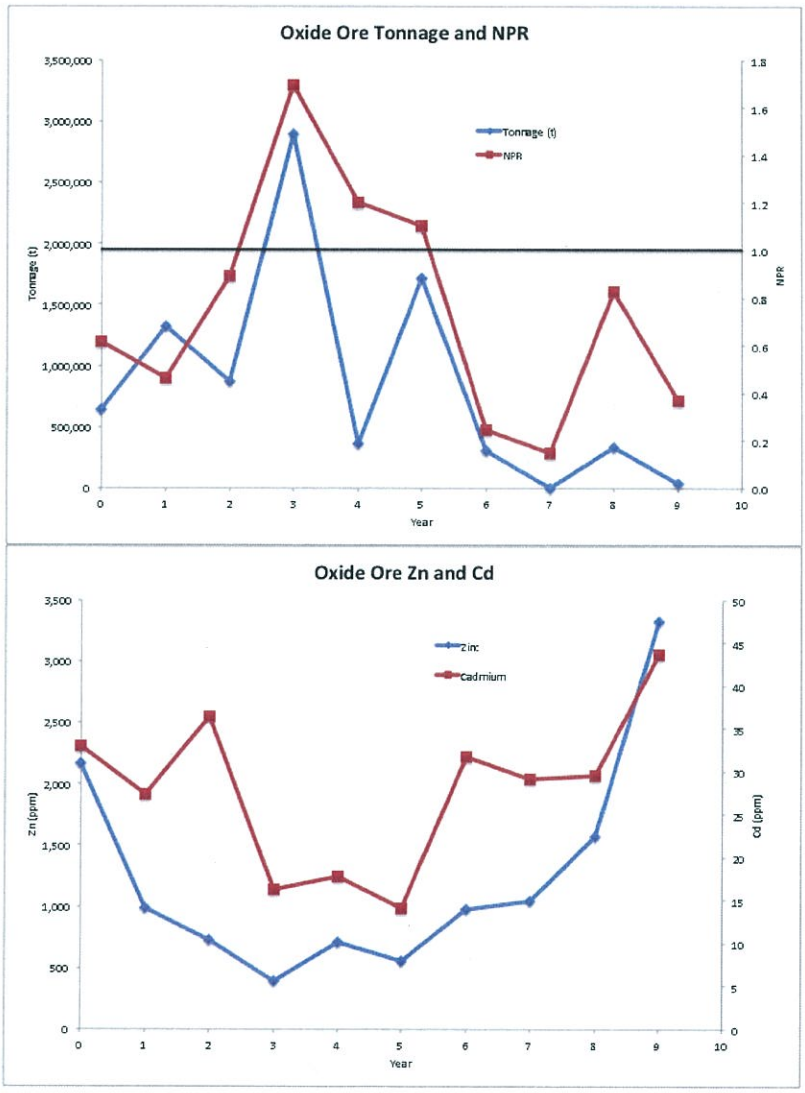


Figure 2-8: Tonnage produdction of oxide ore as a function of mine life (Year 0-10) showing time-dependent ore properties with respect Net Potential Ratio (NPR), cadmium content and zinc content.

As discussed in Section 2.2 (Tailings and Waste Rock Solid Phase Geochemistry), oxide tailings are characterized by significantly reduced metal leaching potential in comparison to the sulfide tailings as illustrated by lower concentrations of sulfur and trace elements (*e.g.*, Cd, Cu, Mn and Zn) and higher NPR in oxide ore (Table 2-2). One exception to this is Pb, which shows considerably higher values in oxide ores (median = 1,328 ppm) in comparison to sulfide (median = 145 ppm) and transition (median = 658 ppm) ores (Table 2-2). These results highlight an increased potential for neutral-pH leaching of Pb associated with the oxide tailings. However, given the low mobility of Pb at circum-neutral pH, Pb is not considered to be a parameter of concern for oxide materials. The metal leaching characteristics of oxide tailings will be more accurately quantified in the early stages of operation (Years 1 to 2) when oxide tailings will become available for detailed geochemical testwork. This will provide sufficient time to verify the utility of oxide tailings as cover material for the TSF. Based on the available information, however, it can be concluded that the use of oxide tailings overlain by overburden will provide an effective cover strategy for the TSF.

2.4 Low Grade Stockpile Drainage

Low grade stockpile (LGS) ore will be stored within the TSF catchment. Drainages from such materials are expected to develop acidic conditions during the operational period. To mitigate loadings of metals and acidity to the TSF, LGS drainages will be treated with lime (to pH 10 to 11) to neutralize acidity and reduce soluble metal concentrations. The treated solution with precipitates will then be discharged as a separate stream to the TSF. This will introduce Fe hydroxides as well as other metal hydroxides (*e.g.*, $Zn(OH)_2$) to the TSF that will be susceptible to pH- and redox-controlled dissolution processes as described above. However, given the relatively small flow predicted for this stream (about 0.19 Mm^3/yr compared to tailings water of 29 Mm^3/yr), such materials are not predicted to contribute significantly to porewater composition or TSF seepage quality. The same conclusion can be offered with respect to the much smaller coarse ore stockpile drainage that will also be neutralized prior to discharge to the TSF.

3. Potential Attenuation Processes

newgold

3. Potential Attenuation Processes

The following section describes attenuation processes that have potential relevance to the Blackwater TSF. These include mechanisms within the TSF Pond, within tailings and waste rock porewaters, sorption to natural substrates along seepage pathways, and attenuation in constructed wetlands. Attenuation processes associated with wetland treatment are addressed in detail in Sobolewski (2013).

3.1 Attenuation processes Within the TSF Pond

As outlined in Section 2.1 (Tailings Supernatant), the evolution of tailings supernatant within the pond environment will involve a suite of reactions that will result in the removal of trace elements from solution. Such reactions include the degradation of cyanide complexes, sorption of trace elements with secondary Fe hydroxides, sorption of metals to tailings particles, and precipitation as secondary phases. Microbial/algal assimilation and volatilization (Se and Hg) may also serve as minor sinks for trace elements. Ammonia (product of cyanide degradation) will also be host to a suite of degradation mechanisms within the TSF pond including nitrification (oxidation of ammonia to nitrate), volatilization, adsorption, sedimentation and biological uptake.

3.2 Attenuation within Tailings and Waste Rock Porewaters

The potential for the attenuation of contaminants within tailings and waste rock porewaters will relate primarily to the development of suboxic conditions within the saturated pore spaces. As outlined in Section 2.2.3.1 (Redox Related Processes), suboxic conditions are predicted to develop within the TSF owing to the long hydraulic retention times (reflecting fine grain size distribution) and oxygen demand imposed by residual organics. Under mildly suboxic conditions, attenuation processes may include denitrification (nitrate reduction) as well as Se reduction. In theory, Se(VI) reduction should occur at a similar redox potential to that of NO_3, and hence only mildly suboxic conditions are required for Se reduction (Table 3-1). Under these conditions, Se will undergo a suite of microbially-mediated processes that favour its removal from solution, including: 1) adsorption of selenite; 2) precipitation of elemental Se; 3) precipitation of Se as inorganic/organic selenides; and 4) co-precipitation of Se with reduced sulfur (Martin *et al.*, 2011). Selenium content in Blackwater host rocks is relatively low with only 5% of deterministic measurements above 10 x average earth's crust values.

Table 3-1:
Oxidation/reduction reactions as a function of redox potential and energy yield. Parameters measured in solution to infer redox conditions are highlighted in bold.

Decreasing Redox Potential

1. Oxygen (O_2) Consumption:

$$\boldsymbol{O_2} + 4H^+ + 4e^- \rightarrow 2H_2O$$

2. Nitrate (NO_3^-) Reduction (Denitrification)

$$2\boldsymbol{NO_3^-} + 12H^+ + 10e^- \rightarrow N_2 + 6H_2O$$

3. Selenate (SeO_4^{2-}) Reduction:

$$\boldsymbol{SeO_4^{2-}} + 3H^+ + 2e^- \rightarrow \boldsymbol{HSeO_3^-} + H_2O$$

4. Manganese Oxide (MnO_2) Reduction:

$$MnO_2(s) + 4H^+ + 2e^- \rightarrow \boldsymbol{Mn^{2+}} + 2H_2O$$

5. Fe Oxide (FeOOH) Reduction:

$$FeOOH(s) + 3H^+ + e^- \rightarrow \boldsymbol{Fe^{2+}} + 2H_2O$$

6. Sulfate (SO_4^{2-}) Reduction:

$$\boldsymbol{SO_4^{2-}} + 9H^+ + 8e^- \rightarrow \boldsymbol{HS^-} + 4H_2O$$

Increasing Free Energy Yield

Under more strongly suboxic conditions (onset to Fe^{3+} reduction; Table 3-1), the precipitation of metal-bearing mixed ferri/ferro cyanide $[Fe^{III}_4(Fe^{II}(CN)_6)_3]$ in suboxic porewaters may serve as a sink for Fe and other trace elements. Such phases have been shown to provide a dominant sink for Ni, Cu and Zn in pond sediments receiving gold mill effluents (Jambor *et al.*, 2009).

Under reducing conditions (defined by occurrence of sulfate reduction; Table 3-1), the generation of dissolved hydrogen sulfide (HS^- at neutral pH) can have a profound effect in attenuating trace elements. Specifically, dissolved HS^- forms highly insoluble precipitates with many trace elements, including Cd, Cu, Co, Fe, Ni and Zn (Stumm and Morgan, 1981). The formation of secondary metal sulfides in anoxic porewaters has been shown to provide an effective sink for trace elements in tailings (Martin *et al.*, 2003b) as well as mine-impacted lake sediments (Martin and Pedersen, 2001; Martin *et al.*, 2003c).

The potential for the development of sulfate-reducing conditions in the Blackwater TSF cannot be predicted with certainty. The requirements include an inventory of reducible sulfate and sufficient oxygen demand to drive redox reactions sufficiently reducing to promote sulfate reduction. The presence of elevated sulfate levels in tailings supernatant (~900 mg/L) implies sulfate will not be a limiting factor. Rather, it is predicted that oxygen demand will present the limitation on the potential for sulfate reduction. In this regard, the greatest potential for sulfate reduction may be at the base on the impoundment where tailings and waste rock are in contact with remnant vegetation and organic soils.

3.3 Sorption within Natural Substrates

A portion of impoundment seepage will infiltrate into the native ground and aquifer underlying the TSF. The significance of this vector for metal loading to the environment depends, in part, on the rate of metal loading and the degree of attenuation in the subsurface environment. In order to provide an indication of metal attenuation within native materials underling the TSF, a series of metal sorption experiments were performed using humidity cell leachate and substrates present at the Blackwater site. The primary objectives were to: 1) quantify the relative sorption potential for metals with respect to three substrate types relevant to seepage pathways (weathered bedrock, sand & gravel, and overburden/till); and 2) assess the implications of the results with regards to the potential for metal attenuation along seepage pathways at the Blackwater site. The results of this study are presented in the memorandum "*Metal sorption potential of natural substrates underlying the Blackwater Tailings Storage Facility: Implications for attenuation along seepage flowpaths*" (Lorax, 2013b).

In overview, the fine-grained fraction (<0.15 mm) of all three rock units (Weathered Bedrock, Basal Till and Sand & Gravel) demonstrate the ability to attenuate Cd and Zn to near detection limit concentrations. Other metals attenuated in the presence of these substrates included Co, Mn, Ni, Tl and Pb. Variations in attenuation capacity between the three rock units were minor. However, based on the particle size distribution analyses of the three units considered, the Weathered Bedrock and Basal Till units have a higher sorption potential than the Sand & Gravel Unit. In addition to sorption properties, the extent of metal attenuation within the different rock units will depend on flow velocities, unit thicknesses, and the development of preferential flow paths.

Based on the experimental data, it can be concluded that the properties of the underlying substrates at the Blackwater TSF afford the potential for significant attenuation of Cd and Zn. In this regard, the results of this study invoke an element of conservatism into water quality predictions which do not account for this removal process along seepage pathways.

Groundwater quality conditions within the local aquifer system were also examined based on review of groundwater data collected from wells installed downgradient of the TSF footprint, including MW12-07 S/D, MW12-08 S/D and MW12-09D (New Gold, 2014). Redox-sensitive parameters (dissolved nitrate, Mn and Fe) were specifically examined to assess the potential for redox-related attenuation processes that may occur under suboxic/reducing conditions (*e.g.*, sulfate reduction, metal sulfide precipitation, and Se reduction/immobilization). The deeper nest at MW12-07-D shows minor enrichment with respect to dissolved Mn (0.16 to 0.28 mg/L) and undetectable levels of nitrate

(<0.005 mg/L), likely reflecting mild suboxia at this location. In the remaining wells, however, including the shallow nest at MW12-07, the presence of detectable nitrate and low values for dissolved Fe and Mn are indicative of more aerobic conditions. These features would preclude significant attenuation associated with redox-controlled processes in the natural groundwater environment. As discussed above, however, there is considerable potential for redox-controlled attenuation processes associated with the saturated tailings deposits.

3.4 Engineered Wetlands

The construction of engineered wetlands will represent a key component of progressive reclamation, closure and contingency planning at the Blackwater Project. As part of progressive reclamation, an engineered wetland will be constructed within the pond environment of C Cell upon cessation of tailings discharge and following placement of an overburden/till cover. At mine closure, further wetland systems will be constructed in the pond environment in D Cell and two wetlands in series downgradient of D Cell in the vicinity of the Environmental Control Dam. Contingency planning also allows for an additional wetland system to be constructed further downgradient of D Cell if required.

Wetlands will serve as zone of passive bioremediation for cyanide, metals, sulfate, nitrogen and phosphorus. Microbial/biological processes will include metal/nutrient uptake, adsorption, precipitation of secondary phases, particle settling, reduction reactions (*e.g.*, sulfate) and volatilization (*e.g.,* cyanide and nitrogen). The benefits and limitations of wetland systems as they relate specifically to the design features of engineered wetlands for the Blackwater Project are described in detail in (New Gold, 2014).

4. Contaminant Behaviour Along Seepage Pathways

newgold

4. Contaminant Behaviour Along Seepage Pathways

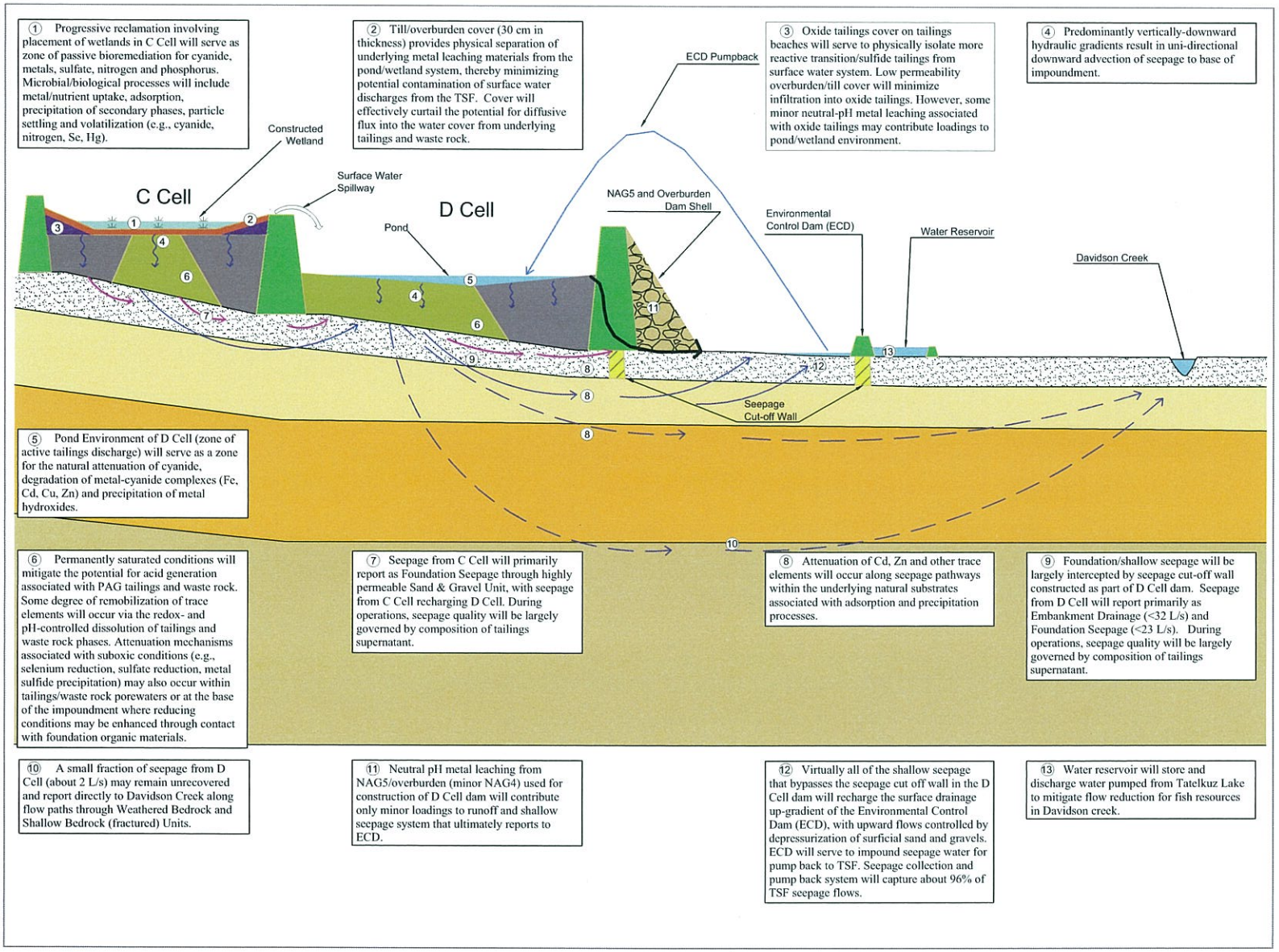
In the following sections, the source mechanisms and attenuation processes described above are linked to seepage pathways, water management and contingency measures. These concepts are illustrated schematically in Figure 4-1 and Figure 4-2 that depict the operational (Year 6) and Post-Closure conceptual models, respectively. Year 6 was chosen to represent the "operational" phase given that the C Cell will be reclaimed in Year 4-5. Contaminant pathways and behaviour relevant to the operation and post-closure mine phases are discussed in turn below.

4.1 Operations

For the operational phase (Year-6) conceptual model, it is assumed that C Cell has been reclaimed, including the placement of an upper layer of oxide tailings on the beaches, a till/overburden cover over all tailings and waste rock, construction of a engineered wetland system within the pond environment, and re-vegetation of the beach environments (Figure 4-1). Surface overflow from C Cell reports to D Cell via an engineered spillway. The impoundment will be engineered to ensure that the vast majority of reactive (transition/sulfide) tailings materials will remain below the final water table elevation at closure. As outlined in the mineralogical analysis, the vast majority of Zn and Cd is predicted to be hosted in sulfide phases. In this manner, permanent submergence will effectively curtail the potential for acidic drainages.

For the transition/sulfide tailings beaches in C Cell, the placement of an oxide tailings cover will serve to physically isolate more reactive transition/sulfide tailings from the surface water system in the TSF (Figure 4-1). The oxide tailings will be further covered by about a 30 cm thick low permeability overburden/till cover, that will minimize infiltration into the oxide tailings. For oxide tailings that remain above the final water table elevation, some minor neutral-pH metal leaching may contribute loadings to pond/wetland environment in C Cell.

In non-beach zones, a till/overburden cover (30 cm in thickness) will be placed to provide physical separation of underlying metal leaching materials from the pond system, thereby minimizing contamination to surface water discharges from the TSF. The overburden/till layer will also provide an effective barrier to the upward migration of dissolved solutes into the pond system from underlying tailings and waste rock porewaters via molecular diffusion. Since diffusional transport is only relevant over short pathways (few centimetres), a 30 cm barrier will effectively curtail the potential for diffusive loadings into the water cover. The vertically-downward hydraulic gradients will also serve to minimize the potential for upward diffusional transport.



① Progressive reclamation involving placement of wetlands in C Cell will serve as zone of passive bioremediation for cyanide, metals, sulfate, nitrogen and phosphorus. Microbial/biological processes will include metal/nutrient uptake, adsorption, precipitation of secondary phases, particle settling and volatilization (e.g., cyanide, nitrogen, Se, Hg).

② Till/overburden cover (30 cm in thickness) provides physical separation of underlying metal leaching materials from the pond/wetland system, thereby minimizing potential contamination of surface water discharges from the TSF. Cover will effectively curtail the potential for diffusive flux into the water cover from underlying tailings and waste rock.

③ Oxide tailings cover on tailings beaches will serve to physically isolate more reactive transition/sulfide tailings from surface water system. Low permeability overburden/till cover will minimize infiltration into oxide tailings. However, some minor neutral-pH metal leaching associated with oxide tailings may contribute loadings to pond/wetland environment.

④ Predominantly vertically-downward hydraulic gradients result in uni-directional downward advection of seepage to base of impoundment.

⑤ Pond Environment of D Cell (zone of active tailings discharge) will serve as a zone for the natural attenuation of cyanide, degradation of metal-cyanide complexes (Fe, Cd, Cu, Zn) and precipitation of metal hydroxides.

⑥ Permanently saturated conditions will mitigate the potential for acid generation associated with PAG tailings and waste rock. Some degree of remobilization of trace elements will occur via the redox- and pH-controlled dissolution of tailings and waste rock phases. Attenuation mechanisms associated with suboxic conditions (e.g., selenium reduction, sulfate reduction, metal sulfide precipitation) may also occur within tailings/waste rock porewaters or at the base of the impoundment where reducing conditions may be enhanced through contact with foundation organic materials.

⑦ Seepage from C Cell will primarily report as Foundation Seepage through highly permeable Sand & Gravel Unit, with seepage from C Cell recharging D Cell. During operations, seepage quality will be largely governed by composition of tailings supernatant.

⑧ Attenuation of Cd, Zn and other trace elements will occur along seepage pathways within the underlying natural substrates associated with adsorption and precipitation processes.

⑨ Foundation/shallow seepage will be largely intercepted by seepage cut-off wall constructed as part of D Cell dam. Seepage from D Cell will report primarily as Embankment Drainage (<32 L/s) and Foundation Seepage (<23 L/s). During operations, seepage quality will be largely governed by composition of tailings supernatant.

⑩ A small fraction of seepage from D Cell (about 2 L/s) may remain unrecovered and report directly to Davidson Creek along flow paths through Weathered Bedrock and Shallow Bedrock (fractured) Units.

⑪ Neutral pH metal leaching from NAG5/overburden (minor NAG4) used for construction of D Cell dam will contribute only minor loadings to runoff and shallow seepage system that ultimately reports to ECD.

⑫ Virtually all of the shallow seepage that bypasses the seepage cut off wall in the D Cell dam will recharge the surface drainage up-gradient of the Environmental Control Dam (ECD), with upward flows controlled by depressurization of surficial sand and gravels. ECD will serve to impound seepage water for pump back to TSF. Seepage collection and pump back system will capture about 96% of TSF seepage flows.

⑬ Water reservoir will store and discharge water pumped from Tatelkuz Lake to mitigate flow reduction for fish resources in Davidson creek.

LEGEND

- Infiltration
- Foundation Seepage
- Shallow Seepage
- Unrecovered Seepage
- Embankment Drain
- Constructed Wetlands
- Tailings
- PAG Waste Rock
- Sand and Gravel
- Overburden/Till
- Weathered Bedrock
- Bedrock
- Overburden/Till Cover
- Dam
- Seepage Cut-off Wall
- Oxide Tails Cover

Drawing is for illustrative purposes only.

Drawing is not to scale

DATE SAVED:	Nov 19, 2013
DRAWN BY:	GM
REVIEWED:	AM
VERSION:	1

CLIENT: newgold

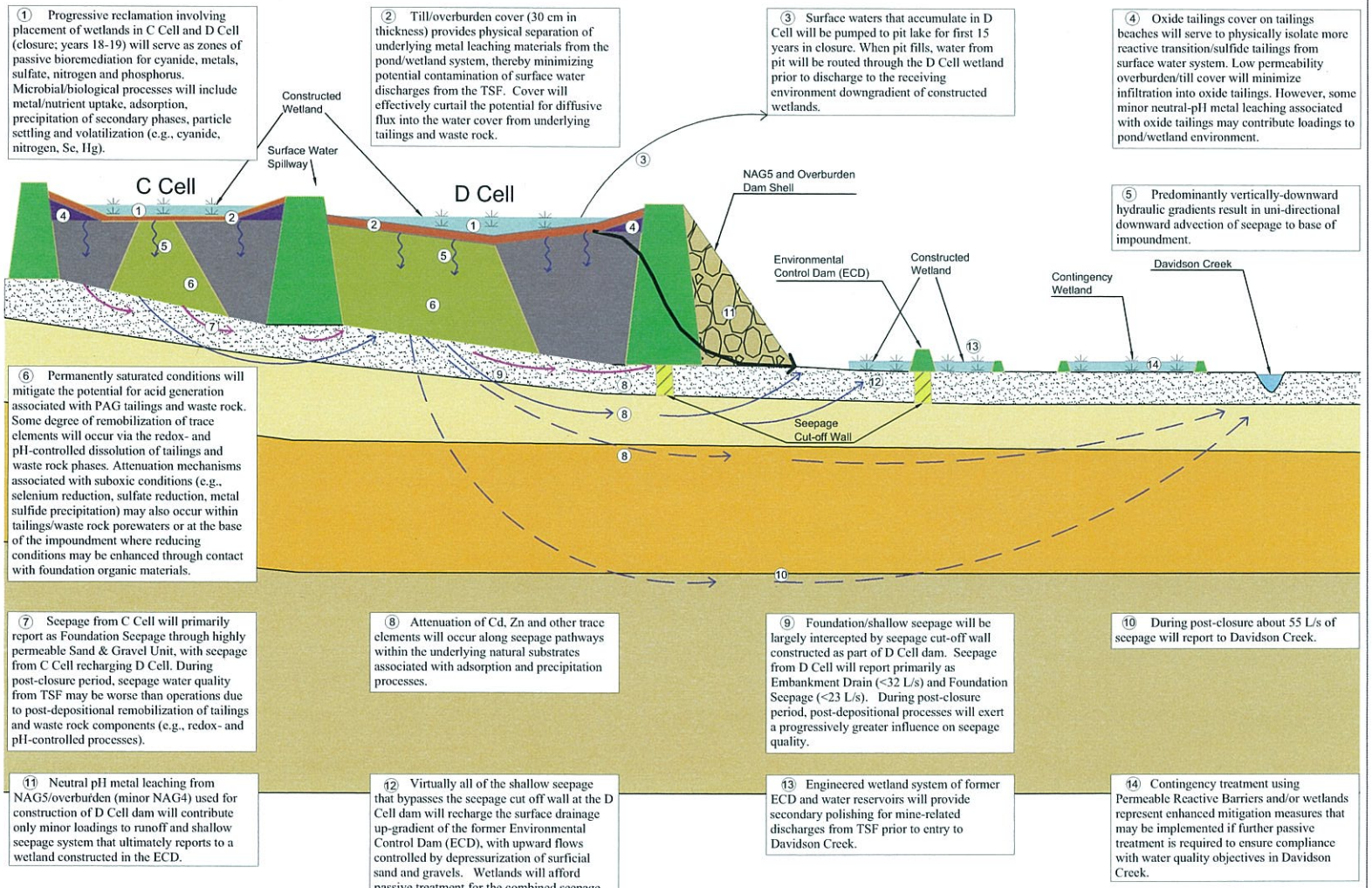
LORAX ENVIRONMENTAL

PROJECT: **Blackwater Project**

TITLE: Conceptual Model for Contaminant Transport and Behaviour in Tailings Storage Facility (Operations)

PROJECT #: A302-3 | FIGURE: 4-1

P:\A302 (Blackwater)\Drafting\Cross Sections\Autocad\TSF Operations Conceptual Cross Section_Lhoy\E_20131119_GM.dwg



① Progressive reclamation involving placement of wetlands in C Cell and D Cell (closure; years 18-19) will serve as zones of passive bioremediation for cyanide, metals, sulfate, nitrogen and phosphorus. Microbial/biological processes will include metal/nutrient uptake, adsorption, precipitation of secondary phases, particle settling and volatilization (e.g., cyanide, nitrogen, Se, Hg).

② Till/overburden cover (30 cm in thickness) provides physical separation of underlying metal leaching materials from the pond/wetland system, thereby minimizing potential contamination of surface water discharges from the TSF. Cover will effectively curtail the potential for diffusive flux into the water cover from underlying tailings and waste rock.

③ Surface waters that accumulate in D Cell will be pumped to pit lake for first 15 years in closure. When pit fills, water from pit will be routed through the D Cell wetland prior to discharge to the receiving environment downgradient of constructed wetlands.

④ Oxide tailings cover on tailings beaches will serve to physically isolate more reactive transition/sulfide tailings from surface water system. Low permeability overburden/till cover will minimize infiltration into oxide tailings. However, some minor neutral-pH metal leaching associated with oxide tailings may contribute loadings to pond/wetland environment.

⑤ Predominantly vertically-downward hydraulic gradients result in uni-directional downward advection of seepage to base of impoundment.

⑥ Permanently saturated conditions will mitigate the potential for acid generation associated with PAG tailings and waste rock. Some degree of remobilization of trace elements will occur via the redox- and pH-controlled dissolution of tailings and waste rock phases. Attenuation mechanisms associated with suboxic conditions (e.g., selenium reduction, sulfate reduction, metal sulfide precipitation) may also occur within tailings/waste rock porewaters or at the base of the impoundment where reducing conditions may be enhanced through contact with foundation organic materials.

⑦ Seepage from C Cell will primarily report as Foundation Seepage through highly permeable Sand & Gravel Unit, with seepage from C Cell recharging D Cell. During post-closure period, seepage water quality from TSF may be worse than operations due to post-depositional remobilization of tailings and waste rock components (e.g., redox- and pH-controlled processes).

⑧ Attenuation of Cd, Zn and other trace elements will occur along seepage pathways within the underlying natural substrates associated with adsorption and precipitation processes.

⑨ Foundation/shallow seepage will be largely intercepted by seepage cut-off wall constructed as part of D Cell dam. Seepage from D Cell will report primarily as Embankment Drain (<32 L/s) and Foundation Seepage (<23 L/s). During post-closure period, post-depositional processes will exert a progressively greater influence on seepage quality.

⑩ During post-closure about 55 L/s of seepage will report to Davidson Creek.

⑪ Neutral pH metal leaching from NAG5/overburden (minor NAG4) used for construction of D Cell dam will contribute only minor loadings to runoff and shallow seepage system that ultimately reports to a wetland constructed in the ECD.

⑫ Virtually all of the shallow seepage that bypasses the seepage cut off wall at the D Cell dam will recharge the surface drainage up-gradient of the former Environmental Control Dam (ECD), with upward flows controlled by depressurization of surficial sand and gravels. Wetlands will afford passive treatment for the combined seepage flow (~55 L/s) prior to discharge to Davidson Creek. Attenuation of metals can also be expected for seepage waters recharging the wetland system through organic-rich sediments.

⑬ Engineered wetland system of former ECD and water reservoirs will provide secondary polishing for mine-related discharges from TSF prior to entry to Davidson Creek.

⑭ Contingency treatment using Permeable Reactive Barriers and/or wetlands represent enhanced mitigation measures that may be implemented if further passive treatment is required to ensure compliance with water quality objectives in Davidson Creek.

LEGEND

- Infiltration
- Foundation Seepage
- Shallow Seepage
- Unrecovered Seepage
- Embankment Drain
- Constructed Wetlands
- Tailings
- PAG Waste Rock
- Sand and Gravel
- Overburden/Till
- Weathered Bedrock
- Bedrock
- Overburden/Till Cover
- Dam
- Seepage Cut-off Wall
- Oxide Tails Cover

Drawing is for illustrative purposes only.

Drawing is not to scale

DATE SAVED:	Nov 15, 2013
DRAWN BY:	GM
REVIEWED:	AM
VERSION:	1

CLIENT: newgold

LORAX ENVIRONMENTAL

PROJECT: **Blackwater Gold Project**

TITLE: Conceptual Model for Contaminant Transport and Behaviour in Tailings Storage Facility (Closure and Post Closure)

PROJECT #: A302-3 | FIGURE: 4-2

P:\A302 (Blackwater)\Drafting\Cross Sections\Autocad\TSF Closure Conceptual Cross Section, Illov\E 20131114 GM.dwg

During the operational phase, the quality of porewaters within the TSF and corresponding seepage waters will be largely governed by the composition of tailings supernatant. However, the "end-of-pipe" supernatant signature will be altered within the pond environment, reflecting the breakdown of cyanide compounds, metal removal following degradation of metal-cyanide complexes, and re-carbonation from the atmosphere. Localized inputs of acidic drainages associated with exposed waste rock (and to a lesser extent exposed tailings) will also affect porewater quality. However, given the large buffering potential of the tailings supernatant, any localized inputs of acidity will be effectively neutralized. Pond pH will also be affected by inputs of meteoric water which will introduce lower pH waters to the system. Overall, water that infiltrates downward through the TSF can be expected to exhibit lower values for pH, cyanide species and metals in comparison to the end-of-pipe tailings signature.

The degradation of cyanide and cyanate will contribute to elevated ammonia levels within the pond environment during operations in comparison to end-of-pipe values. Based on data for other mine analogues, ammonia-N concentration on the order of 10-30 mg/L can be expected. The leaching of residual blasting residues will also contribute to the loadings of nitrite, nitrate and ammonia to the pond system during operations. Concentrations of ammonia and nitrate in seepage flows can be expected to be less than pond values owing to adsorption/oxidation (ammonia) and redox-related attenuation mechanisms (nitrate).

From the pond/wetland systems, waters will migrate downward through the saturated tailings and waste rock mass. Specifically, in both C and D Cells, vertically-downward hydraulic gradients are predicted which will result in the uni-directional advection of seepage to the base of the impoundment (Knight Piesold, 2013). Within the saturated tailings and waste rock, the development of suboxia will evolve both spatially and temporally. Suboxia will have a greater tendency to develop in saturated wastes that have been isolated from atmospheric influences for longer time periods. These will include waste materials at depth, and those within C Cell that will serve as the initial repository for tailings and waste rock.

Within zones of suboxia, the reductive dissolution of redox-sensitive phases (*e.g.*, secondary Fe oxides that form in the mill/treatment process) will result in an increase in dissolved Fe in porewaters. This mechanism may also promote increases in the concentration of other elements associated with Fe oxides (*e.g.*, Zn, Cu and Cd). The pH-controlled dissolution of soluble secondary phases may also contribute to porewater quality. Such post-depositional mechanisms will become relevant during operations and increase in importance during the post-closure period. Given the low abundance of Fe oxides phases identified in tailings and waste rock samples (Section 0 – Tailings and

Waste Rock Solid Phase Geochemistry), reductive dissolution processes are not likely to have a significant effect on the concentrations of trace elements (*e.g.*, Cd, Zn).

At the base of the impoundment where tailings and waste rock are in contact with remnant vegetation and organic soils, there is the potential for more reducing conditions to develop. Under conditions of enhanced oxygen demand, there is an increased potential for sulfate reduction and the precipitation of secondary metal sulfides. Suboxic/reducing conditions will also promote the reduction and attenuation of Se, although initial concentrations are not expected to be elevated given the low Se concentration in Blackwater source rocks.

At the base of the impoundment, seepages from the TSF will recharge the underlying groundwater system. The results of adsorption testwork indicate that the underlying substrates at the Blackwater TSF afford the potential for significant attenuation of Cd and Zn. This imparts an element of conservatism into water quality predictions conducted by Amec that do not account for this removal process along seepage pathways. Although baseline groundwater conditions for the Blackwater TSF do not show widespread suboxia, the introduction of suboxic waters from the TSF into the groundwater system may result in the development of a suboxic seepage plume as the seepage migrates into the natural aquifer system. This seepage plume may be characterized by elevated concentrations of Fe, Mn and ammonia in comparison to background conditions.

Seepage from C Cell is predicted to report to D Cell as foundation seepage and as shallow seepage that migrates within the surficial natural substrates (Figure 4-1). Preferential flow paths in the groundwater environment will be controlled by the relative hydraulic conductivities (K) of the underlying units. Based on the estimated K values of the units considered, seepage will preferentially flow through the Sand & Gravel unit (K_{sat} for sand & gravel = 1.0×10^{-4} m/s *versus* 5.0×10^{-8} m/s for both weathered bedrock and overburden/till units; Knight and Pielsold, 2013).

Seepage from D Cell will report primarily as Embankment Drain and Foundation Seepage flows, ultimately discharging as toe seepage upstream of the Environmental Control Dam (ECD) (Figure 4-1). Hydrologic containment afforded by a seepage cut-off wall in the D Cell dam will facilitate the upward migration of shallow seepage into the surface water system upstream of the ECD. Surface run-off and seepage associated with the D Cell dam will contribute minor loadings to the ECD relating to neutral pH metal leaching from NAG4/5 waste rock in the dam structure.

The vast proportion of shallow seepage that bypasses the seepage cut off wall in the D Cell dam will recharge to the natural surface water drainage up-gradient of the ECD, with upward flows controlled by depressurization of surficial sand and gravels and by a

secondary seepage cut-off wall below the ECD (Figure 4-1). The ECD will serve to impound seepage waters for pumpback into D Cell. A small fraction of seepage from D Cell (~2 L/s) might remain unrecovered and report directly to Davidson Creek along flow paths through Weathered Bedrock and Shallow Bedrock (fractured) Units (Figure 4-1). Overall, the operational seepage collection and pumpback system will facilitate the capture >95% of TSF seepage flows. During operations, a water reservoir will be maintained to hold and discharge water pumped from Tatelkuz Lake to mitigate flow reduction for fish resources in Davidson creek (Figure 4-1).

4.2 Post Closure

In the post-closure scenario, fully reclaimed conditions apply to D Cell (Figure 4-2). Cover reclamation for tailings in D Cell will include a combination of overburden and approximately 3 million tonnes of oxide tailings (derived from low grade ore stockpile). This will include placement of a minimum of 30-cm thick overburden/till cover over the PAG waste rock and submerged tailings, and up to 5 m thick on the tailings beach adjacent to TSF Dam D. The overburden layer will extend over the full footprint of tailings and waste rock. As described for the operational scenario, the overburden/till cover will provide an effective means to physically and chemically isolate the surface water system from underlying waste materials. As in C Cell, an engineered wetland will be constructed in the ponded zone to facilitate passive treatment of surface waters that accumulate within the TSF at closure (Figure 4-2). All transition/sulfide tailings will remain below the final water table elevation. Surface overflows from C Cell report to D Cell via an engineered spillway.

Vertically downward hydraulic gradients will drive the downward advection of seepage towards the base of the impoundment and embankment drain. Within the saturated mass of tailings and waste rock, porewater chemistry will become increasingly governed by post-depositional reactions with respect to pH- and redox-dependent solubility controls. Based on water balance considerations, and taking into account the saturated water volume of the combined tailings and waste rock, a hydraulic residence time of approximately 50 years was calculated for one pore volume of the saturated pore spaces in the TSF. This implies that the supernatant-related signature may persist for at least several decades. In this context, the supernatant "signature" applies to major ions only (*e.g.*, SO_4, Na, Ca, K). For trace elements that exhibit strongly non-conservative behaviour (*e.g.*, Cd, Cu and Zn), post-depositional reactions will become relevant over much shorter time scales (months to years following burial). In this regard, there is the potential that seepages will be of poorer water quality during the late operational and early closure periods owing to the post-depositional remobilization of trace elements (redox- and pH-related dissolution reactions).

Seepage pathways during the post-closure period will be similar as those described above for the operational scenario but with some key differences relating to water management. In the closure period, the ECD and associated pumpback system will be maintained until seepage quality permits direct discharge to Davidson Creek. Following the cessation of mine operations, TSF supernatant will be pumped to the pit to facilitate more rapid filling and flooding of PAG pit walls. The water balance for the open pit indicates that with the addition of TSF overflow to the pit water balance, the pit will fill in approximately 18 years. Once the pit lake is full, pit waters will be re-routed back through the TSF (via the D Cell wetland) for passive treatment prior to release to the Davidson Creek catchment.

In the post-closure schematic in Figure 4-2, the ECD pumpback system has been removed and assumes that TSF effluents are suitable for discharge to Davidson Creek (Figure 4-2). Also shown are engineered wetland systems both upstream and downstream of the former ECD, which will be constructed during mine closure. These wetland systems will operate in series and have relevance to the passive treatment of two contaminant pathways: 1) seepages flows that are conveyed to the surface water system of the wetlands; and 2) seepage flows that are predicted to recharge into the base of the wetlands through organic-rich sediments.

5. Contingency Measures, Monitoring and Confirmatory Testwork

newgold

5. Contingency Measures, Monitoring and Confirmatory Testwork

5.1 Contingency Measures

As part of environmental management planning for the Blackwater Project, several contingency measures have been explored that may be adopted in the event further loading reductions are required to ensure compliance with water quality objectives in Davidson Creek. These options are summarized below.

Engineered Wetlands

As illustrated in Figure 4-2, engineered wetlands will occupy locations in C Cell, D Cell and downgradient of the D Cell dam in the vicinity of the former ECD. To enhance this form of mitigation, the construction of a contingency wetland further downgradient may be considered (shown in Figure 4-2). The wetland in C Cell will be constructed relatively early in mine life (Years 4-5), and therefore the performance data gathered for this system during operations will aid greatly in assessing the design parameters of further wetland systems to be constructed during the closure period.

Sub-Surface Flow Biological Reactors

An evaluation of subsurface passive treatment systems was conducted to assess the potential application permeable reactive barriers (PRBs) and vertical flow biological rectors (VFBRs) as a means to potentially treat seepages from the Blackwater TSF. These systems were considered based on their proven effectiveness, robustness, longevity, and ability to operate with minimal intervention over the long-term. These forms of semi-passive treatment may afford utility for the treatment of lower-flow and higher concentration seepage flows emanating from the TSF. These concepts are addressed in the memorandum "*Blackwater Gold Project – Considerations for Subsurface Passive Treatment using Permeable Reactive Barriers and Vertical Flow Biological Rectors*" (Lorax, 2013c), a summary of which is provided below.

PRBs are designed to intercept plumes of mine-influenced groundwater, whereby flow through a reactive matrix induces chemical transformations that remove contaminants through physical, chemical, and/or biological processes (IRTC, 2005). In particular, PRBs containing organic carbon (*e.g.*, sawdust, spent brewing grain, compost, peat, zero valent iron) promote the removal of dissolved constituents from mine-influenced groundwater by creating conditions suitable for microbially-mediated sulfate reduction and the subsequent precipitation of metal sulfide minerals (Benner *et al.*, 1997).

In VFBR systems, influent waters are forced upward through a permeable reactive matrix where reactions, identical to those for PRBs, take place. In this manner, a primary difference of VFBRs to PRBs is the nature of the hydraulic gradient. For PRBs, the gradient and flow direction are dictated by natural groundwater flow paths. For VFBRs, the upward flow path is afforded by containment (lined system) and water pressure. Given the imposed hydraulic containment of VFBRs, they are less dependent on natural substrate features in comparison to PRBs, which operate most effectively for well-constrained groundwater flow paths. This offers increased flexibility for VFBR placement.

In-Pit Bioremediation

As outlined above for the post-closure conceptual model, the open pit will serve as a temporary repository for TSF supernatant.. In this regard, the potential for in pit bioremediation was assessed for the Blackwater pit lake. A detailed discussion of this topic is provided in the memorandum "*Blackwater Gold Project – Considerations for Pit Lake Bioremediation*" (Lorax, 2013d). A brief summary of this memo is provided below. In-pit bioremediation could be used as a contingency to reduce concentrations in the pit lake, TSF supernatant, or if necessary, TSF seepage pumped to the pit lake.

The *in situ* bioremediation of mine site pit lakes typically involves the addition of nutrients and/or organic matter to create conditions conducive to contaminant removal. The addition of organic matter, in the form of liquid or solid amendments, provides a direct source of organic carbon to the water column. In contrast, the addition of nutrients (nitrogen and phosphorus) adds organic carbon indirectly to the system through the promotion of enhanced algal and bacterial growth. Benefits include: 1) phase transfer from dissolved to particulate forms via algal assimilation and/or adsorption to cellular surfaces; and 2) particle settling, which may include the sinking of organic aggregates or zooplankton faecal pellets. A secondary benefit associated with increased oxidation demand is the potential to enhance suboxia in lake bottom waters and promote metal removal via the precipitation of secondary sulfides. Suboxic conditions are more likely to develop in the bottom waters of stratified lakes due to the reduced influence of atmospheric interaction with pit bottom waters. Pit lake modelling for the Blackwater Pit suggests that there is the potential for temperature and salinity stratification of the water column. In terms of the primary parameters of concern, Cu, Zn and Cd show strong associations with organic matter in natural systems and are amenable to bioremediation via lake fertilization.

The application of organic amendments directly to the TSF was also considered, as outlined in the memorandum "*Blackwater Gold Project – Considerations for use of*

Organic Amendments in Tailings Storage Facility" (Lorax, 2013e). Although available data in the literature suggest that organic amendments have the potential to provide effective control of metal release from saturated tailings deposits through sulfate reduction and metal precipitation, the variability in results, in conjunction with the relative absence of operational-scale applications, do not allow for a high degree of predictability with regards to benefit. In this regard, this mitigation option was excluded from future consideration.

Hydraulic Containment

The hydrologic and hydrogeologic characteristics of the TSF would allow for the implementation of additional hydraulic containment and seepage capture, should such measures be required (as described in New Gold, 2014). This would include measures to enhanced seepage collection, including additional cutoff walls or recovery wells positioned along seepage pathways.

Lime Treatment

Lime treatment offers a potential contingency measure to reduce concentrations of trace elements prior to discharge. Preliminary testwork involving the addition of lime to final tailings effluents (after cyanide destruction and natural degradation) demonstrates effective removal of the primary parameters of concern (Cd, Zn, Cu) at pH greater than 9 to 10 (New Gold, unpublished data). If required, lime treatment could serve as a temporary or long-term measure to ensure compliance of water quality objectives in Davidson Creek.

