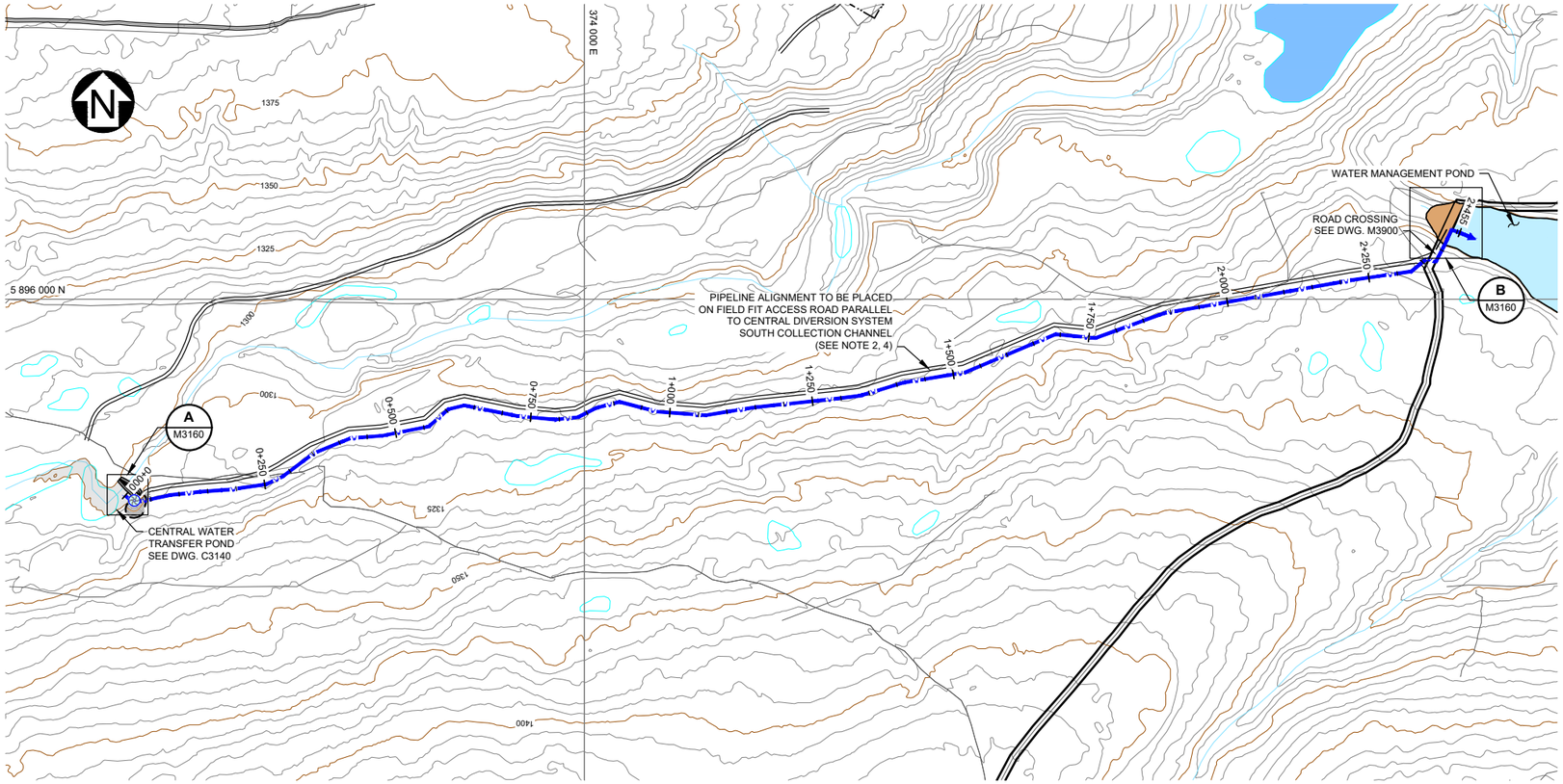
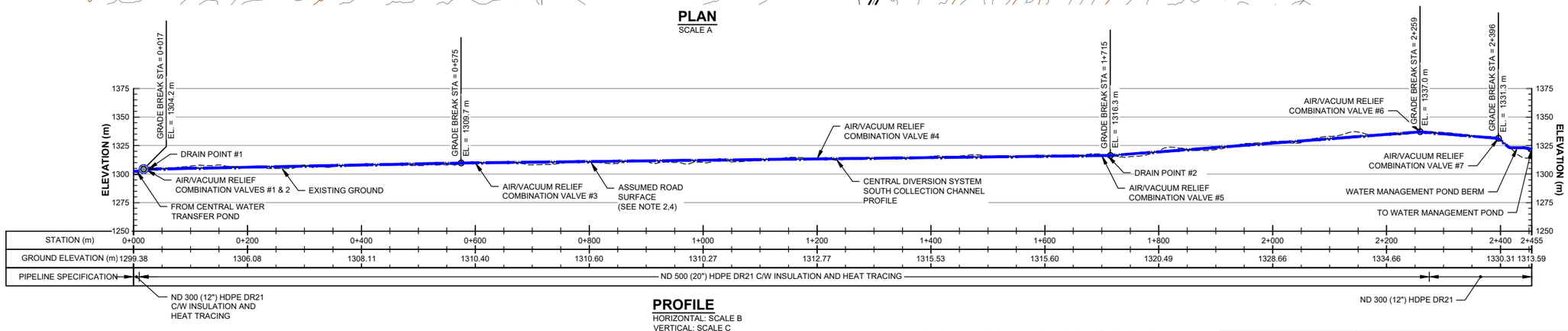
SAVED: M:\1\101\00457\33\A\acad\DWG\M3150_M3160_M3900.dwg 10/29/2021 1:03:02 PM, SCAMMAYO, PRINTED: 10/29/2021 1:04:24 PM, M3150, SCAMMAYO, ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Topo 5m Contours; Fresh Water Reservoir; Hydro; Mine Access Road; Property Boundary; Intake Structure, Option B; Interim Environmental Control Dam; Polishing Pond; Existing Roads & Trails; 2020; Central Diversion Water Transfer Pond, Access and Construction Roads - Central Diversion and Pipelines; IMAGE FILE(S):



PLAN
SCALE A



PROFILE
HORIZONTAL: SCALE B
VERTICAL: SCALE C

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- PUMP STATION
- MINE ACCESS ROAD
- CENTRAL WATER DIVERSION PIPELINE
- EXISTING ACCESS TRAILS
- ACCESS ROAD
- CONSTRUCTION ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. FOR TYPICAL ROAD SECTIONS SEE DWG G0050.
3. SOUTH COLLECTION CHANNEL NOT SHOWN FOR CLARITY, SEE DWG C3130 FOR PLAN AND PROFILE.
4. PIPELINE ACCESS ROAD TO BE GRADED TO ELIMINATE LOCALIZED HIGH/LOW POINTS TO ENCOURAGE FREE DRAINAGE.
5. THE LOCATION OF ALL AIR/VACUUM COMBINATION RELIEF VALVES AND DRAIN POINTS ARE INDICATIVE ONLY. ADDITIONAL VALVE AND DRAIN POINTS MAY BE REQUIRED. AIR/VACUUM RELIEF COMBINATION VALVES ARE REQUIRED AT ALL HIGH POINTS ALONG THE THE PIPELINE ALIGNMENT OR AT A MAXIMUM SPACING OF 600 m. DRAIN POINTS ARE REQUIRED AT ALL LOW POINTS ALONG THE PIPELINE ALIGNMENT. LOCATIONS TO BE CONFIRMED IN THE FIELD.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE C: 40 20 0 40 80 120 160 200 m
SCALE B: 80 40 0 100 200 300 400 m
SCALE A: 100 50 0 100 200 300 400 500 m

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PROFESSIONAL ENGINEER
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2021-10-29

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
PIPELINE
PLAN AND PROFILE

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3150	0

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
G0050	TYPICAL ROAD SECTIONS
C3130	CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - PLAN AND PROFILE
C3140	CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND - PLAN
M3160	CENTRAL DIVERSION SYSTEM - PIPELINE - SECTIONS AND DETAILS
M3900	WATER MANAGEMENT - PIPELINE ROAD CROSSING - TYPICAL DETAILS

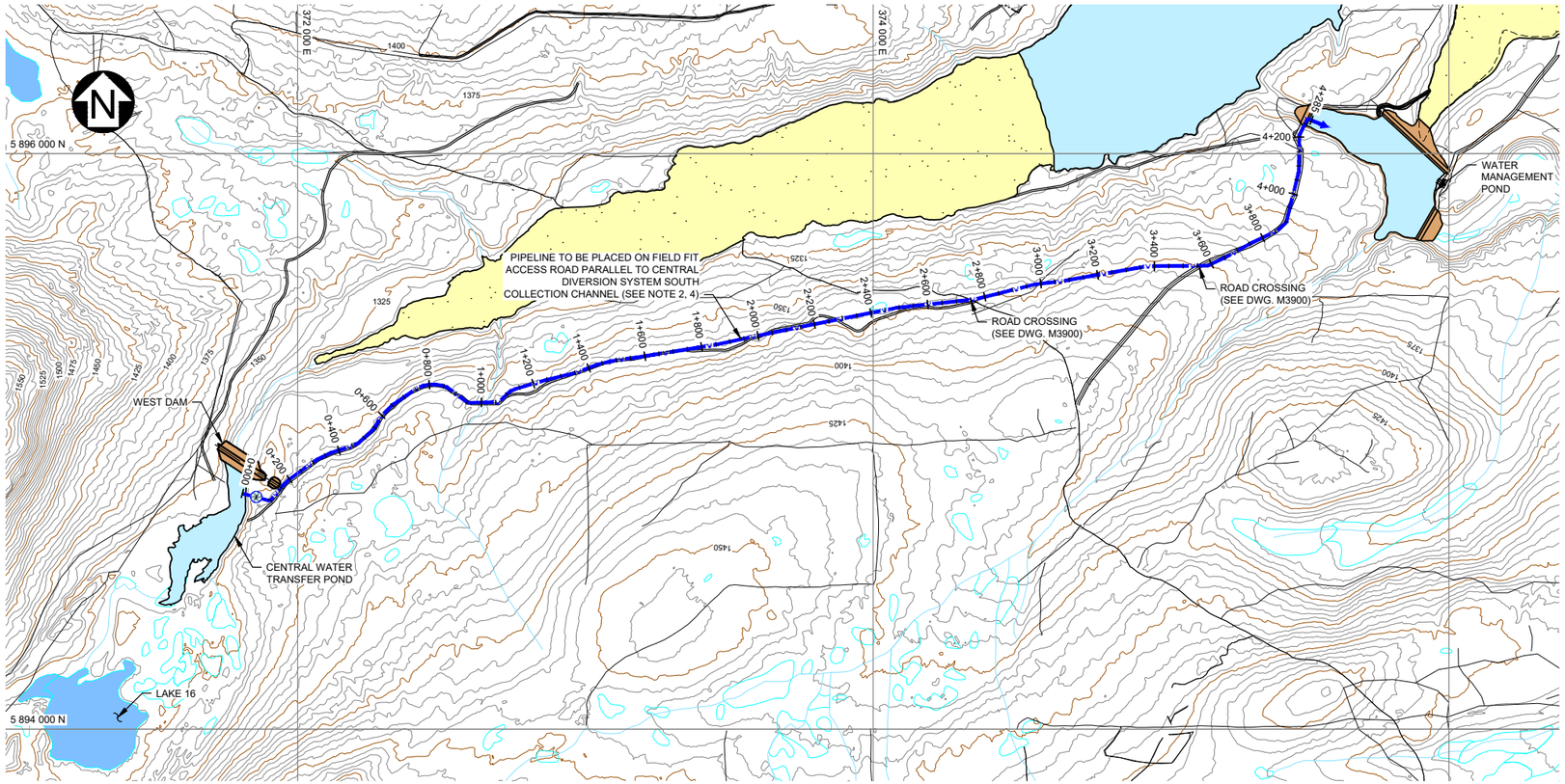
REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

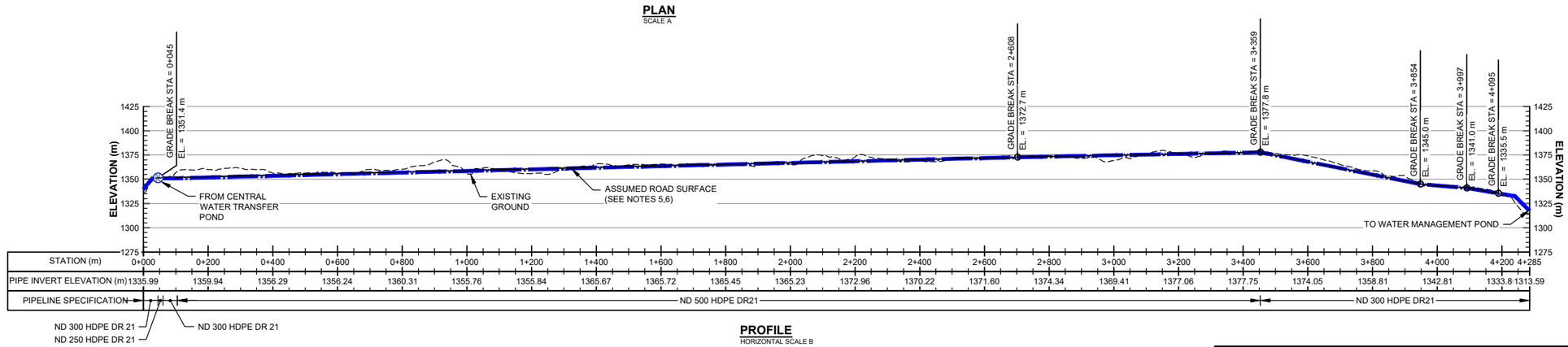
REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	R		

REVISIONS



PLAN
SCALE A



PROFILE
HORIZONTAL SCALE B
VERTICAL SCALE C

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- TAILINGS
- PUMP STATION
- CENTRAL WATER DIVERSION PIPELINE
- EXISTING ACCESS TRAILS
- ACCESS ROAD
- CONSTRUCTION ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. FOR TYPICAL ROAD SECTIONS SEE DWG G0050.
3. SOUTH COLLECTION CHANNEL NOT SHOWN FOR CLARITY, SEE DWG C3135 FOR PLAN AND PROFILE.
4. PIPELINE ACCESS TO BE GRADED TO ELIMINATE LOCALIZED HIGH/LOW POINTS TO ENCOURAGE FREE DRAINING.
5. THE LOCATION OF ALL AIR / VACUUM RELIEF VALVES AND DRAIN POINTS ARE NOT SHOWN. AIR/VACUUM RELIEF COMBINATION VALVES ARE REQUIRED AT ALL HIGH POINTS ALONG THE THE PIPELINE ALIGNMENT OR AT A MAXIMUM SPACING OF 600 m. DRAIN POINTS ARE REQUIRED AT ALL LOW POINTS ALONG THE PIPELINE ALIGNMENT.
6. NORTH COLLECTION CHANNEL NOT SHOWN FOR CLARITY. SEE DWG. C3115 FOR DETAILS.