5.2 Monitoring

Monitoring results obtained during the operational period will inform both the type and scale of enhanced mitigation measures that may be required for the Blackwater Project (described in New Gold, 2014). In overview, key monitoring components will relate to:

- Quality of TSF supernatant;
- Effectiveness of treatment process (SO_2/air);
- Quality of seepage flows;
- Groundwater quality along seepage flow paths (assessment of natural attenuation); and
- Wetland performance (initially for C Cell engineered wetland).

5.3 Confirmatory Testwork

Confirmatory testwork will be used to support the assumptions provided herein with regards to contaminant behaviour. Such work will include:

- Saturated column testwork on pilot-scale tailings. Such experiments will be initiated in Q4 of 2013 to assess the chemical stability of tailings materials under a range of redox conditions; and
- Oxide tailings geochemical testwork: during the early operational period (Years 1 to 2), oxide tailings produced as part of initial ore processing will be used to confirm their suitability as cover material for the TSF. Such work will include static testwork, mineralogy and kinetic testwork (humidity cells and saturated column experiments).
- Monitoring of constructed wetlands in Cell C.

References

newgold

References

AMEC (2013). Blackwater Gold Project, Metal Leaching and Acid Rock Drainage Characterization Report.

Benjamin M.M., Leckie J.O. (1981) Multiple site adsorption of Cd, Cu, Zn and Pb on amorphous iron oxyhydroxide. J. Colloid Inter. Sci. 79:209-221.

Benner, S.G., Blowes, D.W., Ptacek, C.J., 1997. A full-scale porous reactive wall for prevention of acid mine drainage. *Ground Water Monit. Rem.* 17, 99-107.

Bigham, J.M., Schwertmann, U., Carlson, I. and Murad, E. (1990). A Poorly Crystallized Oxyhydroxysulfate Formed by Bacterial Oxidation of Fe(II) in Acid Mine Waters. Geochim. Cosmochim. Acta, 54:2743-2758.

Devuyst E.A., Mosoiu A., Krause E. (1989) Inco's SO_2-air cyanide removal process., Proceedings - 21st Annual Meeting of the Canadian Mineral Processors, Ottawa: 257-263.

Environment Australia (1998) Cyanide Management: Best Practice Environmental Management in Mining series Commonwealth of Australia, June 1998, ISBN 0 642 54563 4, Canberra.

Ghosh G.M., Dzombak D.A., Wong-Chong G.M. (2006) Physical-Chemical Forms of Cyanide, in: D. A. Dzombak, *et al.* (Eds.), Cyanide in Water and Soil: Chemistry, Risk and Management., Taylor and Francis/CRC Press, Boca Raton, FL. pp. 57-92.

IRTC, 2005. Permeable Reactive Barriers: Lessons Learned/New Directions. PRB-4: Permeable Reactive Barriers Team. Washington, D.C.

Jambor J.L., Martin A.J., Gerits J. (2009) The post-depositional accumulation of metal-rich cyanide phases in submerged tailings deposits. Appl. Geochem. 24:2256-2265.

Knight Piesold (2013). Blackwater TSF - Downstream Seepage Estimates. Draft memorandum prepared for New Gold Inc. Prepared by Knight Piesold Consulting, June 6, 2013.

Lorax (2013a). Blackwater Gold Project: Mineralogical Characterization of Waste Rock & Tailings – DRAFT. Memorandum prepared for New Gold Inc. Prepared by Lorax Environmental Services Ltd., August 7, 2013.

Lorax (2013b). Metal sorption potential of natural substrates underlying the Blackwater Tailings Storage Facility: Implications for attenuation along seepage flowpaths.

Memorandum prepared for New Gold Inc. Prepared by Lorax Environmental Services Ltd., July 24, 2013.

Lorax (2013c). Blackwater Gold Project – Considerations for Subsurface Passive Treatment using Permeable Reactive Barriers and Vertical Flow Biological Rectors. Memorandum prepared for New Gold Inc. Prepared by Lorax Environmental Services Ltd., February 18, 2013.

Lorax (2013d). Blackwater Gold Project – Considerations for Pit Lake Bioremediation. Memorandum prepared for New Gold Inc. Prepared by Lorax Environmental Services Ltd., February 24, 2013.

Lorax (2013e). Blackwater Gold Project – Considerations for use of Organic Amendments in Tailings Storage Facility. Memorandum prepared for New Gold Inc. Prepared by Lorax Environmental Services Ltd., March 4, 2013.

Martin A.J., Crusius J., McNee J.J., Yanful E.K. (2003b) The mobility of radium-226 and trace metals in pre-oxidized subaqueous uranium mill tailings. Appl. Geochem. 18:1095-1110.

Martin A.J., Jambor J.L., Pedersen T.F., Crusius J. (2003c) Post-depositional mobility of Cu in a metal-mining polish pond (East Lake, Canada). Env. Sci. Tech. 37:4925-4933.

Martin A.J., McNee J.J., Crusius J., Pedersen T.F., Yanful E.K. (2003a) Mechanisms of metal release from subaqueous mine waste at circum-neutral pH: examples from four case studies, International Conference on Acid Rock Drainage, Cairns, Australia, July 2003. pp. 297-306.

Martin A.J., McNee J.J., Pedersen T.F. (2001) The Reactivity of Sediments Impacted by Metal-Mining in Lago Junin, Peru. J. Geochem. Explor. 74:179-191.

Martin A.J., McNee J.J., Pedersen T.F., Rollo A., Jambor J.L., Aziz M., Yanful E.K. (2005) Water Covers: Failure Modes for Sustained Water Quality Degradation Following Mine Closure, Securing the Future: International conference on Mining and the Environment, Metals and Energy Recovery, Skellefteå, Sweden, June 27-July 1, 2005.

McCorkle D.C., Klinkhammer G.P. (1991) Porewater cadmium geochemistry and the porewater δ13C relationship. Geochim. Cosmochim. Acta 55:161-168.

New Gold (2014). Blackwater Gold Project - Application for an Environmental Assessment Certificate / Environmental Impact Statement. Submitted to British Columbia Environmental Assessment Office.

Peltier, E., Dahl, A. L., & Gaillard, J. F. (2005). Metal speciation in anoxic sediments: When sulfides can be construed as oxides. *Environmental science & technology*, *39*(1), 311-316.

Smith A.C.S., Mudder T.I. (1991) The Chemistry and Treatment of Cyanidation Wastes, Mining Journal Books, London, United Kingdom.

Stumm W., Morgan J.J. (1981) Aquatic Chemistry. 2nd Edition ed. Wiley-Interscience, New York.

Tessier, A., Campbell, P. G., & Bisson, M. (1979). Sequential extraction procedure for the speciation of particulate trace metals. *Analytical chemistry*, *51*(7), 844-851.

Vachon D., Siwik R.S., Schmidt J., Wheeland K. (1987) Treatment of Acid Mine Water and the Disposal of Lime Neutralization Sludge. Proceedings of Acid Mine Drainage Seminar/Workshop, Halifax, Nova Scotia March 23-26, Environment Canada:537-564.

Appendix A
Blackwater Gold Project – Mineralogical Characterization of Waste Rock and Tailings

newgold

newgold™

Blackwater Gold Project: Mineralogical Characterization of Waste Rock & Tailings

Report prepared for:
New Gold Inc.
Suite 1800, Two Bentall Centre 555 Burrard Street
Vancouver, B.C., V7X 1M9

Report prepared by:
Lorax Environmental Services
2289 Burrard St.
Vancouver, B.C., V6J 3H9

September 23, 2013

FINAL

LORAX ENVIRONMENTAL

Table of Contents

newgold™

Table of Contents

TABLE OF CONTENTS i

1. INTRODUCTION 1-1

2. METHODS 2-1
   2.1 SAMPLE SELECTION 2-1
   2.2 ANALYTICAL METHODS 2-2

3. MINERALOGY AND MINERAL CHEMISTRY 3-1
   3.1 WASTE ROCK SAMPLES 3-1
      3.1.1 PETROGRAPHIC OVERVIEW 3-1
      3.1.2 SEM-RESULTS 3-4
         3.1.2.1 BW-ARD2-10 (TYPE 1 - PAG) 3-4
         3.1.2.2 BW-ARD-510 (TYPE 2 - PAG) 3-9
         3.1.2.3 BW-ARD-648 (TYPE 3 - NAG) 3-9
         3.1.2.4 BW-ARD-468 (TYPE 4 - NAG) 3-17
         3.1.2.5 BW-ARD-473 (TYPE 3 - NAG) 3-17
   3.2 TAILINGS SAMPLES 3-25
      3.2.1 PETROGRAPHIC OVERVIEW 3-25
      3.2.2 SEM RESULTS 3-29
         3.2.2.1 CND 2-4 (SULFIDE TAILINGS) 3-29
         3.2.2.2 CND 1-5 (TRANSITION TAILINGS) 3-30

4. CONCLUSIONS 4-1

REFERENCES R-1

LIST OF FIGURES

FIGURE 3-1 PHOTOMICROGRAPHS SHOWING A) TYPICAL RECRYSTALLIZED QUARTZ-FELDSPAR-MATRIX WITH SERICITE-FILLED PATCHES (TYPE 1, PAG) B) BIOTITE-ALTERED GROUNDMASS WITH SUBHEDRAL PYRITE (TYPE 2, PAG) AND C) IRREGULARLY-SHAPED PYRITE-SPHALERITE CO-PRECIPITATE IN BIOTITE-SERICITE-MATRIX (TYPE 3, NAG). FIELD OF VIEW = 0.75 MM 3-3

FIGURE 3-2 BSE-IMAGE OF A SPHALERITE GRAIN IN WASTE ROCK SAMPLE BW-ARD2-10 (TYPE 1 – PAG), SHOWING (1) CHALCOPYRITE, (2) SPHALERITE, (3) QUARTZ-FELDSPAR MATRIX 3-5

FIGURE 3-3 EELEMENTAL MAPS FOR CU, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-2 (WASTE ROCK SAMPLE BW-ARD2-10; TYPE 1 – PAG). 3-5

FIGURE 3-4 BSE-IMAGE OF PARTIALLY WEATHERED SPHALERITE-PYRITE AGGREGATE IN WASTE ROCK SAMPLE BW-ARD2-10 (TYPE I – PAG), SHOWING (1) SPHALERITE, (2) QUARTZ, (3) BIOTITE, (4) PYRITE, (5) FE-HYDROXIDE. 3-6

FIGURE 3-5 ELEMENTAL MAPS FOR SI, O, S, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-4 (WASTE ROCK SAMPLE BW-ARD2-10; TYPE I – PAG) 3-7

FIGURE 3-6 BSE-IMAGE OF PYRITE FILLING MICROFACTURES IN A QUARTZ-SERICITE GROUNDMASS IN WASTE ROCK SAMPLE BW-ARD2-10 (TYPE 1 – PAG). 3-8

FIGURE 3-7 ELEMENTAL MAPS FOR FE, S, ZN AND CD OF AREA SHOWN IN FIGURE 3-6 (WASTE ROCK SAMPLE BW-ARD2-10; TYPE I – PAG). 3-8

FIGURE 3-8 BSE-IMAGE OF PYRITE (1) GRAINS EMBEDDED IN CALCITE (2) IN WASTE ROCK SAMPLE BW-ARD-510 (TYPE 2 – PAG) 3-10

FIGURE 3-9 ELEMENTAL MAPS FOR S, O, CA, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-8 (WASTE ROCK SAMPLE BW-ARD-510; TYPE 2 – PAG) 3-11

FIGURE 3-10 ANHEDRAL PYRITE AGGEGRAGTE IN WASTE ROCK SAMPLE BW-ARD-510 (TYPE 2 – PAG) 3-12

FIGURE 3-11 SELECTED ELEMENTAL MAPS OF AREA SHOWN IN FIGURE 3-10 (WASTE ROCK SAMPLE BW-ARD-510; TYPE 2 – PAG) 3-12

FIGURE 3-12 BSE IMAGE SHOWING SPHALERITE (1)-PYRRHOTITE (2) ASSEMBLAGE EMBEDDED IN CHLORITE (3) MATRIX IN WASTE ROCK SAMPLE BW-ARD-648 (TYPE 3 – NAG). 3-13

FIGURE 3-13 ELEMENTAL MAPS FOR S, O, FE, CU, ZN AND CD OF AREA SHOWN IN FIGURE 3-12 (WASTE ROCK SAMPLE BW-ARD-648; TYPE 3 – NAG). 3-14

FIGURE 3-14 EDX-SPECTRUM OF SPHALERITE GRAIN IN WASTE ROCK SAMPLE BW-ARD-648 (TYPE 3 – NAG) SHOWING PRESENCE OF CD, MN AND FE. 3-15

FIGURE 3-15 BSE-IMAGE AND COUNTS-VS-DISCTANCE PLOT SHOWING THE LOCATION AND RELATIVE ELEMENTAL ABUNDANCES (ZN, S, CU, FE AND CD) IN AN EDX LINE-SCAN RUNNING FROM SPHALERITE INTO PYRROTHITE IN WASTE ROCK SAMPLE BW-ARD-648 (TYPE 3 – NAG) 3-16

FIGURE 3-16 BSE-IMAGE OF A MASSIVE PYRITE GRAIN IN WASTE ROCK SAMPLE BW-ARD-468 (TYPE 4 – NAG). 3-18

FIGURE 3-17 SELECTED ELEMENTAL FOR S, O, SI, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-16 (WASTE ROCK SAMPLE BW-ARD-468; TYPE 4 – NAG). 3-19

FIGURE 3-18 EDX-SPECTRUM OF A REPRESENTATIVE SPHALERITE GRAIN IN WASTE ROCK SAMPLE BW-ARD-468 (TYPE 4 – NAG) HIGHLIGHTING THE PARTITIONING OF CD, MN, AND FE INTO THE CRYSTAL LATTICE. 3-20

FIGURE 3-19 BSE-IMAGE OF FRAGMENT CONTAINING LIKELY MN-FE-CA CARBONATE (1; RHODOCHROSITE) IN WASTE ROCK SAMPLE BW-ARD-473 (TYPE 3 – NAG). OTHER MINERALS ARE (2) CHLORITE, (3) QUARTZ, AND (4) SERICITE. 3-20

FIGURE 3-20 SELECTED ELEMENTAL MAPS FOR FE, O, S, CA, CD AND ZN OF AREA SHOWN IN FIGURE 3-18 (WASTE ROCK SAMPLE BW-ARD-473; TYPE 3 – NAG). 3-21

FIGURE 3-21 EDX-SPECTRUM OF MINERAL 1 IN FIGURE 3-19, SUGGESTING A MN-FE-CA-CARBONATE WITH CONSIDERABLE ZN CONTENT IN WASTE ROCK SAMPLE BW-ARD-473 (TYPE 3 – NAG). 3-22

FIGURE 3-22 BSE-IMAGE OF POLYMETALLIC SULFIDE CLUSTER (1) ENCLOSED BY RHODOCHROSITE (2) IN SAMPLE BW-ARD-473 (TYPE 3 – NAG). 3-22

FIGURE 3-23 ELEMENTAL MAPS FOR FE, S, O, CU, ZN AND CD OF AREA SHOWN IN FIGURE 3-22 (WASTE ROCK SAMPLE BW-ARD-473; TYPE 5 – NAG). 3-23

FIGURE 3-24 BSE- IMAGE AND EDX SPECTRUM SHOWING LOCATION AND QUALITATIVE CHEMISTRY OF A CD-SULFIDE PHASE (1) IN WASTE ROCK SAMPLE BW-ARD 473 (BW-ARD-473; TYPE 3 – NAG). 3-24

FIGURE 3-25 BSE-IMAGE SHOWING FE-HYDROXIDE RIM (1) ADJACENT TO QUARTZ-BIOTITE (2) MATRIX IN WASTE ROCK SAMPLE BW-ARD-473 (TYPE 3 – NAG). 3-26

FIGURE 3-26 ELEMENTAL MAPS S, O, SI, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-25 (WASTE ROCK SAMPLE BW-ARD-473; TYPE 3 – NAG). 3-27

FIGURE 3-27 BSE-IMAGE AND COUNTS-VS-DISCTANCE PLOT SHOWING THE LOCATION AND RELATIVE ELEMENTAL ABUNDANCES IN AN EDX LINE-SCAN RUNNING FROM A SECONDARY FE-HYDROXIDE INTO THE ADJACENT QUARTZ-BIOTITE-MATRIX IN WASTE ROCK SAMPLE BW-ARD-473 (TYPE 3 – NAG). 3-28

FIGURE 3-28 BSE-IMAGE OF A TYPICAL FRAGMENT ASSEMBLAGE SEEN IN TAILINGS SAMPLE CND 2-4 SHOWING (1) ALTERED ARSENOPYRITE (?) AND (2) SPHALERITE. 3-31

FIGURE 3-29 EELEMENTAL MAPS FOR SI, S, MG, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-28 (TAILINGS SAMPLE CND 2-4). 3-32

FIGURE 3-30 BSE-IMAGE OF FRAGMENT ASSEMBLAGE IN TAILINGS SAMPLE CND 2-4 SHOWING (1) SPHALERITE, (2) ARSENOPYRITE, (3) PYRITE AND (4) ALUMINOSILICATE WITH FE-HYDROXIDE RIM. 3-33

FIGURE 3-31 EELEMENTAL MAPS FOR SI, S, MG, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-30 (TAILINGS SAMPLE CND 2-4). 3-34

FIGURE 3-32 EDX-SPECTRUM OF ARSENOPYRITE GRAIN IN TAILINGS SAMPLE CND 2-4 SHOWING DETECTABLE FE, AS, SB, AND S. 3-35

FIGURE 3-33 BSE-IMAGE OF TAILINGS SAMPLE CND 2-4 SHOWING CO-PRECIPIATETD PYRITE (1) AND SPHALERITE (2). GANGUE MINERALS ARE BIOTITE (3) AND MUSCOVITE (4). 3-35

FIGURE 3-34 ELEMENTAL MAPS FOR FE, S, ZN AND CD OF AREA SHOWN IN FIGURE 3-33 (TAILINGS SAMPLE CND 2-4). 3-36

FIGURE 3-35 BSE-IMAGE OF TAILINGS SAMPLE CND 1-5 SHOWING A RELATAIVELY LOW-MAGNIFICATION OVERVIEW OF A FRAGMENT ASSEMBLAGE. 3-36

FIGURE 3-36 ELEMENTAL MAPS FOR S, SI, O, FE, ZN AND CD OF AREA SHOWN IN FIGURE 3-35 (TAILINGS SAMPLE CND 1-5). 3-37

FIGURE 3-37 BSE-IMAGE OF TAILINGS SAMPLE 1-5 SHOWING BIOTITE CLUSTER WITH SECONDARY PRECIPITATES ALONG GRAIN BOUNDARIES. 3-38

FIGURE 3-38 ELEMENTAL MAPS OF AREA SHOWN IN FIGURE 3-37 (TAILINGS SAMPLE CND 1-5)..... 3-38

FIGURE 3-39 BSE-IMAGE OF TAILINGS SAMPLE 1-5 SHOWING NETWORK OF REPLACIVE FE-HYDROXIDE IN POLYMINERALIC FRAGMENT (TAILINGS SAMPLE CND 1-5) 3-39

FIGURE 3-40 ELEMENTAL MAPS OF AREA SHOWN IN FIGURE 3-39 (TAILINGS SAMPLE CND 1-5)..... 3-39

LIST OF TABLES

TABLE 2-1 CLASSIFICATIONS AND ABA RESULTS FOR WASTE ROCK AND TAILINGS SAMPLES SELECTED FOR MINERALOGICAL CHARACTERIZATION 2-1

TABLE 3-1 RIETVELD XRD RESULTS FOR TWO OF THE FIVE WASTE ROCK SAMPLES FROM THE BLACKWATER DEPOSIT (IN %)..... 3-1

1. Introduction

newgold™

1. Introduction

Newgold's Blackwater Gold Project targets an epithermal gold deposit that is expected to produce approximately 450 Mt of waste rock and 243 Mt of tailings over a 10-year production period of open-pit mining. As part of environmental planning for the site, the management of metal leaching (ML) and acid rock drainage (ARD) represents a key focus. Geochemical testwork conducted to date indicates that Zn and Cd will likely be the main elements of concern with respect to mine waste management. Based on acid-base accounting characteristics as well as Zn content, the following five major waste rock types have been established to support ML/ARD characterization and management:

Type 1 - NPR < 1.0 (PAG)

Type 2 - 1.0 < NPR < 2.0 (PAG)

Type 3 - NPR > 2.0 and Zn > 1000 ppm (NAG)

Type 4 - NPR > 2.0 and 600 ppm < Zn < 1000 ppm (NAG)

Type 5 - NPR > 2.0 and Zn < 600 ppm (NAG)

In this classification, the risk of the different waste rock types to produce environmentally harmful drainage decreases with increasing waste type number. Waste rock of Types 1, 2 and 3 will be disposed of subaqueously into the TSF pond while Types 4 and 5 will be used for construction with residual waste rock stored in two out-of-pit waste rock dumps. For the tailings, classifications of oxide, transition and sulfide, have been adopted to reflect the weathering profile through the deposit. The bulk of the tailings to be generated are derived from the milling of sulfide ores and, to a much lesser extent, transition and oxide ore.

In order to support the ML/ARD assessment, and to provide further insight into the geochemical controls governing the remobilization of metals in both subaerial and subaqueous settings, detailed mineralogical assessment of waste rock and tailings samples was conducted. A specific goal of this study was to gain a better understanding of the general mineralogical composition and texture of waste rock and tailings materials, with a special focus on the partitioning behaviour of Zn and Cd within the various assemblages. For that purpose, five waste rock samples (one from each class) and two tailings samples were studied using optical as well as a scanning-electron microscopy (SEM) for textural observations and qualitative insight into mineral chemistry, respectively. The results of this assessment have relevance to the ML/ARD characterization program, the weathering characteristics associated with subaerially exposed materials, chemical stability in saturated settings, and mine waste management.

2. Methods

2. Methods

2.1 Sample Selection

Characteristics and acid-base-accounting (ABA) results for samples analyzed as part the mineralogical assessment are summarized in Table 2-1. Five waste rock samples, representing waste rock classification Types 1-4, were characterized. Initially it was thought that sample BW-ARD-473 belonged to waste type 5, however it was found that this sample was in fact misclassified and now falls into the Type 3 category. It should be noted however that this sample differs from the other Type 3 waste rock sample (BW-ARD-648) as it was recovered from the transition zone while all other samples originated from the sulfide zone. Two tailings samples, one representing transition zone material (CND 1-5) and the other originating from the sulfide zone (CND 2-4), were also examined. Both tailings samples were previously subjected to cyanide leaching and cyanide destruction. Sulfide tailings will represent over 80% of the total materials generated at the site, with transition tailings (~18%) and oxide tailings (~2%) representing much small fractions.

Table 2-1:
Classifications and ABA Results for Waste rock and Tailings Samples Selected for Mineralogical Characterization

Sample ID	Sample Type	Sub Class	Paste pH	TIC	CaNP	NP	Total S	Sulfate S	Sulfide S	MAP	NPR	NPR
				% CO2	kg CaCO3/t	kg CaCO3/t	%	%	%	kg CaCO3/t	NP/ TAP	CaNP/ TAP
BW-ARD2-10	Waste rock	Type 1 (Sulfide Zone; PAG)	5.2	0.18	4.2	4.0	1.1	0.010	1.1	34	0.12	0.12
BW-ARD-510	Waste rock	Type 2 (Sulfide Zone; PAG)	8.6	0.33	7.5	14	0.35	0.020	0.35	11	1.3	0.69
BW-ARD-648	Waste rock	Type 3 (Sulfide Zone; NAG)	8.3	1.1	25	37	0.45	0.010	0.45	14	2.6	1.8
BW-ARD-473	Waste rock	Type 3 (Transition Zone; NAG)	7.8	2.5	57	27	0.080	0.010	0.070	2.5	11	23
BW-ARD-468	Waste rock	Type 4 (Sulfide Zone; NAG)	7.4	0.99	23	13	0.16	0.010	0.14	5.0	2.6	4.5
CND 2-4	Tailings	Sulfide Zone	7.9	0.40	33	11	0.81	0.030	0.78	25	0.43	1.3
CND 1-5	Tailings	Transition Zone	7.6	0.20	17	4.0	0.45	0.050	0.40	14	0.28	1.2

Notes: TIC = total inorganic carbon; NP = neutralization potential; CaNP = carbonate NP; MAP = maximum acid potential; NPR = net potential ratio; sample BW-ARD-473 was initially misclassified as Type 5.

2.2 Analytical Methods

X-ray diffraction (XRD) was conducted at the University of British Columbia (UBC) using a Siemens D5000 detector with Bruker D8 Focus (LynxEye detector) diffractometers. XRD, with Rietveld refinement, allows for semi-quantitative determinations of mineral abundance. XRD identifies minerals by measuring the angle at which a mineral diffracts incident X-rays, which is in turn dependent on the arrangement of atoms within the crystal lattice of minerals. Due to the fact that amorphous materials contain no regularly ordered crystal lattice, these materials do not diffract X-rays and are therefore unidentifiable by XRD (*e.g.*, Raudsepp and Pani, 2003).

Optical microscopy was undertaken using a Nikon Optiphot polarizing microscope at Lorax Environmental Services Ltd. Photomicrographs were taken using a AmScope MD900E camera. Based on the findings of the petrographic analysis, areas of interest were specified and marked for analysis using scanning electron microscopy (SEM). The latter was conducted at UBC using a Philips XL-30 scanning electron microscope with a Bruker Quanta 200 energy-dispersion X-ray (EDX) system. Samples were observed in back-scattered electron (BSE) mode at a voltage of 15 kV for imaging purposes.

SEM is used to gain both physical and chemical information of solid materials. Imaging on the SEM provides information on grain size, texture, and mineralogical associations. In addition, the relative greyscale intensity shown in back scatter electron (BSE) images corresponds to the average atomic number such that bright areas indicate relatively high atomic numbers (*e.g.*, ZnS) while darker areas indicate low atomic numbers (*e.g.*, SiO_2). Elemental analysis was conducted using point energy dispersive X-ray spectroscopy (EDX) and by producing 2-D elemental maps. Under optimized EDX experimental setups, the volume of beam interaction can be as small as 1 x 1 x 3 µm. Point EDX analyses produce spectra which are processed to reveal the elements that are present within the volume of beam interaction as well as their relative quantity. While not quantitative, the production of 2-D elemental maps is useful in visualizing elemental distributions and elemental associations over a given area.

3. Mineralogy and Mineral Chemistry

newgold™

3. Mineralogy and Mineral Chemistry

3.1 Waste Rock Samples

3.1.1 Petrographic Overview

Blackwater waste rock samples were examined by X-ray diffraction (XRD) and optical methods in order to gain a general understanding of mineralogy and texture and to select areas of interest for SEM analysis. Mineral abundances measured by Rietveld XRD-analysis are given in Table 3-1. The following section provides a general description of textural relationships and major minerals, and is not intended to give a detailed petrographic representation.

Table 3-1:
Rietveld XRD results for two of the five waste rock samples from the Blackwater deposit (in %)

Mineral	Ideal Formula	BW-ARD-2-10	BW-ARD-510	BW-ARD-648	BW-ARD-473	BW-ARD-468
Biotite	$K(Mg,Fe^{2+})_3AlSi_3O_{10}(OH)_2$		7.7	7.9	1.7	4.6
Calcite	$CaCO_3$			0.1		13
Chlorite	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$		2.8	7.4	2.9	4.9
Diopside	$CaMgSi_2O_6$				2.5	
Grossular	$Ca_3Al_2(SiO_4)_3$		0.9			
Halite	NaCl				1.4	
Kaolinite	$Al_2Si_2O_5(OH)_4$		1.1			
K-feldspar	$KAlSi_3O_8$	33.1	19.9	9.6	10.1	
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	19.4	17.9		10.7	18.3
Plagioclase	$NaAlSi_3O_8 - CaAl_2Si_2O_8$		13.9	38.4	21.4	
Pyrite	FeS_2	0.5				2.9
Quartz	SiO_2	46.3	35.8	36.6	44.4	56.3
Rhodochrosite	$MnCO_3$				5	
Sphalerite	(Zn,Fe)S	0.7				
Total		100	100	100	100	100

Features pertinent to all studied samples include the presence of a pervasively altered, partly to fully recrystallized quartz-feldspar groundmass with fine to medium grain sizes of granoblastic to sutured texture (Figure 3-1a). Relict igneous textures are only rarely preserved, and if so, they occur as partly to fully replaced feldspar phenocrysts. All samples have been pervasively altered/recrystallized with the primary alteration assemblages being secondary feldspar, sericite/muscovite, chlorite and biotite (Figure 3-1a,b) with the exception of the Type 1 (PAG) sample (BW-ARD2-10)..This alteration is varitextured and was found primarily as fine-grained irregular patches, schlieren, honeycomb-networks and pseudomorphs after feldspar. Sample BW-ARD-510 (Type 2, PAG) and NAG samples are somewhat more mafic than BW-ARD2-10 (Type 1, PAG) and display additional chlorite and amphibole (likely actinolite; not detected by XRD) alteration. As to be expected, carbonate minerals were observed in the three NAG samples. In sample BW-ARD-473 (Type 3, NAG) a considerable proportion of the carbonate assemblage was identified to be rhodochrosite, thus limiting the acid-buffering potential of this material. In many cases, alteration assemblages were too fine-grained and pervasive to identify the exact mineral composition, although XRD-analysis suggests that clay-minerals (*e.g.*, kaolinite), grossular and halite are additional minor components within the Blackwater waste rock samples.

Sulfide mineralogy and texture were found to be variable between the different waste rocks samples with the Type 1 (PAG) sample (BW-ARD2-10) showing the highest abundance of sphalerite, generally occurring as medium- to coarse-grained masses (typically ~0.5 mm in diameter) with relatively straight grain boundaries. In this sample, sphalerite may be present within the groundmass or co-precipitated with quartz in veinlets. Although less abundant, medium- to coarse-grained sphalerite aggregates were also identified in the Type 3 (NAG) sample (BW-WRD-648) (Figure 3-1c) which is consistent with this sample having the second highest solid-phase Zn content (1180 ppm) of all waste rock samples. In all other samples, sphalerite is relatively rare and was found primarily as fine (<25 μm) anhedral grains dispersed throughout the fragments. The dominant sulfide mineral in samples other than the Type 1 (PAG) is pyrite, which varies in textural appearance between samples. In the Type 1 (PAG) sample, pyrite is most commonly found in coarse networks of elongated and oriented schlieren-like aggregates with highly corroded grain boundaries. Some fragments in Type 4 (NAG) sample show similar pyrite occurrences; however, in other Blackwater waste rock samples, anhedral, fine- to medium-grained disseminated pyrite embedded within the recrystallized matrix and associated with sericite and/or biotite is the most typical occurrence. Rare pyrrhotite co-precipitated with sphalerite was additionally found in sample BW-ARD-648 (Type 3, NAG).

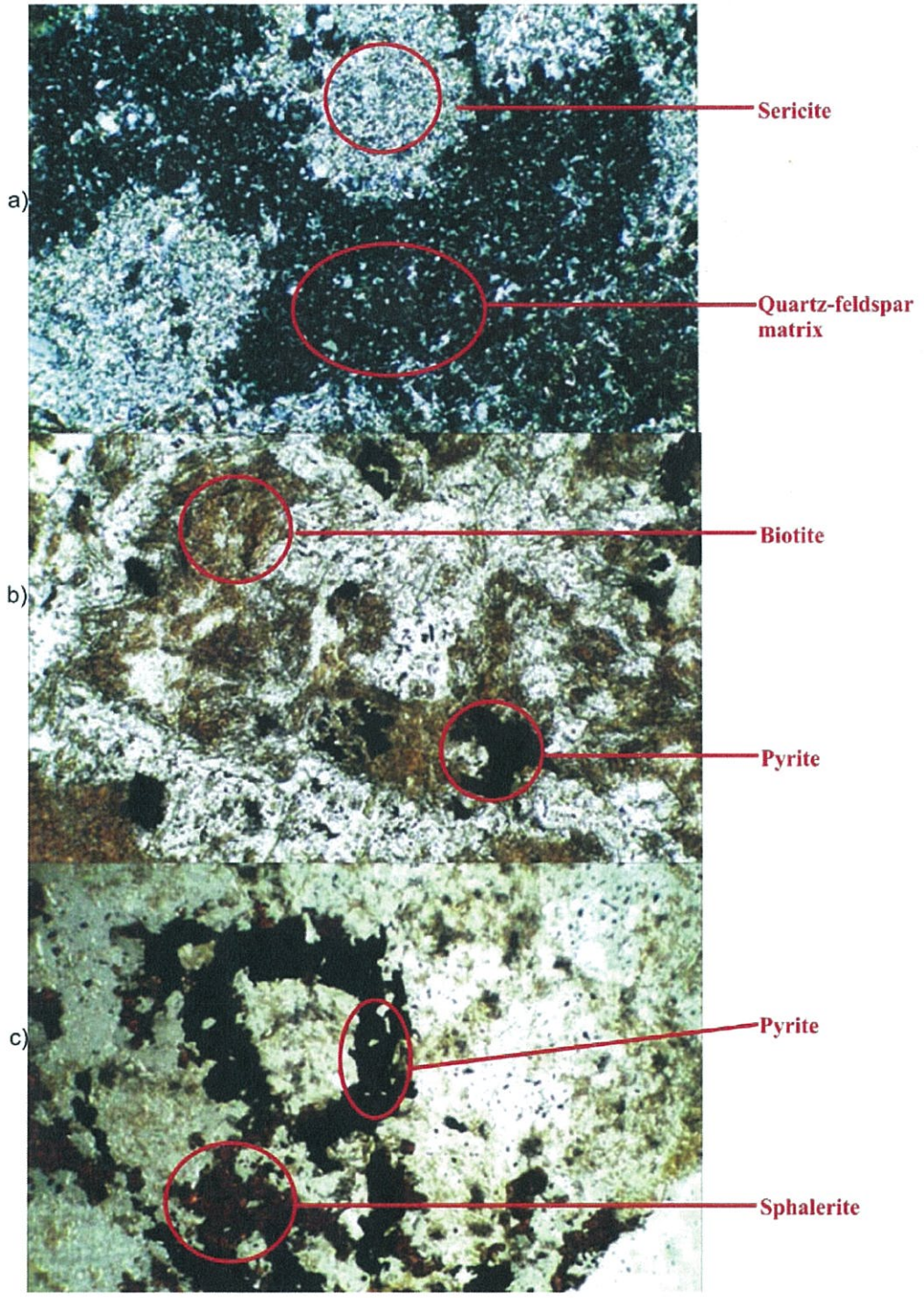


Figure 3-1: Photomicrographs showing a) typical recrystallized quartz-feldspar-matrix with sericite-filled patches (Type 1, PAG) b) biotite-altered groundmass with subhedral pyrite (Type 2, PAG) and c) irregularly-shaped pyrite-sphalerite co-precipitate in biotite-sericite-matrix (Type 3, NAG). Field of view = 0.75 mm.

3.1.2 SEM-Results

3.1.2.1 BW-ARD2-10 (Type 1 - PAG)

Relatively large, anhedral to subhedral sphalerite grains are a common feature in sample BW-ARD2-10, and may occur as replacive aggregates within the silicate groundmass of the rock or as co-precipitates in veins. A BSE-image of a replacive grain is provided in Figure 3-2 where contrast and brightness were adjusted to make subtle differences in sulfide-mineralogy discernible. In this figure, slightly darker inclusions (1) within the sphalerite (2) grain are represented by chalcopyrite that exsolved during cooling of the rock or replaced sphalerite (Barton and Bethke, 1987). The surrounding, black phases are silicate minerals with low heavy metal content. A map of selected elements within this grain is shown in Figure 3-3 and nicely illustrates the location of chalcopyrite where the intensity of Cu-signals is high. The iron content in this sphalerite is considerable, and both Cu and Cd were detected at minor concentrations.

An example of a sphalerite grain (1) that precipitated within a vein is shown in Figure 3-4. The surrounding silicates phases are quartz (*e.g.*, mineral 2) and biotite (3). Where in contact with quartz (left side, Figure 3-4), the grain appears unweathered with relatively straight grain boundaries. In contrast, the contact on the right side, is more corroded and elemental mapping (Figure 3-5) suggests some co-precipitation of pyrite (4) as well as incipient sphalerite replacement by Fe-hydroxides (5). Closer examination of the Cd and Zn signatures in this assemblage reveals that both of these elements are only at background levels in minerals other than sphalerite, indicating that their affinity to pyrite and secondary Fe-phases is limited in this sample.

Pyrite-filled cracks that show sub-parallel orientation were identified in several areas within the studied sample. Pyrite of this texture may form in response to remobilization of pre-existing S-bearing phases and commonly precipitates as fine-grained aggregates (*e.g.*, Craig *et al.*, 1998) that are prone to fast weathering and acid generation. The BSE image and elemental distribution for elements of interest are shown in Figure 3-6 and Figure 3-7, respectively, and suggest that this pyrite occurrence is a relatively pure phase with no detectable Zn or Cd incorporated in the crystal lattice.

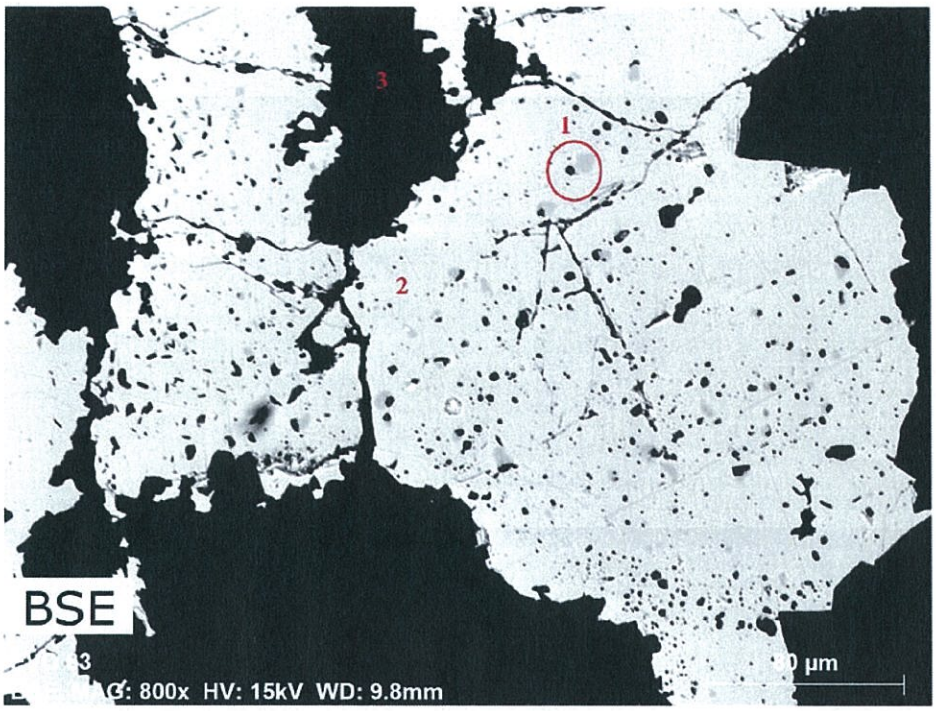


Figure 3-2: BSE-image of a sphalerite grain in waste rock sample BW-ARD2-10 (Type 1 – PAG), showing (1) chalcopyrite, (2) sphalerite, (3) quartz-feldspar matrix.

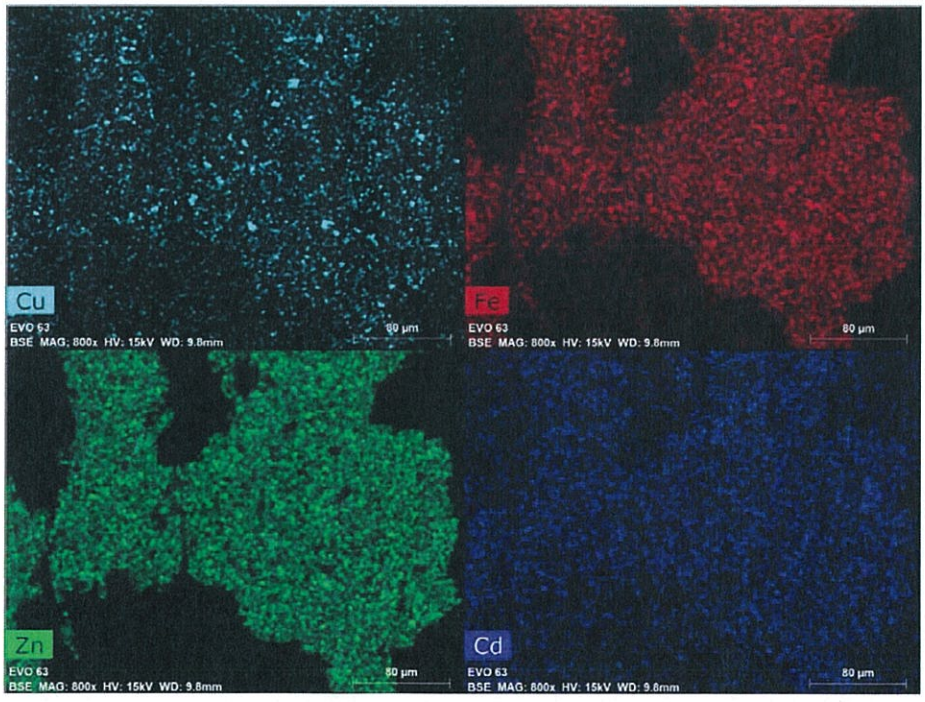


Figure 3-3: Eelemental maps for Cu, Fe, Zn and Cd of area shown in Figure 3-2 (waste rock sample BW-ARD2-10; Type 1 – PAG).

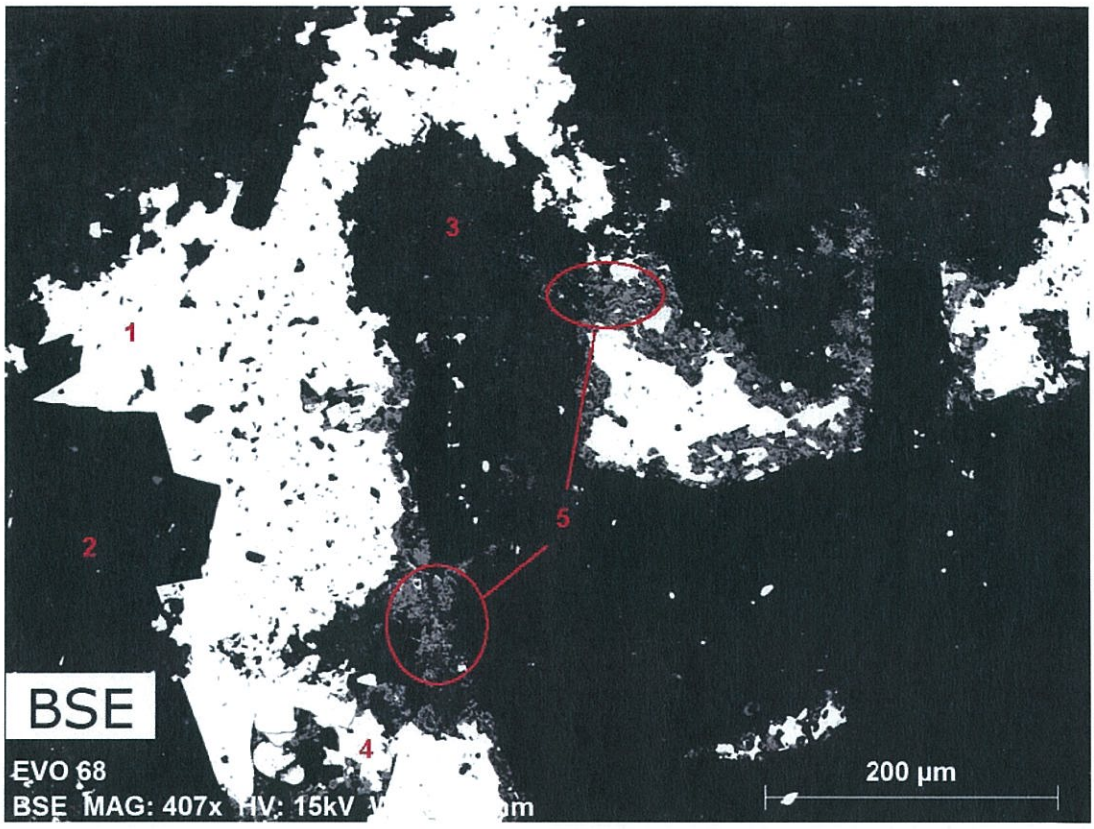


Figure 3-4: BSE-image of partially weathered sphalerite-pyrite aggregate in waste rock sample BW-ARD2-10 (Type I – PAG), showing (1) sphalerite, (2) quartz, (3) biotite, (4) pyrite, (5) Fe-hydroxide.

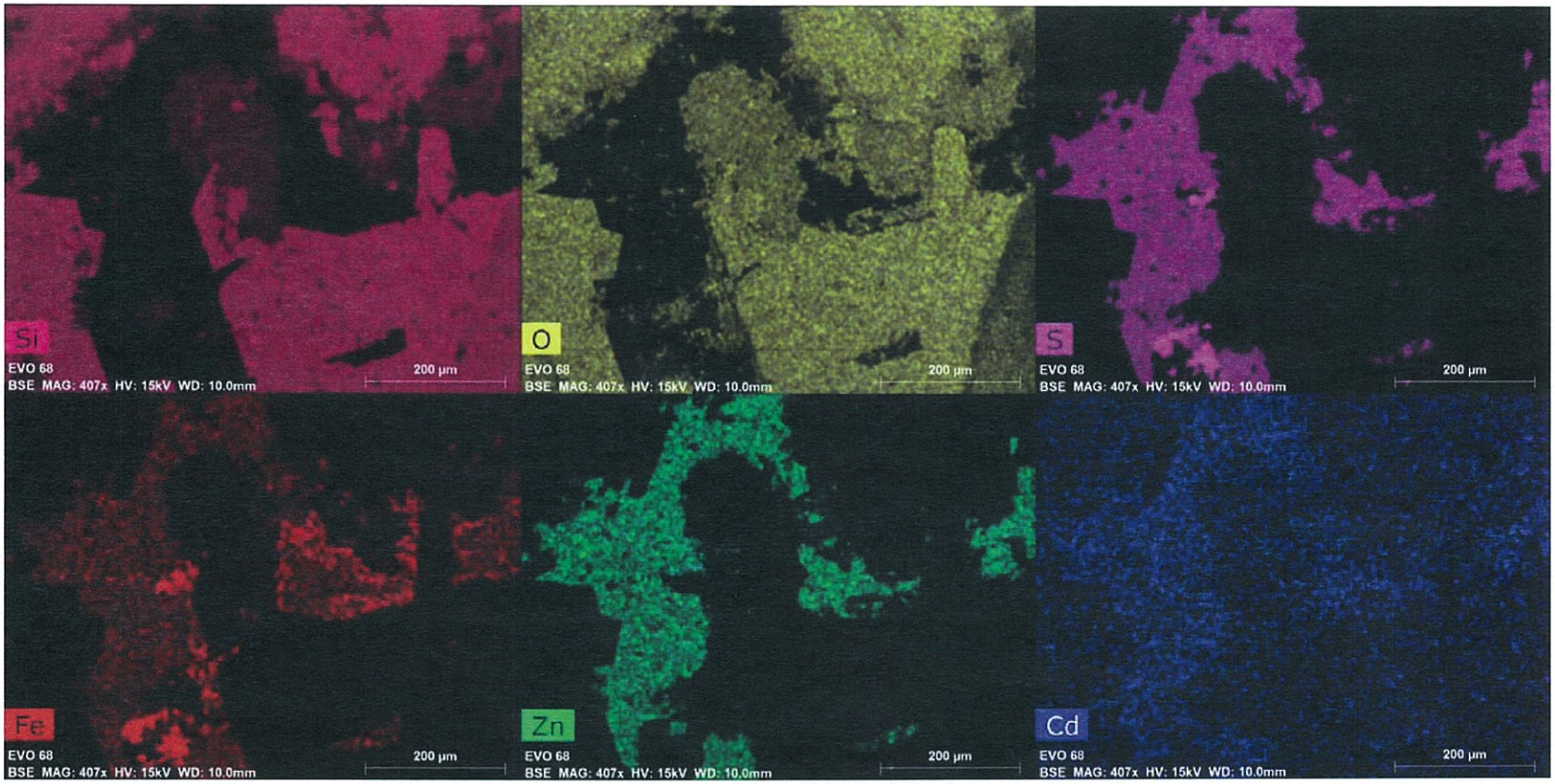


Figure 3-5: Elemental maps for Si, O, S, Fe, Zn and Cd of area shown in Figure 3-4 (waste rock sample BW-ARD2-10; Type I – PAG)

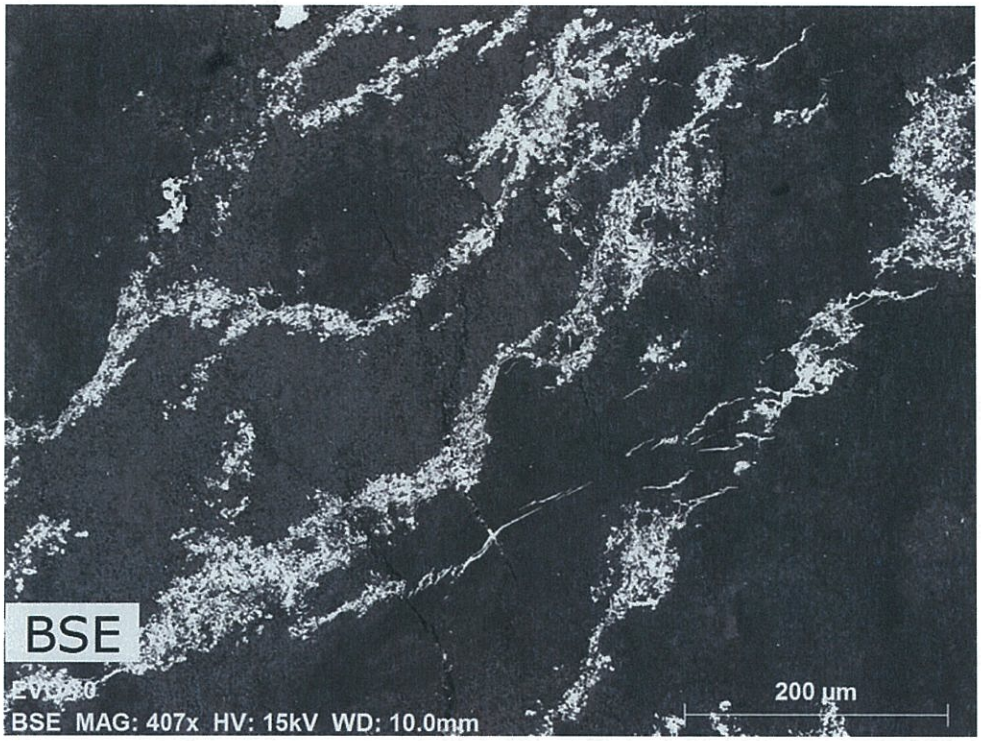


Figure 3-6: BSE-image of pyrite filling microfactures in a quartz-sericite groundmass in waste rock sample BW-ARD2-10 (Type 1 – PAG).

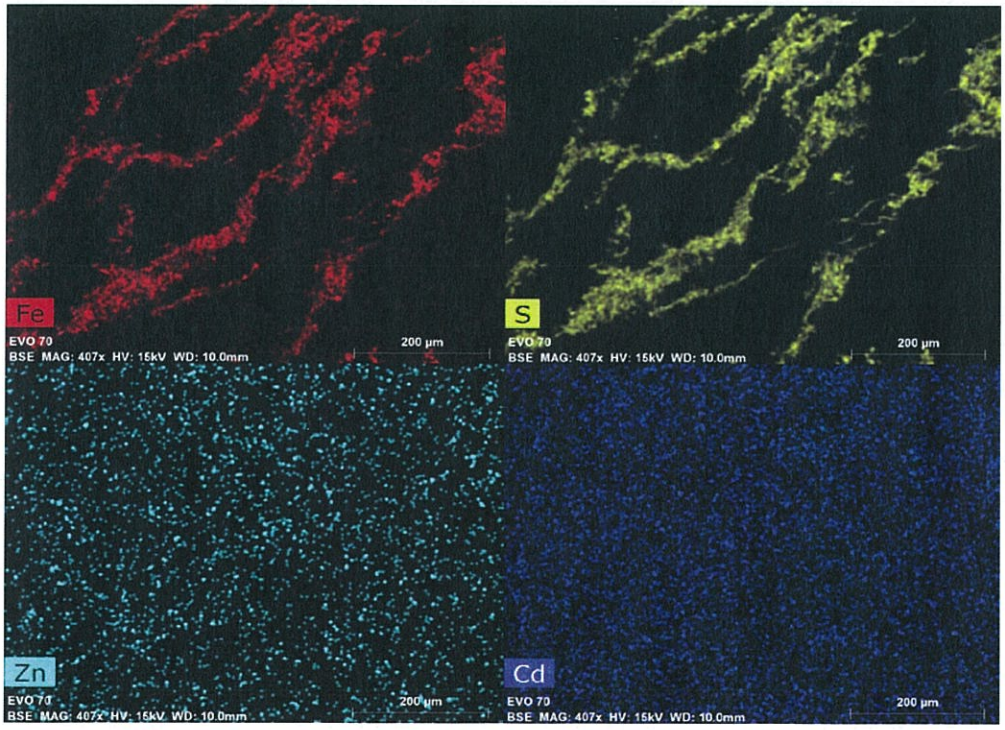


Figure 3-7: Elemental maps for Fe, S, Zn and Cd of area shown in Figure 3-6 (waste rock sample BW-ARD2-10; Type I – PAG).

3.1.2.2 BW-ARD-510 (Type 2 - PAG)

In accordance with geochemical and petrographic results, discrete Zn-phases (generally sphalerite) were found to be relatively rare in sample BW-ARD-510. Where sphalerite was identified, Zn and Cd showed similar distribution patterns and EDX-spectra as observed in sample BW-ARD2-10 (not shown). A major difference between the two PAG samples was, however, that both Zn and Cd partition into pyrite more strongly than in sample BW-ARD2-10 (Type 1 – PAG). This finding is supported by the BSE images and elemental maps shown in Figure 3-8 through Figure 3-11. The pyrite grain shown in Figure 8 is embedded in calcite which is known to be able to incorporate Cd into its crystal lattice, a behaviour that is being explored for remedial purposes in mining environments (Tesoriero *et al.*, 1996). The Cd map of this area (Figure 3-9) suggests, however, that Cd is more abundant in pyrite in the Type 2 sample (with Cd in calcite at background signal levels), making calcite an unlikely source of Cd during water-rock interaction.

3.1.2.3 BW-ARD-648 (Type 3 - NAG)

Sample BW-ARD-648 was classified as NAG based on ABA results; however, this sample still hosts relatively high Zn content (1180 ppm) and thus metal leaching may be an issue in this waste rock sub-group. The first area of interest represents a sphalerite(1)-pyrrhotite(2)-cluster embedded in a chlorite (3) matrix (Figure 3-12). Chalcopyrite occurs as oriented exsolution blebs within the larger sphalerite agglomerate ("chalcopyrite disease"). Grain boundaries at the contact between sulfide and silicate minerals are straight to sutured. Elemental maps illustrate that, like in other samples, Zn is sharply confined to sphalerite. Due to the low signal intensity of Cd, its map appears much less clear. However, comparison between the different elemental maps (Figure 3-13) suggests that Cd is contained in sphalerite and potentially pyrrhotite.

In order to better resolve the chemistry of this sphalerite grain as well as to shed light on the elemental distribution between sphalerite and pyrrhotite, EDX spot and line scans were produced. The chemical composition of the sphalerite was found to be qualitatively homogenous with a typical EDX-spectrum provided in Figure 3-14. Note that, besides the considerable Fe-content in sphalerite already observed in other samples, Mn also shows a clearly distinguishable peak. Although minor, EDX analysis also generally returned above-background peaks for cadmium. The results for selected elements measured in a cross-mineral EDX line-scan are presented in Figure 3-15. The line was positioned to traverse from the large sphalerite grain into the adjacent pyrrhotite. The elemental counts indicate a relatively sharp transition between the two minerals with a small gap between the individual grains. Note the spike in the Zn-signal after the grain boundary was

crossed from sphalerite into pyrrhotite. This phenomenon may be indicative of Zn-diffusion from sphalerite into pyrrhotite. Cadmium is consistently low in both grains, with no clear drop-off in concentration being recognizable for either grain.

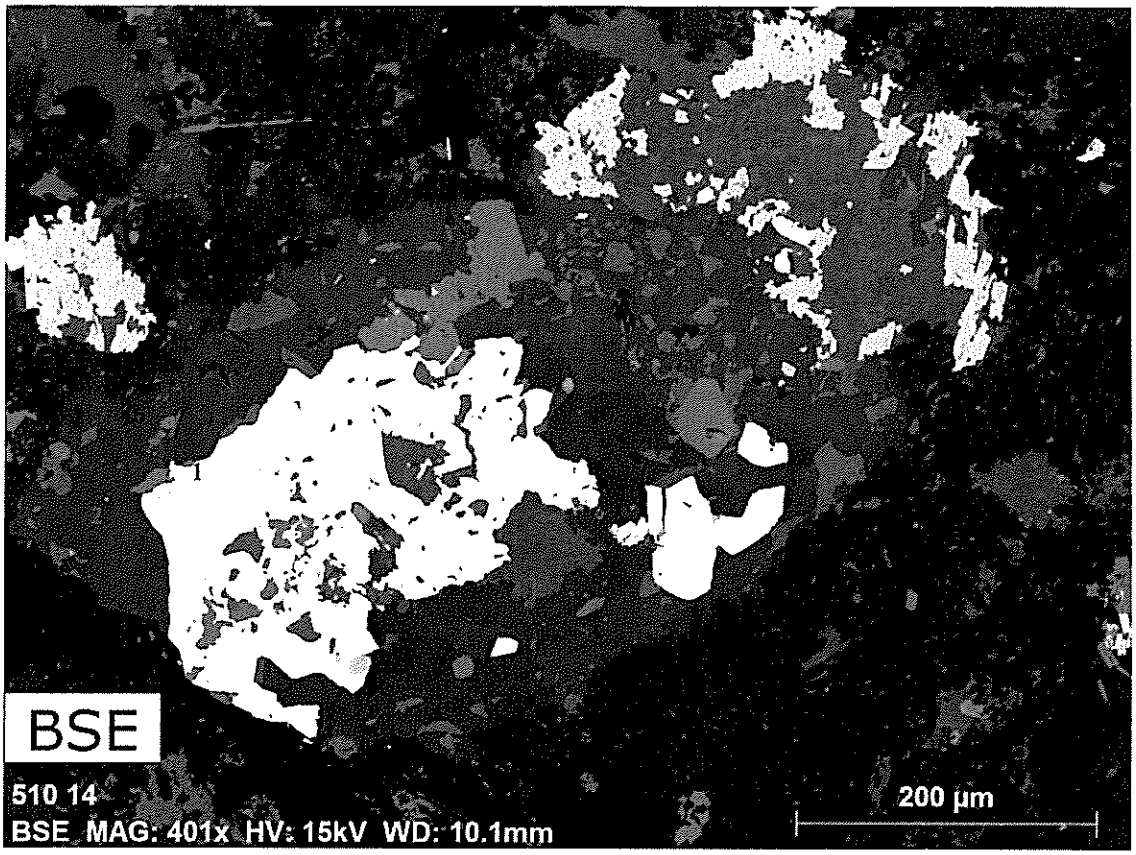


Figure 3-8: BSE-image of pyrite (1) grains embedded in calcite (2) in waste rock sample BW-ARD-510 (Type 2 – PAG).

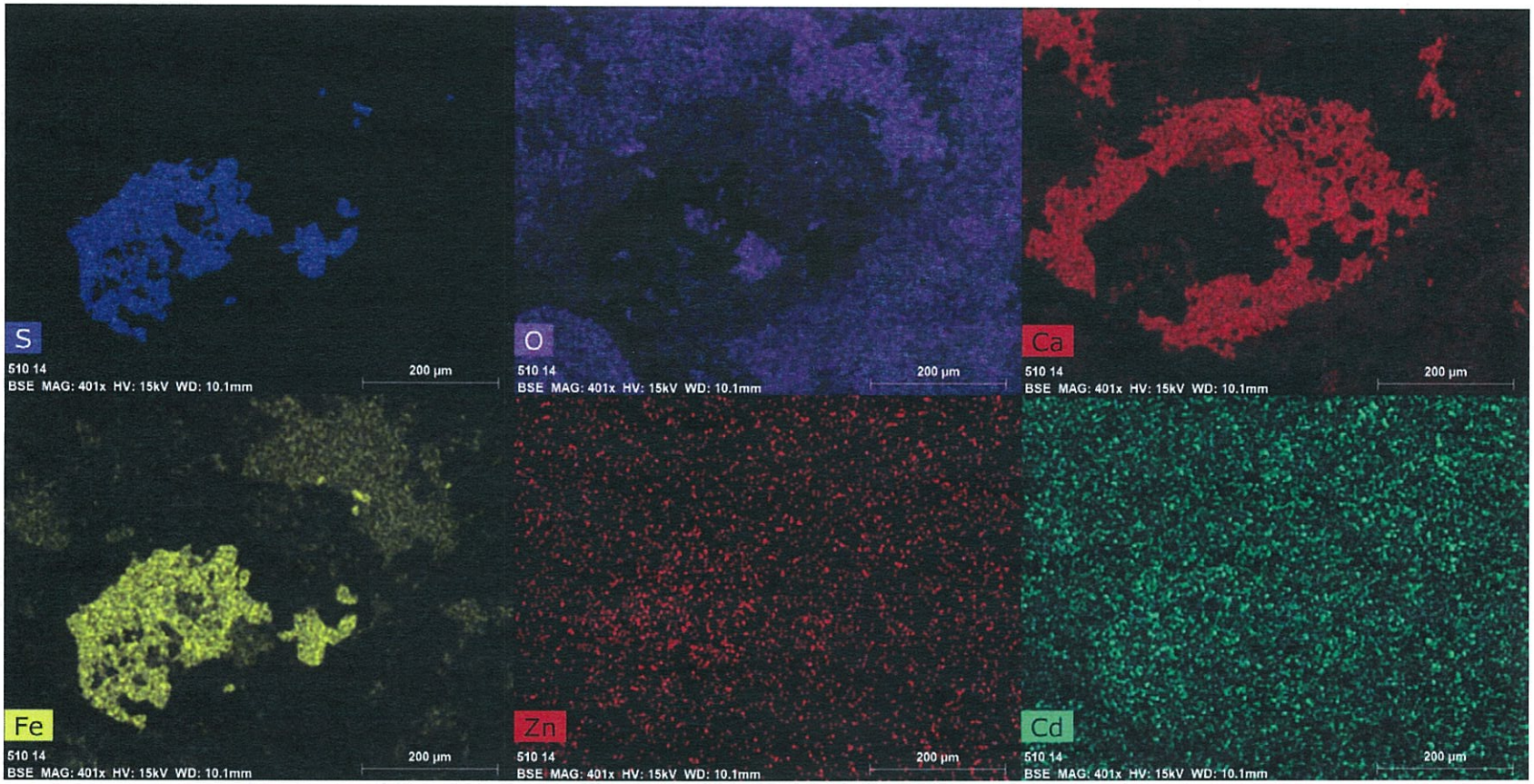


Figure 3-9: Elemental maps for S, O, Ca, Fe, Zn and Cd of area shown in Figure 3-8 (waste rock sample BW-ARD-510; Type 2 – PAG).

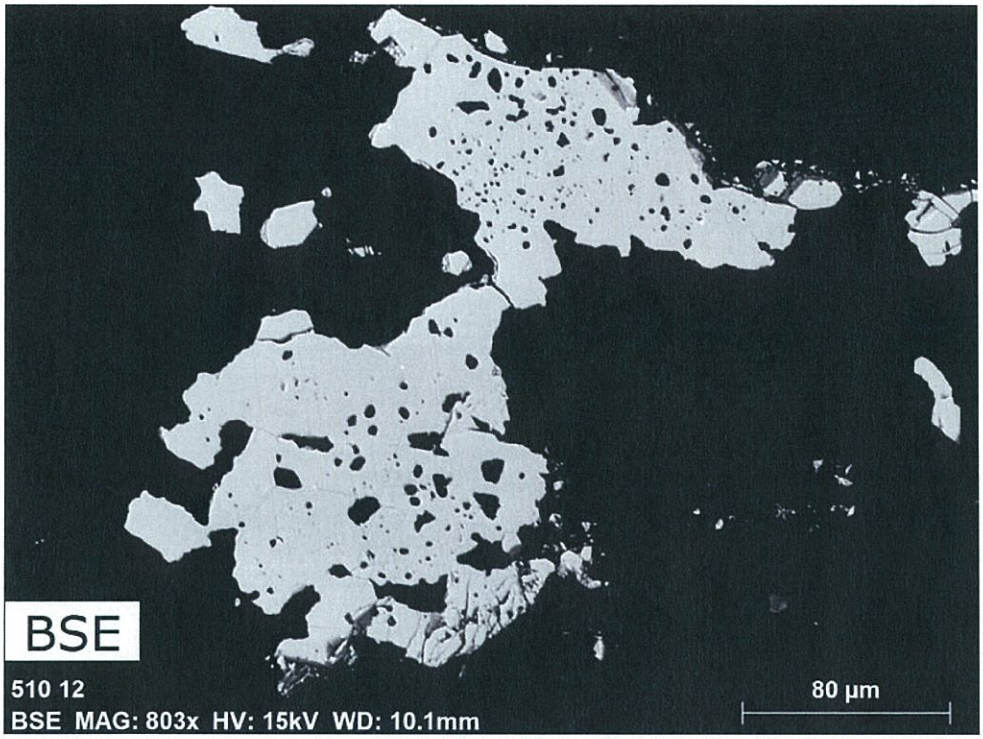


Figure 3-10: Anhedral pyrite aggegragte in waste rock sample BW-ARD-510 (Type 2 – PAG).

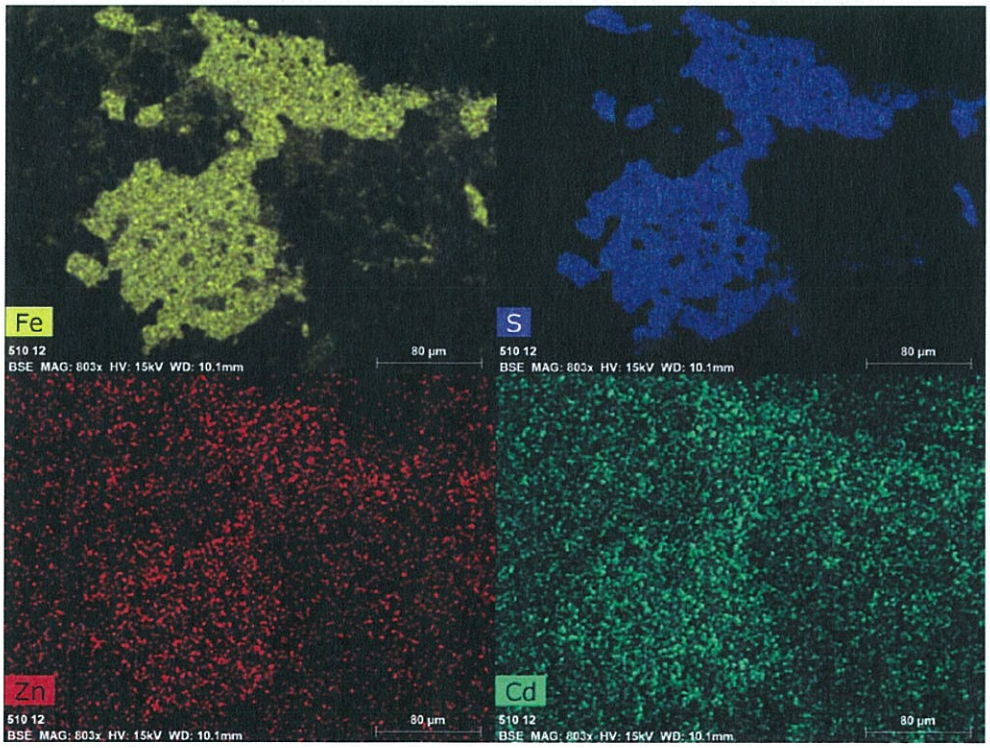


Figure 3-11: Selected elemental maps of area shown in Figure 3-10 (waste rock sample BW-ARD-510; Type 2 – PAG).

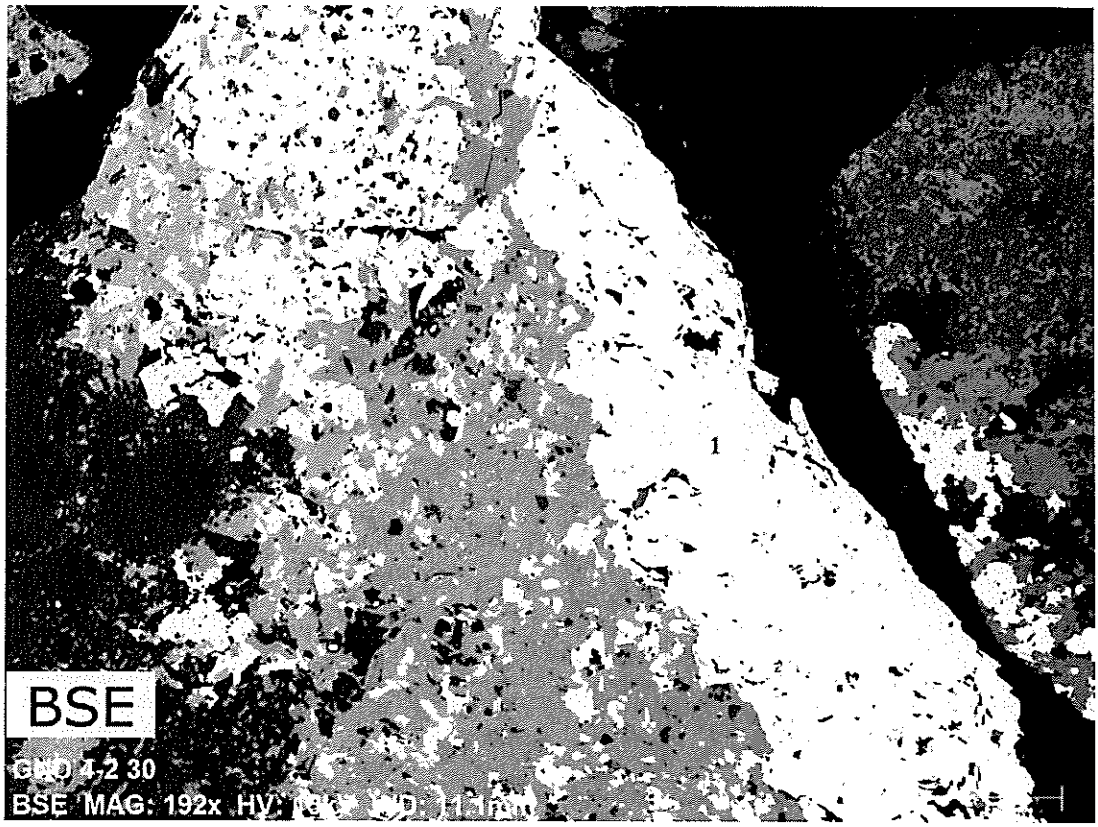


Figure 3-12: BSE image showing sphalerite (1)-pyrrhotite (2) assemblage embedded in chlorite (3) matrix in waste rock sample BW-ARD-648 (Type 3 – NAG).

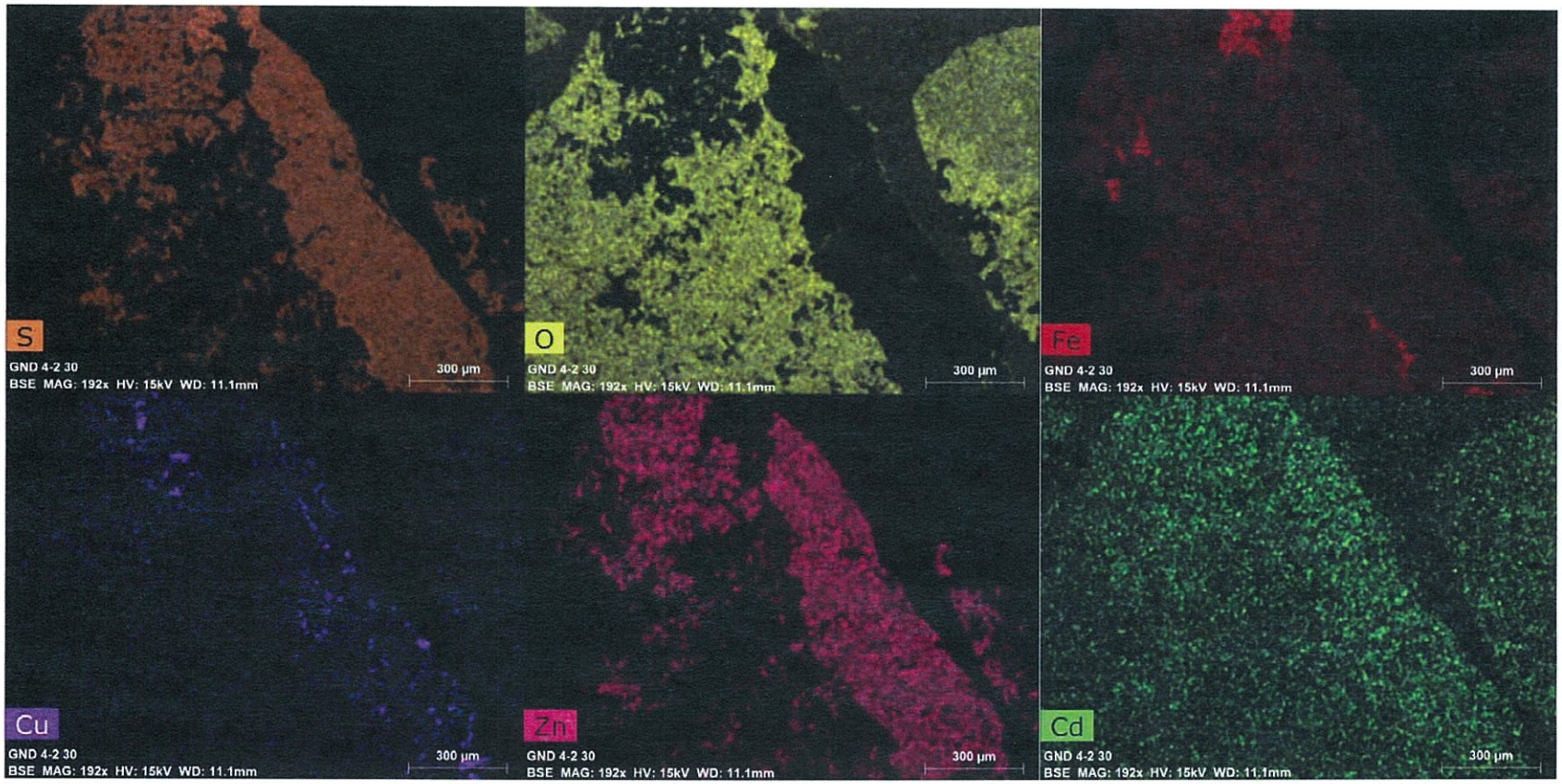


Figure 3-13: Elemental maps for S, O, Fe, Cu, Zn and Cd of area shown in Figure 3-12 (waste rock sample BW-ARD-648; Type 3 – NAG).

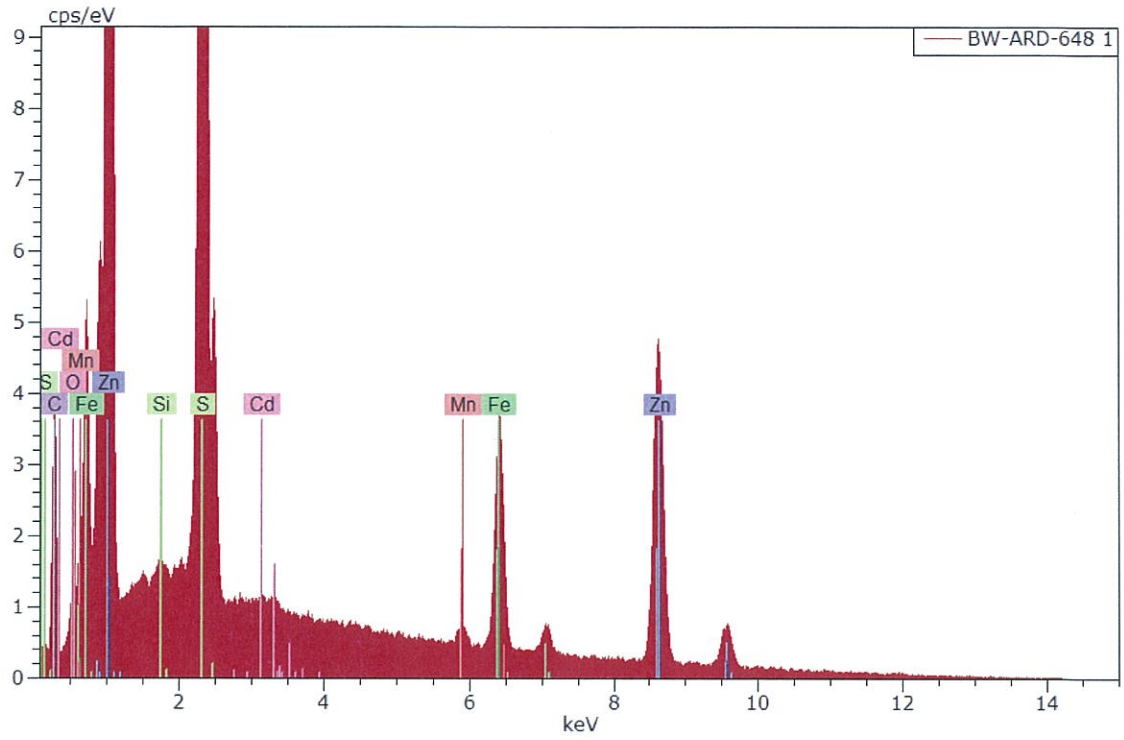


Figure 3-14: EDX-spectrum of sphalerite grain in waste rock sample BW-ARD-648 (Type 3 – NAG) showing presence of Cd, Mn and Fe.

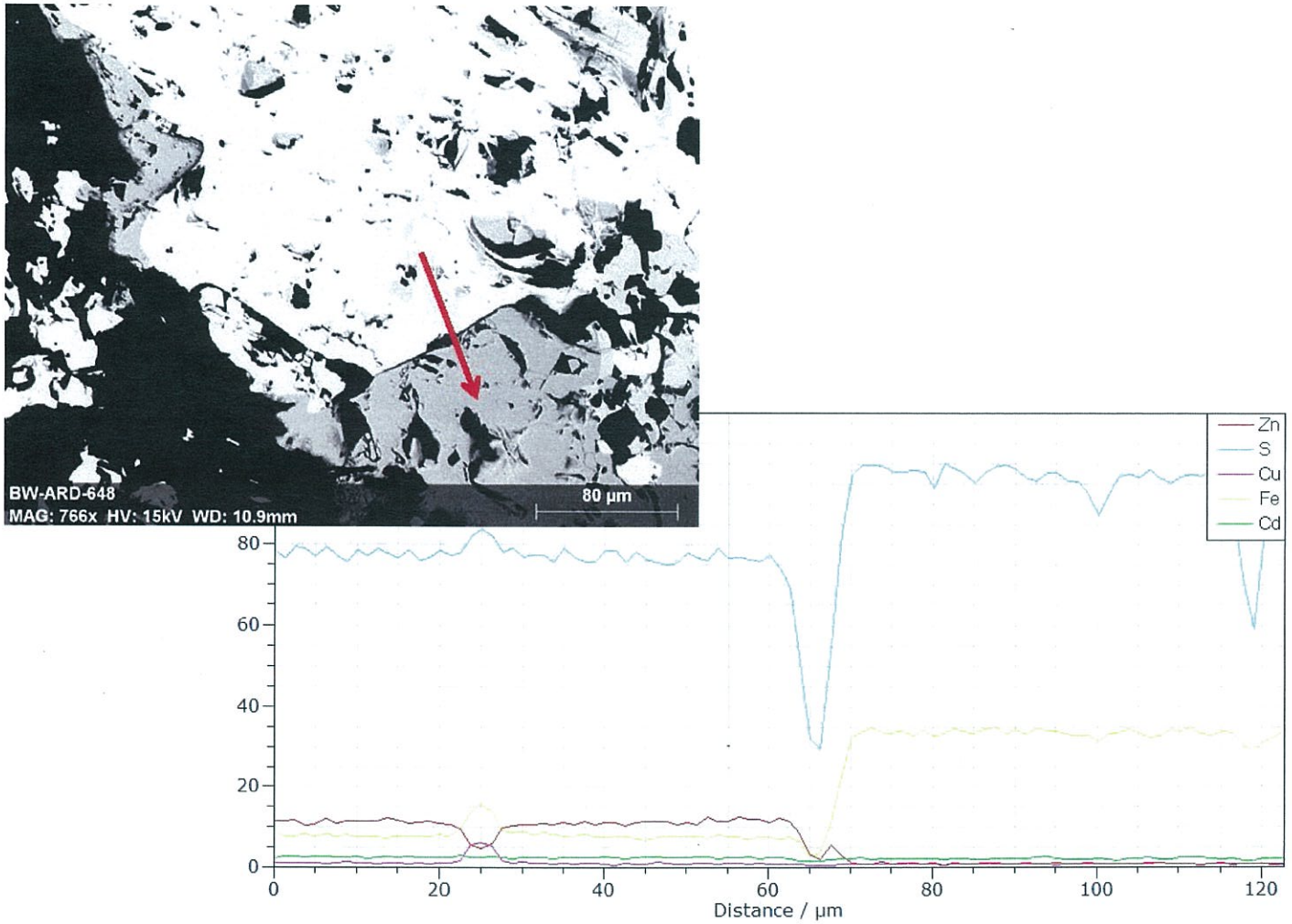


Figure 3-15: BSE-image and counts-vs-disctance plot showing the location and relative elemental abundances (Zn, S, Cu, Fe and Cd) in an EDX line-scan running from sphalerite into pyrrothite in waste rock sample BW-ARD-648 (Type 3 – NAG).

3.1.2.4 BW-ARD-468 (Type 4 - NAG)

The Type 4 (NAG) sample is relatively poor in discrete Zn-phases with pyrite being by far the most common sulfide mineral. A massive pyrite grain with a calcite-chlorite rim was studied and BSE image and elemental maps are shown in Figure 3-16 and Figure 3-17, respectively. Zn is notably enriched in the pyrite grain while Cd, like in other examined aggregates, shows a more diffuse pattern, possibly due to the its low concentration. Nevertheless, it can be concluded that Cd, too, is partitioned into pyrite. The incorporation of these metals into pyrite (also found in other pyrite grains not shown) in a sample with relatively low sphalerite abundance is a feature already observed in sample BW-ARD-510 (Type 2 – PAG). The EDX-spectrum of one of the few larger sphalerite grains is presented in Figure 3-18 and shows that, like in sample BW-ARD-648 (Type 3 – PAG), sphalerite is capable of taking up detectable amounts of Fe, Mn, and Cd into its structure.

3.1.2.5 BW-ARD-473 (Type 3 - NAG)

As discussed in Section 2, sample BW-ARD-473 was initially classified as Type 5 material (NAG; Zn < 600 ppm); however, an error discovered in the selection of the core interval led to the re-classification of this sample to Type 3 (NAG) due to a Zn content of 3790 ppm. Along with sphalerite, several non-sulfide Zn and Cd-bearing phases were discovered during EDX analysis. For example, Figure 3-19 and 3-20 show the BSE image and elemental maps of a Mn-Fe-(±Ca)-carbonate (likely rhodochrosite solid solution) (1) containing considerable Zn and minor Cd in a chlorite(2)-quartz(3)-sericite(4)-groundmass. The associated EDX-spectrum for this phase is given in Figure 3-21. Mineral aggregates of similar composition were also found elsewhere in this sample.

In another area of this sample, multiple grains of a rare polymetallic sulfide (1) containing Zn, Cd, As, Sb and Cu were found to be enclosed by a rhodochrosite assemblage (2) (Figure 3-22). Interestingly, Fe is relatively depleted in the sulfide-aggregate. The chemical heterogeneity of this precipitate is illustrated by an EDX-spectrum recorded within the largest grain (Figure 3-23), showing a Zn-poor aureole with distinct peaks of Sr and Al in addition to Cd, Sb and As. One of the smaller grains in the periphery of this sulfide/Fe-oxide assemblage shows a distinctly strong Cd-response (mineral 3 in Figure 3-24). The EDX-spectrum of this grain confirms the qualitative chemistry given by the elemental map and identifies this grain as a relatively pure CdS-mineral (*e.g.*, Greenockite) with minor Fe- and Mn-contamination.

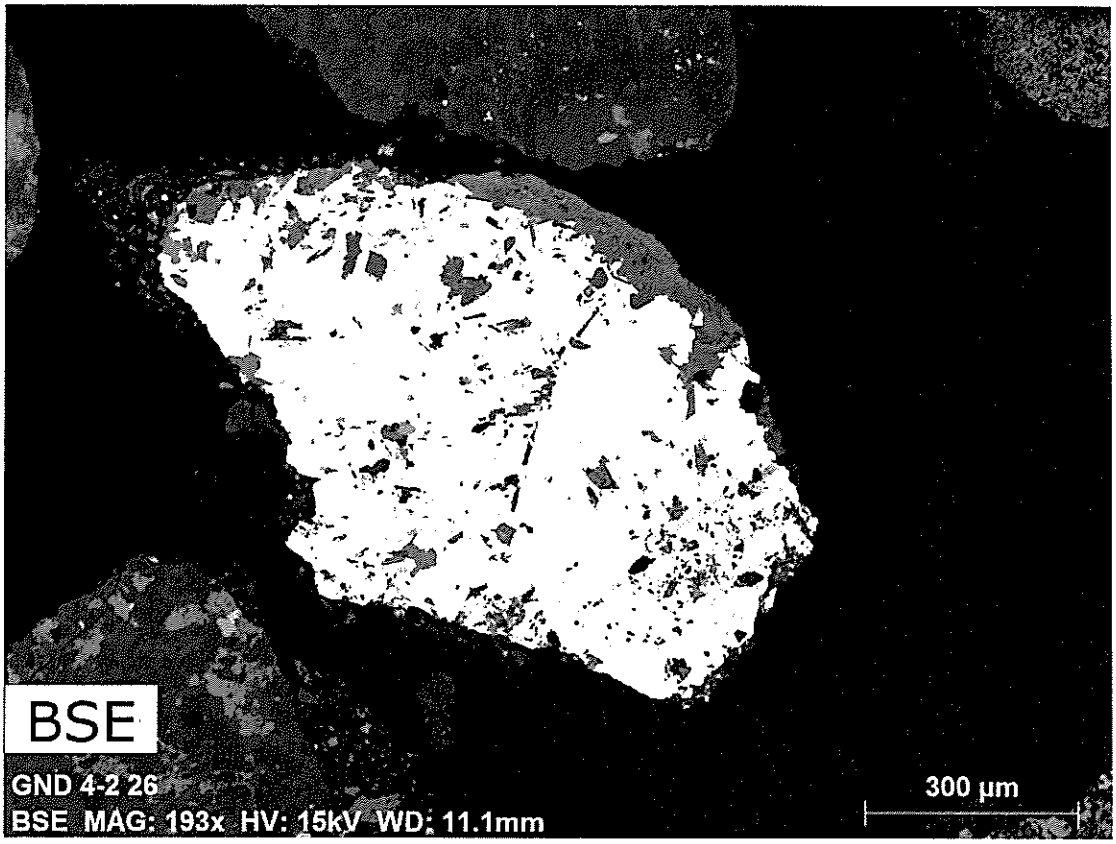


Figure 3-16: BSE-image of a massive pyrite grain in waste rock sample BW-ARD-468 (Type 4 – NAG).

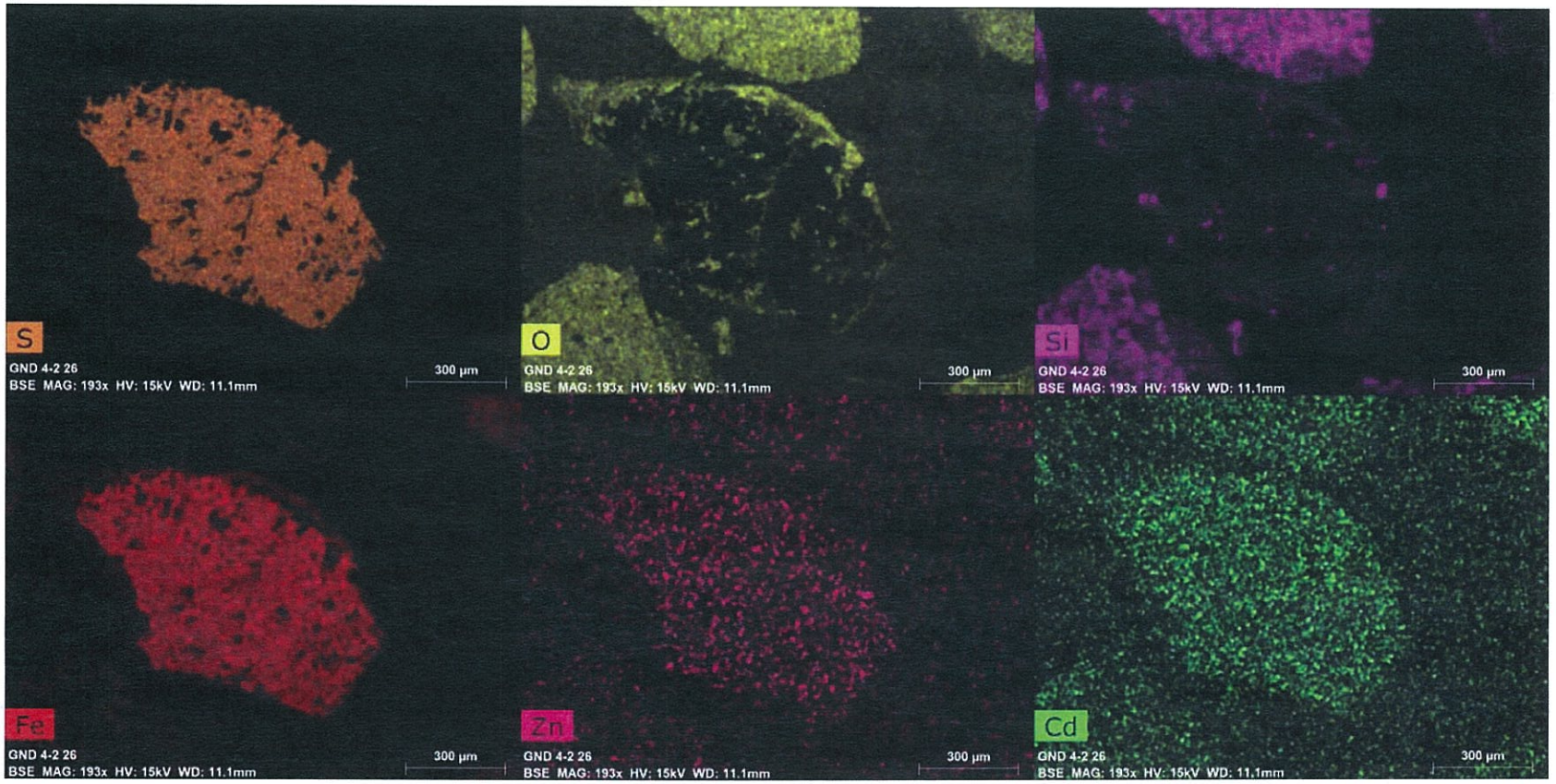


Figure 3-17: Selected elemental for S, O, Si, Fe, Zn and Cd of area shown in Figure 3-16 (waste rock sample BW-ARD-468; Type 4 – NAG).