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE C 50 25 0 50 100 150 200 250 m
SCALE B 150 75 0 250 500 750 m
SCALE A 100 50 0 100 200

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2021-11-15

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT CENTRAL DIVERSION SYSTEM PIPELINE PLAN AND PROFILE YEAR 7

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3151	0

DRG. NO.	DESCRIPTION
C3115	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH COLLECTION CHANNEL - PLAN AND PROFILE - YEAR 7
C3135	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - PLAN AND PROFILE - YEAR 7
G0006	CIVIL GENERAL NOTES
G0050	TYPICAL ROADS SECTIONS
M3900	WATER MANAGEMENT - PIPELINE ROAD CROSSING - TYPICAL DETAILS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DES
0	15NOV'21	ISSUED FOR PERMITTING	M

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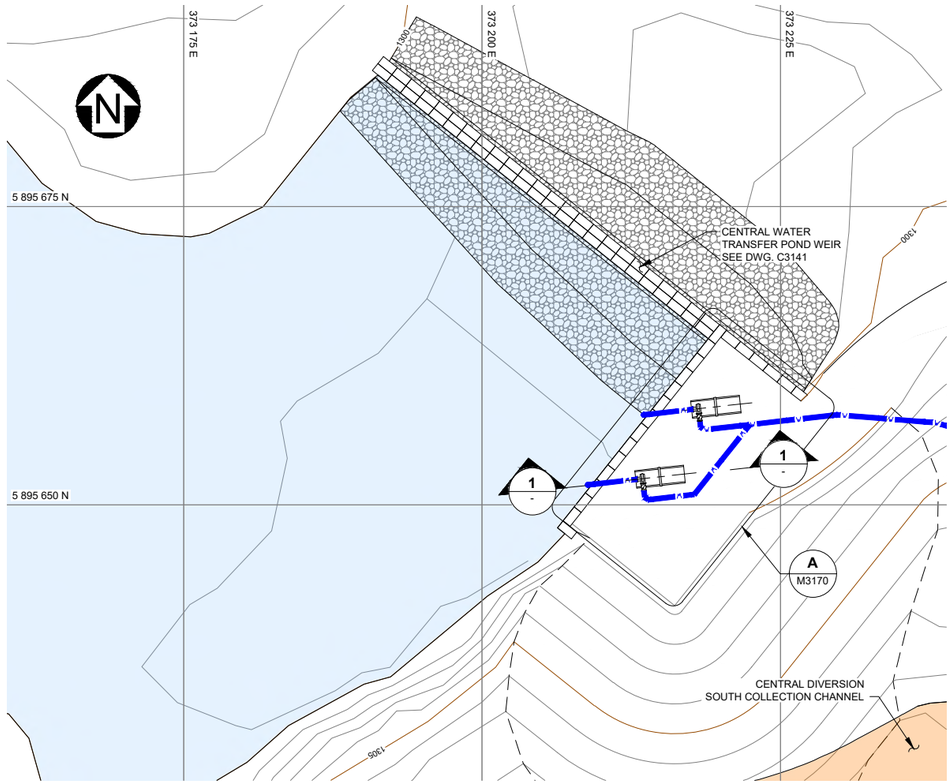
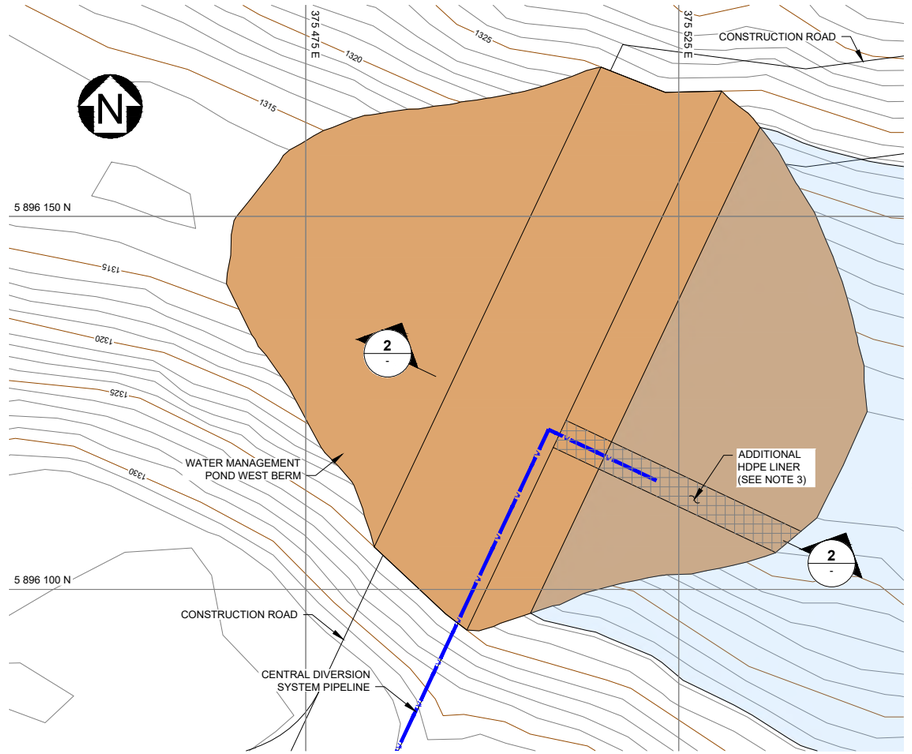
XREF FILE(S): Topo 5m Contours; Fresh Water Reservoir; Hydro; Mine Access Road; PropertyBoundary; Intake Structure_Option B; Interim Environmental Control Dam; Polishing Pond; YR13 Mine Objects; Plant Site Facility - 20210122; YR08 Mine Objects; Site C Embankment - YEAR 8; West Dam - Stage 2; Access and Construction Roads - Central Diversion and Pipelines; Existing Roads & Trails_2020 IMAGE FILE(S):



A M3150 DETAIL
CENTRAL DIVERSION SYSTEM INTAKE
SCALE C



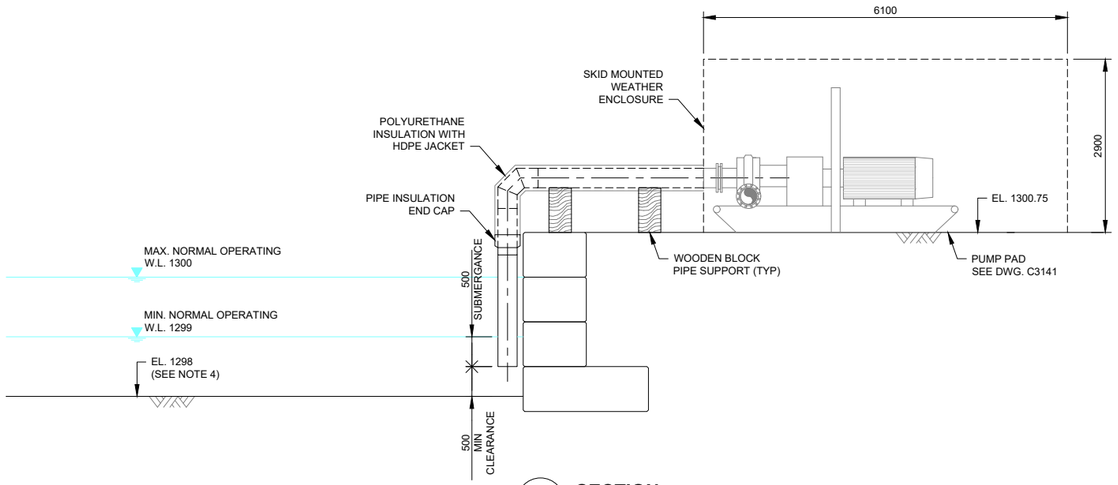
B M3150 DETAIL
CENTRAL DIVERSION SYSTEM OUTLET
SCALE A

LEGEND:

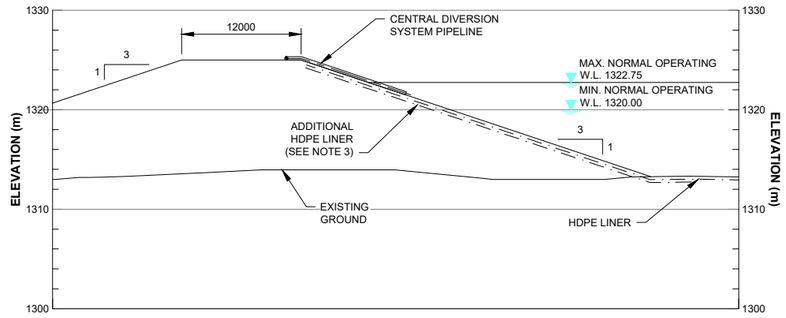
- CENTRAL DIVERSION SYSTEM PIPELINE
- HDPE LINER
- WATER
- HDPE LINER
- EMBANKMENT FILL
- ACCESS ROAD
- CONSTRUCTION ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. PIPE ANCHORS TO COUNTERACT BUOYANCY FORCES ON THE PIPE DURING CONSTRUCTION, COMMISSIONING AND OPERATIONS.
3. ADDITIONAL HDPE LINER WEAR SHEET UNDER DISCHARGE PIPE TO BE WELDED TO PRIMARY LINER.
4. POND BED TO BE EXCAVATED AND/OR DREDGED AS NEEDED TO MAINTAIN SUFFICIENT CLEARANCE FROM SUCTION LINES.



1 - SECTION
SCALE D



2 - SECTION
WATER MANAGEMENT POND WEST BERM
SCALE B

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE D: 1 0.5 0 1 2 3 4 5 m
SCALE C: 5 2.5 0 5 10 15 20 25 m
SCALE B: 6 3 0 10 20 30 m
SCALE A: 8 4 0 10 20 30 40 m

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
C3141	CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND - SECTIONS AND DETAILS
M3141	CENTRAL DIVERSION SYSTEM - PUMP STATION - SECTION AND DETAIL
M3150	CENTRAL DIVERSION SYSTEM - PIPELINE - PLAN AND PROFILE
M3170	CENTRAL DIVERSION SYSTEM - PUMP STATION - SECTION AND DETAIL

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAW
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PROFESSIONAL ENGINEER
PROVINCE OF
M. J. BARRETT

<original signed by>
2021-10-29

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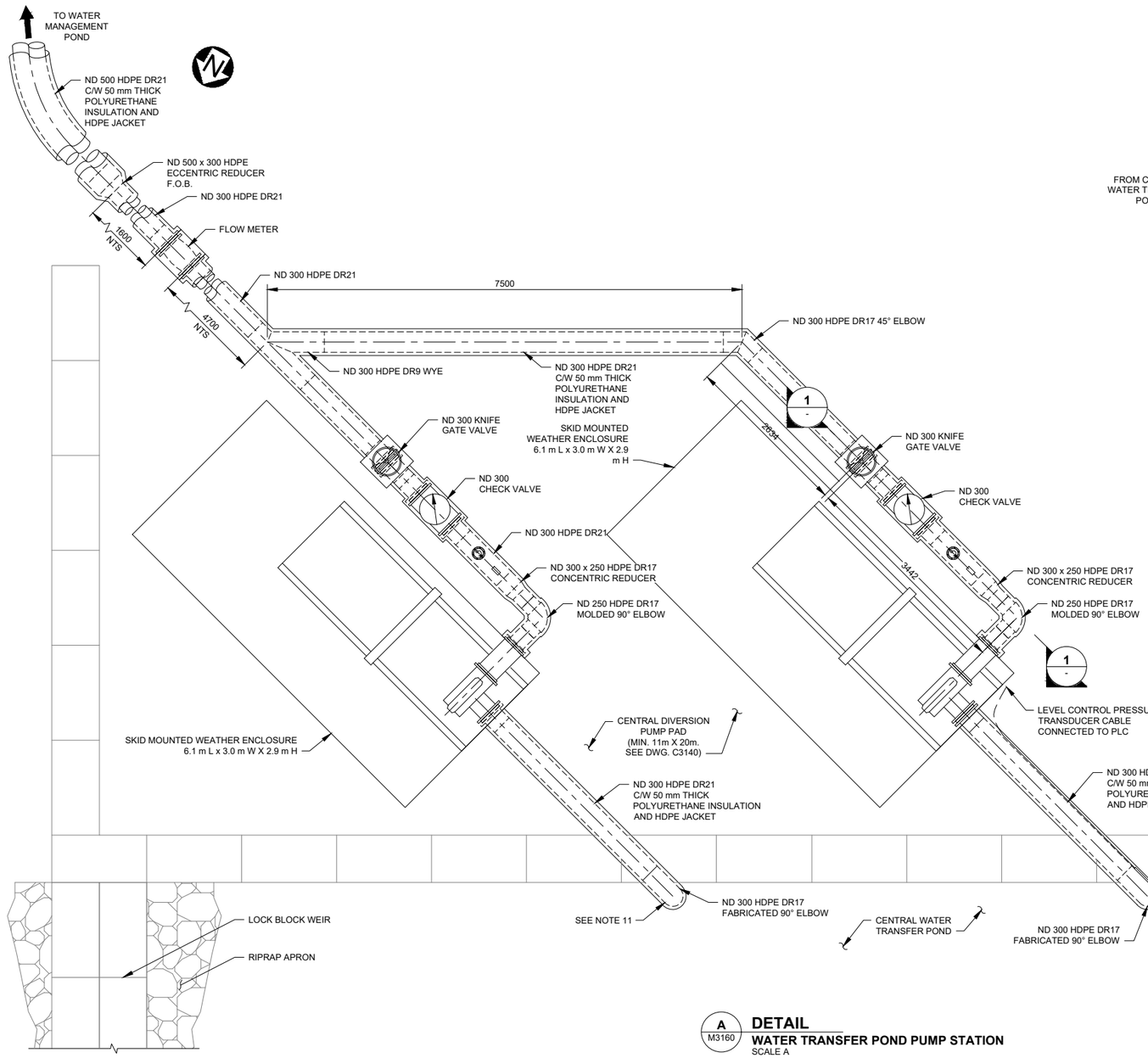
BLACKWATER GOLD PROJECT

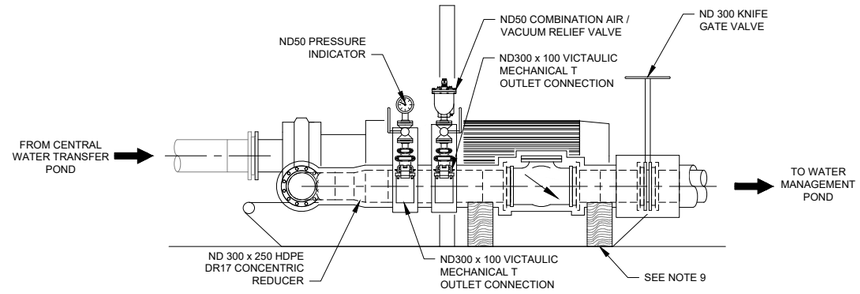
WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM PIPELINE
SECTIONS AND DETAILS

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3160	0

SAVED: M:\1\101\00457\33\A\acad\DWG\M3160\M3160_10/29/2021 1:03:18 PM - SCAMMAYO, PRINTED: 10/29/2021 1:05:09 PM, M3160_SCAMMAYO.ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): topo 1m contours, Polishing Pond, Central Diversion System - Collection Channels (Years -1 to 6), Central Diversion Water Transfer Pond, Access and Construction Roads - Central Diversion and Pipelines, IMAGE FILE(S):