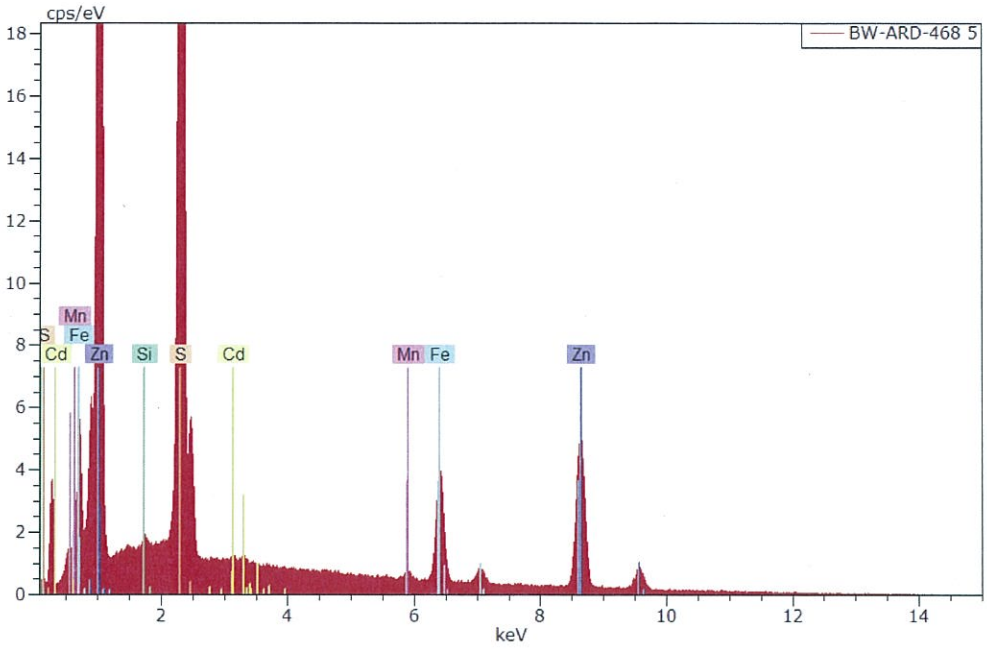


Figure 3-18: EDX-spectrum of a representative sphalerite grain in waste rock sample BW-ARD-468 (Type 4 – NAG) highlighting the partitioning of Cd, Mn, and Fe into the crystal lattice.

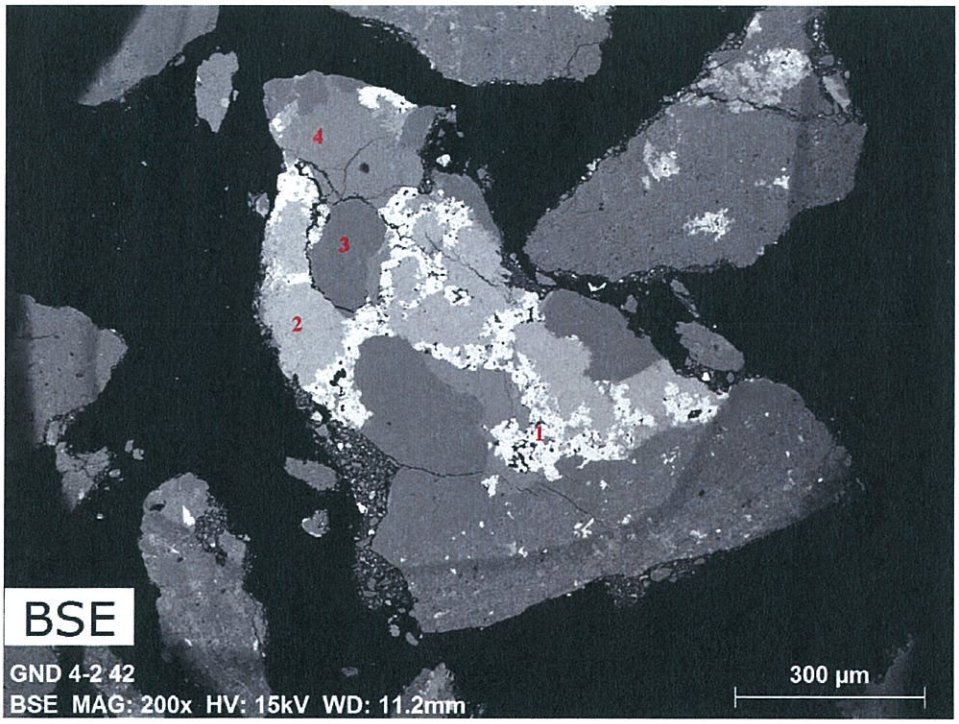


Figure 3-19: BSE-image of fragment containing likely Mn-Fe-Ca carbonate (1; rhodochrosite) in waste rock sample BW-ARD-473 (Type 3 – NAG). Other minerals are (2) chlorite, (3) quartz, and (4) sericite.

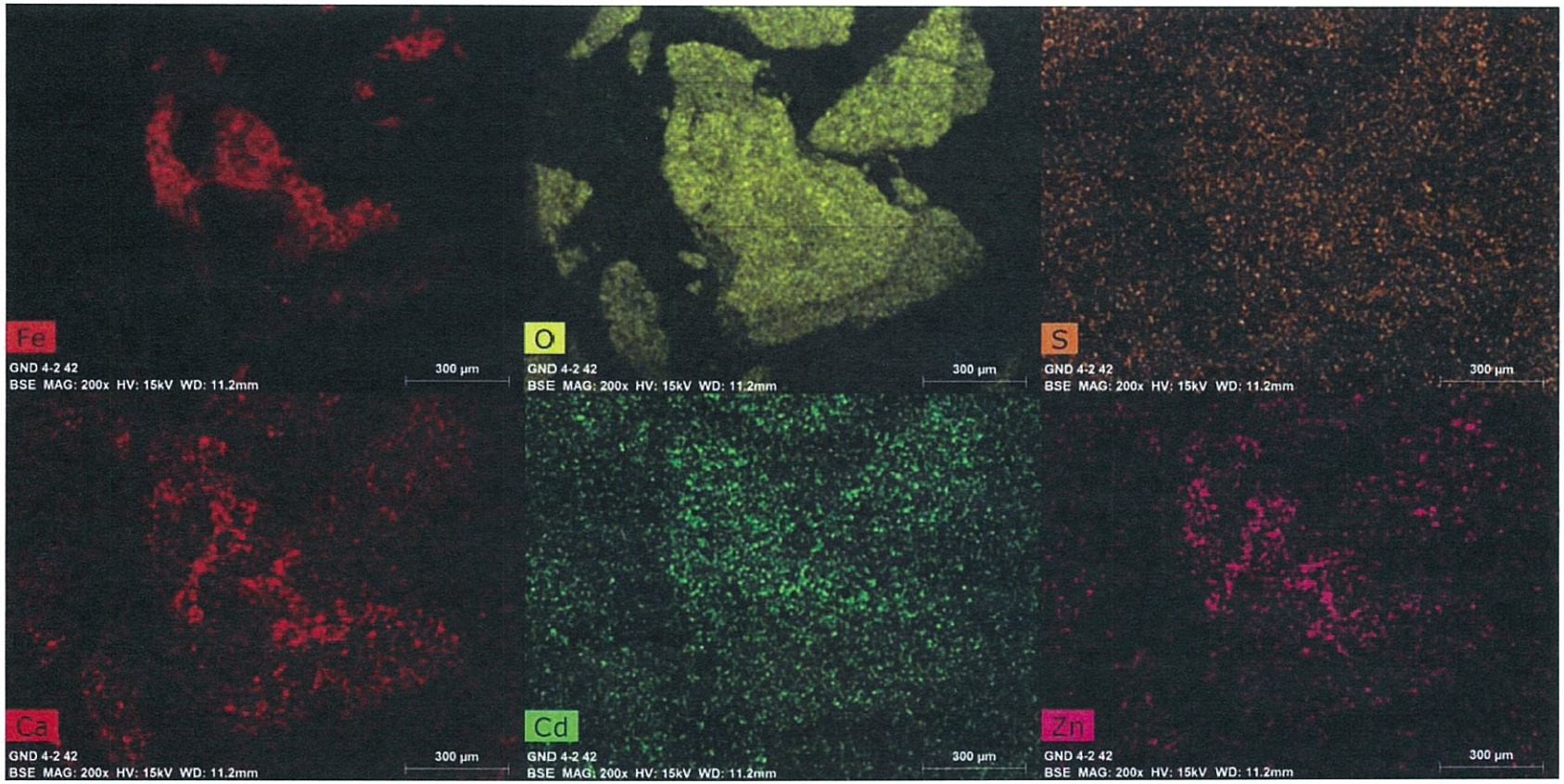


Figure 3-20: Selected elemental maps for Fe, O, S, Ca, Cd and Zn of area shown in Figure 3-18 (waste rock sample BW-ARD-473; Type 3 – NAG).

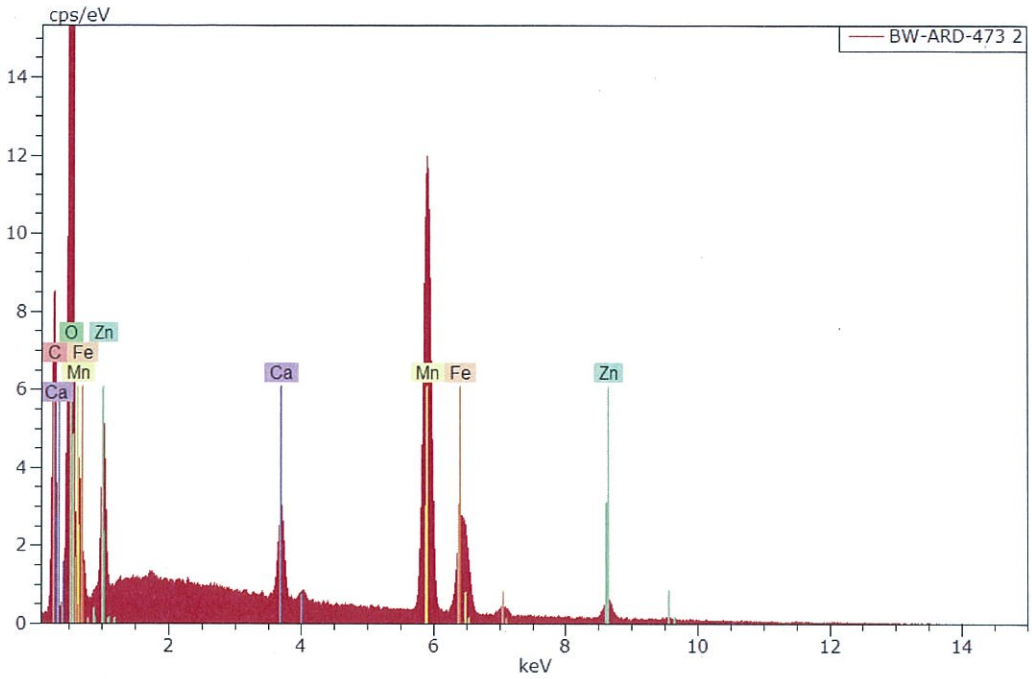


Figure 3-21: EDX-spectrum of mineral 1 in Figure 3-19, suggesting a Mn-Fe-Ca-carbonate with considerable Zn content in waste rock sample BW-ARD-473 (Type 3 – NAG).

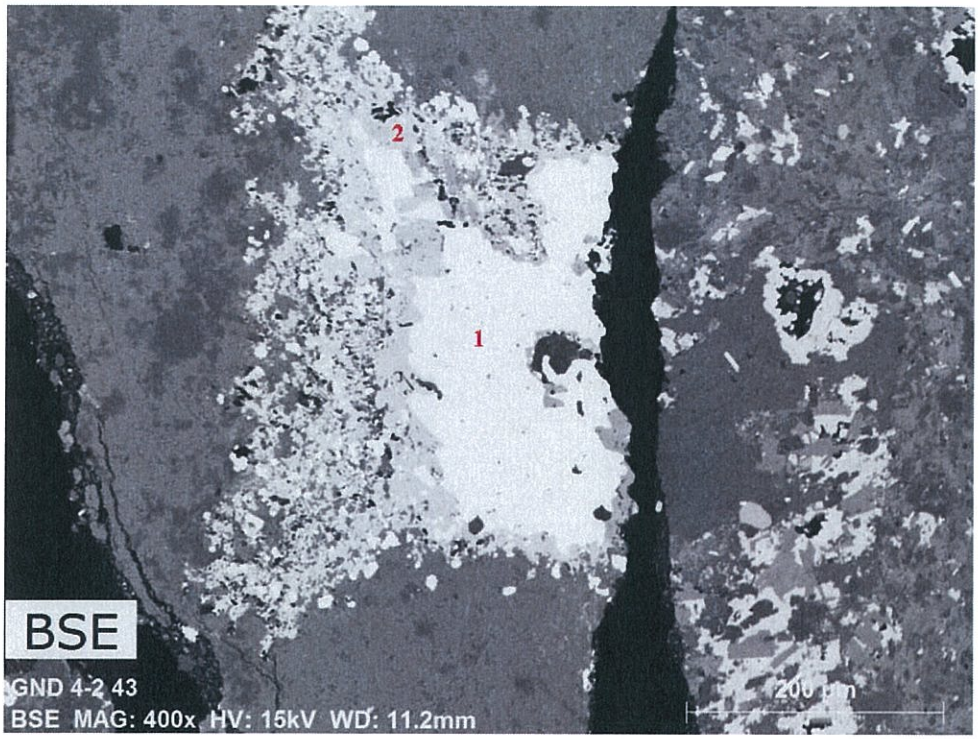


Figure 3-22: BSE-image of polymetallic sulfide cluster (1) enclosed by rhodochrosite (2) in sample BW-ARD-473 (Type 3 – NAG).

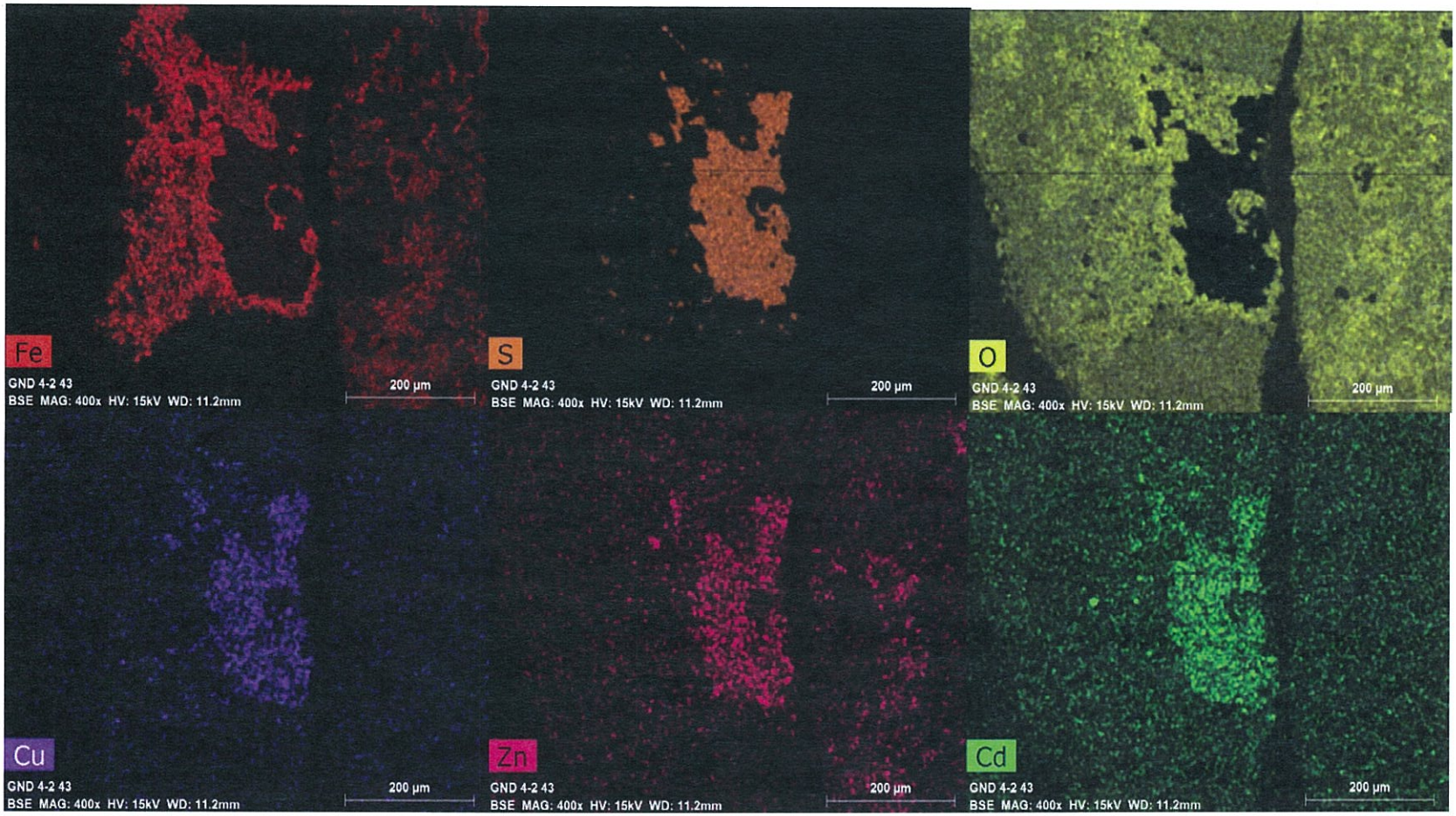


Figure 3-23: Elemental maps for Fe, S, O, Cu, Zn and Cd of area shown in Figure 3-22 (waste rock sample BW-ARD-473; Type 5 – NAG).

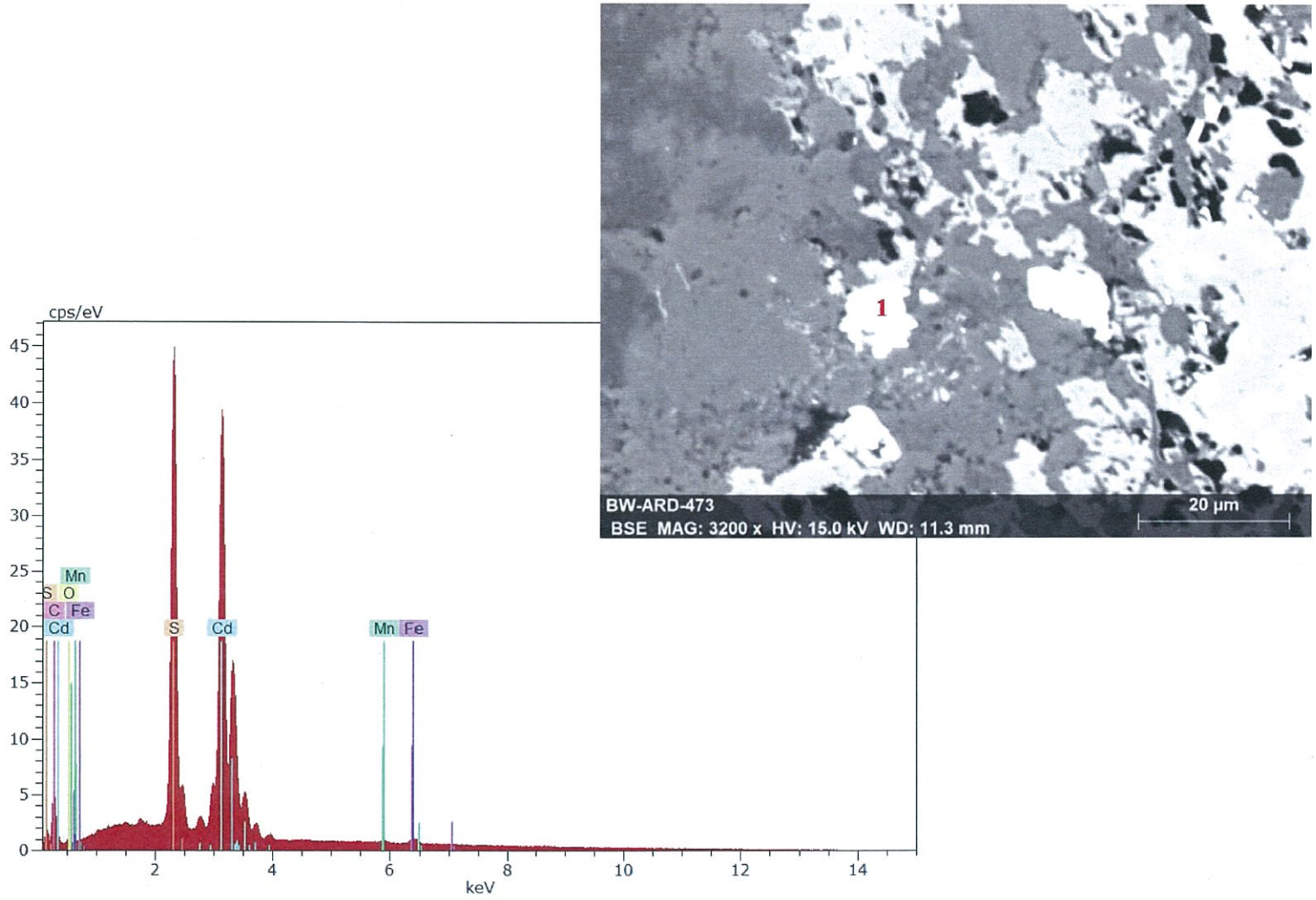


Figure 3-24: BSE- image and EDX spectrum showing location and qualitative chemistry of a Cd-sulfide phase (1) in waste rock sample BW-ARD 473 (BW-ARD-473; Type 3 – NAG).

The BSE image in Figure 3-25 shows a quartz-biotite fragment with a rim of Fe-oxide (or hydroxide) (1). The elemental maps taken of this area (Figure 3-26) suggest that both Zn and Cd were incorporated into this Fe-phase. Interestingly, sulfur was detected as well potentially indicating that this phase may represent an oxidized sulfide mineral. A line scan was conducted from this Fe-rich rim into biotite and then quartz (Figure 3-27) and recorded a relatively gradual drop in concentration across the grain boundaries for Cd but not Zn. This suggests that either Cd is taken up into biotite more readily or that Cd diffusion from the Fe-precipitate into adjacent minerals is faster. Both of these hypotheses would explain the generally more diffuse pattern of Cd distribution observed elsewhere.

3.2 Tailings Samples

3.2.1 Petrographic Overview

As for waste rock samples from the Blackwater Gold Project, mineralogical characterization on tailings was conducted using both optical as well as SEM/EDX methods. Mineralogically and texturally, the two tailings samples are relatively similar and are primarily composed of angular, polymineralic fragments and fragment assemblages. Grain sizes of these fragments show a wide range, with the lower end of the spectrum falling below 1 μm in diameter, while the largest fragments measure around 250 μm. Silicates are the dominant mineral group, making up ~90% of the overall assemblage. Among the silicate phases identified by microscopy are (sorted by estimated modal abundance): quartz, feldspar (both K-feldspar and plagioclase), biotite, and sericite.

Naturally, tailings silicate mineralogy is relatively similar to that observed in waste rock samples and is indicative of strong hydrothermal alteration associated with epithermal ore formation where primary textures are overprinted pervasively.

Opaque and semi-opaque minerals can be subdivided into two major mineral classes, namely sulfides and Fe-oxides/hydroxides. These phases constitute around 10% of the tailings samples (with secondary Fe-oxides having an abundance of <5%); however, due to the affinity of trace elements for these phases, and their chemical instability in saturated settings, such materials can play a dominant role in neutral-pH metal leaching (Tessier and Campbell 1988; Martin and Pedersen, 2002). Optically it appears that sulfide minerals sample CND 1-5 (transition zone) are somewhat more weathered than in sample CND 2-4 with orange-brown coatings (likely Fe-hydroxides) being more prevalent in the transition zone sample. Sulfur primarily resides in sulfide minerals, including pyrite, pyrrhotite and sphalerite with minor chalcopyrite and galena. Sulfides occur as

disseminated, equant and anhedral grains rarely exceeding a diameter of 20 µm. Less commonly, secondary sulfate minerals (Mg- and Fe-bearing) were identified as irregular patches or schlieren.

Fe-bearing oxides (*e.g.*, magnetite and ilmenite) and hydroxides (*e.g.*, goethite) are moderately common among the (semi)-opaque mineral phases. Due to the similarity of magnetite and sphalerite in reflected light, particularly given the small grain sizes, it was difficult to assess the modal abundance of magnetite. However, where EDX-data were available, it was found that magnetite occurs as fine, euhedral grains while sphalerite is generally anhedral. Fe-hydroxides were detected as weathering rims and as amorphous, interstitial masses in most studied areas. In transmitted light, these phases commonly appear as semi-opaque patches with a translucent, dark orange-brown periphery.

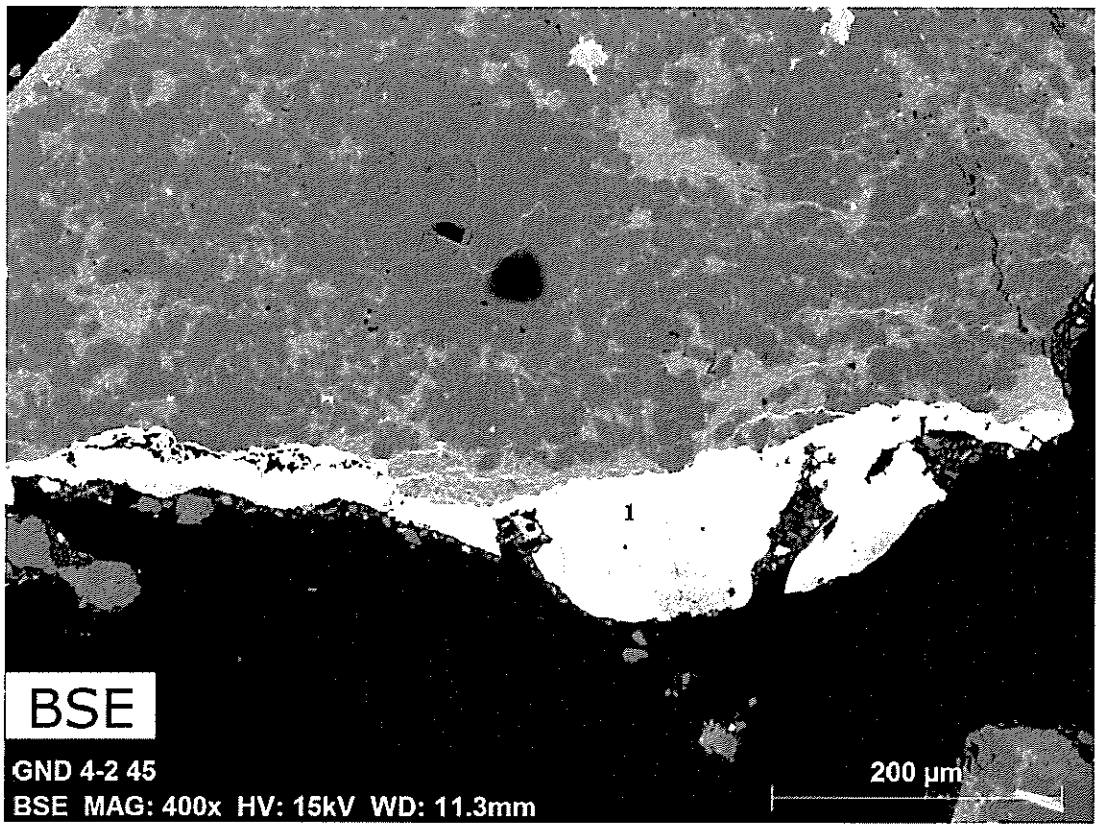


Figure 3-25: BSE-image showing Fe-hydroxide rim (1) adjacent to quartz-biotite (2) matrix in waste rock sample BW-ARD-473 (Type 3 – NAG).

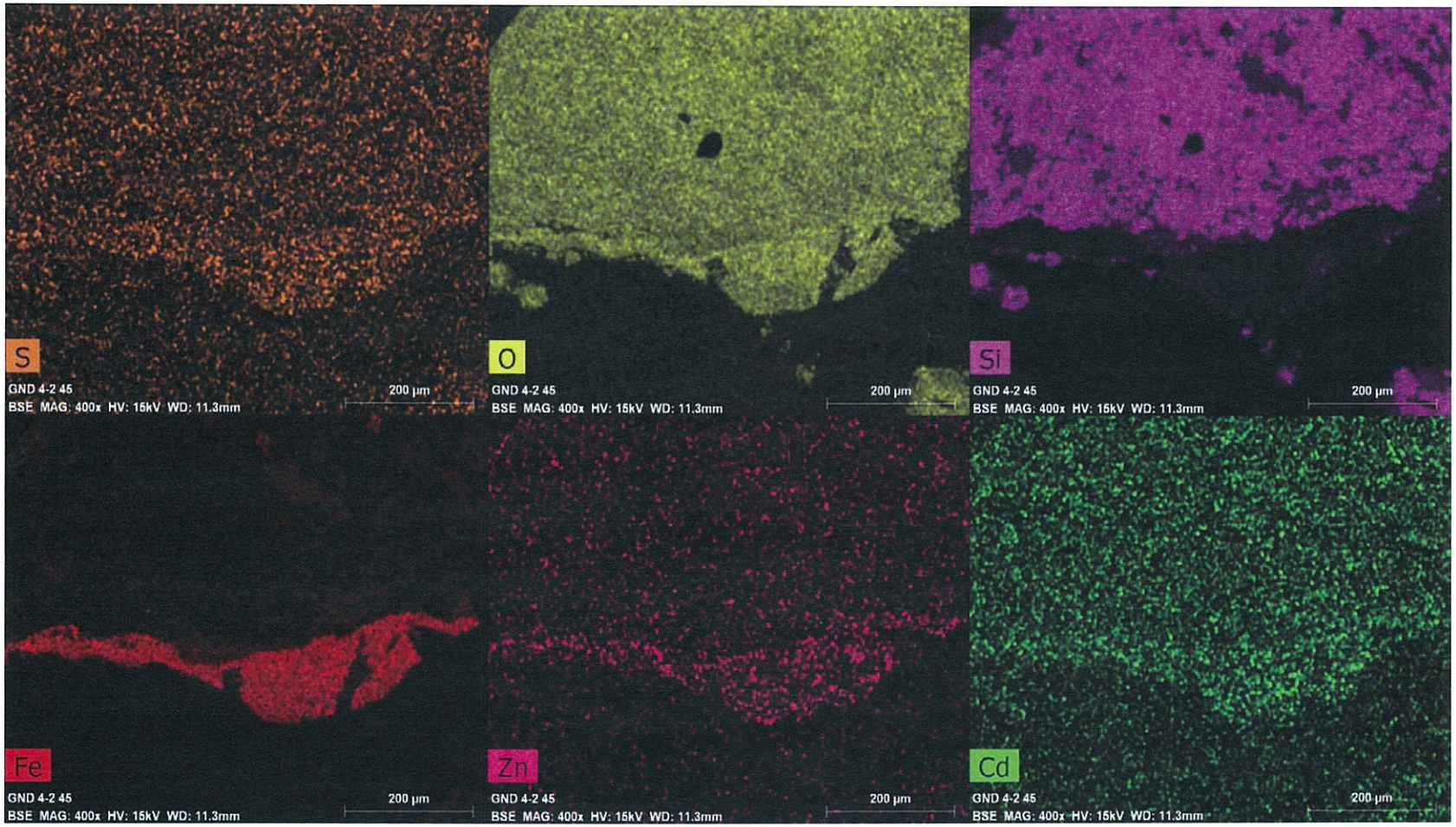


Figure 3-26: Elemental maps S, O, Si, Fe, Zn and Cd of area shown in Figure 3-25 (waste rock sample BW-ARD-473; Type 3 – NAG).

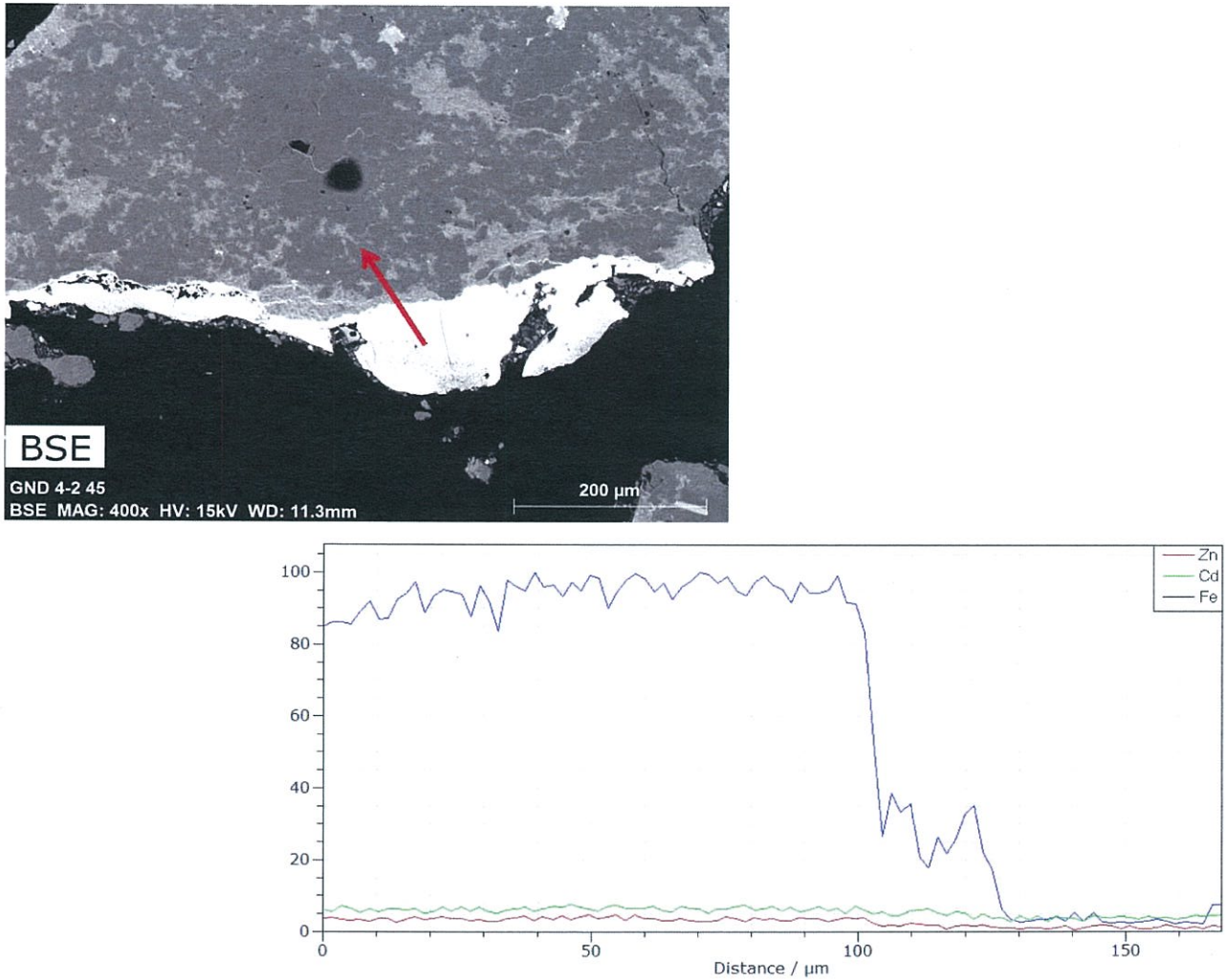


Figure 3-27: BSE-image and counts-vs-disctance plot showing the location and relative elemental abundances in an EDX line-scan running from a secondary Fe-hydroxide into the adjacent quartz-biotite-matrix in waste rock sample BW-ARD-473 (Type 3 – NAG).

3.2.2 SEM Results

3.2.2.1 CND 2-4 (Sulfide Tailings)

Figure 3-28 shows a BSE image of a fragment assemblage typical of the sulfide tailings sample. Elemental mapping of this area (Figure 3-29) gives useful qualitative information about the chemical composition of the various minerals and, in some cases, allows the determination of rare minerals that cannot be identified by petrography alone due to their small grain sizes. For example, EDX-analysis showed that mineral 1 in Figure 3-28 is possibly a Fe-bearing As-sulfate that has above-background Cd content. Note that despite the fact that As was not mapped, the high apparent Mg content is an indicator of As incorporation into the crystal lattice since the As and Mg peaks interfere. Given the relatively bright appearance of this mineral in reflected light and back-scattered imaging, the mapped elements are more likely to be As than Mg. Therefore, this phase was inferred to represent an altered arsenopyrite grain. Another example in the same area shows two sphalerite grains (2) in the center of the image that appear relatively fresh and incorporate appreciable amounts of Fe as well as minor Cd (Figure 3-29). Mineral grain 3 represents a typical morphology of poorly crystalline Fe-hydroxide. Zn does not have an EDX-detectable concentration in this grain. On closer inspection, however, it appears that minor Cd is partitioned into the upper rim of this phase.

A BSE image of another area within tailings sample CND 4-2 is shown in Figure 3-30. Phases of interest in this assemblage include sphalerite (1), arsenopyrite (2), pyrite (3), and a poorly crystalline mixture of Fe-hydroxide surrounding Fe-Al-silicate (4). The elemental map in Figure 3-31 indicates that Cd is enriched in sphalerite and arsenopyrite. An EDX-spectrum of the latter is provided in Figure 3-32 and highlights the interference of As and Mg addressed above. Secondary peaks of As and detectable Sb make clear that Mg is misidentified in the elemental map. In contrast to Cd, Zn is restricted to associations with sphalerite.

A nice example of co-precipitated pyrite (1) and sphalerite (2) showing irregular, almost skeletal grain boundaries is illustrated in Figure 3-33. The surrounding silicate matrix is composed primarily of biotite (3) and muscovite (4). The according elemental distribution depicted in Figure 3-34 shows that Zn is almost exclusively partitioned into sphalerite in detectable amounts. As already observed in other studied areas, the distribution of Cd is less straightforward with the signal being only slightly above background and, in this case, without discernible mineral association.

3.2.2.2 CND 1-5 (Transition Tailings)

Figure 3-35 shows a relatively low-magnification overview of one of the marked areas within tailings sample CND 1-5 (transition tailings). This BSE-image gives a good idea of the typical grain size range as well as the distribution and abundance of sulfide and oxide minerals (brightest shades). The elemental maps illustrated in Figure 3-36 show that Zn is irregularly dispersed and appears to primarily reside in relatively small sphalerite grains (<20 µm). However, the resolution is too low to exclude other mineral associations. The Si-map in combination with other major elements confirms findings from petrographic analysis that silicate minerals such as quartz, feldspar, biotite and muscovite are by far the dominant mineral class. Diffuse iron enrichments circled in the Fe-map of Figure 3-36 are patches of Fe-hydroxide, likely a weathering product of pyrite. High Ca-counts are represented by calcite grains that rarely exceed a grain size of 30 µm. Cadmium signals are at or only slightly above background such that, at this magnification, no ULFCd-host is discernible.

A biotite assemblage that was penetrated by a hydrothermal fluid along grain boundaries and cleavage planes is shown in Figure 3-37. The precipitate from this fluid fills void space and microfractures and appears to act as cementing material for loose fragments. The distribution of selected elements within this cluster is illustrated in Figure 3-38 and indicates that the bright, fluid-derived alteration rims in the BSE-image contain sulfur and iron with minor zinc and copper. Oxygen was detected throughout the assemblage (not shown) suggesting that the precipitated phase is at least partly made up of a sulfate phase. Cadmium does not show a distinct enrichment but appears to show above-background signals in a diffuse pattern. One area that shows clear Fe- and Zn-enrichment (top of Figure 3-37) is devoid of sulfur, giving rise to the conclusion that this precipitate represents a non-sphalerite Zn-phase.

A fragment containing secondary Fe-hydroxide (dark orange-brown in optical microscopy) was investigated and the BSE image of this grain is provided in Figure 3-39. The Fe-map shown in Figure 3-40 illustrates the irregular shape of this Fe-hydroxide aggregate. EDX analysis also revealed an enrichment in Zn in this phase (Figure 3-40), while Cd distribution was found to be inconclusive and generally more random.

Overall the above findings suggest that Zn (and possibly Cd) in transition zone tailings are fractionated into a wider variety of phases with detectable metal contents not restricted to sulfide minerals but also observable in secondary Fe-phases.

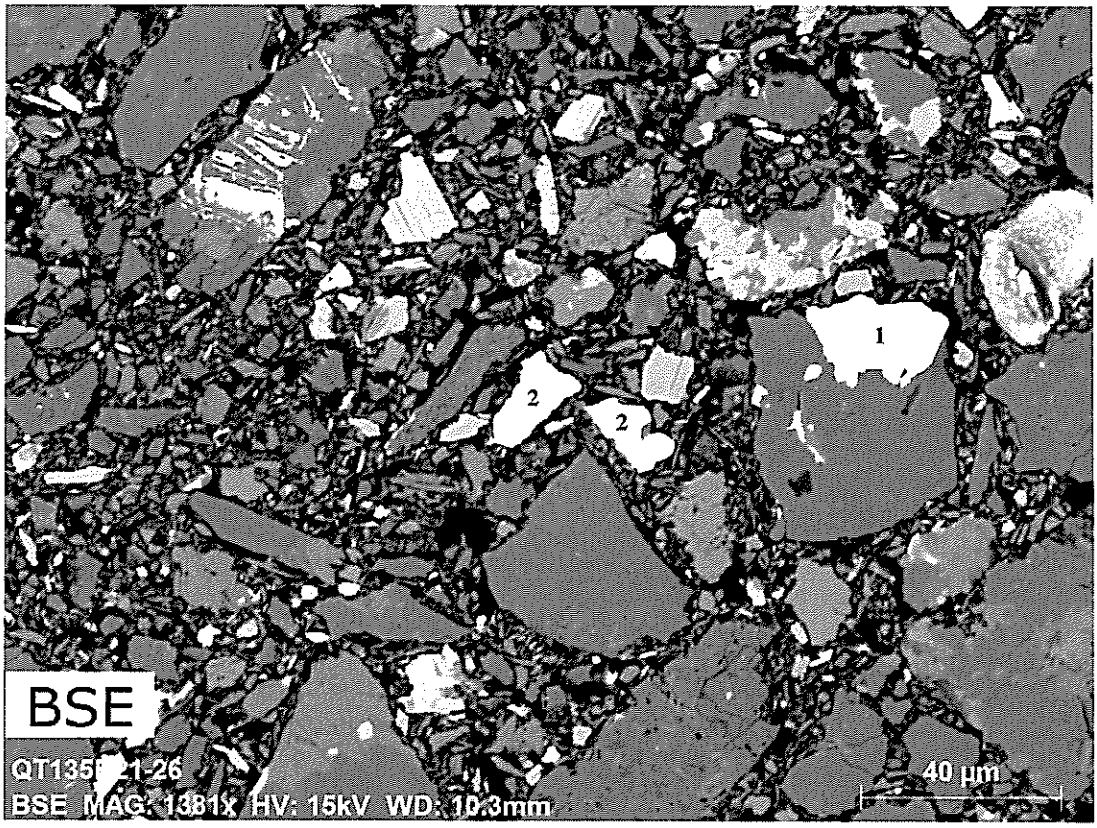


Figure 3-28: BSE-image of a typical fragment assemblage seen in tailings sample CND 2-4 showing (1) altered arsenopyrite (?) and (2) sphalerite.

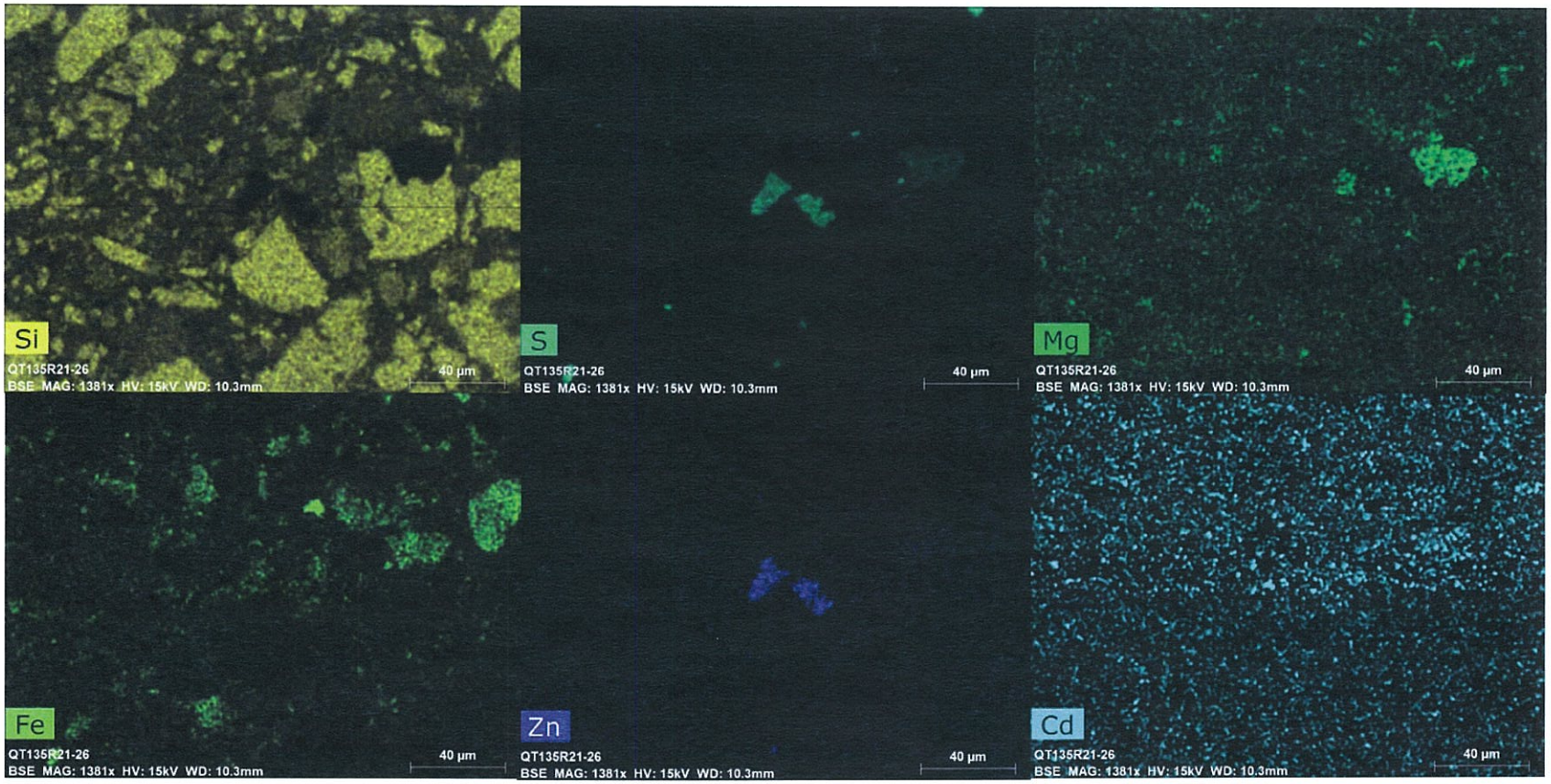


Figure 3-29: Eelemental maps for Si, S, Mg, Fe, Zn and Cd of area shown in Figure 3-28 (tailings sample CND 2-4).