A M3160 **DETAIL**
WATER TRANSFER POND PUMP STATION
SCALE A



1 - **SECTION**
SCALE B

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. ALL VALVES AND FITTINGS ARE CLASS 150 UNLESS SPECIFIED OTHERWISE.
3. MATERIAL PRESSURE RATING IS THE MINIMUM REQUIRED.
4. ALL HDPE MATERIALS ARE TO BE PE4710 AS PER ASTM D3350-06 UNLESS NOTED OTHERWISE.
5. HDPE FLANGE ASSEMBLY INCLUDES: FLANGE ADAPTER & BACK-UP RING.
6. ALL BOLTS ARE TO BE ASTM F3125 GRADE A325 UNLESS NOTED OTHERWISE.
7. ALL NUTS ARE TO BE AS PER ASTM A563A UNLESS NOTED OTHERWISE.
8. ALL GASKETS FOR HDPE ADAPTER FLANGES ARE TO BE INSTALLED AS PER MANUFACTURERS RECOMMENDATIONS.
9. WOODEN SUPPORT BLOCKS TO PROVIDE CLEARANCE FOR FLANGE INSTALLATION/MAINTENANCE.
10. REGRADING AS REQUIRED TO PROVIDE CLEARANCE FOR FLANGE INSTALLATION/MAINTENANCE.
11. SUCTION LINES TO BE EQUIPPED WITH FLOAT MOUNTED DE-ICER.
12. ALL LINES AND FITTINGS OT BE INSULATED AND HEAT TRACED.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE B 0.6 0.3 0 1 2 3 m
SCALE A 0.8 0.4 0 1 2 3 4 m

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
PUMP STATION
SECTION AND DETAIL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA
<original signed by>
2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3170	0

REFERENCE DRAWINGS	
M3160	CENTRAL DIVERSION SYSTEM - PIPELINE - SECTIONS AND DETAILS
C3140	CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND - PLAN
G0006	CIVIL GENERAL NOTES

DRG. NO.	DESCRIPTION

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	R

REVISIONS			
REV	DATE	DESCRIPTION	DESIGNED	DR

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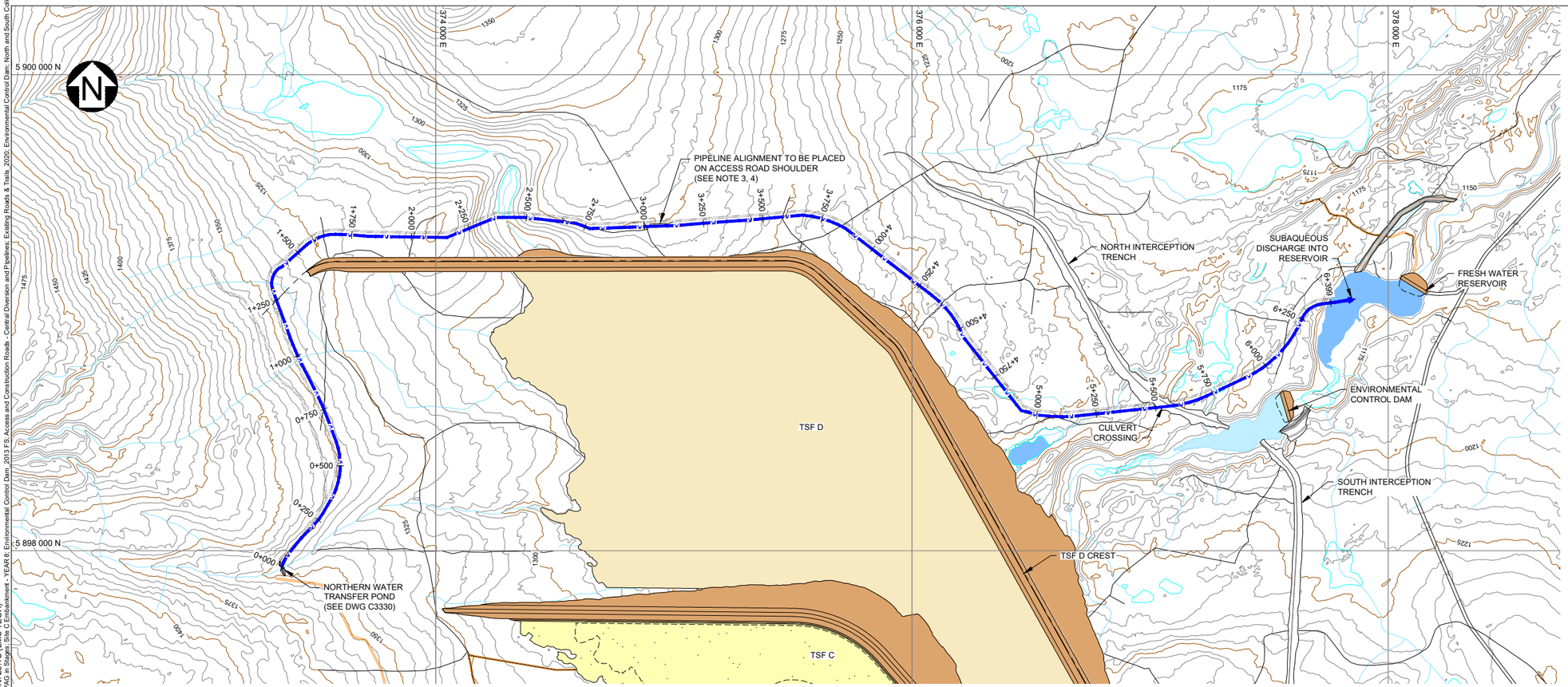
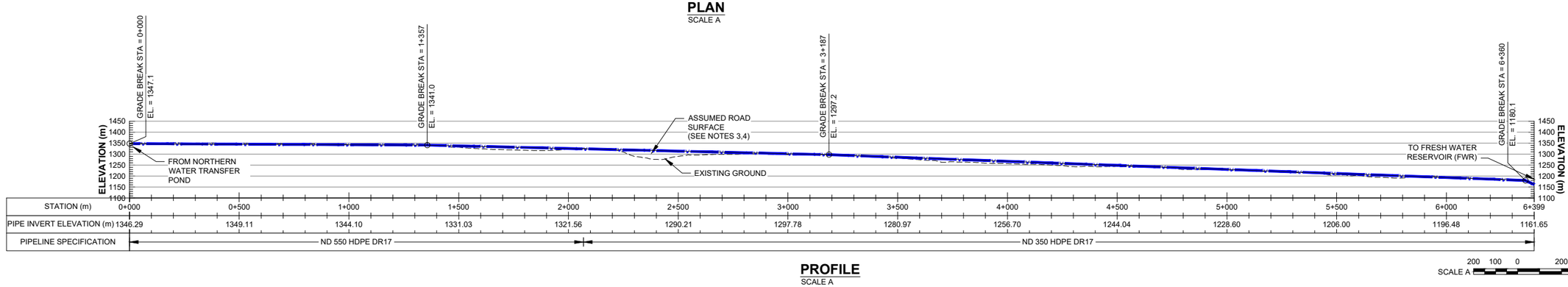


PLAN
SCALE A



PROFILE
SCALE A

LEGEND:

- FRESH WATER
- EMBANKMENT FILL
- TAILINGS
- PAG WASTE
- NORTHERN WATER DIVERSION PIPELINE
- EXISTING ACCESS TRAILS
- ACCESS ROAD
- CONSTRUCTION ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. FOR TYPICAL ROAD SECTIONS SEE DWG G0050.
3. PIPELINE ACCESS ROAD TO BE GRADED TO ELIMINATE LOCALIZED HIGH/LOW POINTS TO ENCOURAGE FREE DRAINING.
4. THE LOCATION OF ALL AIR / VACUUM RELIEF VALVES AND DRAIN POINTS ARE NOT SHOWN. AIR/VACUUM RELIEF COMBINATION VALVES ARE REQUIRED AT ALL HIGH POINTS ALONG THE PIPELINE ALIGNMENT OR AT A MAXIMUM SPACING OF 600 m. DRAIN POINTS ARE REQUIRED AT LOW POINTS ALONG THE PIPELINE ALIGNMENT.
5. NORTHERN DIVERSION SYSTEM COLLECTION CHANNELS NOT SHOWN FOR CLARITY. SEE DWGS. 3310 AND C3320 FOR DETAILS.

200 100 0 200 400 600 800 1000 m
SCALE A

DRG. NO.	DESCRIPTION
C3310	WATER MANAGEMENT - NORTHERN DIVERSION SYSTEM - NORTH COLLECTION CHANNEL - PLAN AND PROFILE - YEAR 7
C3320	WATER MANAGEMENT - NORTHERN DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - PLAN AND PROFILE - YEAR 7
G0006	CIVIL GENERAL NOTES
G0050	TYPICAL ROADS SECTIONS
C3330	NORTHERN DIVERSION - INTAKE STRUCTURE - GENERAL ARRANGEMENT - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
0	15NOV'21	ISSUED FOR PERMITTING	MJB1

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2021-11-15

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT NORTHERN DIVERSION SYSTEM PIPELINE PLAN AND PROFILE

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3350	0

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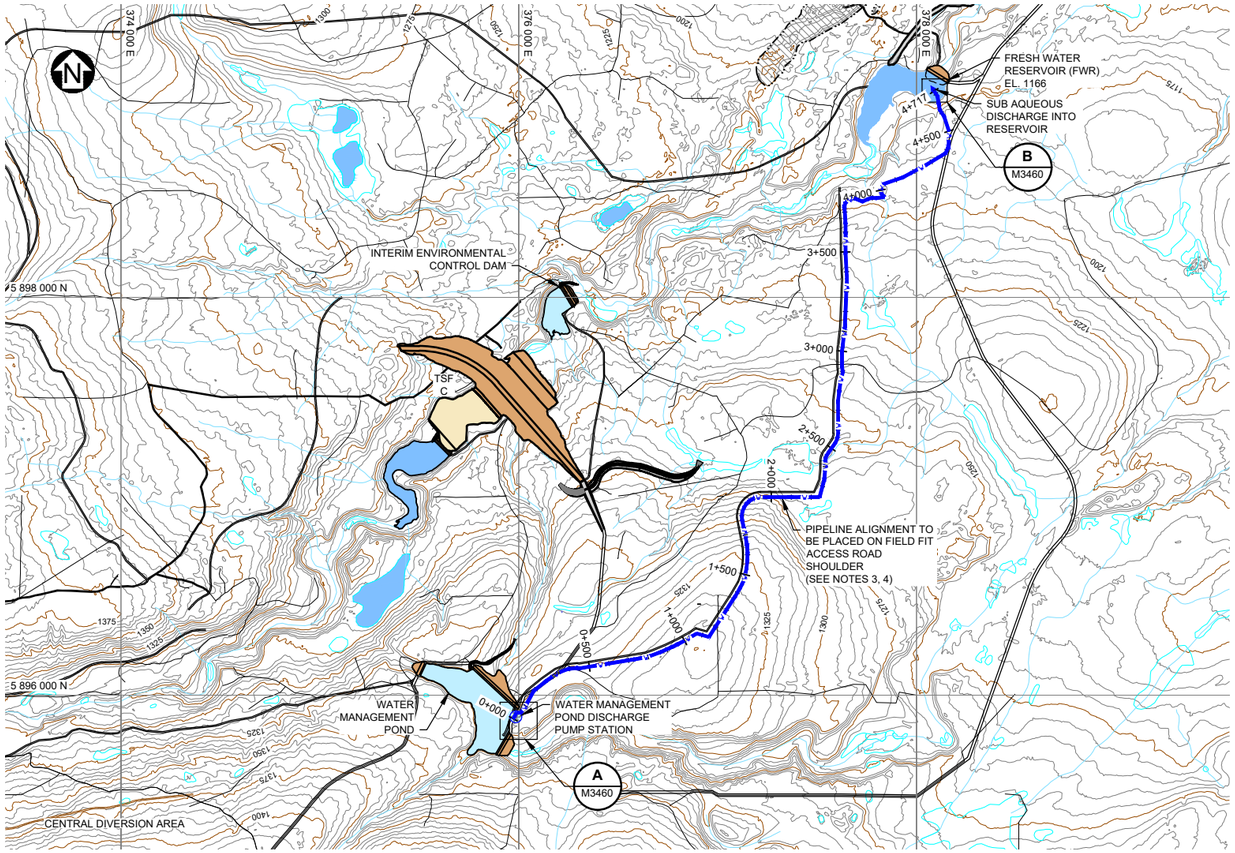
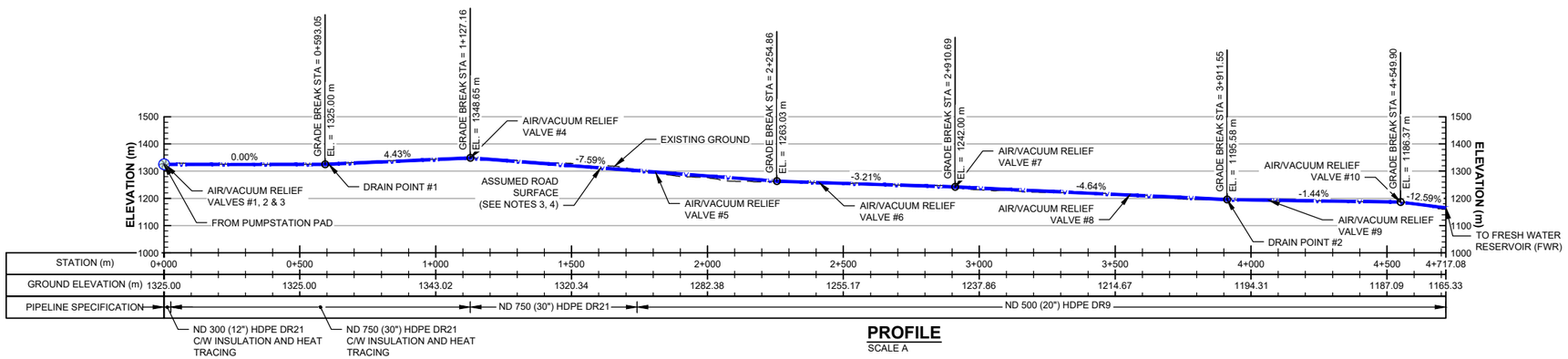
XREF FILE(S): 1 Topo 5m Contours; Fresh Water Reservoir; Hydro; Mine Access Road; PropertyBoundary; Intake Structure_Option B; Interim Environmental Control Dam; Site D Embankment and PAG in Stages; Site C Embankment - YEAR 8; Environmental Control Dam, 2013 FS; Access and Construction Roads - Central Diversion and Pipelines; Existing Roads & Trails, 2020; Environmental Control Dam; North and South Collection Trenches



PLAN
SCALE A



PROFILE
SCALE A

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- TAILINGS
- PAG WASTE
- PUMP STATION
- WATER MANAGEMENT POND DISCHARGE PIPELINE
- EXISTING ACCESS TRAILS
- ACCESS ROAD
- CONSTRUCTION ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. FOR TYPICAL ROAD SECTIONS SEE DWG G0050.
3. PIPELINE ACCESS ROAD TO BE GRADED TO ELIMINATE LOCALIZED HIGH/LOW POINTS TO ENCOURAGE FREE DRAINING.
4. AIR/VACUUM RELIEF COMBINATION VALVES ARE REQUIRED AT ALL HIGH POINTS ALONG THE PIPELINE ALIGNMENT OR AT A MAXIMUM SPACING OF 600 m. DRAIN POINTS ARE REQUIRED AT LOW POINTS ALONG THE PIPELINE ALIGNMENT.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE B 200 100 0 200 400 600 800 1000 m
SCALE A 300 150 0 500 1000 1500 m

DRG. NO.	DESCRIPTION
M3460	WATER MANAGEMENT POND - DISCHARGE SYSTEM - PIPELINE - SECTIONS AND DETAILS
G0050	TYPICAL ROADS SECTIONS
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1

REVISIONS

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PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA
<original signed by>
2021-10-29

Knight Piésold CONSULTING

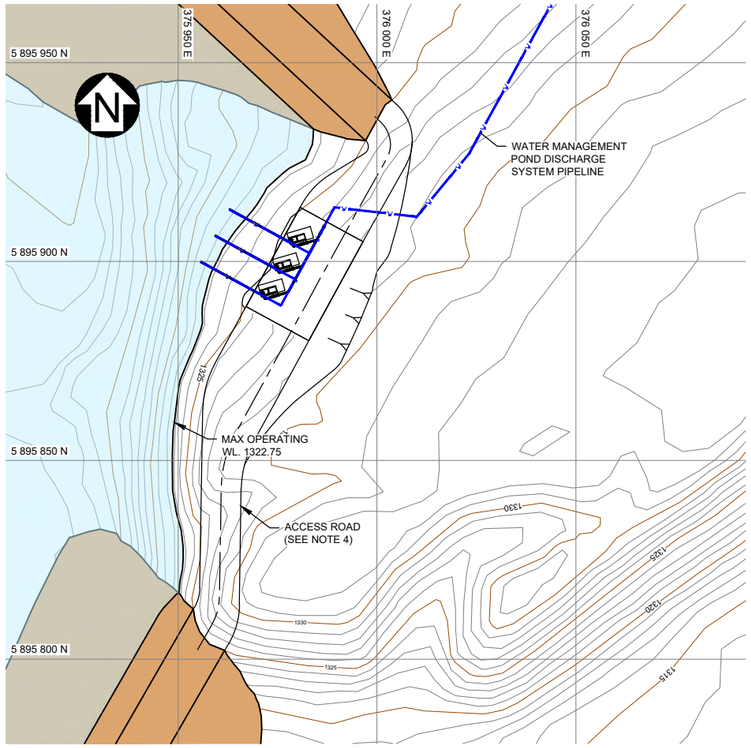
BW GOLD LTD.