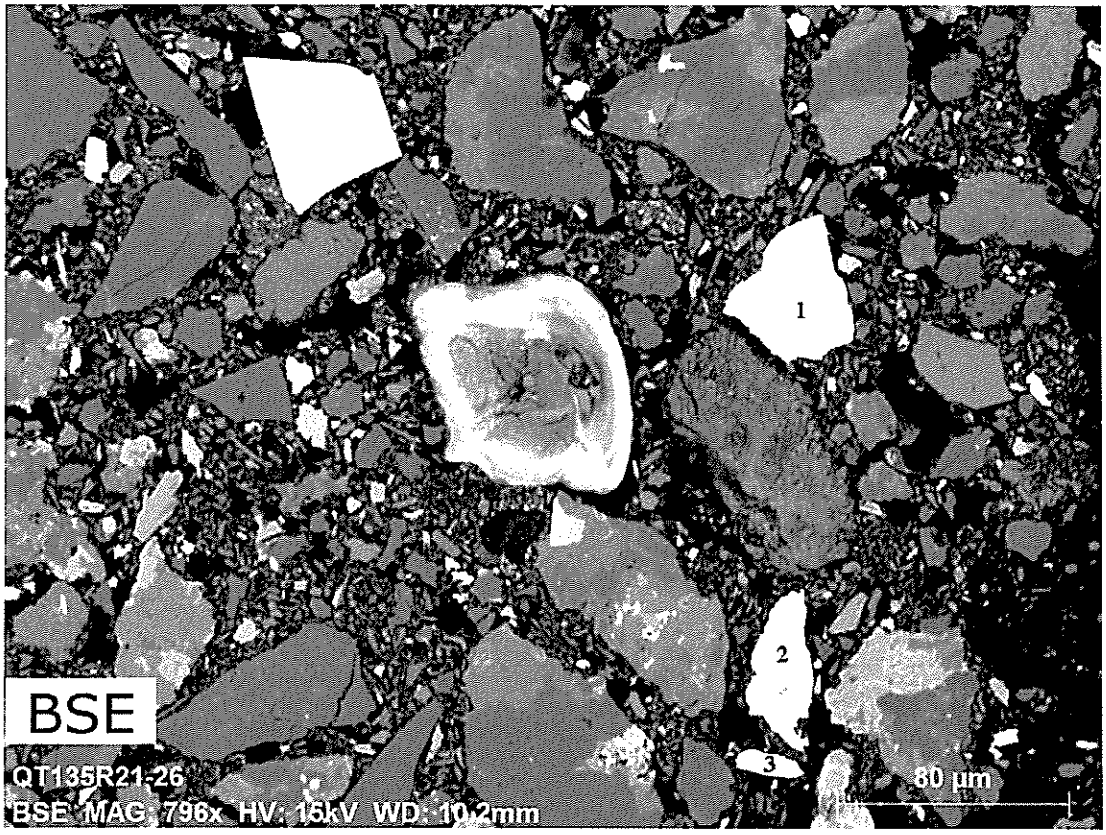


Figure 3-30: BSE-image of fragment assemblage in tailings sample CND 2-4 showing (1) sphalerite, (2) arsenopyrite, (3) pyrite and (4) aluminosilicate with Fe-hydroxide rim.

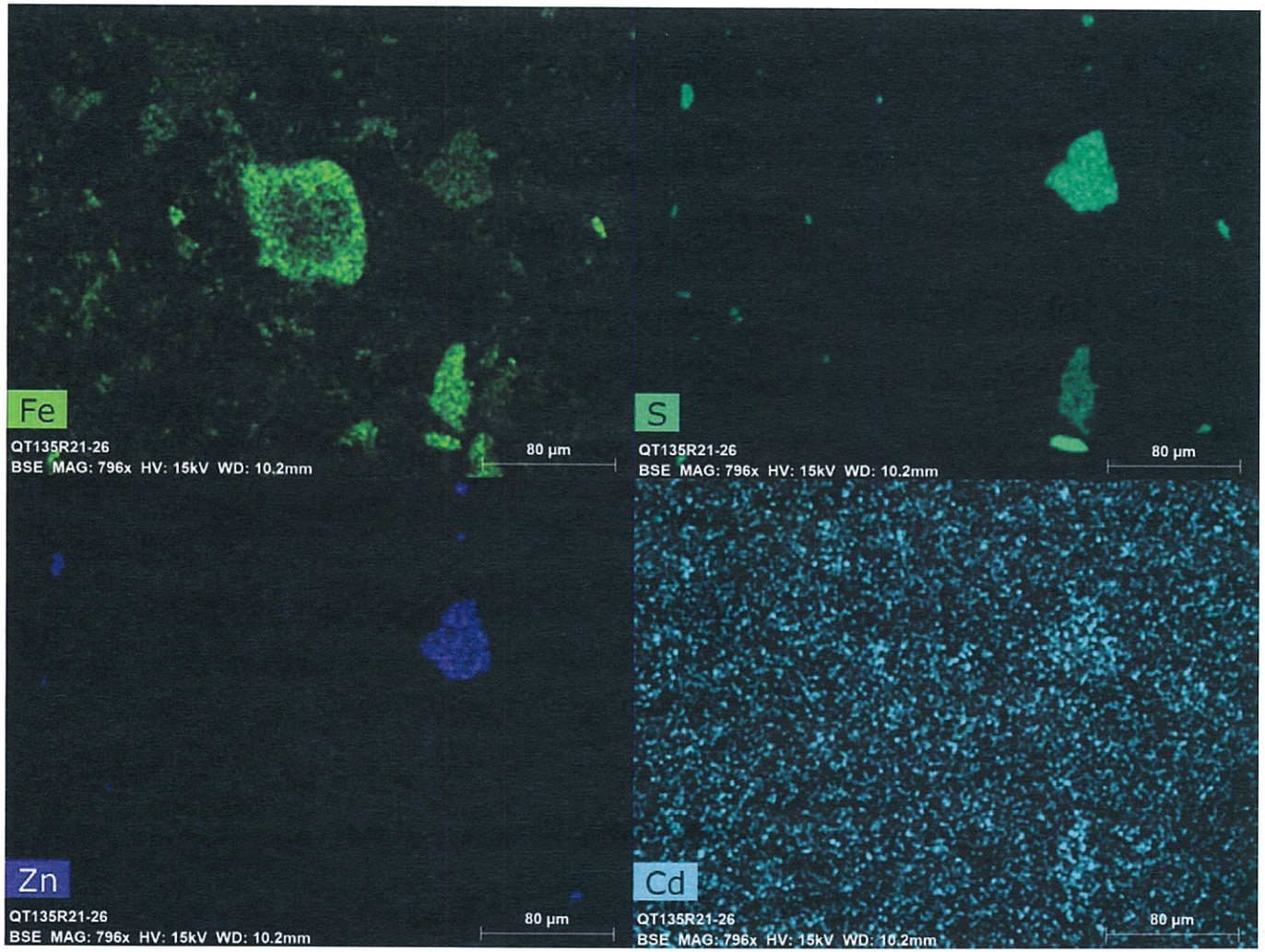


Figure 3-31: Eelemental maps for Si, S, Mg, Fe, Zn and Cd of area shown in Figure 3-30 (tailings sample CND 2-4).

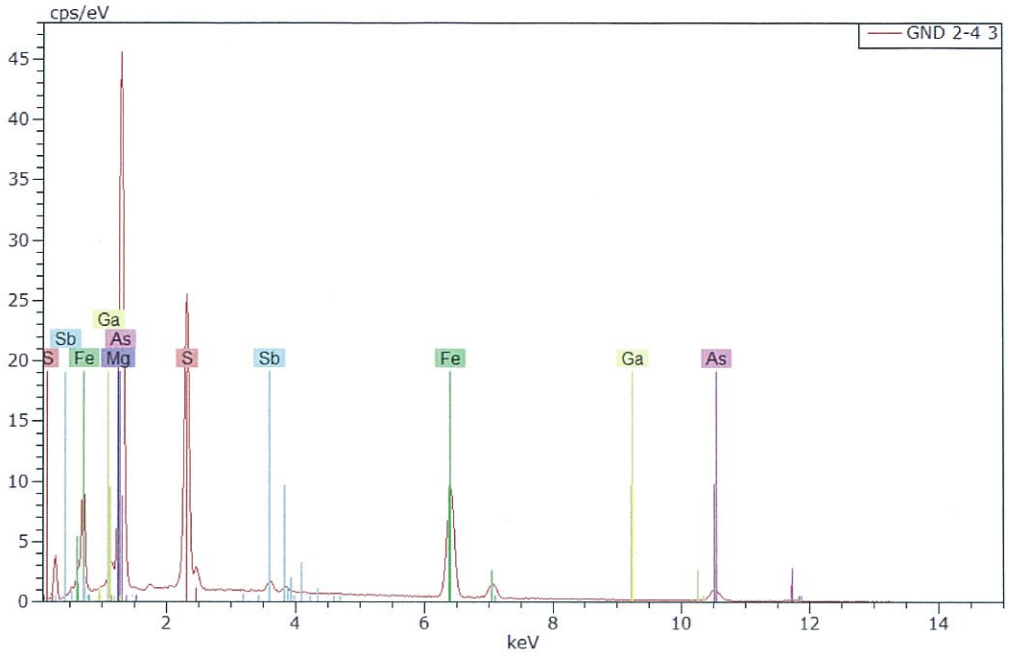


Figure 3-32: EDX-spectrum of arsenopyrite grain in tailings sample CND 2-4 showing detectable Fe, As, Sb, and S.

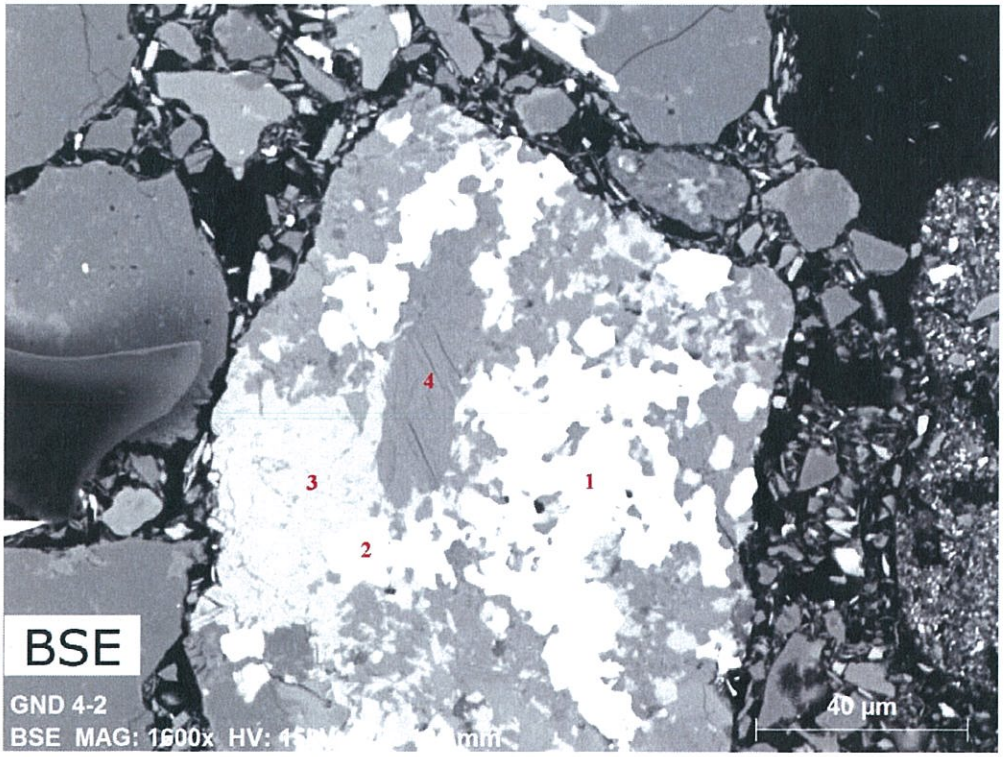


Figure 3-33: BSE-image of tailings sample CND 2-4 showing co-precipiatetd pyrite (1) and sphalerite (2). Gangue minerals are biotite (3) and muscovite (4).

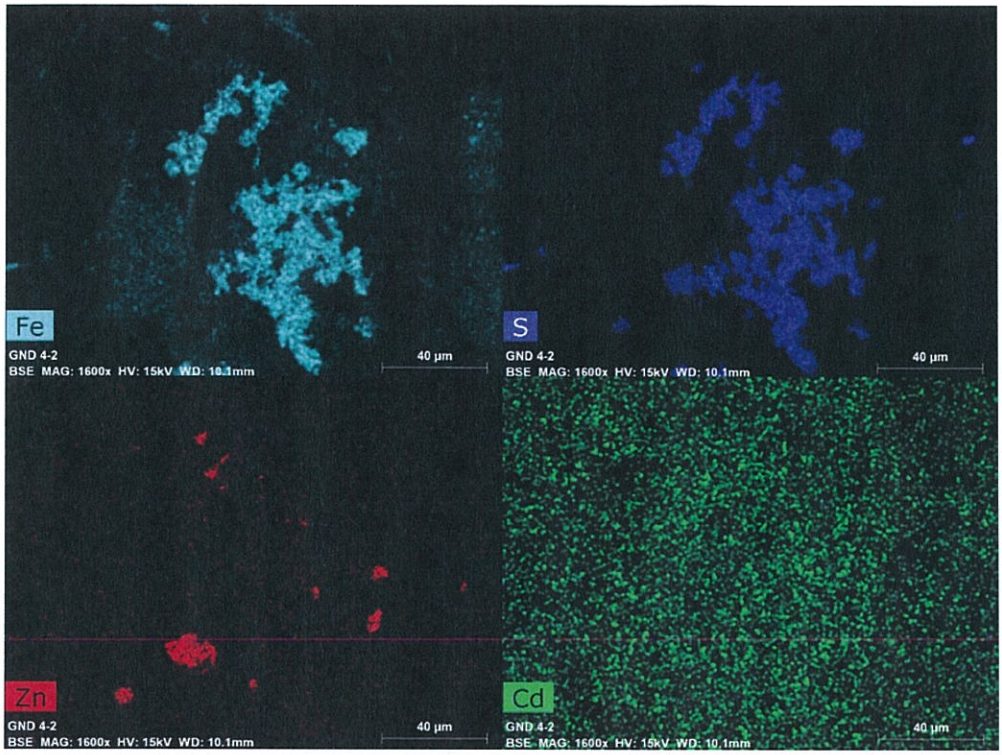


Figure 3-34: Elemental maps for Fe, S, Zn and Cd of area shown in Figure 3-33 (tailings sample CND 2-4).

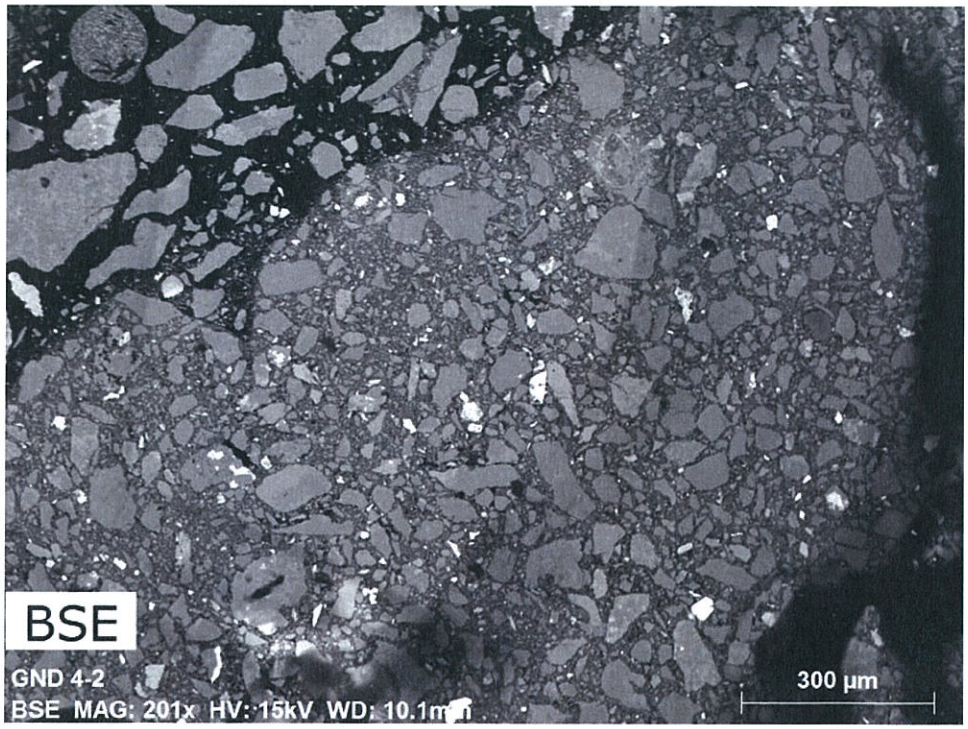


Figure 3-35: BSE-image of tailings sample CND 1-5 showing a relataively low-magnification overview of a fragment assemblage.

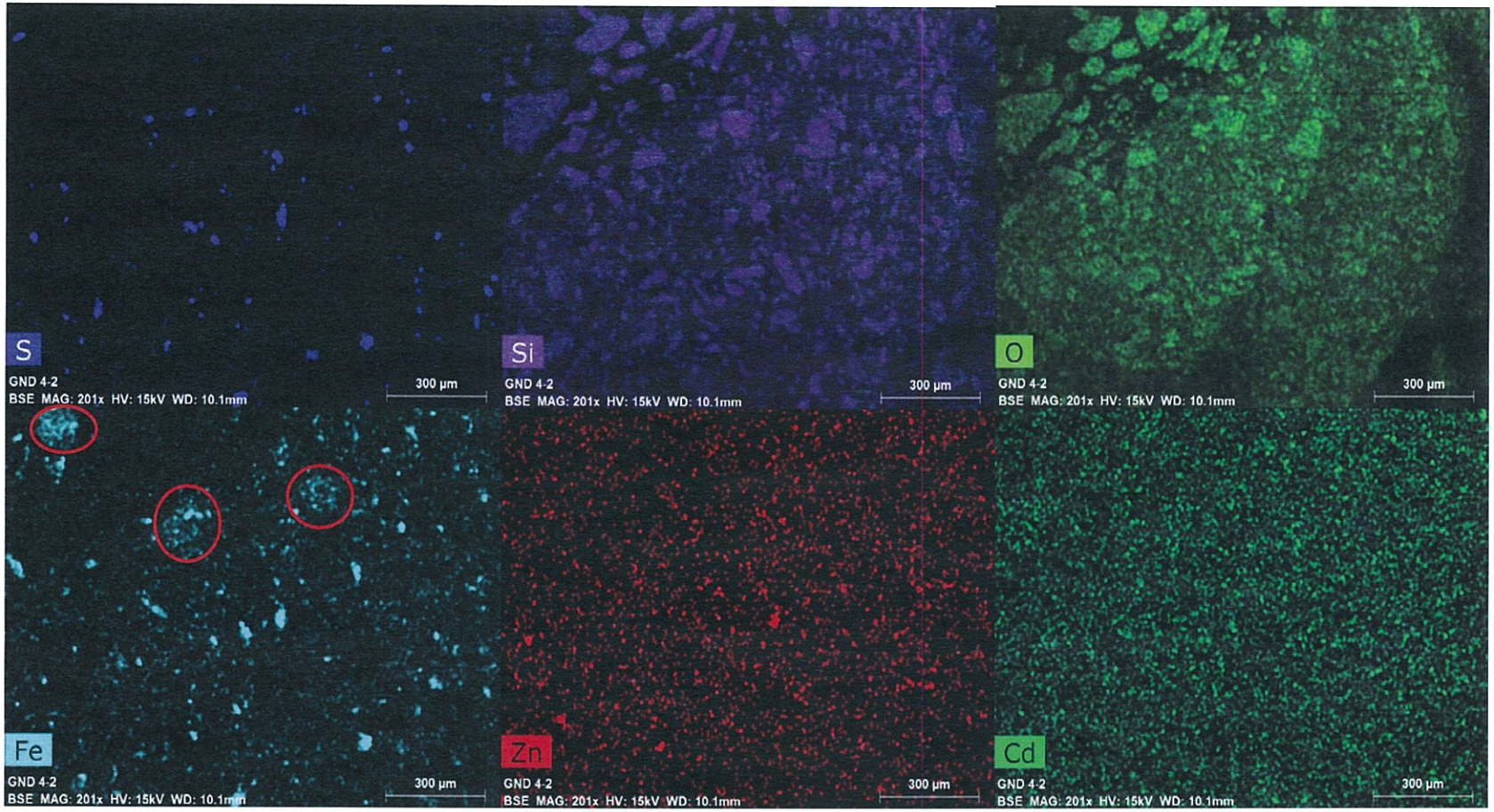


Figure 3-36: Elemental maps for S, Si, O, Fe, Zn and Cd of area shown in Figure 3-35 (tailings sample CND 1-5).

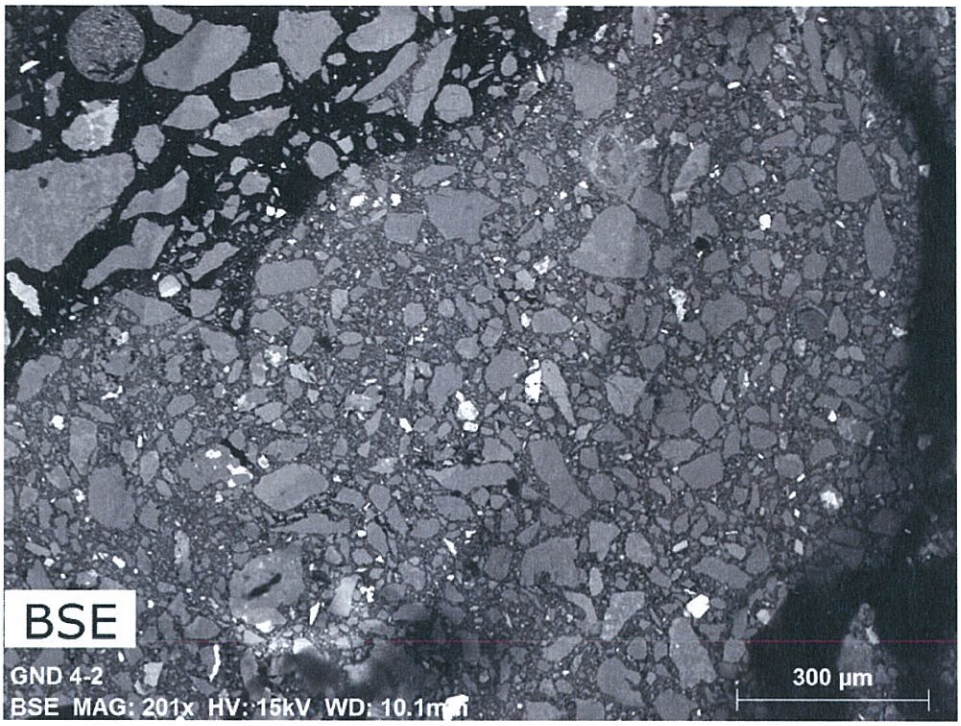


Figure 3-37: BSE-image of tailings sample 1-5 showing biotite cluster with secondary precipitates along grain boundaries.

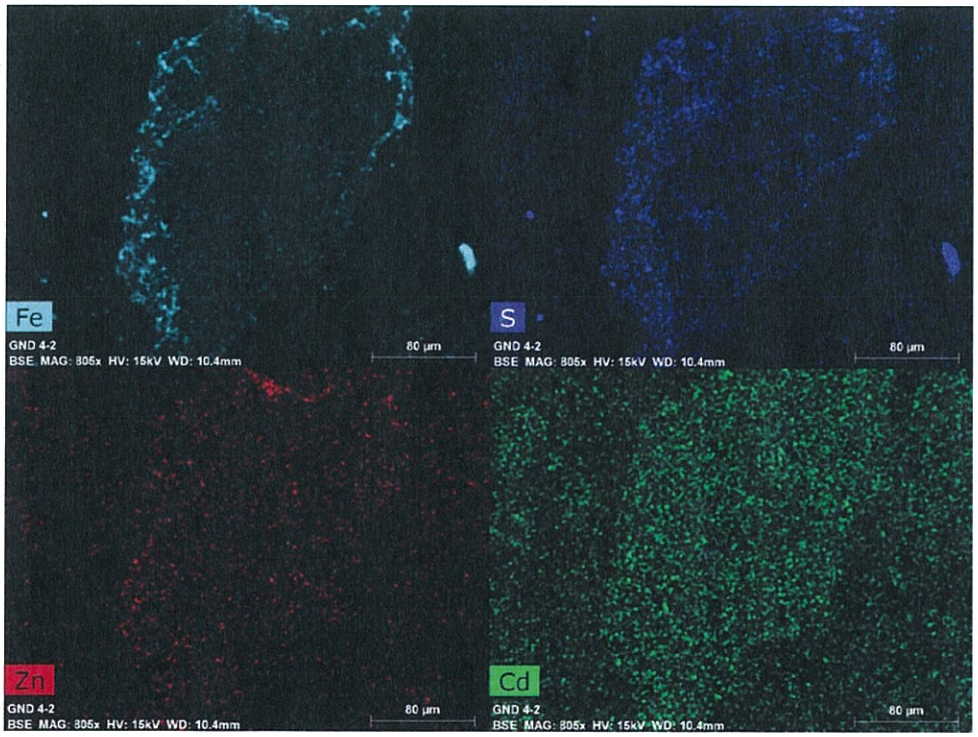


Figure 3-38: Elemental maps of area shown in Figure 3-37 (Tailings sample CND 1-5).

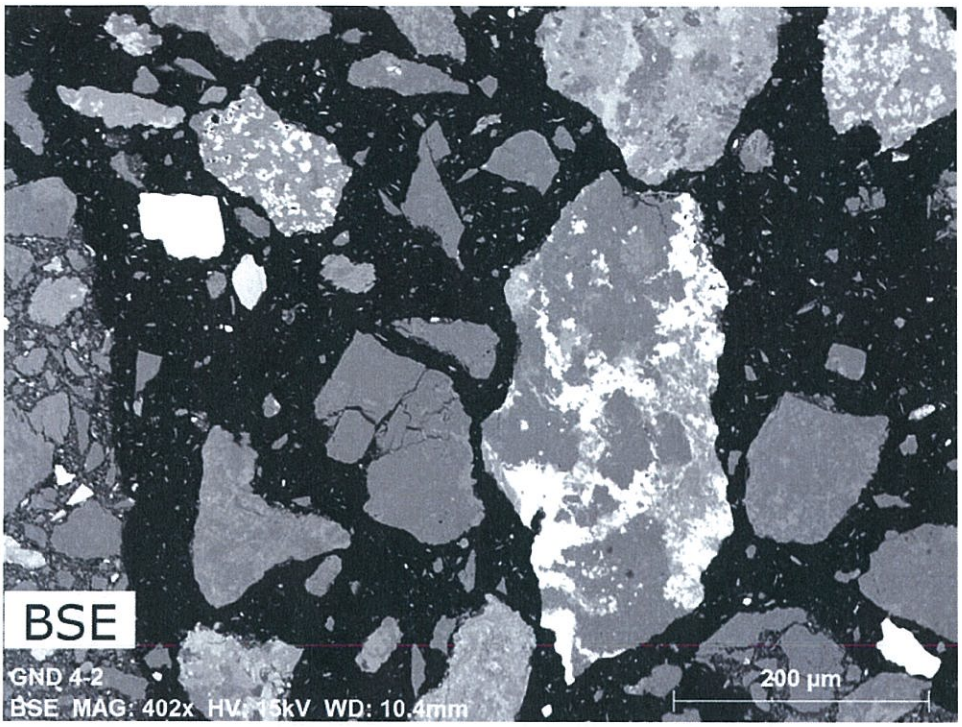


Figure 3-39: BSE-image of tailings sample 1-5 showing network of replacive Fe-hydroxide in polymineralic fragment (Tailings sample CND 1-5)

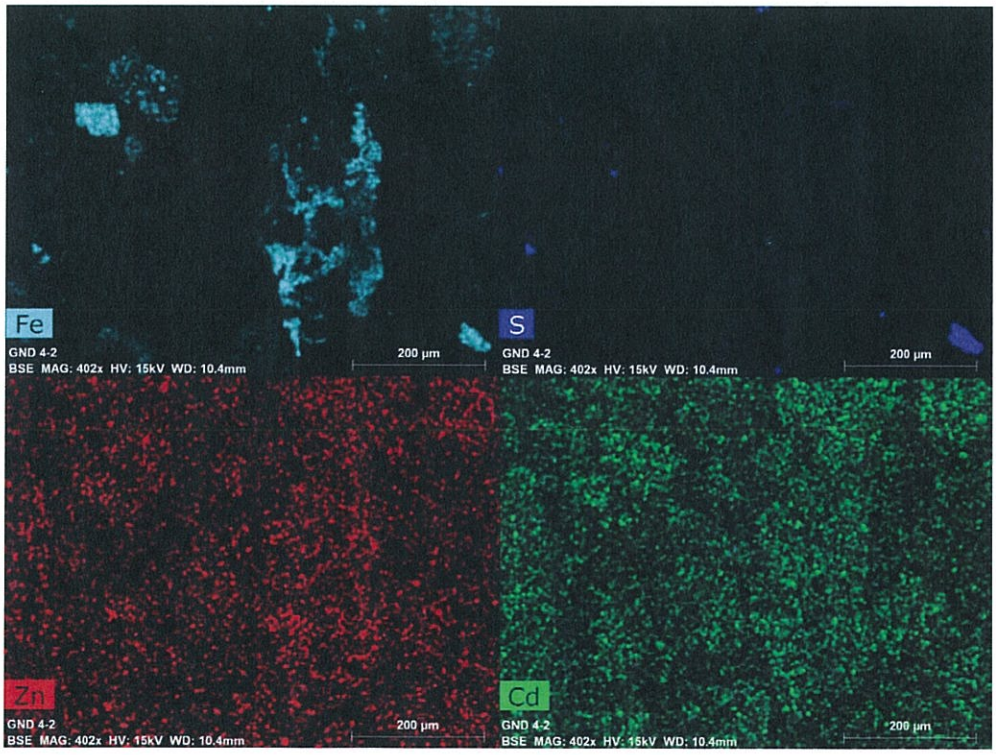


Figure 3-40: Elemental maps of area shown in Figure 3-39 (Tailings sample CND 1-5).

4. Conclusions

4. Conclusions

A mineralogical examination of five waste rock and two tailings samples from the Blackwater Gold project was conducted using XRD, petrographic and SEM-analysis in order to gain a better understanding of the general mineralogy as well as the major host minerals for cadmium and zinc. The key findings can be summarizes as follows:

Waste rock

- Waste rock from the Blackwater deposit is composed of varitextured, felsic volcanic and sub-volcanic rock in which igneous textures are largely overprinted by strong hydrothermal alteration that led to partial or full recrystallization of a quartz-feldpar matrix as well as replacement by dominantly sericite-biotite assemblages;
- Samples with high solid-phase Zn content (waste rock Type 1 and Type 3 samples) were found to have the highest sphalerite abundance. This mineral is the dominant host for both zinc and cadmium in these samples;
- While sphalerite still appears to be the main repository for Zn and Cd in all Blackwater waste rock classifications, both elements were additionally identified as minor components in pyrite, polymetallic sulfide as well as in several non-sulphide phases such as Fe-Mn-carbonate and Fe-hydroxide in sample BW-ARD-473 (Type 3). One discrete Cd-mineral (CdS) was also identifed in the latter sample;
- In general, Cd shows a more diffuse distribution pattern than Zn which may be attributed to Cd residing in wider varity of phases, faster diffusion or lack of resolution owing to the low abundance of Cd (*i.e.,* Cd concentrations near the limits of analytical detection of the SEM).

Tailings

- Tailings show generally the same gangue mineralogy as waste rock units; however, grain-sizes are too small to accurately quantify mineral abundances petrographically;
- Cd and Zn distribution patterns are comparabable to those seen in waste rock with Cd apparently residing in a wider variety of non-sphalerite phases (*e.g.*, sulfates and arsenopyrite), while Zn is largely restricted to sphalerite. Generally, the analysis revealed only minor amounts of oxide/hydroxide phases that may be

prone to reductive dissolution in the permanently saturated setting of the TSF. Slightly higher abundances of Fe oxide phases observed in the transition tailings sample imply redox-related dissolution processes will have more relevance to these materials.

References

newgold™

References

Barton, Jr, P. B.; Bethke, P. M. (1987): Chalcopyrite disease in sphalerite: pathology and epidemiology. *American Mineralogist, 72*, 451 – 467.

Craig, J. R., Vokes, F. M., & Solberg, T. N. (1998). Pyrite: physical and chemical textures. *Mineralium Deposita, 34(1)*, 82-101.

Martin A.J., Pedersen T.F. (2002) Seasonal and interannual mobility of arsenic in a lake impacted by metal-mining. *Env. Sci. Tech., 36*, 1516-1523.

Raudsepp. M. and Pani, E. (2003): Application of Rietveld analysis to environmental mineralogy. *Mineralogical Association of Canada, Short Course 31*, Chapter 8, 165-180.

Tessier A., Campbell P.G.C. (1988) Partioning of Trace Metals in Sediments., in: J. R. Kramer and E. A. Herbert (Eds.), Metal Speciation: Theory, Analysis, and Application., Lewis Publishers. pp. 183-200.

Tesoriero, A. J., & Pankow, J. F. (1996). Solid solution partitioning of Sr^{2+}, Ba^{2+}, and Cd^{2+} to calcite. *Geochimica et Cosmochimica Acta, 60*(6), 1053-1063.

ANNEX 14
SGS 2013. Excerpt of Cyanide Destruction Test Work

An Investigation of

THE RECOVERY OF GOLD FROM THE BLACKWATER PROJECT SAMPLES

prepared for

NEW GOLD INC.

Project 13989-001 Final Report

Revision No. 1
October 18, 2013

EXCERPT OF CYANIDE DESTRUCTION TEST WORK

NOTE:
The practice of this Company in issuing reports of this nature is to require the recipient not to publish the report or any part thereof without the written consent of SGS Minerals Services. This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. WARNING: The sample(s) to which the findings recorded herein (the 'Findings') relate was (were) drawn and / or provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativity of the goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is/are said to be extracted. The findings report on the samples provided by the client and are not intended for commercial or contractual settlement purposes. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Test method information available upon request.

SGS Canada Inc. | P.O. Box 4300, 185 Concession Street, Lakefield, Ontario, Canada K0L 2H0
Tel: (705) 652-2000 Fax: (705) 652-6365 www.met.sgs.com www.ca.sgs.com

Member of the SGS Group (SGS SA)

Table of Contents

Introduction iv
Testwork Summary 1
1. Sample Receipt and Description 1
2. Sample Preparation and Characterisation 3
2.1. Sample Preparation 3
2.2. Head Analysis 4
3. Metallurgical Test Program 6
3.1. Cyanide Destruction Testwork 8
3.1.1. The SO_2/Air Process 8
3.1.2. Cyanide Destruction Testwork Using SO_2/Air 10
3.1.3. Preparation of CND Pulp for Environmental Characterisation (Test CND4 & CND5) 16
3.2. Environmental Characterisation 18
Conclusions 24

Executive Summary

New Gold is continuing with the development of their Blackwater property in northern British Columbia, Canada. In support of that effort SGS Minerals Services undertook a metallurgical test program to examine the response of two samples to a previously developed process. The samples were low grade assaying about 0.5 g/t gold and were designated as Transition Ore and Sulphide Ore.

The test program included an examination of a method to treat the cyanide leach discharge pulp to destroy the contained cyanide. The destruction method selected for investigation was the SO_2/air process, a method widely used in the gold extraction industry. The results of the destruction test work are summarised in Table 1.

After a review of the results of the investigation New Gold selected a set of operating parameters (pH 8.0, retention time 60 minutes, and SO_2 stoichiometry of 2.0) to be used to treat samples of the Transition and Sulphide Ores that had been cyanide leached. These materials that had been through cyanide leaching and cyanide destruction were than submitted to the Environmental laboratory for basic characterisation, in support of New Gold's on-going environmental assessment of the project.

Table 1 – Summary of Cyanide Destruction Conditions and Results

Feed/ Test	Actual Conditions				Assays				
	Reten. Time (min)	pH	SO_2 Stoich	Cu (mg/L)	CN_T mg/L	CN_{WAD} Lab mg/L	CN_{WAD} Picric mg/L	Metals (total) Cu mg/L	Fe mg/L
Transition									
CND 1-1	60	9.0	2.1	22	1.12	<0.1	<0.1	0.10	0.38
CND 1-2	90	8.1	2.0	21	0.23	<0.1	5.0	13.2	0.14
CND 1-3	86	9.0	2.0	20	0.79	<0.1	2.0	5.99	0.08
CND 1-4	166	9.1	1.9	45	0.18	<0.1	<0.1	0.71	0.06
CND 1-5	86	10.0	2.0	53	2.53	<0.1	<0.1	1.09	1.51
CND 1-6	89	9.0	2.6	50	0.35	<0.1	<0.1	0.21	0.10
CND 5-1	61	8.0	2.0	16	0.34	<0.1	6.88	16.9	< 0.05
CND 5-1b	60	8.0	2.0	16	0.18	<0.1	2.40	1.84	< 0.05
Sulphide									
CND 2-1	59	9.0	2.0	22	3.11	<0.1	3.5	6.17	0.75
CND 2-2	91	8.0	2.1	21	1.01	<0.1	8.5	15.5	0.09
CND 2-3	91	9.0	2.1	53	<0.1	<0.1	0.35	1.68	<0.05
CND 2-4	175	9.0	2.4	49	0.30	<0.1	<0.1	0.68	0.12
CND 2-5	93	10	2.2	56	2.82	<0.1	<0.1	0.71	1.38
CND 2-6	94	9.0	2.7	55	0.35	<0.1	<0.1	1.69	0.16
CND 3-1	92	8.0	2.3	0	0.39	<0.1	2.73	1.82	0.09
CND 3-2	62	8.1	2.1	0	2.15	1.4	10.5	15.9	0.44
CND 3-3	58	8.0	2.1	21	0.41	<0.1	7.42	4.49	0.17
CND 3-4	87	8.1	2.1	21	0.19	<0.1	5.17	6.78	0.12
CND 3-5	62	8.7	2.2	22	0.80	0.04	5.26	14.3	0.24
CND 3-6	88	8.5	2.1	20	0.83	< 0.1	5.38	11.4	0.52
CND 4-1	63	8.0	2.2	11	0.55	< 0.1	4.95	0.84	0.11
CND 4-2	62	8.0	2.1	16	0.46	< 0.1	5.58	15.2	0.17
CND 4-2b	64	8.0	2.2	16	0.30	<0.1	6.78	10.3	0.14

Introduction

This report presents the results of testwork on New Gold Inc. Blackwater project samples, shipped via G&T Metallurgical Services. Three sample types were received; Oxide, Transition, and Sulphide, which were representative of the three predominant ore types at Blackwater.

The metallurgical testwork described in this report, carried out by SGS Minerals Services in Lakefield Ontario, utilised only the Transition and Sulphide ore samples. The objectives of the metallurgical program were to confirm the metallurgical response of these two ore types to whole ore cyanidation for gold and silver extraction, and to examine the response of the materials to cyanide destruction. Representative cyanide destruction products were to be prepared for detailed environmental characterisation.

The test program was directed initially by Mr. Tony Casagranda and later Mr. Dave Hall of New Gold Inc. Test results were forwarded to Mr. Tony Casagranda and Mr. Dave Hall as they became available.

John Geldart
Senior Project Metallurgist

Inna Dymov, P. Eng
Manager – Gold Group, Metallurgical Operations

Experimental work by: M Unger
Report preparation by: S.Lacasse, M.Unger, J.Geldart
Reviewed by: S. McKenzie, I. Dymov

Testwork Summary

1. Sample Receipt and Description

The samples received at SGS were identified by ore type; Oxide, Transition or Sulphide, prior to arrival at SGS' Lakefield laboratory. The as-received weights of the samples are listed by ore type in Table 2, Table 3 and Table 4 including four notes about mislabelled samples.

Table 2 – Oxide Ore Samples Received (not used in this project)

Ore Type	G&T Starting mass (kg)	SGS as received mass (kg)
Oxide Comp #1	11.6	9.4
Oxide Comp #2	11.4	11.5
Oxide Comp #3	8.4	7.5
Oxide Comp #4	16.1	15.8
Oxide Comp #5	3.2	3.3
Oxide Comp #6	12.4	12.3
Oxide Comp #7	11.7	11.7
Oxide Comp #8	17.2	14.6
Oxide Comp #9	9.6	8.2
Oxide Comp #10	6.3	5.6
Oxide Comp #11	15.3	15.5
Oxide Comp #13	13.1	13.0
Oxide Comp #15	3.2	3.3
Totals (kg)	139.5	131.7

Table 3 – Transition Ore Samples Received

Ore Type	G&T Starting mass (kg)	SGS as received mass (kg)
Transition Comp #1	15.0	14.7
Transition Comp #2	21.6	20.7
Transition Comp #3	6.8	5.8
Transition Comp #4	8.5	7.2
Transition Comp #5 *	20.0	19.6
Transition Comp #6 **	15.0	14.9
Transition Comp #7	19.1	18.5
Transition Comp #8	8.1	6.4
Transition Comp #9	4.3	4.5
Transition Comp #10	17.3	16.9
Transition Comp #11	17.7	17.2
Transition Comp #12	15.5	14.9
Transition Comp #13	17.7	20.6
Transition Comp #14	14.8	14.5
Transition Comp #15	21.2	20.0
Totals (kg)	222.6	216.4

* Previously mis-labelled as Oxide Comp #5

** Previously mis-labelled as Transition Comp #2

Table 4 – Sulphide Ore Samples Received

Ore Type	G&T Starting mass (kg)	SGS as received mass (kg)
S-AND Comp #1	20.0	19.6
S-AND Comp #2	2.0	2.3
S-AND Comp #4	15.9	15.4
S-AND Comp #7	7.5	6.4
S-AND Comp #9	21.7	20.6
S-AND Comp #10 *	13.4	13.2
S-AND Comp #11	20.9	20.5
S-AND Comp #12	13.2	13.0
S-AND Comp #13	10.8	8.7
S-AND Comp #14	22.1	21.3
S-AND Comp #17	8.5	7.4
S-AND Comp #18	9.2	8.0
S-AND Comp #19	14.9	14.7
S-AND Comp #20	5.3	4.8
S-AND Comp #22	15.2	185.1
S-AND Comp #23	12.5	10.4
S-AND Comp #24	16.9	16.6
S-AND Comp #25	13.3	14.9
S-FLPT Comp #1	4.4	4.4
S-FLPT Comp #2	5.9	6.0
S-FLPT Comp #5	9.9	2.0
S-FLPT Comp #10	2.5	Missing
S-FLPT Comp #12	9.7	8.1
S-FLPT Comp #13	12.9	13.0
S-FLPT Comp #14	8.0	7.2
S-FLPT Comp #15	9.9	13.4
S-FLPT Comp #17	9.9	8.9
S-FLPT Comp #19	4.2	4.4
S-FLPT Comp #20 **		2.8
S-FLPT Comp #21	14.7	14.4
S-FLPT Comp #22	13.2	12.9
S-FLPT Comp #23	21.7	20.4
S-FLPT Comp #24	10.2	9.0
S-FLPT Comp #25	15.6	15.3
S-FLPT Comp #26	4.0	4.1
S-FLPT Comp #27	4.0	3.9
S-FLPT Comp #28	2.9	3.1
S-FLPT Comp #29	15.8	15.8
S-FLPT Comp #30	19.4	17.8

Ore Type	G&T Starting mass (kg)	SGS as received mass (kg)
S-FT Comp #3	6.3	6.1
S-FT Comp #5	6.4	5.7
S-FT Comp #7	8.9	7.8
S-FT Comp #8	5.9	5.2
S-FT Comp #10	10.1	9.0
S-FT Comp #14	6.9	6.4
S-FT Comp #15	11.2	11.0
S-FT Comp #19	6.5	5.8
S-FT Comp #20	8.7	7.8
S-FT Comp #22	1.2	1.5
S-FT Comp #23	6.6	5.7
S-FT Comp #24	1.9	2.3
S-FT Comp #25	3.7	3.6
S-VC Comp #3	4.5	4.6
S-VC Comp #4	7.7	6.3
S-VC Comp #6	15.3	15.3
S-VC Comp #7	4.8	4.7
S-VC Comp #8	7.2	6.2
S-VC Comp #9	4.0	5.0
S-VC Comp #11	19.0	17.9
S-VC Comp #12	3.0	3.1
S-VC Comp #14	1.5	1.8
S-VC Comp #15	17.3	17.1
S-VC Comp #16	13.3	12.9
S-VC Comp #19	23.0	21.4
S-VC Comp #24	12.1	11.8
S-VC Comp #25	12.2	10.8
Totals (kg)	671.3	806.6

* Previously mislabelled as S-AND Comp #2

** Not on list - Assumed to be S-FLPT Comp #10

2. Sample Preparation and Characterisation

2.1. Sample Preparation

The as-received Transition and Sulphide ore samples were inventoried, then prepared into individual composites. The composites were homogenised and then head samples and metallurgical and environmental test charges were split from each, as per Figure 1, each composite being kept separate throughout the process. All Transition and Sulphide ore received was prepared at the same time and all remaining material, together with the test charges produced, were placed in freezer storage.

The Oxide Ore samples were not used in this test program, therefore the as-received materials were only inventoried and then placed in freezer storage for possible future use.

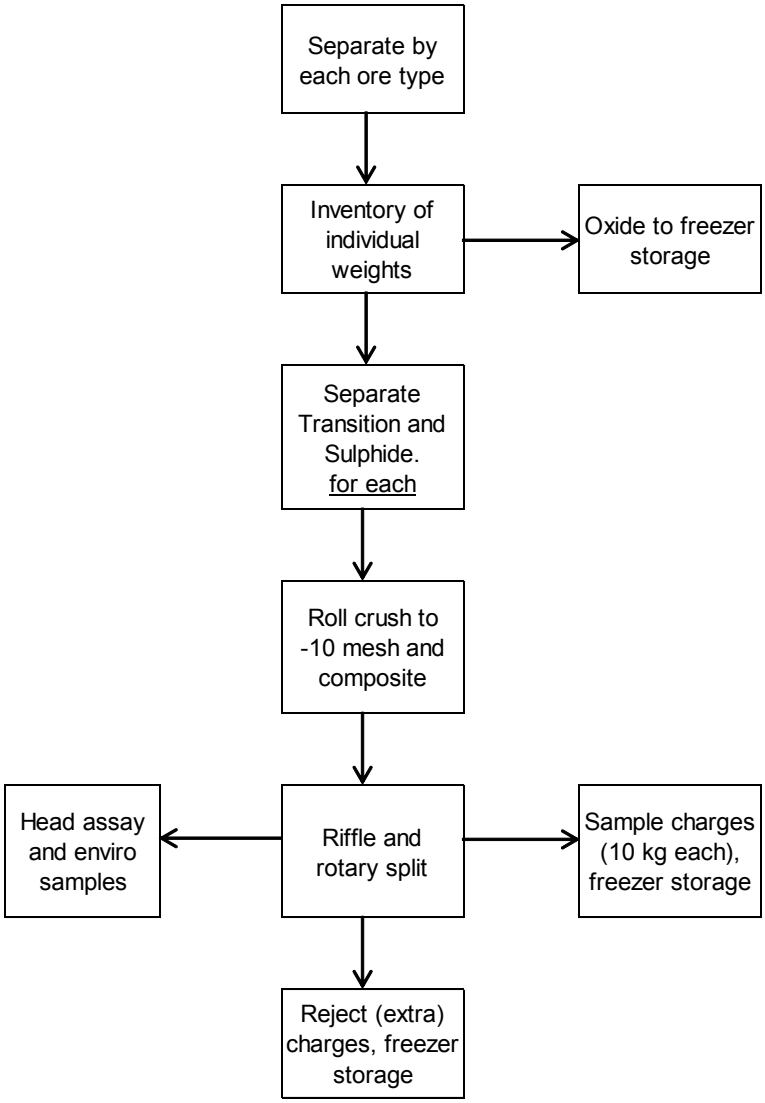


Figure 1: Sample Preparation Procedure

2.2. Head Analysis

Head samples of each composite were submitted to the laboratory for detailed chemical analysis.

The gold head grade was determined by two different methods, a standard fire assay on triplicate a 30 gram samples, and by a "screened metallics protocol". The screened metallics protocol allows for the analysis of a larger sample mass, 1000 grams in this case, and may be more suitable for samples containing free gold. The protocol requires the sample be stage pulverised and screened until all but 20 to 30 grams of material is finer than 150 mesh. The entire screen oversize portion is assayed to extinction, and the screen undersize is sampled and assayed in duplicate for gold. The results of duplicate 1000 gram screened metallics assays on the two composite samples are summarised in Table 5. The -150 mesh 'a' and 'b' analyses refer to duplicate riffled samples from the -150 mesh fraction.

Table 5 – Gold Head Analyses by Screened Metallics Protocol

Composite	Calculated Au Head (g/t)	Fraction					Au Distribution	
		+150 Mesh		-150 Mesh			Mesh	
		Mass (%)	Au (g/t)	Mass (%)	Au (g/t) a	Au (g/t) b	+ 150 (%)	-150 (%)
Sulphide Comp - Cut A	0.51	1.73	0.2	98.3	0.54	0.50	0.6	99.4
Sulphide Comp - Cut B	0.61	1.62	0.9	98.4	0.62	0.59	2.4	97.6
average	0.56							
Transition Comp - Cut A	0.59	1.43	3.1	98.6	0.60	0.50	7.6	92.4
Transition Comp - Cut B	0.51	2.07	0.1	97.9	0.45	0.58	0.5	99.5
average	0.55							

Additional analytical samples were riffled from each composite and submitted for quantitative and semi-quantitative analysis including sulphur and sulphide analyses. The results of these analyses are given in Table 6. These results indicated that the Transition and Sulphide ore samples have similar gold head grades averaging 0.55 g/t and 0.56 g/t, respectively by screened metallics, the Sulphide ore sample contain approximately double the sulphur (1.19%) and sulphide (1.11%) concentration as the Transition ore sample.

The results of the analysis of the samples for gold by 30 gram fire assay are shown in Table 6. The results for the Transition sample are very consistent, but the analysis of the Sulphide sample shows a good deal of scatter.

During the test program 7 individual 10-kg cyanide leach tests were performed, three on the Transition sample and 4 on the Sulphide sample. The calculated gold and silver head grades from these tests are shown in Table 7. The average calculated gold head grade of the Transition sample was 0.54 g/t and for the Sulphide sample it was 0.53 g/t.

Table 6 – Additional Analyses

Element	Unit	Composite	
		Transition	Sulphide
Fire Assay			
Au - Cut A	g/t	0.62	0.32
Au - Cut B	g/t	0.56	0.26
Au - Cut C	g/t	0.56	0.79
Au - average	g/t	0.58	0.46
Ag - Cut A	g/t	3.9	3.1
Ag - Cut B	g/t	3.7	3.5
Ag - Cut C	g/t	3.7	3.5
Ag - average	g/t	3.8	3.4
Cold Vapour			
Hg	g/t	< 0.3	< 0.3
Leco			
S	%	0.67	1.19
S=	%	0.49	1.11
Dionex			
SO_4	%	0.2	< 0.1
S°	%	< 0.05	0.32
Skalar			
C(org)	%	0.10	< 0.05
Semi-Quantitative ICP Scan			
Ag	g/t	4	3
Al	g/t	72,200	80,000
As	g/t	140	< 30
Ba	g/t	506	722
Be	g/t	1	2
Bi	g/t	< 20	< 20

Element	Unit	Composite	
		Transition	Sulphide
Semi-Quantitative ICP Scan			
Ca	g/t	882	4,840
Cd	g/t	30	29
Co	g/t	< 7	13
Cr	g/t	45	51
Cu	g/t	121	121
Fe	g/t	28,700	46,200
K	g/t	38,700	43,900
Li	g/t	< 30	< 30
Mg	g/t	2,050	5,120
Mn	g/t	1,260	3,700
Mo	g/t	< 7	< 7
Na	g/t	991	1,810
Ni	g/t	< 20	< 20
P	g/t	236	707
Pb	g/t	786	393
Sb	g/t	< 30	< 30
Se	g/t	< 30	< 30
Sn	g/t	< 20	< 20
Sr	g/t	42	86
Ti	g/t	1,410	2,840
Tl	g/t	< 30	< 30
U	g/t	< 20	< 20
V	g/t	22	56
Y	g/t	6	7
Zn	g/t	2,250	3,790

Table 7 – Calculated Head Values from 10-kg Cyanide Leach Tests

Test No.	Sample	Assay (g/t)	
		Au	Ag
CN1	Transition	0.53	3.8
CN3	Transition	0.54	3.8
CN5	Transition	0.54	3.8
Average	Transition	0.54	3.8
STD	Transition	0.005	0.03
CN2	Sulphide	0.50	3.4
CN4	Sulphide	0.56	3.4
CN6	Sulphide	0.55	3.4
CN7	Sulphide	0.48	2.5
Average	Sulphide	0.53	3.1
STD	Sulphide	0.040	0.49

3. Metallurgical Test Program

The metallurgical process for the treatment of the Blackwater ore was developed previously by another test laboratory. The present work was to follow the developed methodology, which was a 30 hour cyanide leach followed by dilution of the pulp and then a 6 hour pulp/carbon contact (a modified carbon-in-pulp (CIP) process). As requested by the client some post leach solution adjustment measures were included in the test procedure, to ensure that the leached pulp feeding the cyanide destruction process was representative of the overall proposed process. This procedure, denoted as an “Integrated Process” is illustrated Figure 2. The test program was broken into two phases, an initial “Confirmation Phase” to determine if the test samples responded to the leach procedure as expected, and a second “Integrated Phase” where the procedure was used to prepare material for cyanide destruction testwork and environmental characterisation.

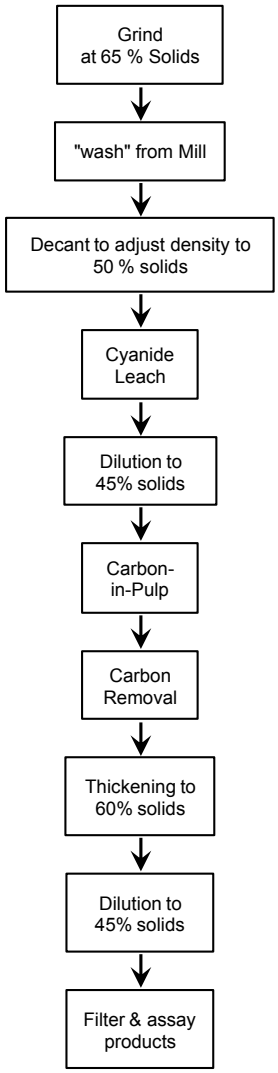


Figure 2 – Test Procedure

In the "Confirmation Phase", two initial tests were conducted (Tests CN-1 and CN-2) on the Transition and Sulphide ore samples. The phased approach to the test program is illustrated in Figure 3.

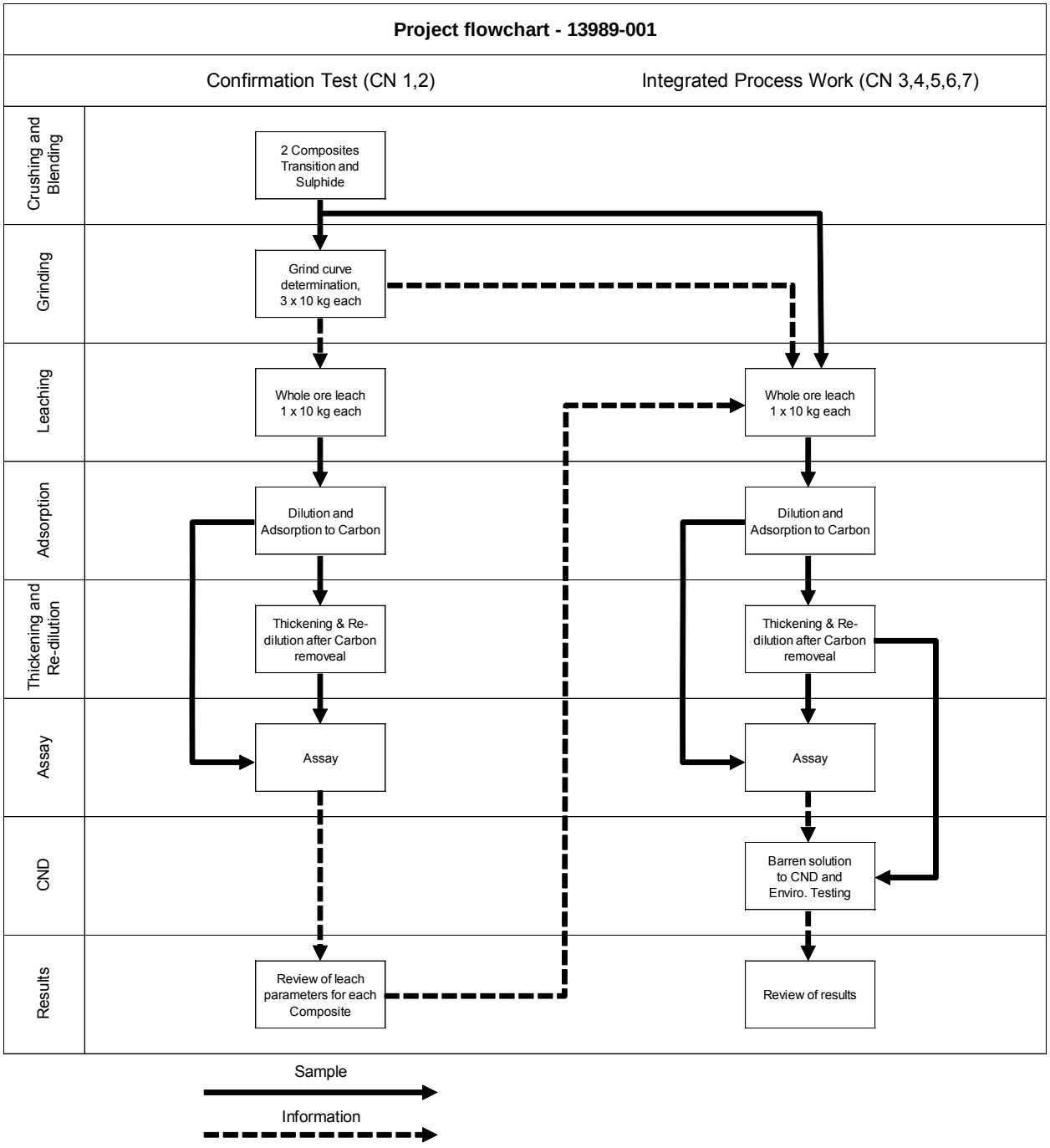


Figure 3: Metallurgical Testwork Outline

Following the analysis of the results from the "Confirmation Tests" and full review by New Gold the second phase of the test program using the "Integrated Process" was undertaken.

This second phase of testwork was carried out in three steps, for Transition and Sulphide ore in Tests CN3, CN4, and in CN5, CN6 respectively and a final time with Sulphide ore only in CN7.

All of the testwork was performed at a moderately large scale. Each leach was performed on 10 kg of ground material.

3.1. Cyanide Destruction Testwork

The cyanide destruction testwork was performed in three phases. An initial set of tests (Tests CND1 and CND2) were performed on one Transition cyanide leach pulp and one Sulphide leach pulp examining the effects of pH and retention time on the destruction of the contained cyanide and the concentration of metals in solution. The main objective of the testwork was to generate a cyanide destruction discharge pulp containing less than 1 mg/L CN(wad), while minimising reagent additions.

This first set of two tests was followed by one further test on the Sulphide leach pulp (Test CND 3), to further optimise the cyanide destruction process. In consultation with New Gold the cyanide destruction conditions were selected and Transition and Sulphide leach samples were treated (CND4 and CND5) to generate material for environmental characterisation.

The feed solutions for each test were sampled and analysed. Selected feed solution analyses are given in Table 8, and further detailed analysis are appended.

Table 8 – CND Feed Sample Analysis

		Transition		Sulphide		
Test No		CND 1	CND 5	CND 2	CND 3	CND 4
Cyanide Leach No.		*CN3*	*CN5*	*CN4*	*CN6*	*CN7*
CN(total)	mg/L	94	140	95	117	133
CN(wad)	mg/L	79	115	68	85.8	123
Cu	mg/L	16.3	26.0	12.9	18.8	19.4
Fe	mg/L	3.58	6.4	5.6	7.77	9.3
As	mg/L	0.237	…	0.358	0.226	…
Cd	mg/L	0.242	…	0.0193	0.00474	…
Hg	mg/L	0.00002	…	< 0.00001	< 0.00001	…
Sb	mg/L	0.142	…	0.302	0.248	…
Zn	mg/L	44.9	…	43.4	25.1	…
SO4	mg/L	310	…	170	100	…
NH3	mg/L	1.08	…	1.04	0.38	…
pH		10.3	…	10.4	9.98	…
Conductivity	µS/cm	2160	…	1960	1080	…

3.1.1. The SO_2/Air Process

The chemical reaction for the oxidation of weak-acid dissociable cyanide (CN_{WAD}) using sodium metabisulphite ($Na_2S_2O_5$ as the source of SO_2) and air (source of oxygen) is as follows:

$$2\ CN^- + Na_2S_2O_5 + 2\ O_2 + 2\ OH^- \rightarrow 2\ CNO^- + Na_2SO_4 + SO_4^{2-} + H_2O \quad (1)$$

This reaction is catalyzed by the presence of copper. The feed usually contains some copper (as copper cyano complexes), and if required, additional copper is added as copper sulphate. Hydrated lime is added to the reactor to provide the OH^- ion for the above reaction.

The base metals (such as copper, zinc and nickel) that previously complexed with the cyanide are liberated and precipitated as metal hydroxides:

$$Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2 \quad (2)$$

Ferrocyanide is not destroyed in the process and is instead precipitated with other base metals, such as copper, zinc and nickel as mixed metal ferrocyanide solids:

$$Fe(CN)_6^{4-} + 2\,Cu^{2+} \rightarrow Cu_2Fe(CN)_6 \quad (3)$$

$$Fe(CN)_6^{4-} + 2\,Zn^{2+} \rightarrow Zn_2Fe(CN)_6 \quad (4)$$

Thiocyanate, if present, is partially oxidized to cyanate and sulphate:

$$SCN^- + Na_2S_2O_5 + 3\,O_2 + 4OH^- \rightarrow CNO^- + Na_2SO_4 + 2\,SO_4^{2-} + 2\,H_2O \quad (5)$$

The cyanate ion is unstable, and slowly hydrolyzes to ammonium and carbonate ions:

$$CNO^- + 2\,H_2O \rightarrow CO_3^{2-} + NH_4^+ \quad (6)$$

The rate of hydrolysis of the cyanate ion increases with decreasing pH. The carbonate ion precipitates as calcium carbonate. A small amount of the ammonium ions is found to form ammonia (NH_3) and eventually escapes from the solution as NH_3 gas.

The standard procedure for cyanide destruction (CND) using SO_2/air starts with a batch test. The reactor is first filled with the feed solution or pulp. The required amount of copper sulphate is added. The reactor content is then treated in batch mode with $Na_2S_2O_5$ and air to reduce the concentration of CN_{WAD} in solution to approximately 1 mg/L. The oxidation reduction potential of the pulp is monitored with a Pt/Ag/AgCl combination electrode, whilst the residual CN_{WAD} concentration in the solution phase is monitored during the test using the picric acid method. The objective of the batch test is to produce treated product with low residual cyanide for use as starting material for the first continuous test. In subsequent tests, the treated product in the reactor from the previous test is used as the starting material for the new test. At the end of each test, a solution sample is taken for analysis of CN_T, Cu and Fe. Samples from selected tests are usually submitted for CN_T, CN_{WAD}, SCN, ICP scan and other species of interest.

It should be noted that sodium metabisulphite, a partially neutralized form of SO_2, is used in laboratory testing to allow accurate addition of reagent. It is anticipated that in a commercial plant using SO_2 gas, the lime requirement for pH control may be higher by approximately 0.5 mole lime per mole SO_2, or 0.58 g lime per g SO_2 as suggested by the following chemical reactions:

$$2\,SO_2 + 2\,NaOH \rightarrow Na_2S_2O_5 + H_2O \quad (7)$$

$$Na_2S_2O_5 + Ca(OH)_2 \rightarrow CaSO_3 + Na_2SO_3 + H_2O \quad (8)$$

$$2\ SO_2 + 2\ Ca(OH)_2 \rightarrow 2\ CaSO_3 + 2H_2O \quad (9)$$

3.1.2. Cyanide Destruction Testwork Using SO_2/Air

The main objective of the testwork was to treat each pulp sample using the SO_2/air method to generate product containing <1 mg/L residual CN_{WAD}. An initial set of test parameters were specified by New Gold, examining the effect of retention time, operating pH and SO_2 stoichiometry. The initial test parameters are listed in Table 9, and additional operating conditions are listed in Table 10.

Table 9 – Initial CND Test Parameters

Retention Time (min)	pH	SO_2 Stoichio-metry
60	9.0	2.0
90	8.0	2.0
90	9.0	2.0
180	9.0	2.0
90	10.0	2.0
90	9.0	2.5

The results of these tests are summarized in Table 11 and Table 12 and the concentration of selected metals in the discharge solutions are illustrated in Figure 4 through Figure 7. The reagent additions for each of the tests are summarized in Table 13. Additional test details and chemical analysis are given in the Appendix.

The CND tests resulted in residual CN(wad) values of <0.1mg/L in all cases. With respect to pH the higher values generally resulted in lower metal concentrations in solution with the exception of some elements such as arsenic and antimony which showed the opposite trend.

The CN(wad) by “picric acid” assay was done during the continuous tests. The solutions were preserved and the CN(wad) by “lab” assay was done at a later time. The residual SO_2 may have reacted which resulted in lower CN(wad) values in a few tests.

Table 10 – Test Conditions for Initial CND Tests

Feed/ Test	Target Conditions						Actual Conditions				
	Reten. Time (min)	pH	SO_2 Stoich	Cu (mg/L)	Dur'tn (min)	Pulp Dens. %	Reten. Time (min)	pH	SO_2 Stoich	Cu (mg/L)	Dur'tn (min)
Feed - Test CN 3 Pulp (Transition)								*10.5*			
Batch Test											
CND 1	...	8.5	...	20	...	45	165	8.5	4.08	20.0	165
Continuous Tests											
CND 1-1	60	9.0	2.0	min	180	45	60	9.0	2.13	22.2	150
CND 1-2	90	8.0	2.0	min	270	45	90	8.1	2.02	20.7	180
CND 1-3	90	9.0	2.0	min	270	45	86	9.0	1.98	20.0	210
CND 1-4	180	9.0	2.0	min	540	45	166	9.1	2.03	45.4	510
CND 1-5	90	10.0	2.0	min	270	45	86	10.0	2.04	53.2	240
CND 1-6	90	9.0	2.5	min	270	45	89	9.0	2.58	49.5	205
Feed - Test CN 4 Pulp (Sulphide)							*...*	*10.3*			
Batch Test											
CND 2	...	8.5	...	20	...	45	135	8.5	2.97	20.0	135
Continuous Tests											
CND 2-1	60	9.0	2.0	min	180	45	59	9.0	2.03	22.0	150
CND 2-2	90	8.0	2.0	min	270	45	91	8.0	2.05	21.1	180
CND 2-3	90	9.0	2.0	min	270	45	91	9.0	2.12	52.5	210
CND 2-4	180	9.0	2.0	min	540	45	175	9.0	2.36	49.2	510
CND 2-5	90	10.0	2.0	min	270	45	93	10	2.19	55.6	240
CND 2-6	90	9.0	2.5	min	270	45	94	9.0	2.73	54.7	237

Table 11 – Initial CND Test Results

Feed/ Test	Actual Conditions				Assays				
	Reten. Time (min)	pH	SO_2 Stoich	Cu (mg/L)	CN_T mg/L	CN_{WAD} by Lab mg/L	CN_{WAD} by Picric mg/L	Metals (total) Cu mg/L	Metals (total) Fe mg/L
Test CN 3 Pulp (Transition)									
Batch Test									
CND 1	165	8.5	4.08	20	…	…	<0.1	…	…
Continuous Tests									
CND 1-1	60	9.0	2.13	22	1.1	<0.1	<0.1	0.10	0.38
CND 1-2	90	8.1	2.02	21	0.23	<0.1	5.0	13.2	0.14
CND 1-3	86	9.0	1.98	20	0.79	<0.1	2.0	5.99	0.08
CND 1-4	166	9.1	2.03	45	0.18	<0.1	<0.1	0.71	0.06
CND 1-5	86	10.0	2.04	53	2.53	<0.1	<0.1	1.09	1.51
CND 1-6	89	9.0	2.58	50	0.35	<0.1	<0.1	0.21	0.10
Test CN 4 Pulp (Sulphide)									
Batch Test									
CND 2	135	8.5	2.97	20	…	…	<0.1	…	…
Continuous Tests									
CND 2-1	59	9.0	2.03	22	3.11	<0.1	3.5	6.17	0.75
CND 2-2	91	8.0	2.05	21	1.01	<0.1	8.5	15.5	0.09
CND 2-3	91	9.0	2.12	53	<0.1	<0.1	0.35	1.68	<0.05
CND 2-4	175	9.0	2.36	49	0.30	<0.1	<0.1	0.68	0.12
CND 2-5	93	10.0	2.19	56	2.82	<0.1	<0.1	0.71	1.38
CND 2-6	94	9.0	2.73	55	0.35	<0.1	<0.1	1.69	0.16

Table 12 – Initial CND Tests – Detailed Solution Analysis

Feed/ Test	Assays										
	Enviro Analysis										
	As mg/L	Cu mg/L	Cd mg/L	Fe mg/L	Hg mg/L	Sb mg/L	Zn mg/L	SO_4 mg/L	NH_3 mg/L	pH	Cond µS/cm
Test CN 3 Pulp (Transition)											
Batch Test											
CND 1	…	…	…	…	…	…	…	…	…	…	…
Continuous Tests											
CND 1-1	0.0281	0.267	0.0036	0.046	0.00001	0.0790	0.01	870	1.50	8.71	2400
CND 1-2	0.0245	2.660	0.0276	0.474	0.01030	0.036	7.90	710	3.79	7.03	2720
CND 1-3	0.0059	1.390	0.0024	0.099	< 0.00001	0.077	0.017	570	2.08	8.86	2080
CND 1-4	0.0129	0.139	0.0037	0.034	< 0.00001	0.053	0.017	760	1.06	8.38	1710
CND 1-5	0.0531	0.269	0.0010	1.150	< 0.00001	0.09	0.009	620	1.57	9.01	2040
CND 1-6	0.0188	0.195	0.0049	0.010	NSS	0.076	0.013	800	1.94	8.41	2350
Test CN 4 Pulp (Sulphide)											
Batch Test											
CND 2	…	…	…	…	…	…	…	…	…	…	…
Continuous Tests											
CND 2-1	0.0079	3.92	0.0003	0.54	0.00002	0.142	0.034	560	1.95	9.10	2010
CND 2-2	0.0022	1.81	0.0006	0.049	0.00031	0.083	0.059	570	1.24	8.34	1920
CND 2-3	0.0106	0.166	0.0003	0.041	< 0.00001	0.070	0.010	640	1.16	8.39	2040
CND 2-4	0.0119	0.019	0.0005	0.022	< 0.00001	0.091	0.004	440	1.33	8.28	1540
CND 2-5	0.0471	0.070	0.0001	0.752	< 0.00001	0.179	0.002	870	1.39	9.46	1910
CND 2-6	0.0171	0.183	0.0004	0.029	< 0.00001	0.121	0.008	740	1.54	8.83	2200

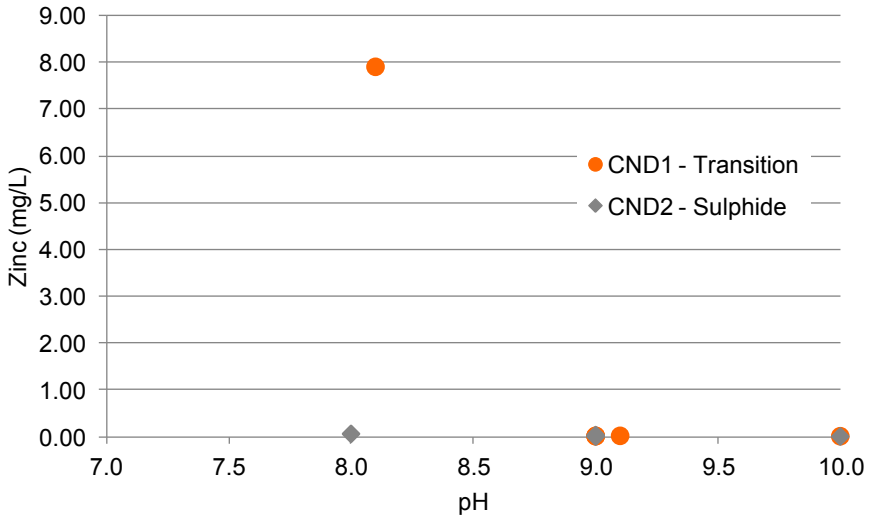


Figure 4 – Zinc in CND Discharge Solution – Tests CND1 and CND2

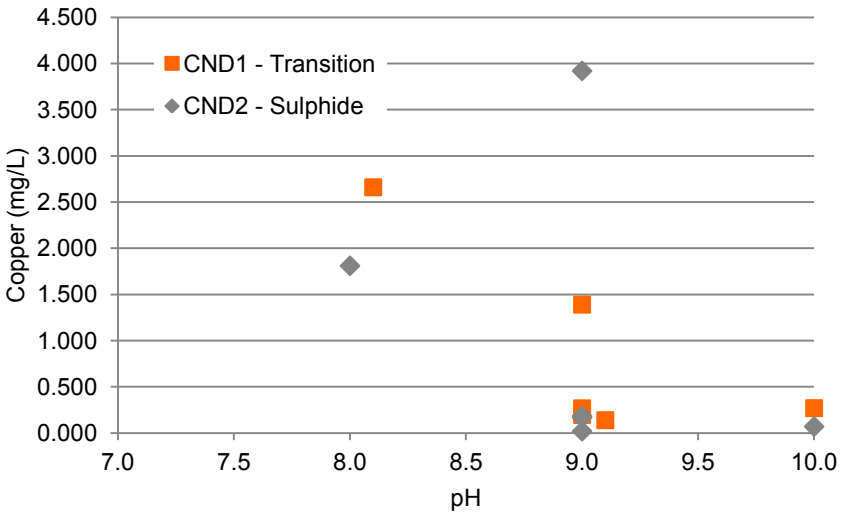


Figure 5 – Copper in CND Discharge Solution – Tests CND1 and CND2

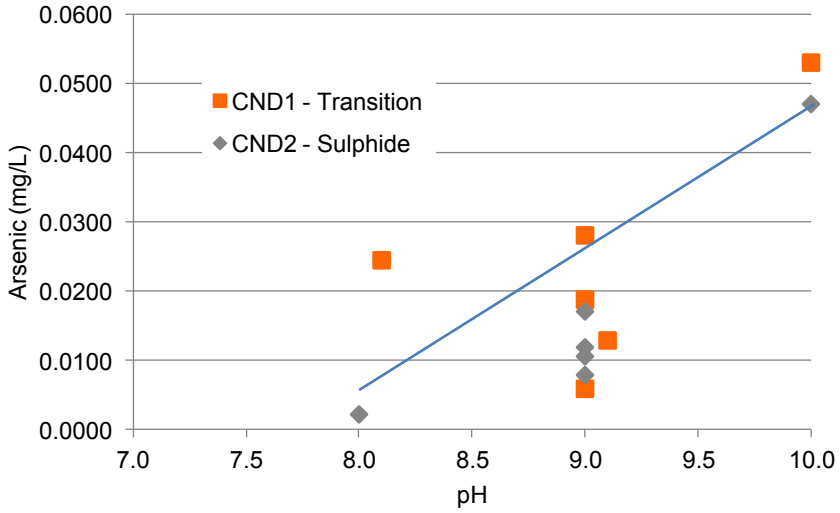


Figure 6 – Arsenic in CND Discharge Solution – Tests CND1 and CND2

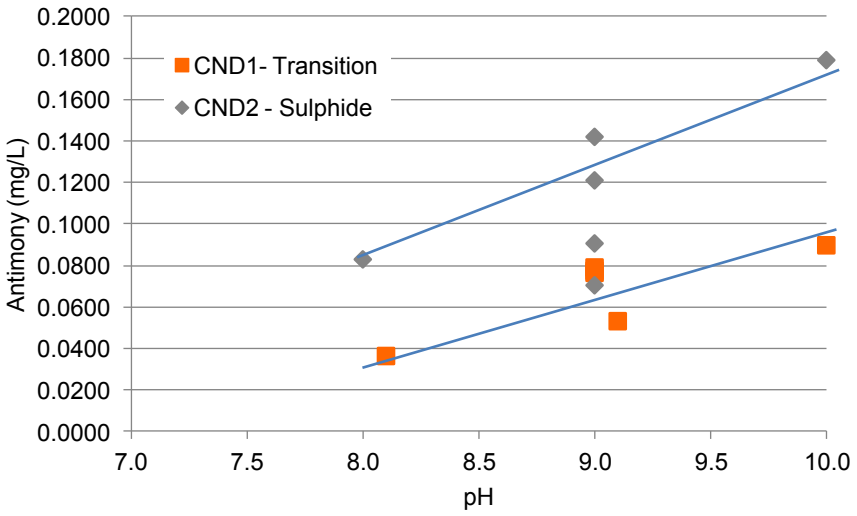


Figure 7 – Antimony in CND Discharge Solution – Tests CND1 and CND2

Table 13 – Tests CND1 and CND2 Reagent Additions

Feed/ Test	Reagent Addition								
	g/g CN_{WAD}			g/L Feed Pulp			kg/t Solids		
	SO_2 Equiv.	Lime	Cu	SO_2 Equiv.	Lime	Cu[(1)]	SO_2 Equiv.	Lime	Cu[(1)]
Feed - Test CN 3 Pulp (Transition)									
Batch Test									
CND 1	13.06	7.99	0.25	0.80	0.49	0.015	1.26	0.77	0.024
Continuous Tests									
CND 1-1	6.83	4.02	0.28	0.42	0.25	0.017	0.66	0.39	0.027
CND 1-2	6.45	0.00	0.25	0.41	0.00	0.016	0.62	0.00	0.024
CND 1-3	6.34	4.64	0.25	0.39	0.29	0.016	0.61	0.45	0.024
CND 1-4	6.18	7.18	0.59	0.39	0.42	0.035	0.60	0.69	0.057
CND 1-5	6.54	8.58	0.66	0.41	0.55	0.041	0.63	0.83	0.064
CND 1-6	8.25	6.51	0.62	0.51	0.41	0.038	0.80	0.63	0.060
Feed - Test CN 4 Pulp (Sulphide)									
Batch Test									
CND 2	9.50	8.50	0.29	0.50	0.45	0.015	0.79	0.71	0.024
Continuous Tests									
CND 2-1	6.51	3.39	0.31	0.36	0.19	0.017	0.54	0.28	0.026
CND 2-2	6.57	0.00	0.29	0.37	0.00	0.016	0.55	0.00	0.024
CND 2-3	6.77	6.48	0.77	0.36	0.35	0.041	0.56	0.54	0.064
CND 2-4	7.54	7.11	0.72	0.40	0.40	0.038	0.63	0.59	0.060
CND 2-5	7.01	9.35	0.80	0.38	0.52	0.043	0.58	0.78	0.066
CND 2-6	8.74	4.80	0.80	0.46	0.26	0.042	0.73	0.40	0.066

[(1)]Cu added using $CuSO_4$ $5H_2O$, SO_2 added using sodium metabisulphite

After reviewing the results of the initial two CND tests, New Gold requested an additional set of CND tests at pH 8.0 to 8.5 on the Sulphide composite. The effect of reaction time (60 and 90 minutes) and copper sulphate addition (0 and 20 mg/L) was examined. The detailed conditions for these tests (Test CND3) are given in Table 14 and the results are shown in Table 15 and Table 16. The reagent additions are given in Table 17. The detailed conditions and results for these tests are given in the Appendix.

The best result from these tests in terms of residue CN(wad) and final dissolved metals was obtained in Test CND 3-1 where a retention time of 90 minutes and a pH of 8 was used in combination with no additional copper sulphate. However, in this test the lime addition was anomalously high. The next best result was obtained in Test CND 3-6 using pH 8.5, 20 mg/L copper and a residence time of 90 minutes.

Table 14 – Additional CND Tests on Sulphide Composite (Test CND3) - Conditions

Feed/ Test	Target Conditions						Actual Conditions				
	Reten. Time (min)	pH	SO_2 Stoich	Cu (mg/L)	Dur'tn (min)	Pulp Dens. %	Reten. Time (min)	pH	SO_2 Stoich	Cu (mg/L)	Dur'tn (min)
Feed - Test CN 6 Pulp (Sulphide)							…	*10.4*			
Batch Test											
CND 3	...	8.0	...	20	...	45	240	8.0	6.04	20.0	240
Continuous Tests											
CND 3-1	90	8.0	2.0	0	270	45	92	8.0	2.28	0.0	195
CND 3-2	60	8.0	2.0	0	180	45	62	8.1	2.10	0.0	180
CND 3-3	60	8.0	2.0	20	180	45	58	8.0	2.05	20.6	180
CND 3-4	90	8.0	2.0	20	270	45	87	8.1	2.07	20.5	270
CND 3-5	60	8.5	2.0	20	180	45	62	8.7	2.18	21.9	180
CND 3-6	90	8.5	2.0	20	270	45	88	8.5	2.14	20.3	92

Table 15 – Test CND 3 Results

Feed/ Test	Actual Conditions				Assays				
	Reten. Time (min)	pH	SO_2 Stoich	Cu (mg/L)	CN_T mg/L	CN_{WAD} by Lab mg/L	CN_{WAD} by Picric mg/L	Metals (total) Cu mg/L	Metals (total) Fe mg/L
Test CN 6 Pulp (Sulphide)									
Batch Test									
CND 3	240	8.0	6.04	20	…	…	0.9	…	…
Continuous Tests									
CND 3-1	92	8.0	2.28	0.0	0.39	<0.1	2.73	1.82	0.09
CND 3-2	62	8.1	2.10	0.0	2.15	1.4	10.5	15.9	0.44
CND 3-3	58	8.0	2.05	21	0.41	<0.1	7.42	4.49	0.17
CND 3-4	87	8.1	2.07	21	0.19	<0.1	5.17	6.78	0.12
CND 3-5	62	8.7	2.18	22	0.80	0.04	5.26	14.3	0.24
CND 3-6	88	8.5	2.14	20	0.83	< 0.1	5.38	11.4	0.52

Table 16 – Test CND3 Detailed Solution Analysis

Feed/ Test	Assays										
	Enviro Analysis										
	As mg/L	Cu mg/L	Cd mg/L	Fe mg/L	Hg mg/L	Sb mg/L	Zn mg/L	SO_4 mg/L	NH_3 mg/L	pH	Cond µS/cm
Test CN 6 Pulp (Sulphide)											
Batch Test											
CND 3	…	…	…	…	…	…	…	…	…	…	…
Continuous Tests											
CND 3-1	0.0020	0.242	< 0.00003	0.104	0.00002	0.056	0.010	1100	1.80	8.42	2800
CND 3-2	0.0089	17.5	0.000117	0.153	0.00003	0.102	0.141	850	1.30	7.68	2340
CND 3-3	0.0090	6.73	0.00021	0.496	< 0.00001	0.103	0.096	760	2.40	8.22	2150
CND 3-4	0.0059	4.03	0.000229	0.559	< 0.00001	0.094	0.056	780	1.80	8.46	2230
CND 3-5	0.0074	4.56	0.000421	0.066	0.00006	0.163	0.037	670	1.70	9.04	2230
CND 3-6	0.0062	2.16	0.000312	0.072	< 0.00001	0.174	0.018	620	1.70	9.07	2110

Table 17 – Test CND3 Reagent Additions

Feed/ Test	Reagent Addition								
	g/g CN_{WAD}			g/L Feed Pulp			kg/t Solids		
	SO_2 Equiv.	Lime	Cu	SO_2 Equiv.	Lime	Cu[(1)]	SO_2 Equiv.	Lime	Cu[(1)]
Feed - Test CN 6 Pulp (Sulphide)									
Batch Test									
CND 3	19.3	16.3	0.23	1.28	1.08	0.015	2.03	1.71	0.024
Continuous Tests									
CND 3-1	7.30	12.7	0.00	0.48	0.86	0.000	0.77	1.33	0.000
CND 3-2	6.72	0.20	0.00	0.48	0.01	0.000	0.70	0.02	0.000
CND 3-3	6.56	3.72	0.24	0.44	0.25	0.016	0.69	0.39	0.025
CND 3-4	6.63	2.57	0.24	0.44	0.17	0.016	0.70	0.27	0.025
CND 3-5	6.98	2.47	0.25	0.46	0.17	0.017	0.73	0.26	0.026
CND 3-6	6.85	1.46	0.24	0.45	0.10	0.016	0.72	0.15	0.025

(1)Cu added using $CuSO_4$ $5H_2O$, SO_2 added using sodium metabisulphite

3.1.3. Preparation of CND Pulp for Environmental Characterisation (Test CND4 & CND5)

After a review of the results of Test CND3, New Gold selected the conditions for the preparation of the environmental characterization test materials. Cyanide destruction conditions were set at pH 8.0, a retention time of 60 minutes and a copper addition of 10 mg/L. The Sulphide composite was tested using these conditions in Tests CND4 and CND4-1. On the recommendation of New Gold's consultant Mr. Randy Agius, the copper addition was increased to 15 mg/L. This concentration was then used for the remainder of the test program. The test conditions are summarized in Table 18 and the details may be found in the Appendix. The test results, solution analysis and reagent additions for these two tests are given in Table 19, Table 20, and Table 21, respectively.

Table 18 – Tests CND4 and CND5 Test Conditions

Feed/ Test	Target Conditions						Actual Conditions				
	Reten. Time (min)	pH	SO_2 Stoich	Cu (mg/L)	Dur'tn (min)	Pulp Dens. %	Reten. Time (min)	pH	SO_2 Stoich	Cu (mg/L)	Dur'tn (min)
Feed - Test CN 7 Pulp (Sulphide)							*…*	*10.3*			
Batch Test											
CND 4	...	8.0	...	10	...	45	300	8.5	7.42	10.0	300
Continuous Tests											
CND 4-1	60	8.0	2.0	10	~180	45	63	8.0	2.17	10.7	210
CND 4-2	60	8.0	2.0	15	~180	45	62	8.0	2.13	15.8	180
CND 4-2b	60	8.0	2.0	15	~500	45	64	8.0	2.18	16.1	480
Feed - Test CN 5 Pulp (Transition)							*…*	*10.2*			
Batch Test											
CND 5	...	8.0	...	15	...	45	150	8.0	3.71	15.0	150
Continuous Tests											
CND 5-1	60	8.0	2.0	15	~180	45	61	8.0	2.03	15.6	180
CND 5-1b	60	8.0	2.0	15	~500	45	60	8.0	1.98	15.6	180

Table 19 – Tests CND4 and CND5 Test Results

Feed/ Test	Actual Conditions				Assays				
	Reten. Time (min)	pH	SO_2 Stoich	Cu (mg/L)	CN_T mg/L	CN_{WAD} by Lab mg/L	CN_{WAD} by Picric mg/L	Metals (total) Cu mg/L	Metals (total) Fe mg/L
Test CN 7 Pulp (Sulphide)									
Batch Test									
CND 4	300	8.5	7.42	10	...	...	0.28	...	...
Continuous Tests									
CND 4-1	63	8.0	2.17	11	0.55	< 0.1	4.95	0.84	0.11
CND 4-2	62	8.0	2.13	16	0.46	< 0.1	5.58	15.2	0.17
CND 4-2b	64	8.0	2.18	16	0.30	<0.1	6.78	10.3	0.14
Test CN 5 Pulp (Transition)									
Batch Test									
CND 5	150	8.0	3.71	15	...	...	0.46	...	...
Continuous Tests									
CND 5-1	61	8.0	2.03	16	0.34	<0.1	6.88	16.9	< 0.05
CND 5-1b	60	8.0	1.98	15	0.18	<0.1	2.40	1.84	< 0.05

Table 20 – Tests CND4 and CND5 Detailed Solution Analysis

Feed/ Test	Assays										
	Enviro Analysis										
	As mg/L	Cu mg/L	Cd mg/L	Fe mg/L	Hg mg/L	Sb mg/L	Zn mg/L	SO4 mg/L	NH3 mg/L	pH	Cond µS/cm
Test CN 7 Pulp (Sulphide)											
Batch Test											
CND 4	…	…	…	…	…	…	…	…	…	…	…
Continuous Tests											
CND 4-1	0.0071	3.38	0.000929	0.24	< 0.00001	0.101	0.033	1000	1.40	8.79	2900
CND 4-2	0.0047	0.288	0.000876	0.009	< 0.00001	0.099	0.013	1200	1.60	9.02	2340
CND 4-2b	0.0079	5.61	0.000042	0.168	< 0.00001	0.106	0.047	900	1.80	9.13	2380
Test CN 5 Pulp (Transition)											
Batch Test											
CND 5	…	…	…	…	…	…	…	…	…	…	…
Continuous Tests											
CND 5-1	0.0101	9.36	0.005710	0.332	0.00002	0.059	0.095	890	3.50	7.89	2550
CND 5-1b	0.0035	1.29	0.000469	0.037	< 0.00001	0.059	0.013	960	2.30	8.51	2490

Table 21 – Tests CND4 and CND5 Reagent Additions

Feed/ Test	Reagent Addition								
	g/g CN_{WAD}			g/L Feed Pulp			kg/t Solids		
	SO_2 Equiv.	Lime	Cu	SO_2 Equiv.	Lime	Cu[(1)]	SO_2 Equiv.	Lime	Cu[(1)]
Feed - Test CN 7 Pulp (Sulphide)									
Batch Test									
CND 4	23.8	12.2	0.08	2.26	1.16	0.008	3.57	1.84	0.012
Continuous Tests									
CND 4-1	6.95	2.41	0.09	0.66	0.23	0.008	1.04	0.36	0.014
CND 4-2	6.81	2.15	0.13	0.65	0.21	0.012	1.02	0.32	0.020
CND 4-2b	6.97	1.70	0.13	0.66	0.17	0.013	1.05	0.26	0.020
Feed - Test CN 5 Pulp (Transition)									
Batch Test									
CND 5	11.9	3.88	0.13	1.06	0.34	0.012	1.67	0.55	0.018
Continuous Tests									
CND 5-1	6.48	1.92	0.14	0.58	0.18	0.012	0.91	0.28	0.020
CND 5-1b	6.33	2.46	0.13	0.56	0.22	0.012	0.89	0.35	0.018

(1) Cu added using $CuSO_4$ $5H_2O$, SO_2 added using sodium metabisulphite

3.2. Environmental Characterisation

The cyanide destruction pulp from Test CND4 and CND5 were submitted to the SGS environmental laboratory for detailed characterisation. The characterisation tests included detailed chemical analysis of the solid and solution phases, modified ABA and shake flask extraction. Additionally, samples of the untreated whole ore materials were submitted for similar characterisation. The details of the analysis are given in the Appendix, and selected data are summarised in Table 22 through Table 26.