BLACKWATER GOLD PROJECT

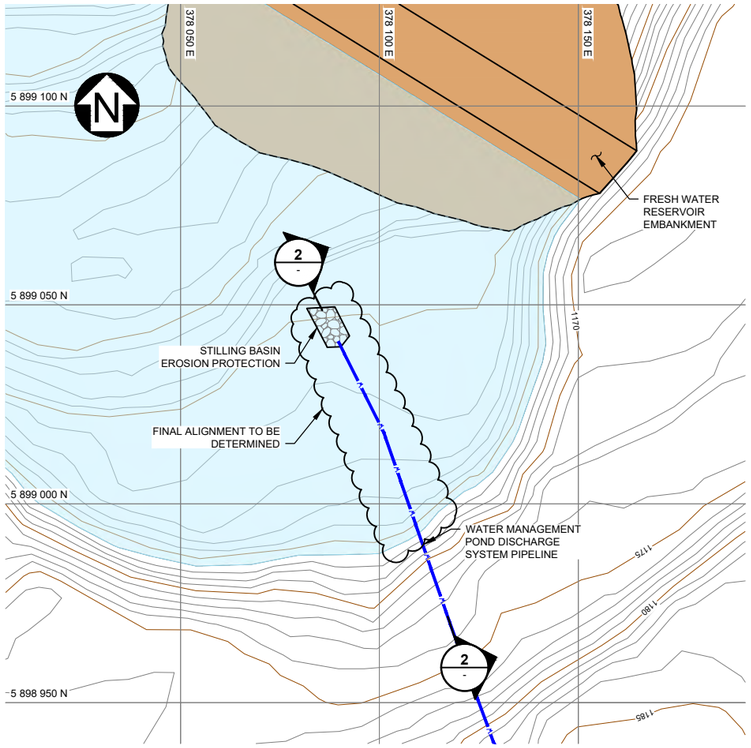
WATER MANAGEMENT WMP DISCHARGE SYSTEM PIPELINE PLAN AND PROFILE

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3450	0

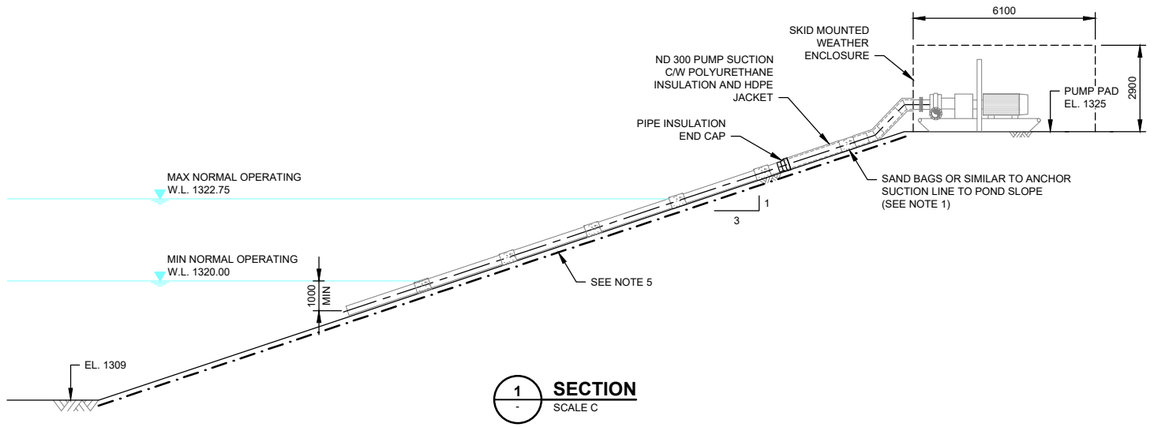
SAVED: M:\1\101\00457\33\A\cad\dwgs\M3450\M3450_10-29-2021 3-20-43 PM_ELEE PRINTED: 10/29/2021 3:35:01 PM, M3450_ELEE ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Topo 5m Contours; Fresh Water Reservoir; Hydro; Mine Access Road; PropertyBoundary; Intake Structure_Option B; Interim Environmental Control Dam; Polishing Pond; YR08 Mine Objects; Site C Embankment - YEAR -1; Site C PAG - Year -1; Stage 1 diversion berm - Spillway EL 1230; Existing Roads & Trails_2020; Access and Construction Roads - Central Diversion and Pipelines IMAGE FILE(S):



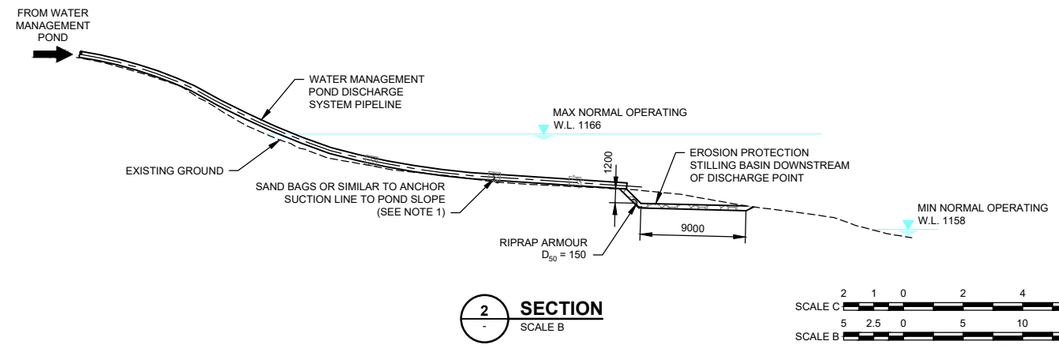
PLAN
WATER MANAGEMENT POND INTAKE PUMPS
SCALE A



PLAN
FRESH WATER RESERVOIR
SCALE A



1 SECTION
SCALE C



2 SECTION
SCALE B

SCALE C: 2 1 0 2 4 6 8 10 m
SCALE B: 5 2.5 0 5 10 15 20 25 m
SCALE A: 15 7.5 0 25 50 75 m

LEGEND:
- WATER MANAGEMENT POND DISCHARGE SYSTEM PIPELINE
- WATER
- EMBANKMENT FILL
- RIPRAP
- HDPE LINER

NOTES:
1. FOR GENERAL NOTES SEE DWG G0006.
2. PIPE ANCHORS TO COUNTERACT BUOYANCY FORCES ON THE PIPE DURING CONSTRUCTION, COMMISSIONING AND OPERATIONS.
3. CONTOUR INTERVAL IS 1 METRE.
4. SCHEMATIC REPPRESENTATION OF ACCESS ROAD ONLY. ROAD DESIGN TO BE DETERMINED. SEE DRAWING G0050 FOR TYPICAL ROAD SECTIONS.
5. ADDITION OF HDPE LINER SECURED WITH STAKES AS REQUIRED TO PREVENT EROSION OF SLOPE.

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DETAILED DESIGN
NOT FOR CONSTRUCTION

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2021-10-29

Knight Piésold CONSULTING

BW GOLD LTD.

BLACKWATER GOLD PROJECT

WATER MANAGEMENT
WMP DISCHARGE SYSTEM
PIPELINE
SECTIONS AND DETAILS

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3460	0

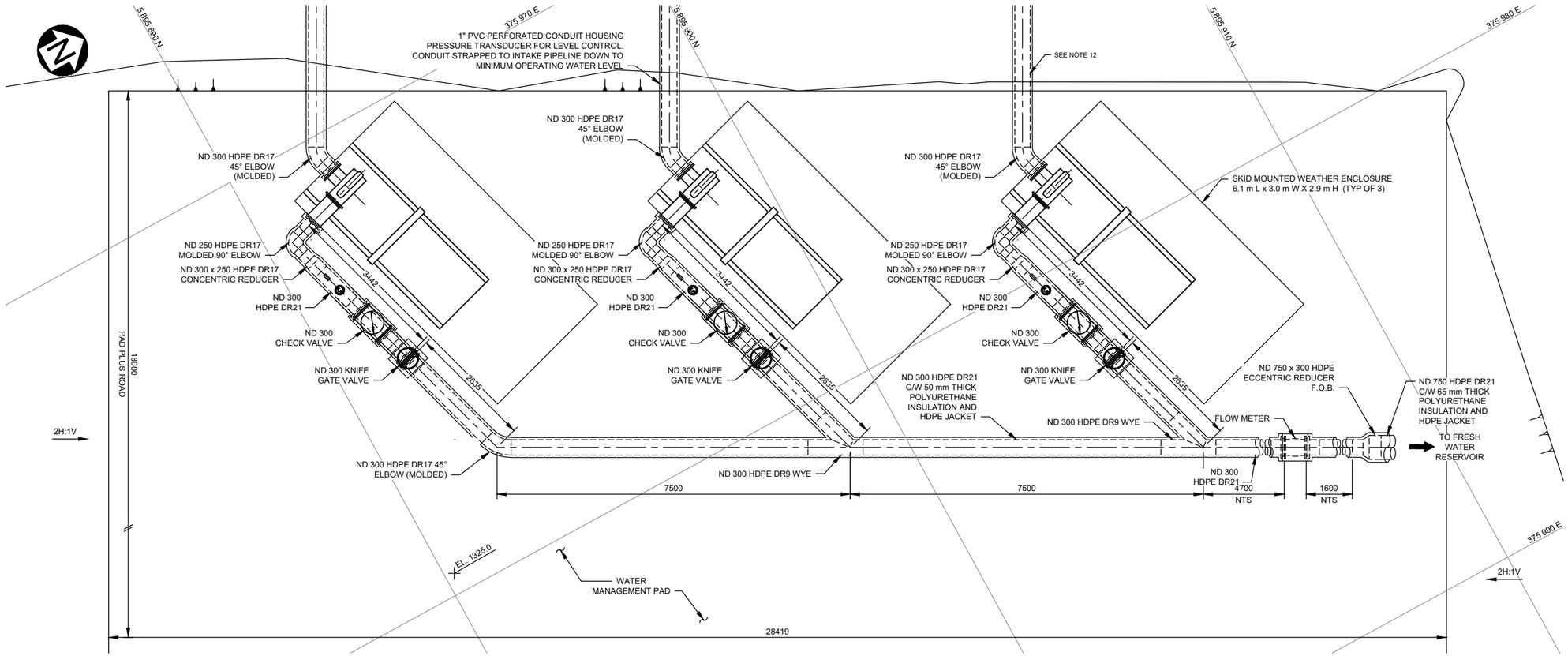
REFERENCE DRAWINGS	
M3470	WATER MANAGEMENT - WMP DISCHARGE SYSTEM - PUMP STATION - SECTION AND DETAIL
G0050	TYPICAL ROAD SECTIONS
G0006	CIVIL GENERAL NOTES

DRG. NO.	DESCRIPTION

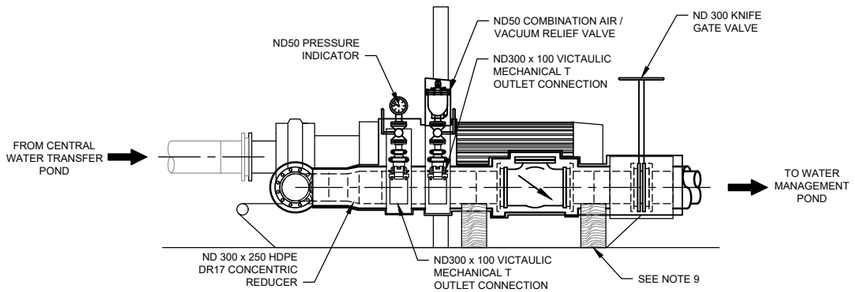
REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED	D

REVISIONS				
REV	DATE	DESCRIPTION	DESIGNED	D
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	

SAVED: M:\101\100\457\3\A\cad\DWGS\M3460\M3460_10/29/2021 3:46:34 PM - RMCLELLAN PRINTED: 10/29/2021 3:56:36 PM, M3460, RMCLELLAN ACAD VERSION: 23.0S (LMS TECH)
XREF FILE(S): topo 1m contours; Polishing Pond; Central Diversion System - Collection Channels (Years -1 to 6); Fresh Water Reservoir (IMAGE FILE(S);



A M3160 **DETAIL**
WATER MANAGEMENT POND
DISCHARGE PUMP STATION
SCALE A



1 - **SECTION**
SCALE B

NOTES:

1. SEE DWG. G0006 FOR GENERAL NOTES.
2. ALL VALVES AND FITTINGS ARE CLASS 150 UNLESS SPECIFIED OTHERWISE.
3. MATERIAL PRESSURE RATING IS THE MINIMUM REQUIRED.
4. ALL HDPE MATERIALS ARE TO BE PE4710 AS PER ASTM D3350-06 UNLESS NOTED OTHERWISE.
5. HDPE FLANGE ASSEMBLY INCLUDES: FLANGE ADAPTER & BACK-UP RING.
6. ALL BOLTS ARE TO BE ASTM F3125 GRADE A325 UNLESS NOTED OTHERWISE.
7. ALL NUTS ARE TO BE AS PER ASTM A563A UNLESS NOTED OTHERWISE.
8. ALL GASKETS FOR HDPE ADAPTER FLANGES ARE TO BE INSTALLED AS PER MANUFACTURERS RECOMMENDATIONS.
9. WOODEN SUPPORT BLOCKS TO PROVIDE CLEARANCE FOR FLANGE INSTALLATION/MAINTENANCE.
10. REGRADING AS REQUIRED TO PROVIDE CLEARANCE FOR FLANGE INSTALLATION/MAINTENANCE.
11. SUCTION LINES TO BE EQUIPPED WITH FLOAT MOUNTED DE-ICERS.
12. ALL LINES AND FITTINGS TO BE INSULATED AND HEAT TRACED.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE B 0.6 0.3 0 1 2 3 m
SCALE A 1 0.5 0 1 2 3 4 5 m