The analysis of the CND solutions indicated that they contained low levels of dissolved copper, iron and zinc; for the Sulphide Sample (CND 4) the dissolved levels were 0.0033 mg/L copper, 1.1 mg/L iron, and

<0.002 mg/L zinc; for the Transition Sample (CND 5) they were 0.0371 mg/L copper, 0.18 mg/L iron and <0.002 mg/L dissolved zinc.

The modified Acid-Base Accounting test (ABA Mod) results indicated that all of the samples had a ratio of Neutralising Potential (NP) to Acid Potential (AP) value in the range of 0.1 to 0.5. This ratio is normally considered to indicate that a given sample is likely to become acid generating.

Table 22 – Detailed Solids Analysis

Parameter	Unit	CND4 Discharge Comp Solids	CND5 Discharge Comp Solids
LIMS		14411-JUN13	14411-JUN13
Si	%	31.1	34.0
Ag	µg/g	1.8	1.3
Al	µg/g	73000	64000
As	µg/g	150	250
B	µg/g	95	73
Ba	µg/g	630	460
Be	µg/g	1.7	1.3
Bi	µg/g	2.8	4.5
Ca	µg/g	5000	1600
Cd	µg/g	32	30
Co	µg/g	8.9	3.9
Cr	µg/g	66	50
Cu	µg/g	150	160
Fe	µg/g	46000	27000
K	µg/g	48000	40000
Li	µg/g	34	23
Mg	µg/g	5100	2000
Mn	µg/g	2900	1100
Mo	µg/g	6.8	6.3
Na	µg/g	1900	1000
Ni	µg/g	31	26
P	µg/g	750	260
Pb	µg/g	380	740
Sb	µg/g	23	20
Se	µg/g	< 0.7	< 0.7
Sn	µg/g	4.9	4.6
Sr	µg/g	110	73
Th	µg/g	9.3	9.4
Ti	µg/g	2700	1300
Tl	µg/g	2.4	2.1
U	µg/g	4.4	4.4
V	µg/g	60	23
W	µg/g	4.1	2.8
Y	µg/g	12	9.5
Zn	µg/g	3600	2000
Ag (FA Mean)	g/t	1.67	1.3
Au (FA Mean)	g/t	0.11	0.08

Table 23 – Detailed Solution Analysis

Parameter	Unit	Detection Limits	CND 4 Discharge Comp Solution	CND 5 Discharge Comp Solution
LIMS			14406-JUN13	14406-JUN13
Temp Upon Receipt	°C	---	20.0	20.0
pH	units	1.10	7.91	8.11
Conductivity	µS/cm	2	2830	2670
Alkalinity (total)	mg/L as $CaCO_3$	2	78	69
Alkalinity (HCO_3)	mg/L as $CaCO_3$		78	69
Alkalinity (CO_3)	mg/L as $CaCO_3$		< 2	< 2
Alkalinity (OH)	mg/L as $CaCO_3$		< 2	< 2
Acidity	mg/L as $CaCO_3$	1.2	----	----
Turbidity	NTU		26.0	68.8
Colour	TCU		< 3	< 3
TSS	mg/L		26	106
TDS	mg/L		2120	1990
NH_3+NH_4	as N mg/L	0.02	3.4	3.5
TKN	as N mg/L		41.8	42.8
Tot.Reactive P	mg/L		< 0.03	0.05
Br	mg/L		< 0.3	< 0.3
Cl	mg/L		14	20
F	mg/L		0.23	0.57
SO_4	mg/L	0.5	1100	1000
NO_2	as N mg/L	0.005	< 0.03	< 0.03
NO_3	as N mg/L	0.005	0.22	0.39
TIC	mg/L		16.4	26.5
TOC	mg/L		41.4	40.0
Carbon (tot)	mg/L		58	66
CN(T)	mg/L		*3.73	*0.26
CN_{WAD}	mg/L		*0.03	*0.01
CNS	mg/L		*74	*77
CNO	mg/L		*92	*120

Table 24 – Detailed Solution Analysis - Metals

Parameter	Unit	Detection Limits	CND 4 Discharge Comp Solution		CND 5 Discharge Comp Solution	
LIMS			14406-JUN13		14406-JUN13	
Metals			**Total**	**Dissolved**	**Total**	**Dissolved**
Hg	mg/L	0.00001	< 0.00001	< 0.00001	0.00001	< 0.00001
Ag	mg/L	0.0001	0.00011	< 0.00001	0.00009	< 0.00001
Al	mg/L	0.003	1.46	0.06	3.54	0.07
As	mg/L	0.0002	0.0058	0.0050	0.0234	0.0054
Ba	mg/L	0.00005	0.0413	0.0365	0.0404	0.0261
Be	mg/L	0.0001	0.00004	< 0.00002	0.00007	< 0.00002
B	mg/L	0.01	0.0293	0.0300	0.0314	0.0296
Bi	mg/L	0.0005	0.00009	0.00001	0.00054	< 0.00001
Ca	mg/L	0.050	134	138	171	163
Cd	mg/L	0.00002	0.000242	< 0.000003	0.00466	0.000239
Co	mg/L	0.0001	0.0678	0.0716	0.0903	0.0886
Cr	mg/L	0.0005	0.0007	< 0.0005	0.0017	< 0.0005
Cu	mg/L	0.0005	0.0035	0.0033	0.0503	0.0371
Fe	mg/L	0.030	2.09	1.10	2.88	0.183
K	mg/L	0.05	87.0	88.9	73.4	68.4
Li	mg/L	0.001	0.010	0.010	0.009	0.007
Mg	mg/L	0.050	3.74	3.59	3.51	3.24
Mn	mg/L	0.0002	0.0987	0.0631	0.211	0.109
Mo	mg/L	0.00050	0.0876	0.0938	0.0828	0.0815
Na	mg/L	0.50	500	516	447	424
Ni	mg/L	0.0050	0.0078	0.0085	0.0879	0.0922
P	mg/L	0.30	0.031	0.031	0.056	0.013
Pb	mg/L	0.00050	0.0109	0.00053	0.0770	0.00048
Sb	mg/L	0.0020	0.0446	0.0472	0.0306	0.0287
Se	mg/L	0.0010	< 0.001	< 0.001	< 0.001	< 0.001
Si	mg/L	0.050	4.29	1.37	8.18	1.23
S	mg/L		491	505	465	443
Sn	mg/L	0.0010	0.0147	0.0139	0.0218	0.0193
Sr	mg/L	0.0020	0.406	0.402	0.210	0.205
Th	mg/L	0.00020	0.000191	0.000010	0.000793	< 0.000004
Ti	mg/L	0.010	0.0309	0.0006	0.0644	0.0002
Tl	mg/L	0.00020	---	---	---	---
U	mg/L	0.00010	0.00210	0.00210	0.00693	0.00616
V	mg/L	0.010	0.00148	0.00008	0.00226	0.00005
W	mg/L	---	---	---	---	---
Y	mg/L	---	---	---	---	---
Zn	mg/L	0.030	0.045	< 0.002	0.221	< 0.002

Table 25 – Modified Acid-Base Accounting Test Results

Parameter	Unit	Transition Comp	Sulphide Comp	CND4 Discharge Comp Solids	CND5 Discharge Comp Solids
LIMS		10306-FEB13	10306-FEB13	14409-JUN13	14409-JUN13
Paste pH	units	5.64	7.32	8.25	8.43
Fizz Rate	---	2	2	1	1
Sample weight	g	2.02	2.04	1.97	1.95
HCl added	mL	20.00	20.00	20.00	20.00
HCl	Normality	0.10	0.10	0.10	0.10
NaOH	Normality	0.10	0.10	0.10	0.10
NaOH to pH=8.3	mL	18.96	18.96	15.67	18.03
Final pH	units	1.10	1.46	1.44	1.10
NP	t $CaCO_3$/1000 t	2.6	2.6	11	5.1
AP	t $CaCO_3$/1000 t	15.9	21.9	20.9	18.1
Net NP	t $CaCO_3$/1000 t	-13.3	-19.3	-9.94	-13.0
NP/AP	ratio	0.16	0.12	0.53	0.28
S	%	0.804	1.21	1.05	0.722
Acid Leachable SO_4-S	%	0.29	0.51	0.38	0.14
Sulphide	%	0.51	0.70	0.67	0.58
C	%	0.043	0.084	0.107	0.074
CO_3	%	0.02	0.11	0.130	0.025
TOC	%	---	---	0.060	0.050

Table 26 – Shake Flask Extraction Test Results

Parameter	Unit	Transition Comp	Sulphide Comp	CND4 Discharge Comp Solids	CND5 Discharge Comp Solids
LIMS		10305-FEB13	10305-FEB13	14408-JUN13	14408-JUN13
Sample weight	g	250	250	250	250
Volume D.I. Water	mL	750	750	750	750
Initial pH	units	5.24	7.58	9.17	9.00
Final pH	units	5.86	7.51	8.45	8.31
pH	units	5.66	7.41	7.65	7.79
Alkalinity	mg/L as $CaCO_3$	< 2	54	28	36
Acidity	mg/L as $CaCO_3$	39	< 2	51	31
Conductivity	µS/cm	362	288	650	499
F	mg/L	< 0.06	0.14	0.11	0.21
TDS	mg/L	266	194	369	500
EMF	mV	134	111	263	258
NH_3+NH_4	as N mg/L	0.5	0.2	2.3	2.2
SO4	mg/L	130	72	160	120
Cl	mg/L	3.2	< 2	< 2	< 2
NO_2	as N mg/L	< 0.6	< 0.6	< 0.3	< 0.3
NO_3	as N mg/L	< 0.5	< 0.5	< 0.6	< 0.6
Hg	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Ag	mg/L	0.00005	0.00005	0.00074	0.00021
Al	mg/L	< 0.01	0.04	0.0777	0.0437
As	mg/L	0.0012	0.0015	0.0036	0.0025
Ba	mg/L	0.0288	0.00765	0.00730	0.00925
B	mg/L	0.0227	0.0164	0.0129	0.0122
Be	mg/L	0.00011	< 0.00002	< 0.00002	< 0.00002
Bi	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Ca	mg/L	15.9	28.7	55.1	43.6
Cd	mg/L	0.0458	0.000060	0.000771	0.00658
Co	mg/L	0.162	0.000356	0.00480	0.00669
Cr	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Cu	mg/L	< 0.0005	< 0.0005	0.0181	0.0071
Fe	mg/L	14.3	0.022	0.045	0.011
K	mg/L	41.1	34.6	28.2	19.1
Li	mg/L	0.031	0.011	0.012	0.011
Mg	mg/L	3.47	2.33	1.34	1.28
Mn	mg/L	4.71	0.406	0.05837	0.109
Mo	mg/L	0.00007	0.0165	0.0100	0.00988
Na	mg/L	3.75	2.75	51.2	37.0
Ni	mg/L	0.167	0.0006	0.0006	0.0005
P	mg/L	< 0.009	0.014	< 0.009	< 0.009
Pb	mg/L	0.0286	0.00007	0.00023	0.00050
Sb	mg/L	0.0008	0.0136	0.0328	0.0207
Se	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Si	mg/L	6.83	2.41	1.39	1.82
Sn	mg/L	0.00006	< 0.00001	0.00019	0.00020
Sr	mg/L	0.106	0.0956	0.126	0.0575
Ti	mg/L	0.0003	0.0003	< 0.0001	< 0.0001
Th	mg/L	0.000010	0.000004	< 0.000004	< 0.000004
Tl	mg/L	0.00061	< 0.00002	0.00009	0.00027
U	mg/L	0.000236	0.000351	0.000977	0.00185
V	mg/L	< 0.00003	0.00006	0.00003	< 0.00003
W	mg/L	0.00007	0.00014	0.00010	0.00010
Y	mg/L	0.000881	0.000004	0.000001	0.000007
Zn	mg/L	6.02	0.003	0.005	0.017

Conclusions

The two New Gold Blackwater project ore samples received for testing, denoted Transition Ore and Sulphide Ore were similar in gold grade assaying 0.55 and 0.56 g/t respectively by the screen metallics assay method. Direct assaying of the samples by fire assay, on multiple 30-gram samples, gave head analyses of 0.58 g/t and 0.46 g/t gold for the Transition and Sulphide samples, respectively. Seven separate 10 kg cyanide leach tests were performed in the test program (3x10 kg on Transition 4x10 kg on Sulphide) and these tests gave calculated average head grades of 0.54 g/t gold for the Transition sample and 0.52 g/t gold for the Sulphide.

The leach pulps from Tests CN3 through CN7, for which the results are illustrated in the preceding graphs, were used in a systematic series of cyanide destruction tests. The effect of retention time, pH, copper and SO_2 additions were examined. After review of the results of the cyanide destruction tests New Gold determined that the optimal conditions were; pH 8.0, retention time 60 minutes, copper addition 15 mg/L, and a SO_2 stoichiometry of 2.0. These conditions were used in two cyanide destruction tests (Test CND 4 & CND 5) to treat samples of Transition and Sulphide cyanide leach pulps to generate material for environmental characterization tests. The reagent addition rates for these tests are summarized in Table 27.

The cyanide destruction solutions produced from these tests assayed <0.1 mg/L CN(wad), and for the Sulphide Sample (CND 4) the solution assayed 0.0033 mg/L dissolved copper, 1.1 mg/L dissolved iron, and <0.002 mg/L zinc; for the Transition Sample (CND 5) the dissolved metals were 0.0371 mg/L copper, 0.18 mg/L iron and <0.002 mg/L zinc.

Table 27 – CND 4 and CND 5 Reagent Additions

Feed/ Test	Reagent Addition								
	g/g CN_{WAD}			g/L Feed Pulp			kg/t Solids		
	SO_2 Equiv.	Lime	Cu	SO_2 Equiv.	Lime	Cu[(1)]	SO_2 Equiv.	Lime	Cu[(1)]
CND 4 - Sulphide - Continuous Test									
CND 4-2	6.81	2.15	0.13	0.65	0.21	0.012	1.02	0.32	0.020
CND 4-2b	6.97	1.70	0.13	0.66	0.17	0.013	1.05	0.26	0.020
Average	***6.89***	***1.93***	***0.13***	***0.66***	***0.19***	***0.01***	***1.04***	***0.29***	***0.020***
CND 5 - Transition - Continuous Tests									
CND 5-1	6.48	1.98	0.14	0.58	0.18	0.012	0.91	0.28	0.020
CND 5-1b	6.33	2.46	0.13	0.56	0.22	0.012	0.89	0.35	0.018
Average	***6.41***	***2.22***	***0.14***	***0.57***	***0.20***	***0.01***	***0.90***	***0.31***	***0.019***

[(1)]Cu added using $CuSO_4$ $5H_2O$, SO_2 added using sodium metabisulphite

ANNEX 15
Lorax Environmental Metal Sorption Potential of Natural Substrates

LORAX ENVIRONMENTAL

MEMORANDUM

To:	**Keith Ferguson, Ryan Todd**	**Date: July 29 2013**
From:	**John Dockrey, Alison Shaw and Alan Martin (Lorax)**	**Project #: A302-4**
Subject:	**Metal sorption potential of natural substrates underlying the Blackwater Tailings Storage Facility: Implications for attenuation along seepage flowpaths**	

1 Introduction and Objectives

Tailings and a majority of waste rock from the Blackwater mine will be stored sub-aqueously in the proposed Blackwater tailings storage facility (TSF). Sub-aqueous disposal will inhibit sulphide mineral oxidation, thereby minimizing the release of metals, sulphate and acidity. Although the tailings will be treated using the SO_2 air process, some water quality degradation of seepage waters will occur resulting from elevated metal concentrations in mill process waters, which will dominate porewater composition during operations. Some degree of metal leaching may persist within the TSF due to the presence of pH- and/or redox-sensitive secondary phases that may be generated through ore processing or through waste rock weathering prior to submergence. Collectively, the migration of tailings process water in conjunction with metal leaching processes will contribute to the degradation of seepage waters that exit the facility.

A portion of impoundment seepage will infiltrate into the native ground and aquifer underlying the TSF. The significance of this vector for metal loading to the environment depends, in part, on the rate of metal loading and the degree of attenuation in the subsurface environment. In order to provide an indication of metal attenuation within native materials underling the TSF at the Blackwater project, a series of metal sorption experiments were performed using humidity cell leachate and substrates present at the Blackwater site. The primary objectives were to:

- Quantify the relative sorption potential for metals with respect to three substrate types relevant to seepage pathways (weathered bedrock, sand & gravel, and till); and
- Assess the implications of the results with regards to the potential for metal attenuation along seepage pathways at the Blackwater site.

Overall, the results have relevance to seepage management, potential conservatisms associated with water quality predictions, and the aquatic health effects assessment.

1.1 Background

Existing geochemical testwork on Blackwater waste rock and ore indicates that Cd and Zn are the primary water quality parameters of concern with regards to impoundment seepage. These divalent metal cations are relatively soluble at neutral pH, owing to their relatively low tendency to hydrolyze and low charge density (ionic potential). Discrete Cd and Zn precipitates are generally too soluble in the pH range typical of groundwater to control the concentrations of these metals, with the notable exception of secondary sulphide precipitates which only form under highly reducing conditions. As such, sorption to solid surfaces often controls the behavior of these metals in the typical pH-Eh range observed in soils and shallow aquifers (Krishnamurti *et al.*, 1999). In this context, "sorption" refers to both adsorption (binding to surface functional groups) and co-precipitation (removal from solution within crystal matrices of other phases).

The intrinsic sorption capacity of a material depends on the amount of sorption sites available, and the relative attraction of aqueous species to sorption sites at the mineral/water interface. In practice, the sorption capacity of soils and sediments can generally be related to clay content, clay mineralogy, organic matter content and oxide content (Mn-oxide and Fe-oxides) (McLean and Bledsoe, 1992; McNee, 1997).

In addition to sorbent characteristics, porewater chemistry has a large impact on the degree of sorption that will take place in a given environment. For example, the porewater pH can strongly influence the sorption potential of metal cations such as Zn and Cd where sorption rates will increase with increasing pH. Conversely, sorption rates can be inhibited by the presence of other metal ions which either compete for the same sorption sites (*e.g.*, Mg) or form aqueous complexes with Zn and Cd in solution (*e.g.*, Cl). It is important to note that there is competition for sorption sites between Zn and Cd, as high concentrations of Zn have been shown to inhibit the sorption of Cd to iron oxides, increasing Cd mobility (Benjamin and Leckie, 1981; Caroll *et al.*, 1998). The relative sorption potential of Zn and Cd is dependent on the specific types of sorbents. In general, Zn has a greater affinity than Cd to most clay and oxide mineral surfaces (Kinniburgh *et al.*, 1976, Benjamin and Leckie 1981), while Cd has a higher sorption potential to organics and calcium carbonate minerals (Lorens, 1981; Elliot *et al.*, 1986).

There are several examples in mining environments where metal attenuation in the receiving environment has been largely defined by sorptive processes. Studies of neutral pH mine drainage waters in the US tri-state mining district (Kansas-Missouri-Oklahoma) show that aqueous Zn and Cd concentrations are controlled by adsorption processes where Zn adsorbs to Fe-oxyhydroxides and Cd adsorbs to calcium carbonate minerals (Caroll *et al*, 1998). In another study, the transport of Cd and Zn in a neutralizing mine drainage stream was found to effectively track sorption isotherms developed for the system (Donald *et al.*, 1990).

The natural substrates underlying the TSF at the Blackwater Project that can be expected to interact with TSF seepages include weathered bedrock, sand & gravel, and till. These materials are characterized by contrasting grain size distributions and mineralogy, which will affect sorption potential, seepage rates and velocities. In this study, the potential for metal attenuation associated with these substrates is evaluated.

1.2 Report Structure

The experimental approach, methods and materials for the sorption experiments are outlined in Chapter 2, followed by presentation and interpretation of the sorption results for the different substrates (Chapter 3). Chapter 4 considers the implications of the results with respect to attenuation at site, taking into account the local site hydrostratigraphy, subsurface pH controls and scaling of experimental results.

2 Methods

2.1 Sorption Test Work

Laboratory-based sorption experiments were carried out on 3 different rock units: weathered bedrock; sand & gravel; and till. Samples were selected from two different drill holes (GT13-02 and GT13-05) which were sampled at 0.25 m intervals. All samples were air-dried and sieved. The < 0.15 mm (100 mesh) size fraction was collected for sorption experiments, since this fraction contains the majority of a sample's surface area and will largely govern sorption potential. Sample details are given in Table 2-1.

Table 2-1:
Sample details

Rock type	drill hole	core interval	date sampled
Weathered bedrock	GT13-05	73.5-73.75m	Mar 22 2013
Sand & gravel	GT13-02	11.0-11.25m	Mar 22 2013
Basal till	GT13-02	29.0-29.25m	Mar 22 2013

The solutions used for the sorption experiments included two leachate solutions (ARD-526 and ARD-176) collected over several weeks from waste rock humidity cells specific to the Blackwater Project. These solutions were selected on the basis of having relatively high concentrations of Cd and Zn, as well as having circum-neutral pH. The neutral pH of the solutions allowed sorption processes to be evaluated independently from pH-controlled neutralization reactions.

A first set of experiments was conducted to determine a suitable rock to solution ratio such that experiments would yield measureable amounts of Cd and Zn and yet could still be easily

filtered through a 0.45 μm membrane. The weathered bedrock sample was used for these initial experiments at rock to solution mass ratios of 80, 20, 5 and 0, where ratios are described in units of g/L.

The pH of all leachate solutions was measured before and after the experiments. The sieved rock material was weighed and added to the leachate solutions in 250 mL polypropylene centrifuge bottles and then agitated on a shaker table for 24 hours. After the 24 hour incubation period, the bottles were centrifuged, and the supernatant filtered using a 0.45 μm membrane. Approximately 15 mL of the filtrate was used to make a pH measurement and the residual solution was acidified with HNO_3 and shipped to ALS Environmental Laboratories (Burnaby, BC) for dissolved metals analysis.

Based on the results of the initial weathered bedrock tests, subsequent experiments used a single rock to solution ratio depending on the leachate solution used. Experiments using leachate solution ARD-526 were done using a rock to solution ratio of 80 g/L. However, since trace element concentrations were relatively low in leachate solution ARD-176, a lower rock to solution ratio of 5 g/L was used to ensure that metal concentrations in residual solutions did not drop below the detection limits.

In order to evaluate whether metal components were released from the rock materials into the solution during agitation, experiments using de-ionized water at a rock to solution ratio of 80 g/Lwere also conducted. Procedural blanks using de-ionized water and duplicate experiments were also performed. All quality assurance (QA) and quality control (QC) samples were processed in the same manner as the initial experiments described above.

A final set of experiments was conducted on the weathered bedrock sample using neutralized leachate solution ARD-526. A significant rise in pH was observed during sorption experiments using leachate ARD-526. Presumably a similar rise in pH would take place in the aquifer, and thus to separate the relative effects of metal uptake by neutralization reactions versus adsorption, the leachate solution was neutralized prior to reaction with rock materials. Incremental aliquots of a dilute $Ca(OH)_2$ solution were added to the leachate solution to increase the pH from 6.01 to 7.04. This solution was then mixed with the weathered bedrock solution at a rock:solution ratio of 5 g/L and agitated for 24 hours, prior to filtration, acidification and shipment to ALS laboratories.

2.2 ABA Test Work

Subsamples of substrate materials were sent to SGS laboratories in Burnaby B.C. for acid base accounting analyses, including paste-pH, Sobek NP and sulphur species. The methods associated with these analyses are described in MEND (1991).

3 Results and Discussion

Leachate solution compositions for ARD-526 and ARD-176 are shown in Table 3-1. A summary of pH measurements, experimental conditions and the sorption results for Cd and Zn are given in Table 3-2. Complete results for sorption experiments are provided in Appendix A.

Table 3-1:
Composition of solution ARD-176 and ARD-526 used as input solution in sorption experiments.

Sample ID	Units	ARD-176	ARD-526
pH		7.38	6.01
Al	mg/L	0.0189	0.042
Sb	mg/L	0.00429	0.0028
As	mg/L	0.000593	0.00253
Cd	mg/L	0.00202	0.0104
Ca	mg/L	25.8	2.58
Cr	mg/L	<0.0001	0.0001
Co	mg/L	0.000248	0.00212
Cu	mg/L	0.00022	0.00034
Fe	mg/L	0.0015	0.022
Pb	mg/L	0.0000190	0.000581
Mg	mg/L	0.420	0.440
Mn	mg/L	0.160	0.484
Mo	mg/L	0.00110	0.00155
Ni	mg/L	0.000127	0.00223
K	mg/L	4.59	3.02
Se	mg/L	<0.00004	0.0001
Ag	mg/L	<0.000005	0.00001
Na	mg/L	0.103	0.083
Sr	mg/L	0.0924	0.0193
Tl	mg/L	0.0000119	0.00008
U	mg/L	0.0000129	0.00001
Zn	mg/L	0.0169	0.301

Table 3-2:
Summary of Sorption Results for Cd and Zn for all Experiments

Sample ID	Rock ID[1]	Solution ID	Rock:Solution Ratio	pH		Cd concentrations			Zn concentrations		
			(mg/L)	Initial	Final	Initial (µg/L)	Final (µg/L)	Sorbed (µg/g)	Initial (µg/L)	Final (µg/L)	Sorbed (µg/g)
WB-176-80	WB	ARD-176	80	7.38	7.91	2.02	0.0154	0.025	16.9	1.430	0.19
WB-176-20	WB	ARD-176	20	7.38	7.90	2.02	0.0138	0.100	16.9	<0.50	>0.82
WB-176-5	WB	ARD-176	5	7.38	7.69	2.02	0.0429	0.395	16.9	<0.50	>3.3
WB-176-5 duplicate	*WB*	*ARD-176*	*5*	7.38	*7.76*	*2.02*	*0.0391*	*0.395*	*16.9*	<0.50	*>3.3*
BT-176-5	BT	ARD-176	5	7.38	7.70	2.02	0.0815	0.388	16.9	<0.50	>3.3
SG-176-5	SG	ARD-176	5	7.38	7.72	2.02	0.1100	0.382	16.9	<0.50	>3.3
WB-526-80	WB	ARD-526	80	6.01	7.63	10.4	0.0220	0.130	301	2.4	3.7
WB-526-20	WB	ARD-526	20	6.01	7.27	10.4	0.0650	0.516	301	5.3	15
WB-526-5	WB	ARD-526	5	6.01	6.62	10.4	0.2730	2.025	301	4.0	59
BT-526-80	BT	ARD-526	80	6.01	7.70	10.4	0.0312	0.130	301	2.3	3.7
SG-526-80	SG	ARD-526	80	6.01	7.54	10.4	0.0357	0.130	301	1.7	3.7
WB-526 lime-5	WB	ARD-526 +$Ca(OH)_2$	5	7.04	7.25	4.40	0.0758	0.865	199	7.3	38
WB-DI-80	WB	DI Water	80	5.52	8.11	*<0.010*	0.0090	-	<0.50	3.0	-
WB-DI-80 duplicate	*WB*	*DI Water*	*80*	5.52	*8.10*	*<0.010*	*<0.010*	-	<0.50	*5.2*	-
BT-DI-80	BT	DI Water	80	5.52	8.19	*<0.010*	0.0406	-	<0.50	7.8	-
SG-DI-80	SG	DI Water	80	5.52	8.01	*<0.010*	0.0256	-	<0.50	7.3	-
Blank	Blank	DI Water	-	5.52	5.52	*<0.010*	0.0050	-	<0.50	1.7	-

[1] Rock samples sieved to <0.15 mm (100 mesh). WB = weathered bedrock; BT = basal till; SG = sand & gravel

3.1 Initial Sorption Experiments on Weathered Bedrock

Initial tests to evaluate suitable rock to solution ratios were carried out on the weathered bedrock sample and the two leachate solutions (ARD-526 and ARD-176; chemistries shown in Table 3-1). It was anticipated that the weathered bedrock sample would have a relatively high sorption capacity for metals due to the presence of clay minerals. Results indicate that leachate concentrations of Cd and Zn were reduced significantly in all experiments (Figure 3-1). In the case of Cd, the final concentrations in both leachate solutions decreased with increasing rock to solution ratio, demonstrating that the weathered bedrock was effectively attenuating Cd concentrations. Likewise, the Zn content in solution decreased significantly in all cases; however, lower concentrations were not consistently found in solutions with higher rock:solution ratios.

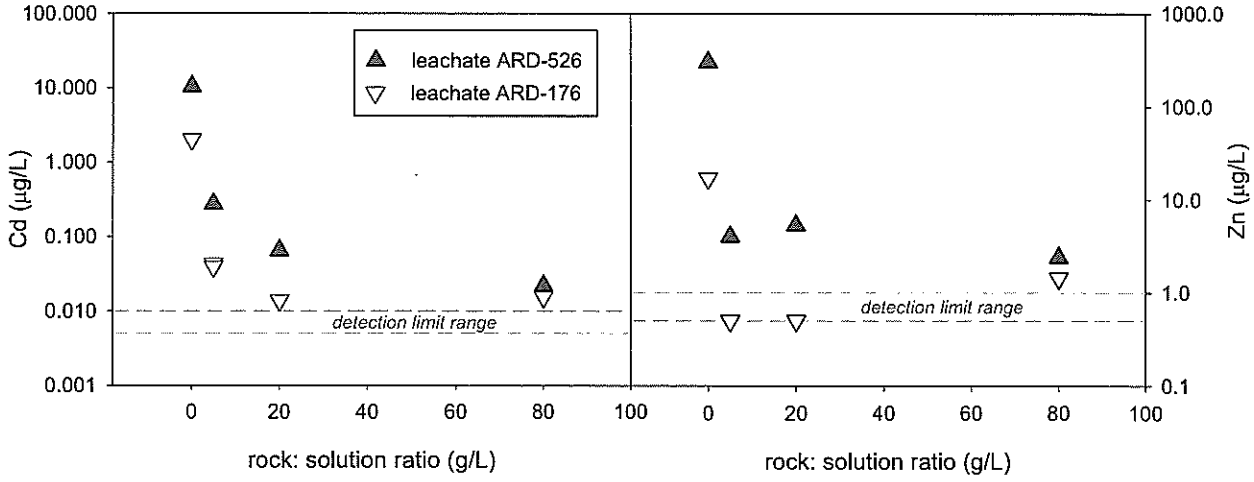


Figure 3-1: Dissolved Cd and Zn concentrations in solution after agitation with weathered bedrock at variable rock:solution ratios. Results for both leachate solutions are shown relative to the detection limit range of values.

Based on the observation that Cd and Zn concentrations were at or near the detection limit for many of the experiments using leachate ARD-176, subsequent experiments on the till and sand & gravel units were carried out at a lower rock:solution ratio of 5 g/L.

The sorption of metals can be quantified as the mass of metal sorbed per unit mass of sorbent, in this case the weathered bedrock. The sorption results for Cd and Zn are shown in Figure 3-2 as a function of their respective concentrations in the residual aqueous solutions. The amount of Cd sorbed onto weathered bedrock surfaces increases linearly with Cd concentration. Likewise, the amount of Zn sorbed onto weathered bedrock surfaces also increases with increasing concentration in solution; however, more variability is observed.

The linear relationships observed between sorbed Cd and aqueous concentrations in Figure 3-2 illustrate an equilibrium between the dissolved and sorbed concentrations. This relationship cannot be extrapolated indefinitely, as at some point the sorption capacity of the substrate will be reached, and the relationship will cease to be linear (*i.e.*, finite number of sorption sites).

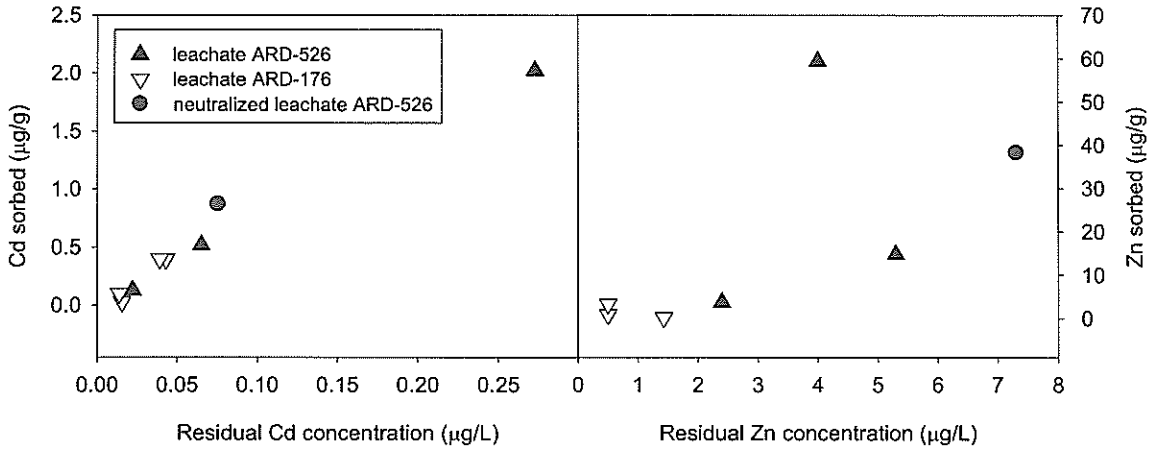


Figure 3-2: The concentration of Cd and Zn sorbed onto weathered bedrock surfaces as a function of their respective residual solution concentrations.

3.2 Sorption Results for Different Rock Units

Sorption test results for experiments using ARD-526 and ARD-176 for the three substrate types are summarized in Table 3-3 and Table 3-4, respectively. Trace elements included are those identified through kinetic test work (AMEC, 2013) to have values exceeding Metal Mining Effluent Regulations and BC water quality guidelines.

During the sorption experiments, a number of parameters increased in concentration. This observation suggests that metals are released from the rock units via dissolution of soluble phases. In order to interpret these results, the sorption experimental results were plotted with the initial humidity cell leachate value, the blank value, and the results of mixing de-ionized (DI) water with the substrate samples for weathered bedrock (Figure 3-3 and Figure 3-4), basal till (Figure 3-5 and Figure 3-6) and sand & gravel (Figure 3-7 and Figure 3-8).

In the sections to follow, the sorption test results are discussed in turn for the three substrate types: weathered bedrock, basal till, and sand & gravel.

Table 3-3
Comparison of initial concentration (Initial C) with final concentration (Final C) for sorption experiments using ARD-526 input solution at a rock:solution ratio of 80 g/L. Elements which increased in concentration by more than 50% are highlighted in red, while elements which declined in concentration by more than 50% are highlighted in blue. All values in mg/L.

	ARD-526	WB-526-80		BT-526-80		S&G-526-80	
Element	Initial C	Final C	% Diff	Final C	% Diff	Final C	% Diff
Al	0.042	1.27	2924%	0.98	2233%	0.495	1079%
Fe	0.022	1.43	6400%	0.535	2332%	0.297	1250%
Ca	2.58	11.4	342%	12.8	396%	14.1	447%
Mg	0.44	3.05	593%	1.61	266%	1.14	159%
Na	0.083	9.04	10792%	4.45	5261%	2.72	3177%
K	3.02	4.68	55%	3.84	27%	2.76	-9%
Sr	0.0193	0.182	843%	0.0819	324%	0.0624	223%
Ca	2.58	11.4	342%	12.8	396%	14.1	447%
Sb	0.0028	0.00257	-8%	0.00217	-23%	0.00229	-18%
As	0.00253	0.00088	-65%	0.00605	139%	0.00681	169%
Cd	0.0104	0.000022	-99%	0.0000312	-99%	0.0000357	-99%
Co	0.00212	0.00072	-66%	0.000254	-88%	0.000132	-94%
Cr	<0.0001	0.00162	1520%	0.00085	750%	0.00036	260%
Cu	0.00034	0.00371	991%	0.00106	212%	0.00078	129%
Pb	0.000581	0.000141	-76%	0.000289	-50%	0.000428	-26%
Mn	0.484	0.0213	-96%	0.0316	-93%	0.0116	-98%
Mo	0.00155	0.0116	648%	0.0291	1777%	0.00803	418%
Ni	0.00223	0.0016	-28%	0.000667	-70%	0.000264	-88%
Se	0.0001	0.0001	0%	0.000087	-13%	0.000108	8%
Tl	0.00008	<0.00001	-88%	0.000013	-84%	0.000008	-90%
Zn	0.301	0.0024	-99%	0.00232	-99%	0.00171	-99%

Table 3-4
Comparison of initial concentration (Initial C) with final concentration (Final C) for sorption experiments using ARD-176 input solution at a rock:solution ratio of 5 g/L. Elements which increased in concentration by more than 50% are highlighted in red, while elements which declined in concentration by more than 50% are highlighted in blue. All values in mg/L.

	ARD-176	WB-176-5		BT-176-5		SG-176-5	
	Initial C	Final C	% Diff	Final C	% Diff	Final C	% Diff
Al	0.0189	0.0365	93%	0.0525	178%	0.0439	132%
Fe	0.0015	0.0179	1093%	0.0079	427%	0.0046	207%
Ca	25.8	25.6	-1%	30.2	17%	30.5	18%
Mg	0.42	2.24	433%	1.04	148%	0.775	85%
Na	0.103	0.874	749%	0.493	379%	0.314	205%
K	4.59	4.88	6%	4.73	3%	4.54	-1%
Sr	0.0924	0.245	165%	0.125	35%	0.106	15%
Sb	0.00429	0.00409	-5%	0.0038	-11%	0.00399	-7%
As	0.000593	0.000302	-49%	0.000906	53%	0.00101	70%
Cd	0.00202	0.0000429	-98%	0.0000815	-96%	0.00011	-95%
Co	0.000248	0.0000155	-94%	2.64E-05	-89%	0.000028	-89%
Cr	<0.0001	<0.0001	0%	<0.0001	0%	<0.0001	0%
Cu	0.00022	0.00035	59%	0.00011	-50%	0.00012	-45%
Pb	0.000019	0.000005	-74%	9.3E-06	-51%	2.16E-05	14%
Mn	0.16	0.0358	-78%	0.093	-42%	0.0709	-56%
Mo	0.0011	0.00184	67%	0.00286	160%	0.00152	38%
Ni	0.000127	0.00005	-61%	0.000064	-50%	0.00005	-61%
Se	0.00004	0.00004	0%	0.00004	0%	0.00004	0%
Tl	0.0000119	0.0000025	-79%	5.5E-06	-54%	6.3E-06	-47%
Zn	0.0169	<0.0005	-97%	<0.0005	-97%	<0.0005	-97%

3.2.1 Weathered Bedrock

Arsenic, Cd, Co, Pb, Tl and Zn were significantly attenuated by weathered bedrock in sorption experiments for both solutions (Table 3-3 and Table 3-4). Cd and Zn exhibited the highest degree of removal, with solution values decreasing by 99% and 97%, respectively, over the course of the experiment. In contrast, the concentration of most major ions and some trace metals increased during the sorption experiments. Trace metals which increased in concentration included Cu, Mo and Cr, suggesting that these elements were released from the weathered bedrock unit by dissolution of water soluble phases. This was confirmed by repeating experiments using DI water rather than humidity cell leachate. Final concentrations

of Cr, Cu and Mo, as well as major ions, in the experiments using DI produced similar concentrations as those produced by the weathered bedrock (Figure 3-3 and Figure 3-4). The trace metal concentrations in WB-DI-80 are remarkably similar to those in WB-526-80 (Figure 3-4), suggesting that an existing load of soluble metals is associated with weathered bedrock material. Further, the data also suggests that the mass of metals from ARD-526 additionally sorbed to weathered bedrock material during experiment is relatively small compared to the pre-experiment sorbed metal inventor.

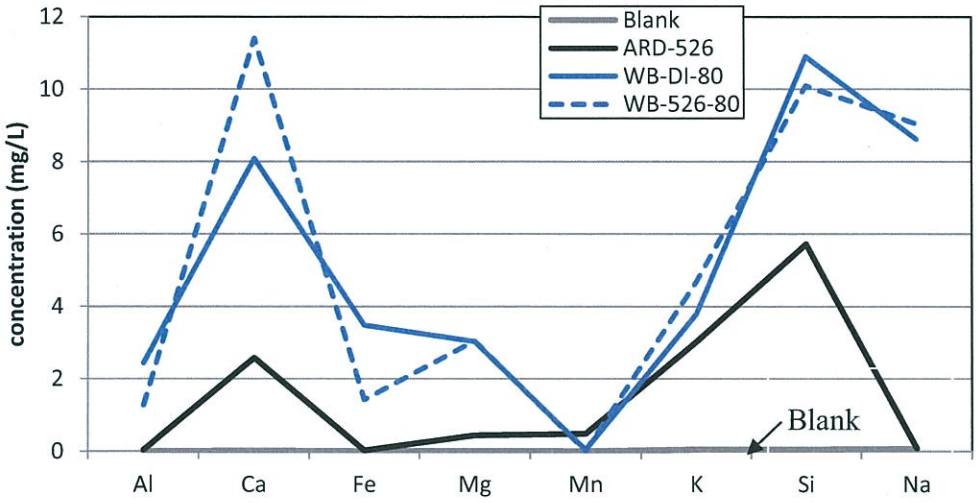


Figure 3-3: Major ion concentrations in solution after weathered bedrock sorption experiments as compared to leachate solution ARD-526 and the analytical blank.

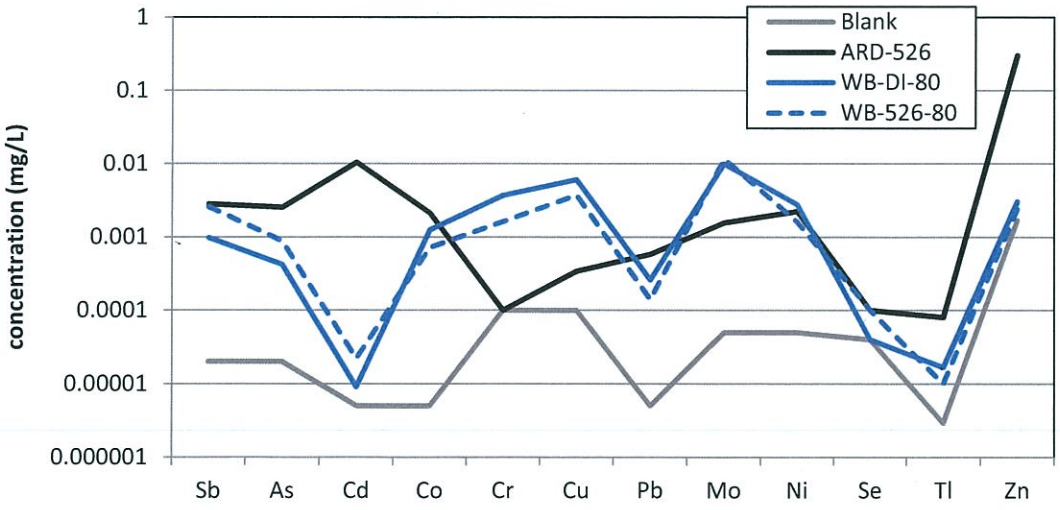


Figure 3-4: Residual trace element concentrations in solution after weathered bedrock experiments as compared to leachate solution ARD-526 and the analytical blank.

3.2.2 Basal Till

The basal till unit attenuated Cd, Co, Pb, Mn, Ni, Tl, and Zn concentrations by 50% or more Sorption test results for experiments using ARD-526 and ARD-176 for the three substrate types are summarized in Table 3-3 and Table 3-4, respectively. Trace elements included are those identified through kinetic test work (AMEC, 2013) to have values exceeding Metal Mining Effluent Regulations and BC water quality guidelines.

During the sorption experiments, a number of parameters increased in concentration. This observation suggests that metals are released from the rock units via dissolution of soluble phases. In order to interpret these results, the sorption experimental results were plotted with the initial humidity cell leachate value, the blank value, and the results of mixing de-ionized (DI) water with the substrate samples for weathered bedrock (Figure 3-3 and Figure 3-4), basal till (Figure 3-5 and Figure 3-6) and sand & gravel (Figure 3-7 and Figure 3-8).

In the sections to follow, the sorption test results are discussed in turn for the three substrate types: weathered bedrock, basal till, and sand & gravel (Table 3-3 and Table 3-4). The metals which were attenuated to the greatest degree were Cd and Zn, the concentrations of which declined by 96% to 99% over the course of the sorption experiments.

As observed for weathered bedrock, the concentrations of most major ions and a number of trace metals (As, Cu, Mo and Cr) increased during the sorption experiment. The basal till substrate was confirmed as the source of these increases by comparison to the experimental blank which showed much lower values (Figure 3-5 and Figure 3-6). This indicates that the increases in concentration for some parameters were not derived via contamination. Of additional interest is that the trace metal concentrations achieved using humidity cell leachate were often lower than those produced using DI water. The cause of this result is uncertain; however, such results may reflect precipitation reactions associated with an increase in pH of the humidity cell leachate solution during the sorption experiments (Table 3-2).

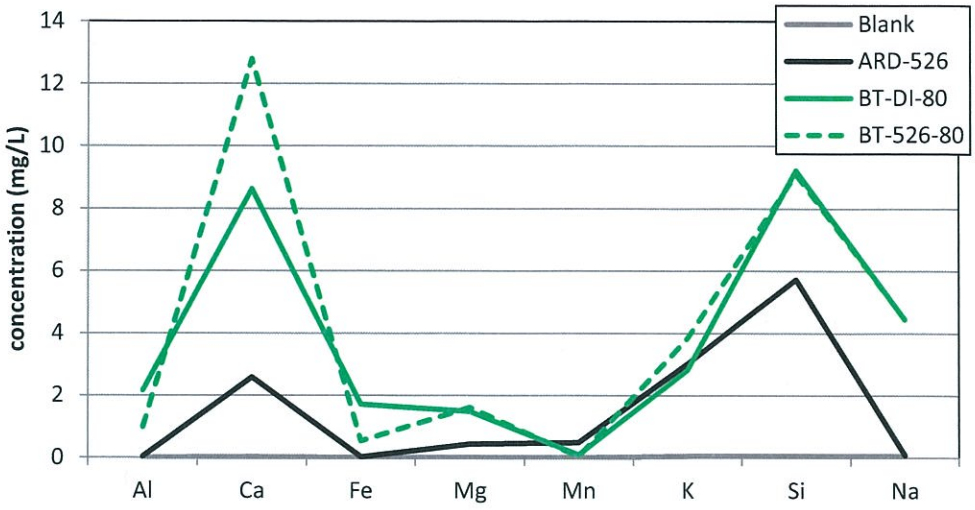


Figure 3-5: Residual major element concentrations in solution after till experiments as compared to leachate solution ARD-526 and the analytical blank (de-ionized water).

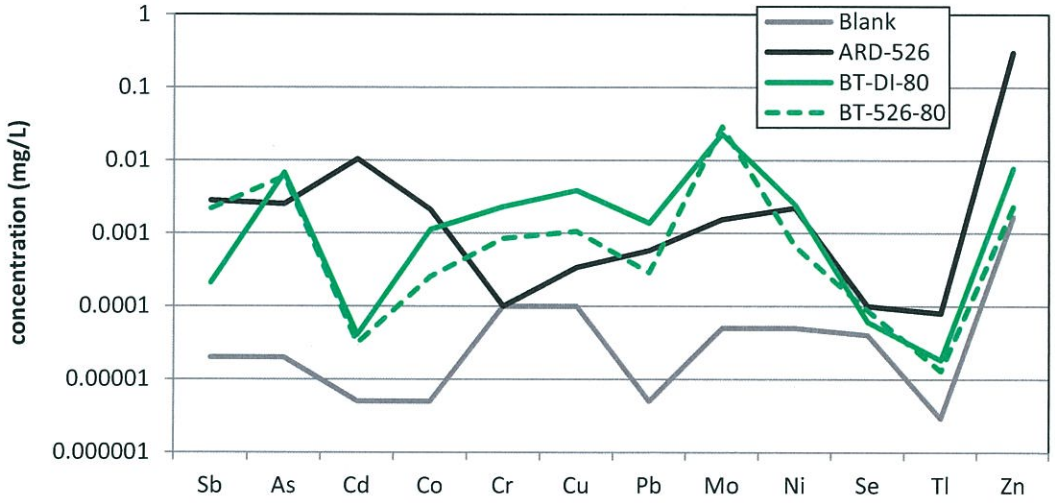


Figure 3-6: Residual trace element concentrations in solution after till experiments as compared to leachate solution ARD-526 and the analytical blank (de-ionized water).

3.2.3 Sand and Gravel

The sand & gravel unit showed marked attenuation of Cd, Co, Mn, Ni, Tl, and Zn concentrations in sorption experiments using humidity cell leachate solution ARD-526 (Table 3-3 and Table 3-4). The metals which were attenuated to the greatest degree were Cd and Zn, the concentrations of which declined by 95% to 99% over the course of the sorption experiments.

As observed for the other substrates, the concentration of most major ions and some trace metals increased during the sorption experiment. Similar to the basal till experiment, trace metals which increased in concentration included As, Mo Cu and Cr. The experimental control sample using the DI water confirmed the sand & gravel as the source of these metals (Figure 3-7 and Figure 3-8). Similar to the basal till unit, the trace metal concentrations produced during the experiments using humidity cell leachate were often lower than those produced using DI water. This may be attributed to precipitates forming from neutralization of the ARD-526 solution, as previously discussed.

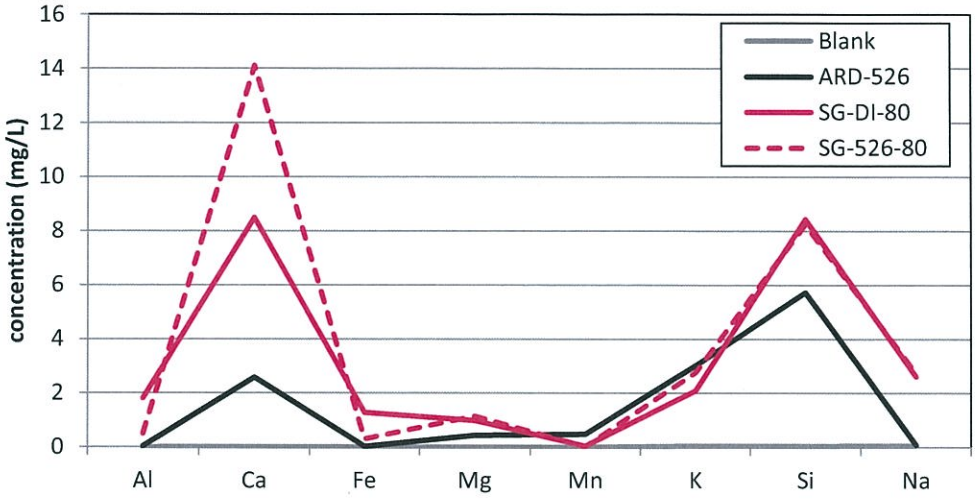


Figure 3-7: Residual major element concentrations in solution after sand & gravel experiments as compared to leachate solution ARD-526 and the analytical blank (de-ionized water).

Figure 3-8: Residual trace element concentrations in solution after sand & gravel experiments as compared to leachate solution ARD-526 and the analytical blank (de-ionized water).

3.2.4 Relative Sorption Potential of Substrate Types

All three substrate types attenuated more than 95% and 92% of Cd and Zn, respectively. In the case of Cd, the weathered bedrock unit consistently had the highest sorption potential, while the sand & gravel unit showed the lowest attenuation potential. However, the final concentrations in all experiments were near detection limits, with variations of less than 1 µg/L between the three substrate types. Therefore, the variation in sorption potential for Cd between the three substrate types is considered minor.

In contrast to Cd, Zn was attenuated most effectively by the sand & gravel unit based on attenuation levels observed in leachate solution ARD-526. A similar comparison of attenuation levels is not possible for experiments using leachate solution ARD-176, since concentrations for all samples dropped from 16.9 µg/L to below the detection limit (0.5 µg/L).

Other metals which were consistently attenuated by all three rock units included Co, Pb, Mn, Ni, and Tl. All five of these trace metals form metal cations in solution, and can be expected to be attenuated by surface sorption under neutral pH conditions. Arsenic was only attenuated by the weathered bedrock unit. Unlike transition metals, As forms oxyanions in solution and is relatively soluble under neutral pH conditions. The ability of the weathered bedrock unit to attenuate As indicates the presence of mineral surfaces which have a high sorption potential for arsenic (*e.g.*, Fe-oxides).

3.3 Effect of pH on Sorption Experiments

The adsorption of Cd, Zn and other trace metals onto particle surfaces is strongly influenced by pH. Over the course of the sorption experiments, the pH increased relative to initial humidity cell leachate values (Table 3-2; Figure 3-9). The magnitude of this increase generally increased with increasing rock to solution ratios, with little variability between different substrate types (Figure 3-9). This increase in pH was likely driven by the dissolution of carbonate minerals present in the samples, as indicated by the observed release of cations associated with carbonates (Ca, Mg and Sr) (Figure 3-3, Figure 3-5 and Figure 3-7). Increasing the pH of the humidity cell leachate may also result in the precipitation of Al and Fe-oxyhydroxide minerals, providing additional mineral surfaces onto which sorption may occur. Note that the high Al and Fe concentrations observed at the end of the sorption experiments are attributed to clay-size particles passing through the filter, as these metals are only sparingly soluble in a neutral pH aerobic solutions.

The increase in pH associated with higher rock to solution ratio complicates interpretation of sorption experiments, as pH is a key variable controlling the degree of sorption. Furthermore, increasing the pH of humidity cell leachates can drive precipitation reactions, potentially attenuating trace metal content.

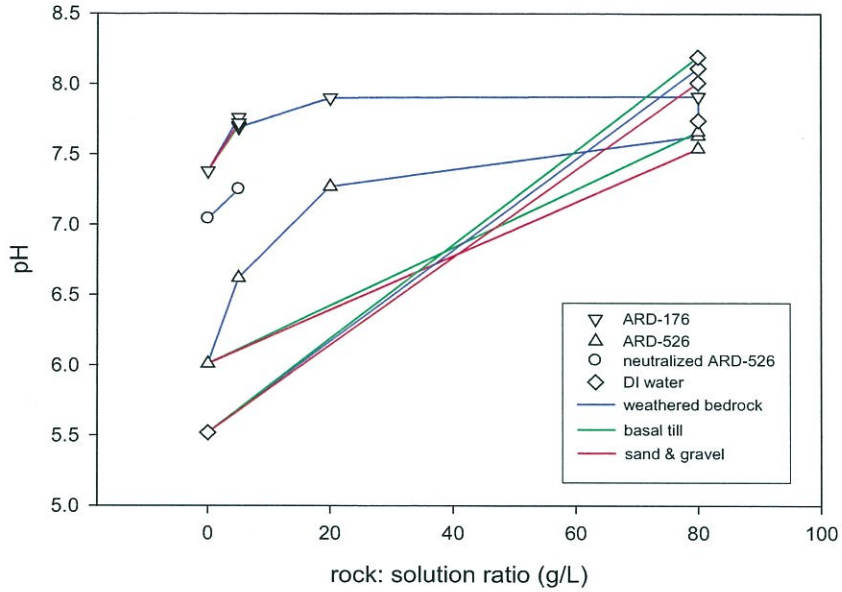


Figure 3-9: pH variations observed in experiments as a function of rock:solution ratios

In order to determine the significance of neutralization reactions on trace metal concentrations, a lime neutralization experiment was initiated. Specifically, to distinguish the relative effects of neutralization *versus* adsorption on Cd and Zn attenuation, a hydrated lime [$Ca(OH)_2$] titration experiment was performed on humidity cell leachate ARD-526. Leachate solution pH was increased from 6.01 to 7.04 by titration with $Ca(OH)_2$. The sorption experiment was then carried out on the weathered bedrock at a rock:solution ratio of 5. The results of the lime neutralization experiment are provided in Figure 3-10, alongside results for sorption experiments with the same substrate (weathered bedrock) and ARD-526. During lime neutralization of ARD-526, approximately 30% and 60% of Zn and Cd were removed from solution. This represents a lower degree of attenuation in comparison to experiments conducted in the presence of weathered bedrock, where a similar increase in pH occurred (Figure 3-10). Upon exposure of the neutralized ARD-526 solution (ARD-526+$Ca(OH)_2$ in Table 3-2) to weathered bedrock, a further decline in metal content and increase in pH was observed. The increase in pH was relatively small (7.04 to 7.26), while the concentration of Cd and Zn declined by over an order of magnitude, to concentrations comparable to those observed in other sorption experiments (Figure 3-10). These results indicate that neutralization reactions play a role in attenuating metal concentrations. However, the near detection limit concentrations observed in the experiments were only achieved when sorption surfaces were present. Thus, while the neutralization afforded by substrates will influence metal removal, pH changes alone are relatively ineffective at attenuating metal concentrations in comparison to the adsorption to particle surfaces.

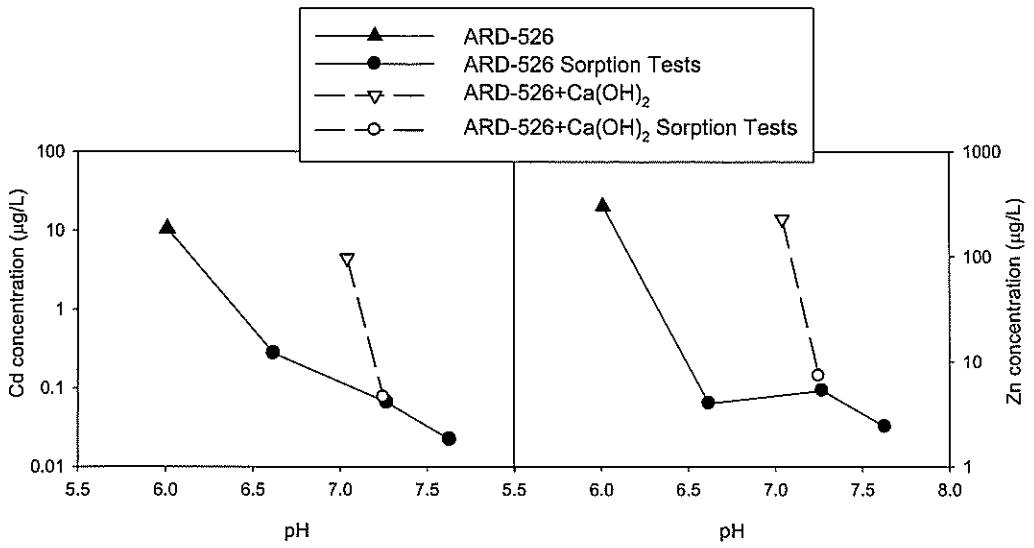


Figure 3-10: Cd and Zn concentration remaining in solution after sorption experiments with weathered bedrock using ARD-526 and lime neutralized ARD-526.

3.3.1 Neutralization Potential of Substrates

The increase in pH over the course of the sorption experiments can be attributed to the dissolution of pH neutralizing minerals present in the substrate samples. In order to determine the relative effectiveness and quantity of neutralization capacity, the three rock units were subjected to ABA testwork. Results of ABA testwork are presented in Table 3-5, with complete results including metal concentrations provided in Appendix B.

Table 3-5:
Acid Base Accounting Results

	Paste pH	CaNP	Sobek NP
		mgCaCO3/kg	mgCaCO3/kg
Basal Till	8.49	13.3	22.9
Sand & Gravel	8.56	0.8	17.3
Weathered Bedrock	8.17	<0.8	13.4

These results indicate that the basal till and sand & gravel units are characterized by higher neutralization potential (NP) than the weathered bedrock unit, with the basal till unit showing a much higher carbonate content. These data suggest that the basal till and sand & gravel units will maintain a higher pH than the weathered bedrock, as is observed in the paste pH values. The relatively high pH in these two units compared to weathered bedrock is due to the presence of carbonate minerals, reported as carbonate neutralization potential (CaNP) in Table 3-5. The weathered bedrock unit does not have measureable CaNP, and has relatively low Sobek NP. These results indicate that carbonate mineral equilibrium will likely control the pH in basal till and sand & gravel porewater, promoting higher pH conditions.

4 Implications for Metal Attenuation at the Blackwater Site

The results presented in this study provide site-specific details on the sorption characteristics of units that will likely be encountered along TSF seepage flow paths at the Blackwater site. In order to evaluate how these results can be applied to the site conditions, a number of parameters must be considered including the relative distribution of geologic units, the overall site hydrostratigraphy, subsurface pH controls and the relative scaling of experimental data. The following sections describe how these parameters influence sorption processes and the attenuation of Cd and Zn.

4.1 Site Hydrostratigraphy

The stratigraphy underlying the central part of the TSF through Davidson Creek follows a succession where the sand & gravel overlies the basal till which overlies the weathered bedrock (Knight and Piesold, 2013). The relative thickness of these units, their hydraulic conductivity, and the residence time of seepage within them will influence the extent of sorption that can occur and thus the potential for attenuation of Zn and Cd in TSF seepages.

The flow path of seepage from the tailings facility will be controlled by the relative hydraulic conductivities (K) of the underlying units. Based on the estimated K values of the units considered (Knight Piesold, 2013), seepage will preferentially flow through the sand & gravel unit (K_{sat} for sand & gravel = 1.0×10^{-4} m/s *versus* 5.0×10^{-8} m/s for both weathered bedrock and till units; Knight and Pielsold, 2013). To reduce the total flow volume, a cutoff wall is planned near the toe of the tailings dam.

The results of the sorption experiments suggest that all three subsurface units share a similar degree of metal attenuation capacity in the <0.15 mm grain size fraction. This indicates that all three units are capable of attenuating Cd and Zn to near detection limit concentrations. However, the total amount of sorption capacity that each unit has will largely be dependent on the available surface area. The available surface area of the three units can be estimated based on the particle size distribution, as will be discussed in section 4.3.

4.2 Subsurface pH Controls

Groundwater pH is a key variable affecting sorption potential. The pH in groundwater beneath the TSF will be determined by the composition of infiltrating tailings water and by interactions with subsurface materials. The pH of TSF infiltration is expected to remain neutral. However, if the pH of TSF water declines to sub-neutral values, the CaNP present in the basal till and to a lesser extent in the sand & gravel unit may act to maintain neutral-alkaline conditions in the subsurface.

Experiments using ARD-526 (initial pH = 6.01) confirmed the ability of the rock units to buffer pH to a neutral-alkaline levels. No CaNP was measurable in the weathered bedrock

unit; however this unit was also shown to buffer pH in the sorption experiments to a similar range as seen in the sand & gravel and basal till units. The basal till unit contains the highest CaNP content of the three substrate types sampled, indicating that the basal till unit is most capable of maintaining a neutral pH.

Although the sand & gravel unit has the highest hydraulic conductivity, the presence of a cut off wall at the toe of the TSF will cause TSF drainage to come into contact with all three sedimentary units. Carbonate minerals present in the basal till and sand and gravel units can be expected to impart some buffering, and maintain TSF seepages at a neutral pH. The degree of buffering may be similar to that observed in the sand & gravel sorption experiments, where ARD-526 was buffered from a pH of 6.01 to 7.54 at a rock to solution ratio of 80 g/L. An increase in pH can be expected to enhance metal sorption potential through increasing metal affinity for particle surfaces as well as through pH-dependent precipitation reactions.

4.3 Scaling up Experimental Results

The availability of reactive surface sites will strongly influence the overall sorption capacity. Because most of a sample's surface area is associated with the finest grain sizes, the sorption experiments were carried out on the <0.15 mm grain size fraction. However, it is important to recognize that when the whole grain size distribution is considered, the sorbents will have lower sorption than experimental sorption results would indicate. In order to place experimental sorption results into context, the particle size distribution must be considered.

Particle size distribution analyses carried out on rock units are summarized in Figure 4-1 (Piesold & Knight, unpublished data). Of the three units considered, the sand & gravel unit has the lowest percentage of grains less than 0.15 mm, with a median value of 26.2 %. The basal till and weathered bedrock units both have a relatively high percentage of grains less than 0.15 mm, with median values of 41.6% and 45.1%, respectively. The weathered bedrock, however, shows a much wider range as indicated by the 25^{th} and 75^{th} percentile values of 34.6% and 68.1% as compared to 37.6% and 48.5% for the till (Figure 4-1).

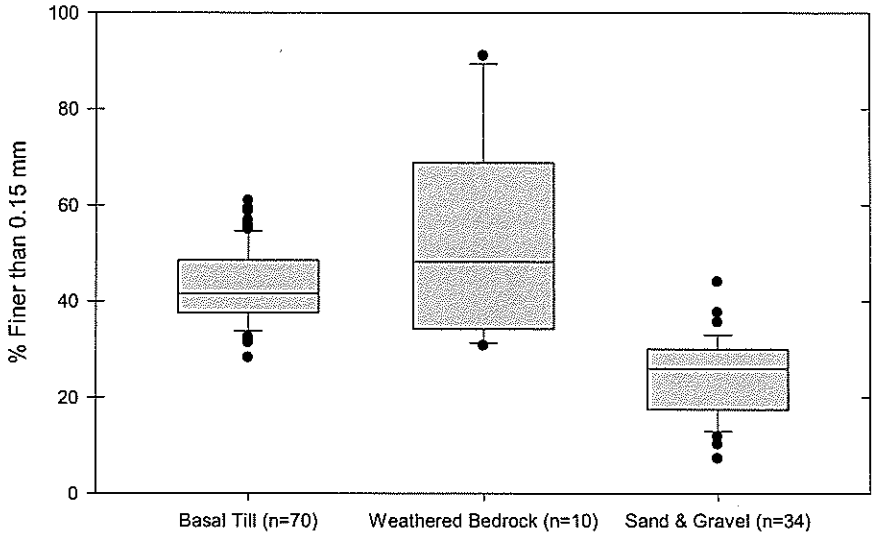


Figure 4-1: Box and whisker diagrams of percent of grain size distribution that is finer than 0.15 mm for the three substrate types. The box shows the median, 25th and 75th percentile values; whiskers denote the 90th and 10th percentiles; and data points beyond the 90th and 10th percentile are marked by dots.

The particle size distribution can be used to upscale sorption capacity measured in laboratory experiments by making the conservative assumption that all available surface area is contained within the <0.15 mm size fraction. The upscaled sorption results are presented in Table 4-1. This table provides an estimate of the mass of Zn and Cd that can be sorbed and the residual equilibrium metal concentration. Note that an equilibrium exists between the sorbed and aqueous concentration, as illustrated in Figure 3-2. That is to say, an aqueous Cd concentration of 0.022 µg/L corresponds to a sorbed concentration of 0.059 µg/g in the weathered bedrock. If the influent concentration were to increase, it would result in an increase in the sorbed concentration, as shown in the linear relationship between aqueous and sorbed concentrations in Figure 3-2. Note that the linear relationship between aqueous concentration and sorbed concentration cannot be extrapolated indefinitely, as the sorption capacity of any substrate is limited by available surface sorption sites. This saturation point was not achieved in the experiments presented herein.

Overall, these results indicate that the sand & gravel unit has a lower attenuation potential for Cd and Zn in comparison to the basal till and weathered bedrock units. This is largely a result of the relatively coarser grained particle size distribution of the sand & gravel unit. It is important to note that the extent of metal attenuation within the different rock units will depend on other variables not considered in this assessment, including seepage velocities, unit thicknesses, and the development of preferential flow paths. With an understanding of these variables, the results from this assessment could be used to generate estimates of relative travel times (*i.e.*, retardation factors) for Cd and Zn.

Table 4-1:
Sorbed concentrations measured using solution ARD-526 and a rock:solution ratio of 80 g/L upscaled as a function of particle size distribution of the three units. The aqueous concentration represents the equilibrium pore water concentration which corresponds to the upscaled sorbed concentration.

	% of unit occupying sub 0.15 mm fraction	Sorption potential of sub 0.15 mm fraction		Upscaled Sorbed Concentration		Equilibrium Aqueous Concentration	
		Cd	Zn	Cd	Zn	Cd	Zn
units	%	µg/g	µg/g	µg/g	µg/g	µg/L	µg/L
Weathered Bedrock	45.1	0.13	3.73	0.059	1.67	0.022	2.4
Basal Till	41.6	0.13	3.73	0.054	1.54	0.03	2.3
Sand & Gravel	26.2	0.13	3.74	0.034	0.97	0.036	1.7

5 Summary

The most relevant findings of the sorption experiments are summarized below:

- All rock units tested effectively attenuated Cd and Zn concentrations by values greater than 95% and 92%, respectively.
- Trace metals which were attenuated by all three rock units included Cd, Co, Mn, Ni, Tl, Pb and Zn.
- The weathered bedrock was the only rock unit to demonstrate a capacity for As attenuation.
- Cd was most effectively attenuated by the weathered bedrock unit, followed by the basal till and the sand & gravel units. Attenuation of Zn was most significant for the sand & gravel unit, followed by the basal till and the weathered bedrock units. Overall, however, variations in attenuation capacity between the three rock units were minor.
- Solution pH increased during the sorption experiments owing to buffering capacity contained in the rock units. A portion of the attenuation observed in sorption experiments can be attributed to this rise in pH, as demonstrated by neutralization of ARD-526 with lime absent of substrate. However, neutralization alone cannot produce the near detection limit concentrations observed in sorption experiments where a mineral surface was provided. Under field conditions, both neutralization and adsorption to particle surfaces will govern the overall attenuation potential for Cd and Zn.

- Acid base accounting testwork indicates that the basal till and sand & gravel units are capable of maintaining a higher pH than the weathered bedrock unit. This is attributed to the presence of abundant carbonate minerals in the till unit and to a lesser extent in the sand & gravel unit.

The most relevant findings regarding implications for mine site conditions are summarized as follows:

- The fine grained fraction (<0.15 mm) of the three rock units demonstrated the ability to attenuate Cd and Zn to near detection limit concentrations. Variability between the attenuation capacities of these three units in the field will be determined mainly by variations in grain size distribution and porewater pH.
- Based on the particle size distribution analyses of the three units considered, the weathered bedrock and basal till have a higher percentage of grains finer than 0.15 mm than the sand & gravel unit.
- The pH in groundwater beneath the TSF will be determined by the composition of infiltrating tailings water and by interactions with underlying substrates. The basal till unit has a relatively high paste pH, and the highest carbonate content, indicating that this unit will be most effective at maintaining a neutral-alkaline pH in porewater.
- The basal till unit is considered to have the highest sorption potential regarding Cd and Zn owing to the particle size distribution and pH buffering capacity. This unit has a relatively low hydraulic conductivity compared to the sand and gravel unit; however, the presence of a cutoff wall transecting the sand and gravel unit will direct TSF seepage to come into contact with all three sedimentary units.
- In addition to sorption properties, the extent of metal attenuation within the different rock units will depend on flow velocities, unit thicknesses, and the development of preferential flow paths.

It is important to note that sorption capacity of any rock unit is limited. Once available sorption sites are occupied, metals will pass through the rock unit unimpeded. Whether or not this sorption capacity becomes exhausted depends upon the mass of contaminants that will be leached from tailings and waste rock within TSF. Based on the existing data, it can be concluded that the properties of the underlying substrates at the Blackwater TSF will result in some degree of attenuation with respect to Cd and Zn. In this regard, the results of this study invoke an element of conservatism into water quality predictions which, to date, have not accounted for non-conservative removal processes along seepage pathways.

References

AMEC (2012) Blackwater Gold Project: Geochemistry 2011 baseline Report prepared for New Gold Inc.

Carroll, S. A., O'day, P. A., & Piechowski, M. (1998). Rock-water interactions controlling zinc, cadmium, and lead concentrations in surface waters and sediments, US Tri-State Mining District. 2. Geochemical interpretation.*Environmental science & technology*, 32(7), 956-965..

Benjamin, M. M., & Leckie, J. O. (1981). Multiple-site adsorption of Cd, Cu, Zn, and Pb on amorphous iron oxyhydroxide. *Journal of Colloid and Interface Science*, *79*(1), 209-221.

Macalady, D. L., Smith, K. S., & Ranville, J. F. (1990). Acid mine drainage: Streambed sorption of copper, cadmium and zinc. Colorado Water Resources Research Institute, Colorado State University.

Knight Piesold (2013) Memorandum for Blackwater TSF – Downstream Seepage Estimates.

Krishnamurti, G.S.R., Huang, P.M., and Kozak, L.M. (1999). Sorption and desorption kinetics of cadmium from soils: influence of phosphate. *Soil Science*, 164, 888-898.

McLean, J.E. and Bledsoe, B.E. (1992). Behavior of metals in soils. EPA Ground Water Issue, EPA 540-S-92-018: 25pp.

McNee, J.J. (1997) The Post-depositional cycling of Cd, Cu, Mo and Zn in several hydrographically distinct B.C. Fjords Ph.D. Thesis. The University of British Columbia, Canada, 272pp.

MEND, (1991). Acid Rock Drainage Prediction Mannual, A Manual of Chemical Evaluation Procedures for the Prediction of Acid Generation From Mine Waste. Mend Project No. 1.161b.

Person, I. (2010). Hydrated metal ions in aqueous solution: How regular are their structures? *Pure Applied Chemistry*, 92(10), 1901-1917.

Yong, R.N., Phadungchewit, Y., (1993). pH influence on selectivity and retention of heavy metals in some clay soils. *Canadian Geotechnical Journal*, 30, 821-833.

Lorens, R.B. (1981). Sr, Cd, Mn and Co distribution coefficients in calcite as a function of calcite precipitation rate. *Geochim. Cosmochim. Acta*, 45, 553-561.

Sample ID	experiment date	pH	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co
			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
ARD-176	April 11 2013	7.10	0.0189	0.00429	0.000593	0.00306	<0.00001	<5E-06	<0.005	0.00202	25.8	<0.0001	0.000248
ARD-526	April 5 2013	5.25	0.0420	0.00280	0.00253	0.000895	<0.00001	<0.0005	<0.01	0.0104	2.58	<0.0001	0.00212
ARD-526 +CaOH2	April 30 2013	7.04	0.0266	0.00235	0.00209	0.000961	<0.00001	<5E-06	0.0061	0.0044	7.42	0.00022	0.00172
Blank	May 7 2013	4.67	0.0007	<0.00002	<0.00002	0.000041	<0.00001	<5E-06	<0.005	<0.000005	<0.02	<0.0001	<0.000005
BT-176-5	April 26 2013	7.70	0.0525	0.00380	0.000906	0.0308	<0.00001	<5E-06	<0.005	0.0000815	30.2	<0.0001	0.0000264
BT-526-80	April 25 2013	7.66	0.980	0.00217	0.00605	0.0285	0.000024	<5E-06	0.0097	0.0000312	12.8	0.00085	0.000254
BT-DI-80	May 7 2013	8.19	2.16	0.00021	0.00678	0.0518	0.000089	6.8E-06	0.0094	0.0000406	8.63	0.00231	0.00113
SG-176-5	April 26 2013	7.72	0.0439	0.00399	0.00101	0.0210	<0.00001	<5E-06	<0.005	0.000110	30.5	<0.0001	0.0000280
SG-526-80	April 25 2013	7.54	0.495	0.00229	0.00681	0.0153	0.000015	<5E-06	0.0104	0.0000357	14.1	0.00036	0.000132
SG-DI-80	May 7 2013	8.01	1.8	0.000223	0.00846	0.0259	0.000055	6.9E-06	0.0107	0.0000256	8.48	0.00137	0.000665
WB-176-20	April 11 2013	7.90	0.0496	0.00383	0.000311	0.125	<0.00001	<5E-06	<0.005	0.0000138	24.0	<0.0001	0.0000218
WB-176-5	April 11 2013	7.69	0.0365	0.00409	0.000302	0.107	<0.00001	<5E-06	<0.005	0.0000429	25.6	<0.0001	0.0000155
WB-176-5 (duplicate)	May 7 2013	7.76	0.0301	0.00402	0.00047	0.104	<0.00001	<5E-06	<0.005	0.0000391	25.3	<0.0001	0.0000192
WB-176-80	April 11 2013	7.91	0.0504	0.00320	0.000340	0.137	<0.00001	<5E-06	0.0069	0.0000154	21.7	<0.0001	0.0000259
WB-526 lime-5	April 30 2013	7.25	0.2	0.00232	0.00155	0.0466	<0.00001	<5E-06	0.0062	0.0000758	8.18	0.00047	0.000126
WB-526-20	April 5 2013	7.27	1.44	0.00254	0.00127	0.0603	<0.00001	<0.0005	<0.01	0.000065	8.16	0.00192	0.00092
WB-526-5	April 5 2013	6.62	0.413	0.00264	0.00080	0.0400	<0.00001	<0.0005	<0.01	0.000273	5.20	0.00055	0.00030
WB-526-80	April 5 2013	7.63	1.27	0.00257	0.00088	0.0782	<0.00001	<0.0005	<0.01	0.000022	11.4	0.00162	0.00072
WB-DI-80	April 5 2013	7.74	2.44	0.00077	0.00038	0.0749	<0.00001	<0.0005	<0.01	<0.00001	8.63	0.00359	0.00212
WB-DI-80 (duplicate)	April 11 2013	8.11	3.23	0.000980	0.000421	0.0605	0.000056	<5E-06	0.0070	0.0000090	8.08	0.00370	0.00124

Sample ID	experiment date	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
ARD-176	April 11 2013	0.00022	0.0015	0.0000190	0.00569	0.420	0.160	<0.00001	0.00110	0.000127	<0.3	4.59	<0.00004
ARD-526	April 5 2013	0.00034	0.022	0.000581	0.00474	0.44	0.484	<0.00001	0.00155	0.00223	<0.05	3.02	<0.0001
ARD-526 +CaOH2	April 30 2013	0.0006	0.0135	0.000637	0.00397	0.368	0.408	<0.00001	0.00137	0.00268	<0.3	2.39	<0.00004
Blank	May 7 2013	<0.0001	<0.001	<0.000005	<0.0005	0.0072	<0.00005	<0.00001	<0.00005	<0.00005	<0.3	<0.05	<0.00004
BT-176-5	April 26 2013	0.00011	0.0079	0.0000093	0.00482	1.04	0.0930	<0.00001	0.00286	0.000064	<0.3	4.73	<0.00004
BT-526-80	April 25 2013	0.00106	0.535	0.000289	0.00217	1.61	0.0316	<0.00001	0.0291	0.000667	<0.3	3.84	0.000087
BT-DI-80	May 7 2013	0.00387	1.71	0.00138	0.00152	1.49	0.0927	<0.00001	0.0231	0.00246	<0.3	2.82	0.000061
SG-176-5	April 26 2013	0.00012	0.0046	0.0000216	0.00438	0.775	0.0709	<0.00001	0.00152	<0.00005	<0.3	4.54	<0.00004
SG-526-80	April 25 2013	0.00078	0.297	0.000428	0.00096	1.14	0.0116	<0.00001	0.00803	0.000264	<0.3	2.76	0.000108
SG-DI-80	May 7 2013	0.00309	1.28	0.00212	0.0009	0.977	0.0321	<0.00001	0.00536	0.00126	<0.3	2.09	0.000088
WB-176-20	April 11 2013	0.00043	0.0273	<0.000005	0.00469	3.52	0.0167	<0.00001	0.00372	<0.00005	<0.3	4.89	<0.00004
WB-176-5	April 11 2013	0.00035	0.0179	<0.000005	0.00550	2.24	0.0358	<0.00001	0.00184	<0.00005	<0.3	4.88	<0.00004
WB-176-5 (duplicate)	May 7 2013	0.00025	0.0142	<0.000005	0.00536	2.38	0.0335	<0.00001	0.00179	<0.00005	<0.3	4.94	<0.000040
WB-176-80	April 11 2013	0.00061	0.0303	0.0000071	0.00300	4.15	0.0135	<0.00001	0.0113	0.000443	<0.3	5.23	0.000056
WB-526 lime-5	April 30 2013	0.00074	0.203	0.0000364	0.00396	1.44	0.0541	<0.00001	0.00189	0.000238	<0.3	2.62	<0.00004
WB-526-20	April 5 2013	0.00395	1.62	0.000194	0.00343	2.31	0.0322	<0.00001	0.00395	0.00203	<0.05	3.79	<0.0001
WB-526-5	April 5 2013	0.00111	0.429	0.000104	0.00433	1.33	0.0851	<0.00001	0.00210	0.00057	<0.05	3.17	<0.0001
WB-526-80	April 5 2013	0.00371	1.43	0.000141	0.00241	3.05	0.0213	<0.00001	0.0116	0.00160	0.052	4.68	<0.0001
WB-DI-80	April 5 2013	0.0101	3.48	0.000389	0.00152	3.03	0.0418	<0.00001	0.00804	0.00459	0.098	3.79	<0.0001
WB-DI-80 (duplicate)	April 11 2013	0.00606	2.71	0.000259	0.00156	2.28	0.0249	<0.00001	0.00988	0.00276	<0.3	3.46	<0.00004

Sample ID	experiment date	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
ARD-176	April 11 2013	1.18	<0.000005	0.103	0.0924		0.0000119	<0.00001	<0.00050	0.0000129	0.000106	0.0169	<0.0001
ARD-526	April 5 2013	5.72	<0.00001	0.083	0.0193	3.16	0.000080	<0.0001	<0.010	<0.00001	<0.001	0.301	
ARD-526 +CaOH2	April 30 2013	4.9	0.0000145	0.094	0.0196		0.000051	0.000021	<0.00050	0.0000114	0.00024	0.199	<0.0001
Blank	May 7 2013	<0.05	<0.000005	0.064	<0.00005		0.0000029	<0.00001	<0.0005	0.0000026	<0.00005	0.00168	<0.0001
BT-176-5	April 26 2013	1.89	<0.000005	0.493	0.125		0.0000055	<0.00001	<0.00050	0.000101	0.00106	<0.0005	<0.0001
BT-526-80	April 25 2013	9.10	<0.000005	4.45	0.0819		0.0000130	0.000036	0.0202	0.000276	0.00900	0.00232	0.00119
BT-DI-80	May 7 2013	9.22	0.0000172	4.44	0.0554		0.0000182	0.000032	0.0355	0.000249	0.0139	0.00777	0.00163
SG-176-5	April 26 2013	1.72	<0.000005	0.314	0.106		0.0000063	<0.00001	<0.00050	0.0000932	0.000846	<0.0005	<0.0001
SG-526-80	April 25 2013	8.24	<0.000005	2.72	0.0624		0.0000080	0.000033	0.0106	0.000271	0.00658	0.00171	0.00060
SG-DI-80	May 7 2013	8.43	0.000024	2.61	0.0371		0.000019	0.000048	0.0314	0.000194	0.0115	0.00726	0.00182
WB-176-20	April 11 2013	4.38	<0.000005	2.82	0.323		<0.000002	<0.00001	0.00096	0.000142	0.00443	<0.0005	<0.0001
WB-176-5	April 11 2013	2.65	<0.000005	0.874	0.245		0.0000025	<0.00001	0.00058	0.0000643	0.00177	<0.0005	<0.0001
WB-176-5 (duplicate)	May 7 2013	2.62	<0.000005	0.936	0.247		0.0000027	<0.00001	<0.00050	0.0000699	0.002	<0.0005	<0.0001
WB-176-80	April 11 2013	6.68	<0.000005	9.31	0.361		<0.000002	<0.00001	0.00094	0.000256	0.00757	0.00143	<0.0001
WB-526 lime-5	April 30 2013	5.86	<0.000005	0.882	0.112		0.0000061	0.000022	0.00603	0.0000203	0.00292	0.00732	0.00036
WB-526-20	April 5 2013	9.18	<0.00001	3.01	0.128	3.22	<0.00001	<0.00001	0.040	0.000052	0.0089	0.0053	
WB-526-5	April 5 2013	7.02	<0.00001	0.985	0.0776	3.15	<0.00001	<0.00001	0.011	<0.00001	0.0028	0.0040	
WB-526-80	April 5 2013	10.1	<0.00001	9.04	0.182	3.44	<0.00001	<0.00001	0.035	0.000136	0.0130	0.0024	
WB-DI-80	April 5 2013	10.9	<0.00001	8.62	0.136	0.52	<0.00001	<0.00001	0.057	0.000117	0.0170	0.0052	
WB-DI-80 (duplicate)	April 11 2013	14.3	0.0000148	7.31	0.132		0.0000166	0.000096	0.0856	0.000135	0.0203	0.00303	0.00522

CLIENT : **Lorax**
PROJECT : **Blackwater (Lorax Project # A302-4)**
SGS Project # : **1305**
Test : **Modified Acid-Base Accounting**
Date : **June 6, 2013**

Sample ID	Paste pH	TIC %	CaCO3 NP	S(T) %	S(SO4) %	S(S-2) %	Insoluble S %	AP	NP	Net NP	Fizz Test
Method Code	Sobek	CSB02V	Calc.	CSA06V	CSA07V	CSA08D	Calc.	Calc.	Modified	Calc.	Sobek
LOD	0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	#N/A	#N/A
Basal Till	8.49	0.16	13.3	0.07	<0.01	0.05	0.02	1.6	22.9	21.3	Slight
Sand & Gravel	8.56	0.01	0.8	0.01	<0.01	<0.01	0.01	<0.3	17.3	17.3	Slight
Weathered Bedrock	8.17	<0.01	<0.8	0.03	<0.01	<0.01	0.03	<0.3	13.4	13.4	None
Duplicates											
Sand & Gravel		0.01		0.02							
Weathered Bedrock	8.16				<0.01	<0.01			14.9		None
QC											
GTS-2A				0.36							
PD-1					4.38						
RTS-3A						2.24					
TIC-L1		0.13									
NBM-1									39.2		Slight
Expected Values		0.1325		0.35	4.27	2.34			42.0		Slight
Tolerance +/-		0.02		0.03	0.3	0.23			3.0		

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from the measured sulphide-sulphur content.

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

Sulphate Sulphur determined by 25% HCl with S by ICP Finish

Sulphide Sulphur determined by Sobek 1:7 Nitric Acid with S by ICP Finish

Insoluble S is acid insoluble S (Total S - (Sulphate S + Sulphide S)).

CLIENT : Lorax
PROJECT : Blackwater (Lorax Project # A302-4)
SGS Project # : 1305
TEST : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : June 24, 2013

Sample ID	Al %	B ppm	Ba ppm	Ca %	Cr ppm	Cu ppm	Fe %	K %	Li ppm	Mg %	Mn ppm	Na %	Ni ppm	P %
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50
Basal Till	1.81	50	170	1.58	111	44.9	4.07	0.23	10	1.01	900	0.19	38.4	1380
Sand & Gravel	1.55	50	108	1.17	126	18.5	2.92	0.17	12	0.91	565	0.1	22	920
Weathered Bedrock	2.91	60	156	1.44	126	41.2	5.6	0.17	9	1.31	415	0.05	56.2	2420
Duplicate														
Weathered Bedrock	2.84	50	152	1.42	126	41.9	5.58	0.16	9	1.3	416	0.05	56.3	2410
QC														
CH4	1.93	50	303	0.65	115	2040	4.93	1.49	12	1.28	343	0.06	52.3	760
Certified Values	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719
Tolerance (%)	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4

CLIENT : Lorax
PROJECT : Blackwater (Lorax Project # A302-4)
SGS Project # : 1305
TEST : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : June 24, 2013

Sample ID	S	Sr	Ti	V	Zn	Zr	Ag	As	Be	Bi	Cd	Ce	Co	Cs
	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	0.5	0.01	1	1	0.5	0.01	1	0.1	0.02	0.01	0.05	0.1	0.05
Basal Till	0.08	69.2	0.17	94	81	9.8	0.11	4	0.5	0.08	0.32	24.7	17.5	1.67
Sand & Gravel	0.02	56	0.1	68	63	9.8	0.15	6	0.4	0.11	0.19	20.4	10.2	1.34
Weathered Bedrock	<0.01	91.1	0.41	93	73	17.3	0.04	2	0.6	0.05	0.11	41.4	22.5	1.32
Duplicate														
Weathered Bedrock	<0.01	91	0.39	91	73	15.8	0.06	2	0.5	0.05	0.1	42.7	22.3	1.11
QC														
CH4	0.69	7.7	0.23	80	208	13.6	2.14	8	0.1	0.55	1.16	26.6	23.1	2.62
Certified Values	0.73	9.38	0.21	79.27	189.4	9	2.13	8.14	0.11	0.51	1.17	28.18	22.8	2.6
Tolerance (%)	13.4	23.3	23.3	13.2	11.3	17.7	10.9	13.1	241.3	19.7	12.1	10.4	11.1	14.8

CLIENT : Lorax
PROJECT : Blackwater (Lorax Project # A302-4)
SGS Project # : 1305
TEST : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : June 24, 2013

Sample ID	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1
Basal Till	6.4	<0.1	0.23	0.04	0.03	11.8	0.1	3.08	0.65	7.6	12.5	0.15	4.1	<1
Sand & Gravel	4.6	<0.1	0.25	0.02	0.02	10.4	0.11	3.45	0.14	9.2	8.3	0.18	4.8	<1
Weathered Bedrock	9.5	0.1	0.39	<0.01	0.03	20.4	0.1	1.32	0.55	7.7	10	<0.05	6.6	<1
Duplicate														
Weathered Bedrock	9.4	0.1	0.35	<0.01	0.03	20.6	0.1	1.21	0.37	7.1	9.8	<0.05	6.4	<1
QC														
CH4	8.7	0.2	0.27	<0.01	0.1	13.8	0.06	2.47	0.22	8.2	65.5	0.25	7.7	2
Certified Values	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57
Tolerance (%)	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6

CLIENT : Lorax
PROJECT : Blackwater (Lorax Project # A302-4)
SGS Project # : 1305
TEST : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : June 24, 2013

Sample ID	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
Basal Till	0.5	<0.05	0.37	<0.05	2.4	0.1	0.6	0.4	9.15	0.7
Sand & Gravel	0.4	<0.05	0.33	<0.05	2.8	0.11	0.63	0.2	8.87	0.7
Weathered Bedrock	0.6	<0.05	0.44	<0.05	3.1	0.02	1.06	0.2	8.89	0.6
Duplicate										
Weathered Bedrock	0.6	<0.05	0.44	<0.05	3.1	0.02	1.08	0.2	8.93	0.7
QC										
CH4	0.6	<0.05	0.26	0.44	2.2	0.39	0.3	3	5.55	0.4
Certified Values	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (%)	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A