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2021-10-29

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
WMP DISCHARGE SYSTEM
PUMP STATION
SECTION AND DETAIL

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3470	0

DRG. NO.	DESCRIPTION
M3160	CENTRAL DIVERSION SYSTEM - PIPELINE - SECTIONS AND DETAILS
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

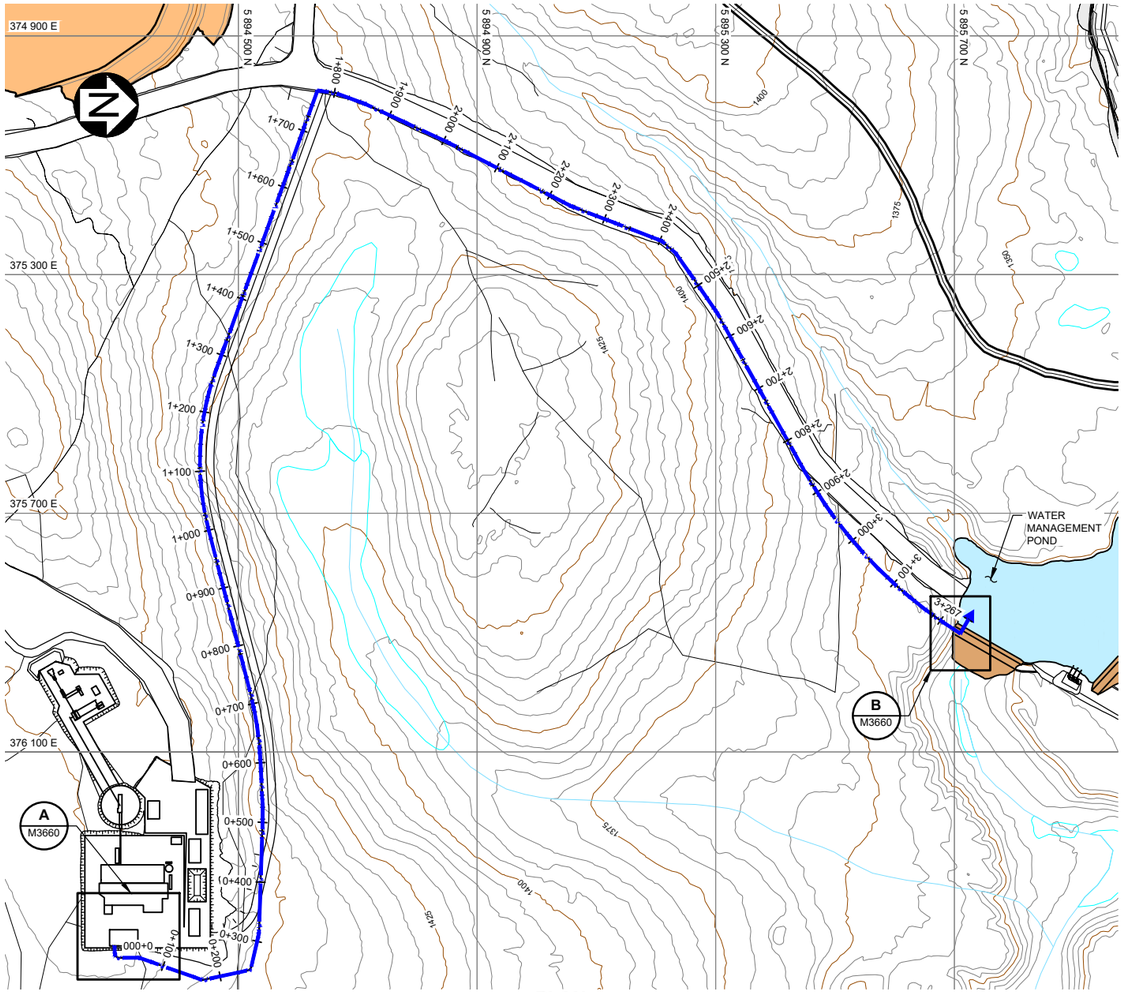
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

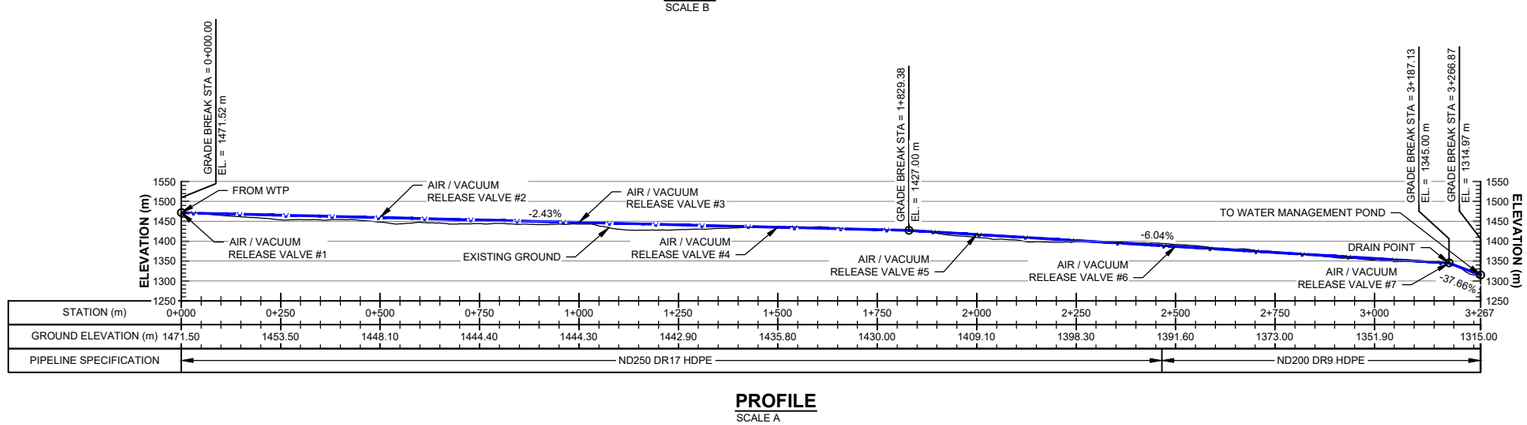
REV	DATE	DESCRIPTION	DESIGNED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1

REVISIONS

SAVED: M:\101\00457\33\A\acad\DWG\SM3470\M3470, 10/29/2021 1:10:18 PM, SCAMMAYO PRINTED: 10/29/2021 1:10:33 PM, M3470, SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Polishing Pond IMAGE FILE(S):



PLAN
SCALE B



PROFILE
SCALE A

LEGEND:

- FRESH WATER
- EMBANKMENT FILL
- WTP DISCHARGE SYSTEM PIPELINE
- EXISTING ACCESS TRAILS
- ACCESS ROAD
- CONSTRUCTION ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. FOR TYPICAL ROAD SECTIONS SEE DWG G0050.
3. PIPELINE ACCESS ROAD TO BE GRADED TO ELIMINATE LOCALIZED HIGH/LOW POINTS TO ENCOURAGE FREE DRAINING.
4. THE LOCATIONS OF ALL AIR/VACUUM RELIEF VALVES AND DRAIN POINTS ARE INDICATIVE ONLY. ADDITIONAL VALVES AND DRAIN POINTS MAY BE REQUIRED. AIR/VACUUM RELIEF COMBINATION VALVES ARE REQUIRED AT ALL HIGH POINTS ALONG THE PIPELINE ALIGNMENT OR AT A MAXIMUM SPACING OF 600 m. DRAIN POINTS ARE REQUIRED AT ALL LOW POINTS ALONG THE PIPELINE ALIGNMENT. LOCATIONS TO BE CONFIRMED IN THE FIELD.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE B: 100 50 0 100 200 300 400 500 m
SCALE A: 150 75 0 250 500 750 m

REFERENCE DRAWINGS	
G0006	CIVIL GENERAL NOTES
G0050	TYPICAL ROADS SECTIONS
M3660	WATER MANAGEMENT - WATER TREATMENT PLANT - DISCHARGE SYSTEM - ALIGNMENT AND PROFILE
M3900	WATER MANAGEMENT - PIPELINE ROAD CROSSING - TYPICAL DETAILS

DRG. NO.	DESCRIPTION

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	EL

REVISIONS				
REV	DATE	DESCRIPTION	DESIGNED	DRAW

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2021-10-29

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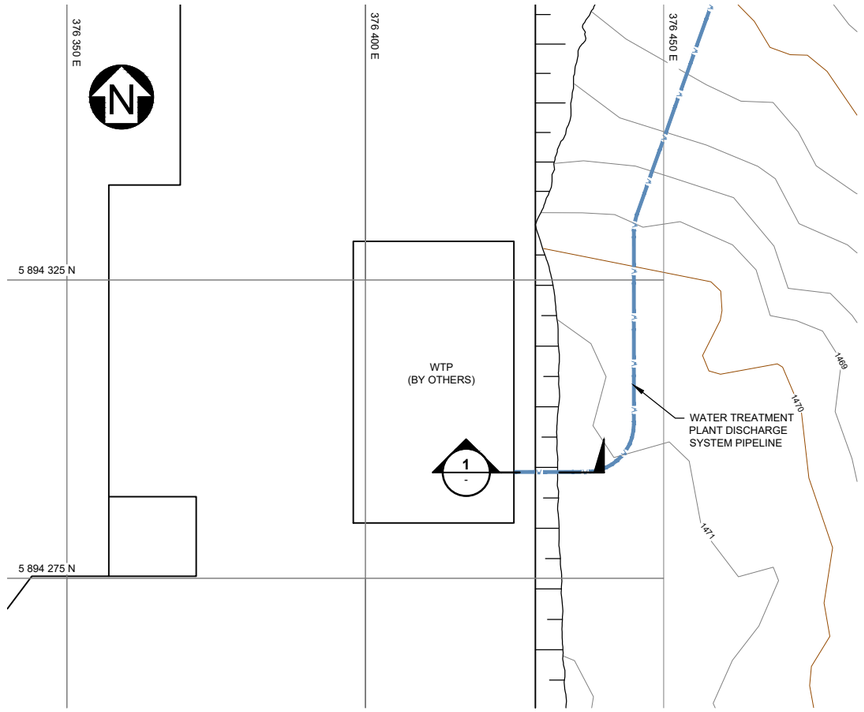
BLACKWATER GOLD PROJECT

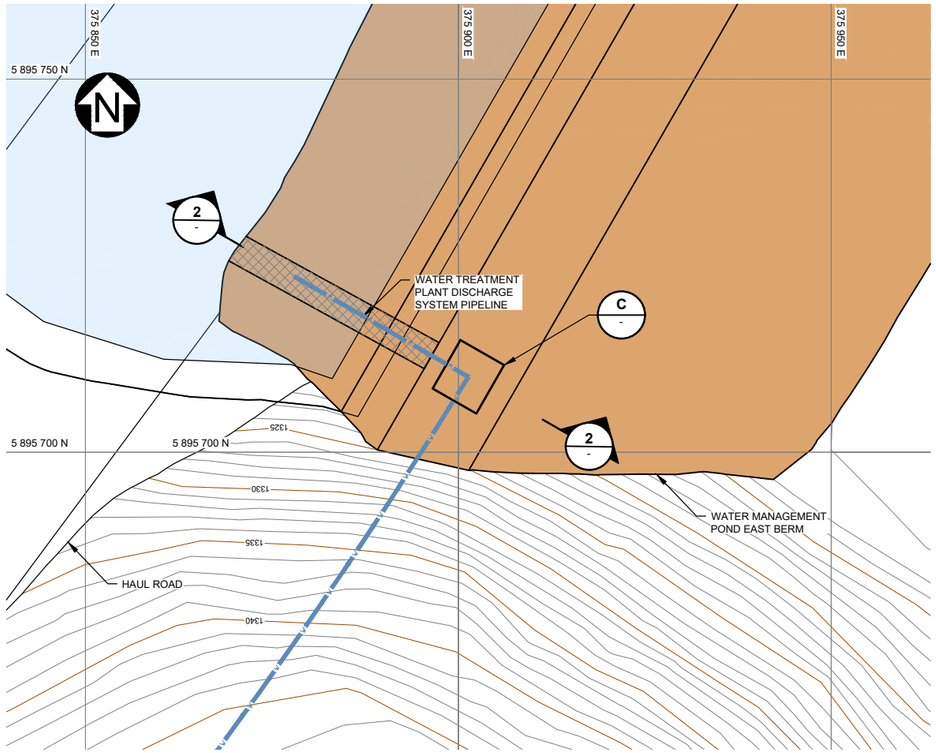
WATER MANAGEMENT METALS WATER TREATMENT PLANT DISCHARGE SYSTEM ALIGNMENT AND PROFILE

A NO.	DRAWING NO.	REVISION
VA101-457/33	M3650	0

SAVED: M:\1\101004573\3\Acad\DWG\M3650\M3650_10-29-2021_1_29-27 PM_SCAMMAYO_PRINTED: 10/29/2021 2:57:19 PM, M3650_RMC\LELAN ACAD VERSION: 23.0S (LMS TECH)
XREF FILE(S): Topo 5m Contours; Central Diversion System - Collection Channels (Years -1 to 6); Polishing Pond; YR00 Mine Objects; Hydro Access and Construction Roads - Central Diversion and Pipelines; Existing Roads & Trails 2020 IMAGE FILE(S): BW Process Plant General Arrangement17893e7b



A M3650 **DETAIL**
WATER TREATMENT PLANT DISCHARGE
SCALE A



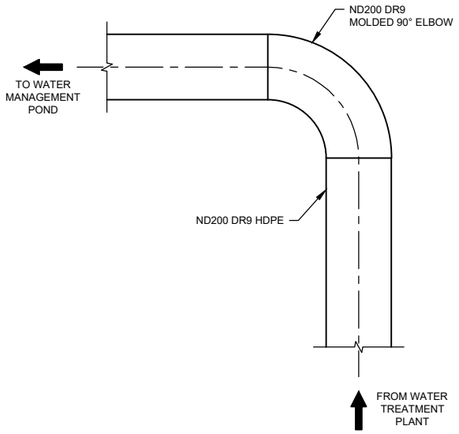
B M3650 **DETAIL**
WATER MANAGEMENT POND BERM
SCALE A

LEGEND:

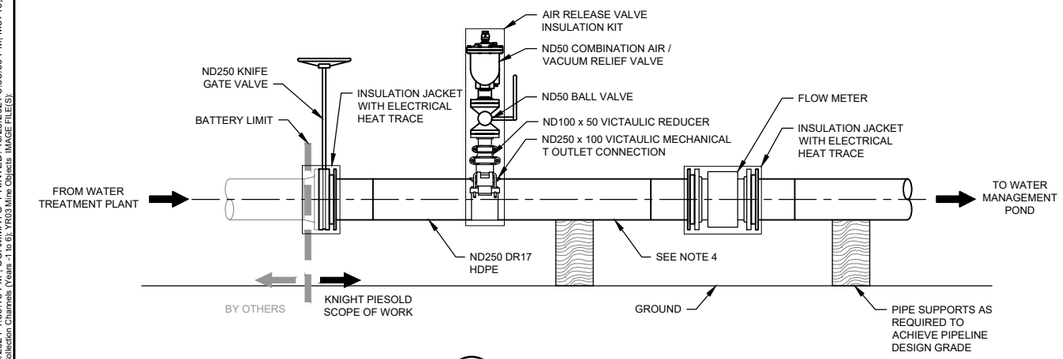
- CENTRAL DIVERSION SYSTEM PIPELINE
- HDPE LINER
- WATER
- HDPE LINER
- EMBANKMENT

NOTES:

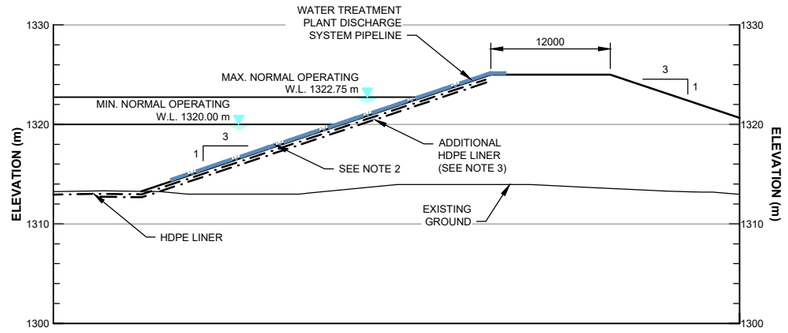
1. FOR GENERAL NOTES SEE DWG G0006.
2. PIPE ANCHORS TO COUNTERACT BUOYANCY FORCES ON THE PIPE DURING CONSTRUCTION, COMMISSIONING AND OPERATIONS.
3. ADDITIONAL HDPE LINER WEAR SHEET UNDER DISCHARGE PIPE TO BE WELDED TO PRIMARY LINER.
4. PIPELINE TO BE GRADED AS PER DRAWING M3650 TO MEET MINIMUM GRAVITY FLOW CAPACITY REQUIREMENTS.



C - **DETAIL**
DISCHARGE POINT ELBOW
SCALE D



1 - **SECTION**
SCALE C



2 - **DETAIL**
WATER MANAGEMENT POND EAST BERM
SCALE B

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE D 0.2 0.1 0 0.2 0.4 0.6 0.8 1 m
SCALE C 0.4 0.2 0 0.4 0.8 1.2 1.6 2.0 m
SCALE B 1 0.5 0 1 2 3 4 5 m
SCALE A 8 4 0 10 20 30 40 m

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
METALS WATER TREATMENT PLANT
DISCHARGE SYSTEM
SECTIONS AND DETAILS

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

<original signed by>

2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3660	0

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
M3650	WATER MANAGEMENT - WATER TREATMENT PLANT - DISCHARGE SYSTEM - ALIGNMENT AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

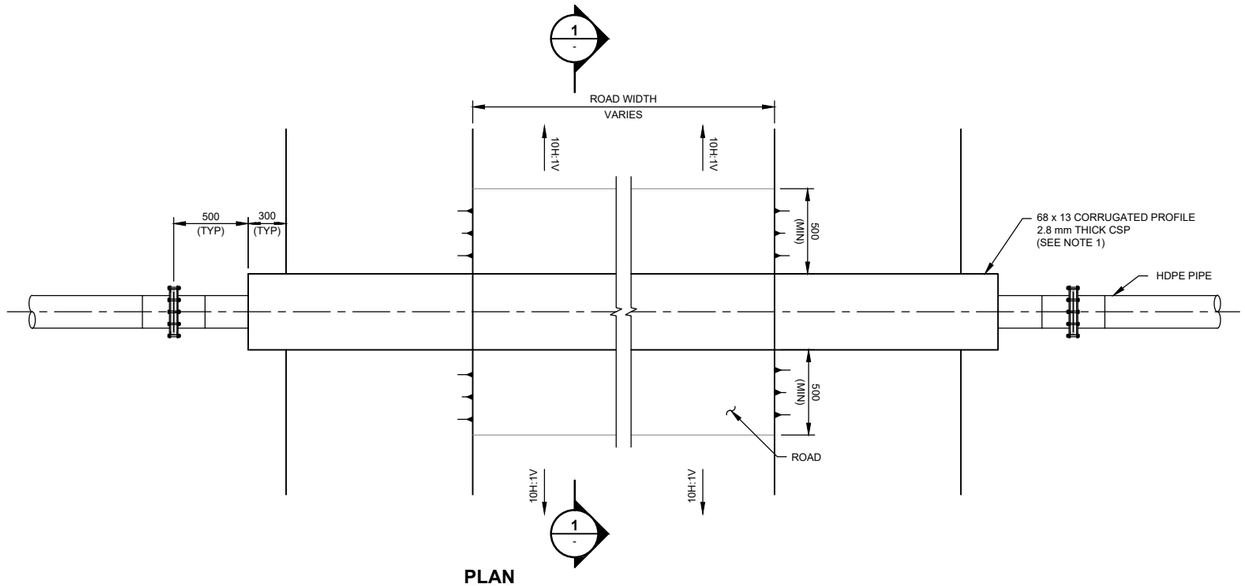
REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1

REVISIONS

SAVED: M:\101\00457\33\A\acad\DWG\M3660\M3660_10/29/2021 1:30:13 PM, SCAMMAYO, PRINTED: 10/29/2021 3:03:00 PM, M3710, RMCLELLAN ACAD VERSION: 23.0S (LMS TECH)
XREF FILE(S): topo 1m contours, Polishing Pond, Central Diversion System - Collection Channels (Yeas -1 to 6), YR03 Mine Objects, IMAGE FILE(S):

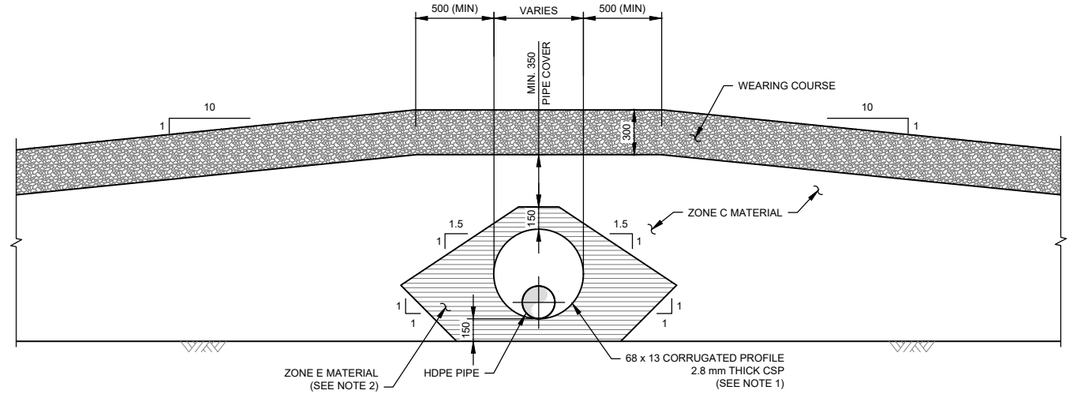
CULVERT DETAILS		
PIPELINE	CHAINAGE	DIAMETER (mm)
CENTRAL DIVERSION SYSTEM (PHASE 1)	0+300	900
CENTRAIL DIVERSION SYSTEM (PHASE 1)	2+300	900
WATER MANAGEMENT POND DISCHARGE SYSTEM	1+250	1,200



PLAN
TYPICAL ROAD CROSSING (A)
PERPENDICULAR TO ROAD ALIGNMENT
SCALE A

LEGEND:

- WEARING COURSE
- ZONE E
- ZONE C



1 - **SECTION**
TYPICAL ROAD CROSSING
SCALE A

NOTES:

1. WHEN TWO PIPELINES CROSS THE ROAD AT THE SAME LOCATION, THE MINIMUM ALLOWABLE SPACING BETWEEN CULVERTS IS 500 mm.
2. FILL MATERIAL NOT TO EXCEED MAXIMUM PARTICLE DIAMETER OF 75 mm. BACKFILL AROUND SIDES AND TOP OF PIPE WITH COVER FILL, COMPACTED IN PLACE WITH HAND-OPERATED PLATE COMPACTOR OR SIMILAR TO AVOID DAMAGING THE PIPE.
3. DESIGN VEHICLE FOR ACCESS ROADS IS CAT 725. DESIGN VEHICLE FOR CONSTRUCTION ROADS IS CAT 777. SEE DWG G0050 FOR TYPICAL ROAD SECTIONS.

DETAILED DESIGN
NOT FOR CONSTRUCTION

400 200 0 400 800 1200 1600 2000 mm
SCALE A

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

WATER MANAGEMENT
PIPELINE ROAD CROSSING
TYPICAL DETAILS

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2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3900	0

REFERENCE DRAWINGS		
DRG. NO.	DESCRIPTION	
G0050	TYPICAL ROADS SECTIONS	

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED	

REVISIONS				
REV	DATE	DESCRIPTION	DESIGNED	DRA
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RM

SAVED: M:\101\00457\33\A\Acad\DWG\SM3900\M3900, 6/25/2021 6:04:18 PM, ELEE PRINTED: 10/29/2021 1:17:43 PM, M3900, SCAMMAYO
XREF FILE(S): infrastructure, Roads (IMAGE FILE(S):

TABLE D.1

BW GOLD LTD.

BLACKWATER GOLD PROJECT

WATER MANAGEMENT STRUCTURES DETAILED DESIGN REPORT

DRAWING LIST

KP DWG No.	Rev.	Revision Date	Package	Drawing Title
G0001	0	15NOV'21	General Series	Title Sheet
G0005	0	15NOV'21	General Series	Legend, Symbols, and Abbreviations
G0006	0	15NOV'21	General Series	Civil General Notes
G0040	0	15NOV'21	General Series	Construction Material Gradations
G0050	0	15NOV'21	General Series	Typical Roads Sections
G0060	0	15NOV'21	General Series	Erosion Protection - Typical Channel Sections
C3100	0	29OCT'21	Water Management	Water Management - Diversion Systems - General Arrangement - Year -1
C3102	0	29OCT'21	Water Management	Water Management - Diversion Systems - General Arrangement - Year 2
C3110	0	29OCT'21	Water Management	Water Management - Central Diversion System - North Collection Channel - Plan and Profile
C3111	0	29OCT'21	Water Management	Water Management - Central Diversion System - North Collection Channel - Cross Sections
C3112	0	29OCT'21	Water Management	Water Management - Central Diversion System - North Collection Channel - Details
C3120	0	29OCT'21	Water Management	Water Management - Central Diversion System - North Diversion Channel - Plan and Profile
C3121	0	29OCT'21	Water Management	Water Management - Central Diversion System - North Diversion Channel - Cross Sections
C3122	0	29OCT'21	Water Management	Water Management - Central Diversion System - North Diversion Channel - Details (Sheet 1 of 2)
C3123	0	29OCT'21	Water Management	Water Management - Central Diversion System - North Diversion Channel - Details (Sheet 2 of 2)
C3130	0	29OCT'21	Water Management	Water Management - Central Diversion System - South Collection Channel - Plan and Profile
C3131	0	29OCT'21	Water Management	Water Management - Central Diversion System - South Collection Channel - Cross Sections
C3132	0	29OCT'21	Water Management	Water Management - Central Diversion System - South Collection Channel - Details
C3140	0	29OCT'21	Water Management	Water Management - Central Diversion System - Water Transfer Pond - Plan
C3141	0	29OCT'21	Water Management	Water Management - Central Diversion System - Water Transfer Pond - Sections and Details
C3160	0	29OCT'21	Water Management	Water Management - Central Diversion System - Minor Diversion Ditches
C3440	0	15NOV'21	Water Management	Water Management - Stilling Basin - Typical Sections and Details
C4001	0	15NOV'21	Water Management	Fresh Water Reservoir - Embankment and Reservoir - General Arrangement
C4100	0	15NOV'21	Water Management	Fresh Water Reservoir - Embankment - Construction Sequence
C4200	0	15NOV'21	Water Management	Fresh Water Reservoir - Overflow Spillway - Plan and Profile
C4201	0	15NOV'21	Water Management	Fresh Water Reservoir - Overflow Spillway - Sections
C4300	0	15NOV'21	Water Management	Fresh Water Reservoir - Embankment - Plan
C4301	0	15NOV'21	Water Management	Fresh Water Reservoir - Embankment - Profile and Section
C4310	0	15NOV'21	Water Management	Fresh Water Reservoir - Outlet Pipes - Profile and Sections
C4311	0	15NOV'21	Water Management	Fresh Water Reservoir - Low Level and Surface Level Intakes - Plan and Section
C4312	0	15NOV'21	Water Management	Fresh Water Reservoir - Low Level and Surface Level Intakes - Details
C4401	0	15NOV'21	Water Management	Fresh Water Reservoir - Flow Control Chamber - Plan, Section and Detail
M3050	0	29OCT'21	Water Management	Water Management - Diversion Piping Systems - General Arrangement - Year -1
M3060	0	29OCT'21	Water Management	Water Management - Diversion Piping Systems - Piping and Intrumentation Diagram - Year -1
M3150	0	29OCT'21	Water Management	Central Diversion System - Pipeline - Plan and Profile
M3160	0	29OCT'21	Water Management	Central Diversion System - Pipeline - Sections and Details
M3170	0	29OCT'21	Water Management	Central Diversion System - Pump Station - Section and Detail
M3450	0	29OCT'21	Water Management	Water Management Pond - Discharge System - Pipeline - Plan and Profle
M3460	0	29OCT'21	Water Management	Water Management Pond - Discharge System - Pipeline - Sections and Details
M3470	0	29OCT'21	Water Management	Water Management Pond - Discharge System - Pump Station - Section and Detail
M3650	0	29OCT'21	Water Management	Water Management - Water Treatment Plant Discharge System - Alignment and Profile
M3660	0	29OCT'21	Water Management	Water Management - Water Treatment Plant Discharge System - Sections and Details
M3900	0	29OCT'21	Water Management	Water Management - Pipeline Road Crossing - Typical Details

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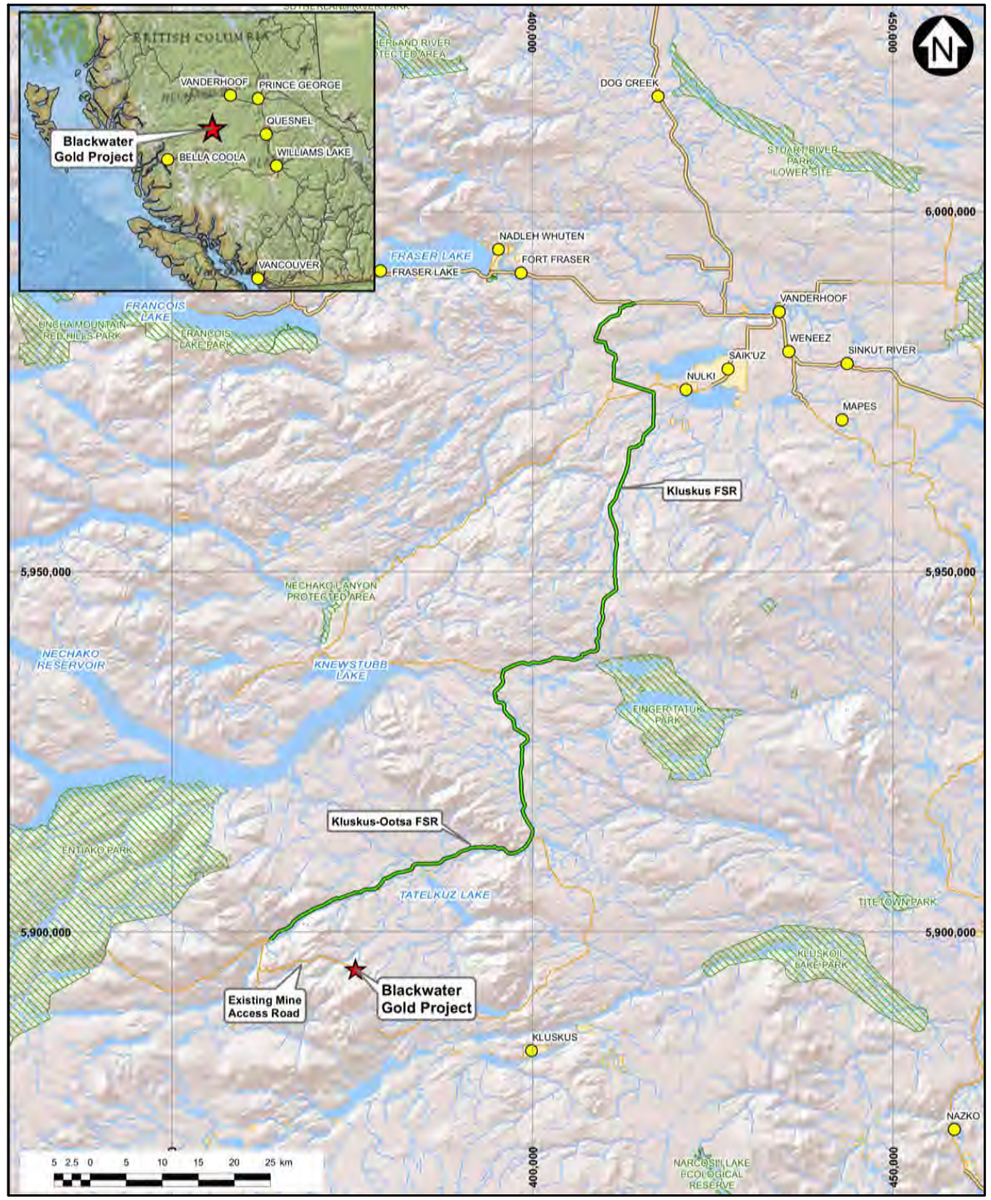
BLACKWATER GOLD PROJECT

PERMITTING LEVEL DESIGN

DRAWING PACKAGE



LEGEND:

- PROJECT LOCATION
- CITY/TOWN
- KLUSKUS FSR
- PAVED ROAD
- GRAVEL ROAD
- RIVER/CREEK
- LAKE
- FIRST NATION RESERVE

NOTES:

1. COORDINATE GRID IS NAD 1983 UTM ZONE 10N
2. BASE MAP: ESRI ARCGIS ONLINE SHADED RELIEF MAPPING.

DETAILED DESIGN

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BLACKWATER GOLD PROJECT

TITLE SHEET

PROFESSIONAL ENGINEER – PROVINCE OF BRITISH COLUMBIA

<original signed by>

2021-11-15

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	G0001	0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
-	-					

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	SKC	DDF	DDF

REVISIONS

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XREF FILE(S): IMAGE FILE(S):

SECTIONAL VIEW AND DETAIL IDENTIFICATION

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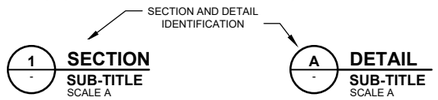

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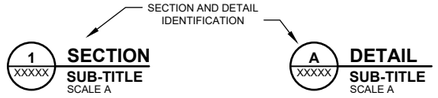
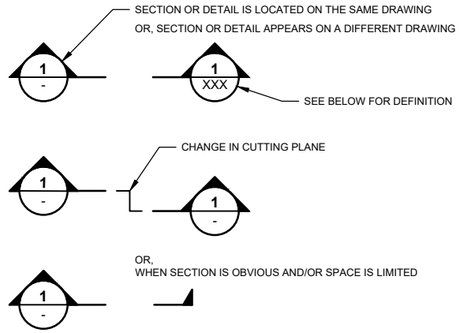
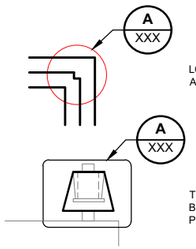


SECTION LOCATION ARROWS



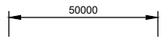
XXX =	"C2110"	NUMBER REFERS TO THE DRAWING FROM WHICH THE SECTION OR DETAIL IS CALLED UP IN DIFFERENT FACILITY.

DETAIL REFERENCE



LOCATED AND IDENTIFIED THUS, THE DETAIL ENLARGEMENT WILL BE IN THE SAME ATTITUDE AND POSITION RELATIVE TO THE DRAWING AS THE PART CIRCLED.

THIS IS A REFERENCE ONLY, TO A DETAIL WHICH, IN ITS ENLARGED FORM, MAY OR MAY NOT BE IN THIS PARTICULAR ATTITUDE. IT WILL, HOWEVER, CONTRIBUTE SOME ADDITIONAL PERTINENT INFORMATION TO THIS VIEW.

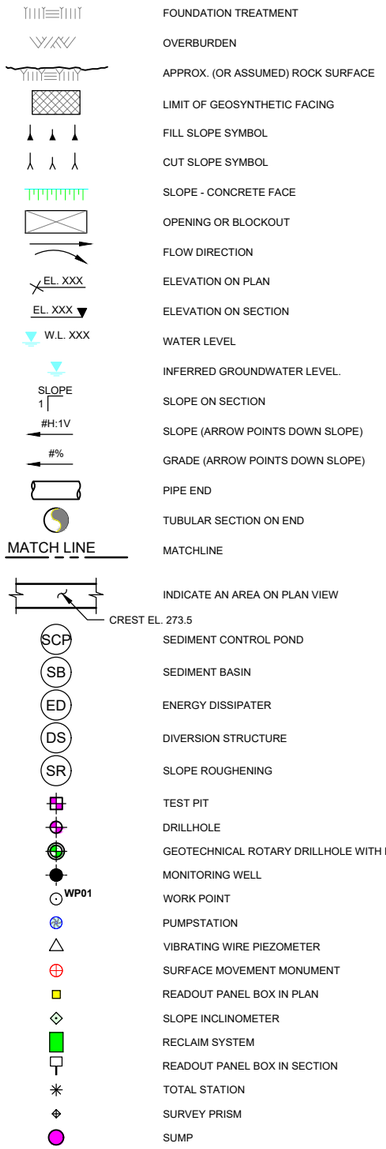


DIMENSIONS IN MILLIMETRES

CENTERLINE ON SECTION

NORTH SYMBOL

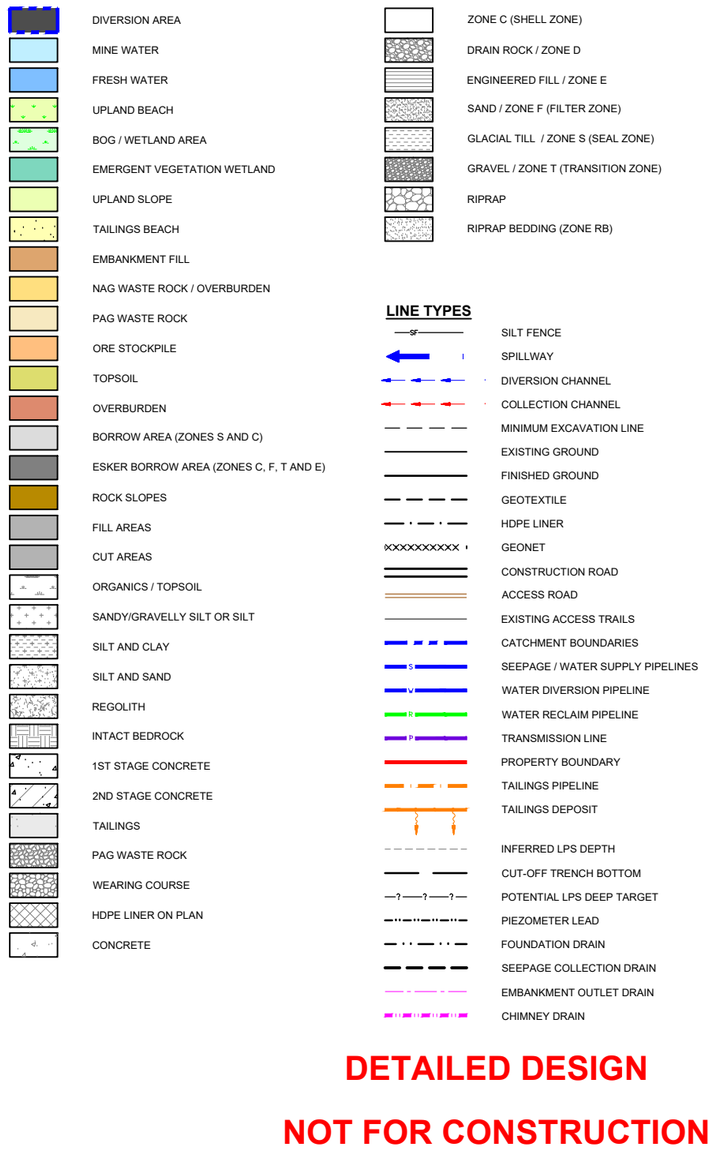
SYMBOLS



ABBREVIATIONS

UNO	UNLESS NOTED OTHERWISE
C/C	CENTER TO CENTER
EL.	ELEVATION IN METRES
EQ.	EQUAL
SP	SPACING
NTS	NOT TO SCALE
DN	DOWN
OPN'G	OPENING
REQ'D	REQUIRED
OD	OUTSIDE DIAMETER
ID	INSIDE DIAMETER
DIA. OR Ø	DIAMETER
R	RADIUS
m	METRE
mm	MILLIMETRE
CTR	CENTER
EA.	EACH
EMBK.	EMBANKMENT
CJ	CONSTRUCTION JOINT
CONTR. JT.	CONTRACTION JOINT
EXP. JT.	EXPANSION JOINT
APPROX.	APPROXIMATE
TYP.	TYPICAL
W/S	WATERSTOP
W/	WITH
BTW	BETWEEN
CONC.	CONCRETE
COL.	COLUMN
BM	BEAM
SOL	SETTING OUT LINE
NA	NOT APPLICABLE
CSP	CORRUGATED STEEL PIPE
SR	SHORT RADIUS
XXS	STEEL PIPE WEIGHT
TSF	TAILING STORAGE FACILITY
GW	GROUND WATER
STA.	STATION
EOH	END OF HOLE
DWG	DRAWING
E	EAST
N	NORTH
masl	METERS ABOVE SEA LEVEL
WP	WORK POINT
BLDG	BUILDING
CHK	CHECKED
CL	CENTERLINE
EG	EXISTING GROUND
FG	FINISHED GROUND
IE	INVERT ELEVATION
HORIZ, H	HORIZONTAL
VERT, V	VERTICAL
NO	NUMBER
NTS	NOT TO SCALE
REV	REVISION
TOC	TOP OF CONCRETE
TYP	TYPICAL

LEGEND:



LINE TYPES

DETAILED DESIGN

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REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ABN	DDF	DDF

REVISIONS

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BLACKWATER GOLD PROJECT

SYMBOLS, AND ABBREVIATIONS

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

C. <original signed by>

2021-11-15

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	G0005	0

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XREF FILE(S): IMAGE FILE(S):

GENERAL:

1. COORDINATE GRID IS UTM NAD 83 ZONE 10U.
2. GROUND TOPOGRAPHY BASED ON INFORMATION PROVIDED BY EAGLE MAPPING ON AUGUST 8 AND 9, 2011.
3. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. DRAWINGS WILL BE READ IN CONJUNCTION WITH THE PROJECT TECHNICAL SPECIFICATIONS. THE DRAWINGS WILL TAKE PRECEDENCE IN THE CASE OF A DISCREPANCY.
5. CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER UPON ANY DISCOVERY OF DISCREPANCIES BETWEEN THE ISSUED DRAWING SET AND/OR CONSTRUCTED WORKS.
6. CONTRACTOR SHALL BE RESPONSIBLE TO MAINTAIN SURVEY CONTROL ON ALL ASPECTS OF THE WORKS. THE CONTRACTOR SHALL VERIFY ALL LINES, GRADES, LOCATIONS AND TIE-IN POINTS PRIOR TO COMMENCEMENT OF THE WORKS AND SHALL NOTIFY THE ENGINEER IMMEDIATELY OF ANY DISCREPANCY.
7. PIPELINE ALIGNMENTS TO BE CONFIRMED BY THE CONTRACTOR IN THE FIELD TO ENSURE PIPELINE INSTALLATION AND OPERATION DO NOT INTERFERE WITH OTHER INFRASTRUCTURE/OPERATING ACTIVITIES.
8. CONTRACTOR TO CONFIRM THE LOCATION OF ALL HIGH AND LOW POINTS ALONG THE PIPELINE ALIGNMENT, FOR THE INSTALLATION OF COMBINATION AIR/VACUUM RELEASE VALVES AND DRAIN POINTS, RESPECTIVELY.
9. PIPE FOUNDATION SHALL BE INSPECTED BY THE ENGINEER PRIOR TO LAYING OF THE PIPE. ANY SOFT OR HARD SPOTS, SUCH AS A ROCK OUTCROPS NOT EXPECTED, SHALL BE SURVEYED AND REPORTED TO THE ENGINEER FOR CHECKING AND INSTRUCTIONS.
10. CONTRACTOR TO CONFIRM THE LOCATION OF ALL ROAD AND PIPE CROSSINGS.
11. ALL MATERIALS USED WILL BE THE BEST SUITED FOR THE APPLICATION BASED ON SUPPLIER SPECIFICATIONS.

DESIGN CHANGE MANAGEMENT:

1. MATERIALS OR PRODUCTS USED WILL BE AS SPECIFIED ON THE DESIGN DRAWINGS OR EQUIVALENT AS APPROVED BY THE ENGINEER.

INSTRUMENTATION:

1. ALL WATER LEVEL, PORE PRESSURE, SURFACE AND SUBSURFACE DEFORMATION INSTRUMENTATION ARE TO BE INSTALLED WITH WIRELESS CAPABILITIES TO AUTOMATICALLY COLLECT AND TRANSMIT DATA.
2. FLOW MONITORING INSTRUMENTATION SHALL BE SURVEILLED AUTOMATICALLY OR MANUALLY DEPENDING ON THE LOCATION AND MONITORING SETUP, AS DETERMINED BY THE ENGINEER. FLOW MONITORING INSTRUMENTATION SHALL BE COMPRISED OF THE FOLLOWING:
   - V-NOTCH WEIRS AT THE END OF PERMANENT INLET AND OUTLET PIPES OR
   - FLOW METERS ON PERMANENT PUMPS.
3. DATA LOGGERS WITH CELLULAR TRANSMITTING CAPABILITIES ARE TO BE INSTALLED AT THE TOE OF MAIN DAM C AT EACH INSTRUMENTATION SECTION.
4. DAM CREST SURFACE DISPLACEMENT TO BE AUTOMATICALLY MONITORED BY TOTAL STATION AND SURVEY PRISMS.
5. SURVEY PRISMS INSTALLED AT 100 METER INTERVALS ON MAIN DAM C CREST.
6. AUTOMATIC TOTAL STATIONS TO SCAN SURVEY PRISMS AT A MINIMUM ONCE DAILY. AUTOMATIC MONITORING TO COMMENCE AT SUBSTANTIAL COMPLETION.

FOUNDATIONS:

1. THE FOUNDATION LEVELS GIVEN ON THE DRAWINGS ARE ANTICIPATED LEVELS. THE FINAL FOUNDATION LEVELS WILL BE DETERMINED BY THE ENGINEER BASED ON ACTUAL SITE CONDITIONS.
2. EXCAVATIONS WITH SIGNIFICANT WATER SEEPAGE MAY REQUIRE REDUCED EXCAVATION SLOPES THAN WHAT IS SHOWN ON THE EXCAVATION DRAWINGS AND WILL REQUIRE DEWATERING. CONTRACTOR TO ALLOW FOR SUCH DEWATERING SYSTEM.
3. BLINDING CONCRETE / LEAN MIX CONCRETE MUDSLAB MAY BE REQUIRED IN THE BOTTOM OF SOME FOUNDATION EXCAVATIONS. MINIMUM THICKNESS OF BLINDING CONCRETE SHALL BE 50 mm WITH A MAXIMUM NOMINAL THICKNESS OF 200 mm. THE BLINDING CONCRETE SHALL NOT BE THICKER THAN 400 mm AT DEEP INFILL AREAS SUCH AS ROCK EXCAVATION OVER-BREAK.
4. BLINDING CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF AT LEAST 15 MPa AT 28 DAYS.
5. FOR BLINDING LAYER CONCRETE THICKER THAN NOMINAL 200 mm USE CONVENTIONAL TYPE C25 CONCRETE UP TO DESIGN GRADE AND ELEVATION, FROM WHERE THE SPECIFIED CONCRETE STRENGTH FOR THE STRUCTURAL MEMBER SHOULD BE USED.
6. PRIOR TO PLACING BLINDING CONCRETE, REMOVE AND REPLACE ALL AREAS OF LOOSE OR SOFT MATERIAL OR COMPACT SUB GRADE SOILS AS SPECIFIED.
7. FREEZING OF BLINDING LAYER CONCRETE AND/OR EXPOSED FOUNDATION MATERIAL SHALL NOT BE ALLOWED AND WILL BE REJECTED BY THE ENGINEER.
8. ALL EXCAVATIONS AND FOUNDATION MATERIAL ARE TO BE INSPECTED AND ACCEPTED BY THE ENGINEER PRIOR TO PLACING BLINDING CONCRETE, FORMWORK OR ANY REINFORCEMENT. HOLD EXCAVATION FOR INSPECTION AND APPROVAL BY ENGINEER.
9. ALL EXCAVATIONS SHALL BE KEPT FREE OF STANDING WATER AT ALL TIMES.

TEMPORARY STRUCTURES:

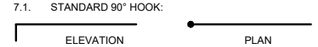
1. THE CONTRACTOR SHALL DESIGN AND DETAIL ALL TEMPORARY STRUCTURES USED FOR THE CONSTRUCTION OF THE PERMANENT WORKS.
2. MAINTAIN ALL STRUCTURES IN A STABLE CONDITION DURING CONSTRUCTION AND ENSURE AT ALL TIMES THAT NO PART OF THE STRUCTURE IS OVER STRESSED DUE TO THE CONSTRUCTION ACTIVITIES.
3. PERMANENT WORKS SHALL NOT BE ALLOWED TO BE UNDERCUT OR UNDERMINED BY ANY CONSTRUCTION ACTIVITIES.

FORMWORK:

1. DESIGN
   1.1. ALL FORMWORK AND FALSEWORK SHALL COMPLY WITH CAN/CSA S269.1 AND CAN/CSA S269.3 OR ACI 347. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF FORMWORK. FORMWORK AND FALSEWORK SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER.
2. FORMED FINISHED SURFACES
   2.1. FINISH F1: FORMS BUILT OF STANDARD FORM PLY WITH A MINIMUM AMOUNT OF REFINEMENT.
   2.2. FINISH F2: FORMS FOR GENERAL APPLICATION FOR SURFACES EXPOSED TO VIEW WITHOUT STRINGENT AESTHETIC REQUIREMENTS; OF PLYWOOD, STEEL OR FORM LINER OF PRE-APPROVED MATERIAL.
   2.3. FINISH F3: FORMS FOR SURFACES WHERE AESTHETIC OR MECHANICAL PERFORMANCE REQUIRES A HIGH QUALITY FINISH; OF PLYWOOD, STEEL OR FORM LINER OF PRE-APPROVED MATERIAL. PATTERN FROM THE FORMS LEFT IN THE CONCRETE SURFACE MUST HARMONIZE WITH THE STRUCTURE AND ITS FUNCTION. ALL JOINTS SHALL BE HORIZONTAL OR VERTICAL.
   2.4. FINISH F4: SEVERE TOLERANCE LIMIT; OF SMOOTH SANDED UNLINED AND UNCOATED PLYWOOD.
3. UNFORMED FINISHES
   3.1. FINISH U1: EVEN, UNIFORM FINISH; CONSOLIDATED, LEVEL AND SCREEDED.
   3.2. FINISH U2: WOOD FLOAT FINISH.
   3.3. FINISH U3: STEEL TOWELLED FINISH.
   3.4. FINISH U4: HARD, STEEL TOWELLED FINISH - BURNISHED.
   3.5. FINISH U5: BROOM FINISH.
   3.6. FINISH U6: HARDENED FINISH; APPLY FLOOR HARDENER PER MANUFACTURER'S INSTRUCTIONS.
4. CHAMFERS
   4.1. FORM ALL EXPOSED CONCRETE CORNERS AND EDGES WITH 20 mm or 25 mm CHAMFER. ALL CONCRETE CORNERS SHALL HAVE A 25 mm CHAMFER TO PREVENT CONCRETE CHIPPING.
5. SPECIFIED CONCRETE FINISH FOR PARTICULAR APPLICATION/EXPOSURE
   5.1. SURFACES EXPOSED TO VIEW (EXTERIOR) - F2, U2
   5.2. SURFACES EXPOSED TO VIEW (INTERIOR) - F3, U3
   5.3. SURFACES AGAINST BACKFILL - F1, U1
   5.4. SURFACES EXPOSED TO WATER OR WATER PASSAGE - F4, U3

STEEL REINFORCEMENT:

1. MATERIALS
   1.1. REINFORCEMENT STEEL SHALL BE DEFORMED BAR REINFORCEMENT FOR STRUCTURAL CONCRETE IN ACCORDANCE TO CSA G30.18 - GRADE 400 R (OR GRADE 400 W WHERE SPECIFIED).
   1.2. WELDED WIRE FABRIC SHALL BE IN ACCORDANCE WITH CSA G30.15M.
   1.3. MINIMUM YIELD STRENGTHS FOR REINFORCEMENT:
   1.3.1. DEFORMED BAR FY = 400 MPA
   1.3.2. WELDED WIRE FABRIC FY = 280 MPA
2. MINIMUM CONCRETE COVER TO REINFORCEMENT
   2.1. EXTERNAL FACES CAST ON/AGAINST SOIL, ROCK OR CONCRETE BLINDING - 75 mm
   2.2. EXTERNAL FACES EXPOSED TO FLOWING WATER:
   2.2.1. PRIMARY REINFORCEMENT - 75 mm
   2.2.2. STIRRUPS, TIES AND SPIRALS - 60 mm
   2.3. EXTERNAL FACES EXPOSED TO WEATHER, STANDING WATER & SOIL BACKFILL:
   2.3.1. PRIMARY REINFORCEMENT - 50 mm
   2.3.2. STIRRUPS, TIES AND SPIRALS - 40 mm
   2.4. INTERNAL FACES EXPOSED TO FLOWING WATER:
   2.4.1. PRIMARY REINFORCEMENT - 75 mm
   2.4.2. STIRRUPS, TIES AND SPIRALS - 60 mm
   2.5. INTERNAL FACES EXPOSED TO AIR & STANDING WATER:
   2.5.1. PRIMARY REINFORCEMENT - 40 mm
   2.5.2. STIRRUPS, TIES AND SPIRALS - 30 mm
   2.6. EXTERNAL SLAB SURFACES EXPOSED TO TRAFFIC - 50 mm
   2.7. INTERNAL SLAB SURFACES EXPOSED TO TRAFFIC - 40 mm
3. EXPOSURE CLASS
   3.1. ALL CONCRETE SHALL BE REGARDED TO HAVE AN EXPOSURE CLASS OF F-2 IN ACCORDANCE WITH CSA A23.3, EXCEPT CONCRETE EXPOSED TO WATER.
   3.2. ALL CONCRETE SURFACES IN CONTACT WITH WATER SHALL BE REGARDED TO HAVE AND EXPOSURE CLASS F-1 IN ACCORDANCE TO CASE A23.3.
4. TOLERANCES
   4.1. ON COVER- -0 mm, +10 mm
   4.2. ON EFFECTIVE DEPTH (FROM FACE OPPOSITE REBAR) - -10 mm, +10 mm
   4.3. ON EMBEDMENT AND LAP LENGTHS- -0 mm, NO UPPER LIMIT
   4.4. ON STANDARD HOOK DIMENSIONS- -0 mm, NO UPPER LIMIT
   4.5. ON LOCATION OF INSERTS, OPENINGS & EMBEDS- -5 mm, +5 mm
   4.6. ON LATERAL SPACING OF REBAR- -15 mm, +15 mm
   4.7. ON REBAR DIMENSION LENGTHS- -25 mm, +25 mm
   4.8. ON OVERALL TIE BAR AND STIRRUP DIMENSIONS- -5 mm, +5 mm
5. SPLICES
   5.1. ALL SPLICE LENGTHS NOT INDICATED EXPLICITLY ON DRAWINGS ARE CLASS B, AS DEFINED BY CLAUSE 12.15.1 OF CSA A23.3.
   5.2. LOCATE STEEL REINFORCEMENT SPLICES ONLY WHERE SHOWN ON THE DRAWINGS. ALTERNATE REINFORCEMENT SPLICES IN SLABS AND WALLS WHERE POSSIBLE TO AVOID SINGLE SPLICE LOCATION LINE THROUGH COMPONENTS. NO SUPPLEMENTARY SPLICES ARE ALLOWED WITHOUT THE PRIOR WRITTEN APPROVAL OF THE ENGINEER.
   5.3. WELDING OF OR TO STEEL REINFORCEMENT IS NOT PERMITTED FOR ANY PURPOSE EXCEPT, IF EXPLICITLY SHOWN ON THE DRAWINGS OR WITH WRITTEN APPROVAL BY THE ENGINEER.
6. FABRICATION AND DETAILING
   6.1. FABRICATE BENDS AND HOOKS OF BARS TO CLAUSE 12.2 OF A23.1 UNLESS OTHERWISE DIMENSIONED ON THE DRAWINGS.
   6.2. ALL STEEL REINFORCEMENT SHALL BE BENT COLD. THE MINIMUM BAR BEND DIAMETER SHALL NOT BE LESS THAN THE VALUES PROVIDED IN CSA A23.1 - TABLE 16.
7. GENERAL REINFORCEMENT DRAWING SYMBOLS
   7.1. STANDARD 90° HOOK:



   7.2 STANDARD 90° HOOK:

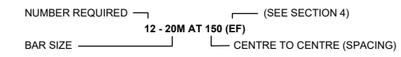
   7.3 LAPPED SPLICE

   7.4 TOP AND NEAR FACE BARS

   7.5 BOTTOM OR FAR FACE BAR

STEEL REINFORCEMENT (CONT'D):

8. REINFORCEMENT SPACING
   8.1. UNLESS OTHERWISE SHOWN, THE FIRST AND LAST BARS IN SLABS AND WALLS, STIRRUPS IN BEAMS, AND TIES IN COLUMNS SHALL BE PLACED AT A MAXIMUM OF HALF THE SPECIFIED SPACING OF ADJACENT BARS FROM THE ENDS OF THE MEMBER. THE MINIMUM CLEAR DISTANCE BETWEEN PARALLEL BARS, OTHER THAN AT SPLICES, SHALL BE THE NOMINAL DIAMETER OF THE BARS IN BEAMS OR ONE AND ONE-HALF TIMES THE NOMINAL DIAMETER IN COLUMNS; BUT IN NO CASE LESS THAN 1.5 X THE MAXIMUM COARSE AGGREGATE SIZE OF 25 mm IN BEAMS OR 40 mm IN COLUMNS.
9. TYPICAL REINFORCEMENT BAR DESIGNATION



10. REINFORCEMENT DOWELS
    10.1. THE MINIMUM PROJECTION AND EMBEDMENT OF ALL DOWELS SHALL COMPLY WITH THE MINIMUM SPECIFIED SPLICE AND EMBEDMENT LENGTHS RESPECTIVELY, UNLESS NOTED OTHERWISE ON THE REINFORCEMENT DRAWINGS. DOWEL PROJECTION INTO CONSECUTIVE CONCRETE POURS SHALL NOT BE LESS THAN 50 X BAR DIAMETER.
11. WELDING TO REINFORCEMENT
    11.1. WELDING OF REINFORCEMENT SHALL NOT BE PERMITTED EXCEPT WHERE REQUIRED FOR SPECIAL END ANCHORAGE OR OTHER REQUIREMENTS AS SHOWN ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER. GRADE 400W REINFORCEMENT STEEL SHALL BE USED AT THESE LOCATIONS. TACK WELDING OF BARS INTO CAGES SHALL NOT BE PERMITTED. TACK-WELDING OF REINFORCEMENT IN LIEU OF WIRE TYING OR FOR ATTACHING EMBEDDED ITEMS TO REINFORCEMENT SHALL NOT BE PERMITTED. ADDITIONAL NON-STRUCTURAL ERECTION BARS OR FRAMES SHALL BE PROVIDED FOR SUCH ELEMENT REQUIRING WELDING OR EMBEDDED ELEMENTS, TO ENSURE THAT NO ACCIDENTAL WELDING OCCURS TO ANY STRUCTURAL REINFORCEMENT STEEL.
    11.2. CAD WELDING OF EMBEDDED COPPER ELEMENTS FOR GROUNDING GRID TO REINFORCEMENT IN VARIOUS CONCRETE STRUCTURES, MAY BE REQUIRED TO FORM AN ELECTRICAL GRID, AS INDICATED ON DRAWINGS. WELDING OF REINFORCING BARS SHALL CONFORM TO CSA STANDARD W186.
12. REINFORCEMENT PLACEMENT
    12.1. REINFORCEMENT MAY BE RELOCATED BY UP TO 50 mm TO CLEAR PIPES, SEALS, WATERSTOPS, RECESSES, EMBEDDED METALWORK AND CONDUITS, EXCEPT AS NOTED BELOW. WHERE POSSIBLE, A MINIMUM CLEARANCE OF AT LEAST 25 mm SHALL BE MAINTAINED BETWEEN REINFORCEMENT AND EMBEDDED MATERIALS.
    12.2. THE MINIMUM CLEARANCE BETWEEN REINFORCEMENT AND POWER CONDUITS SHALL BE 100 mm.
    12.3. THE MINIMUM CLEARANCE BETWEEN REINFORCEMENT AND ANY PART OF EMBEDDED STEEL PENSTOCK COMPONENTS SHALL BE 100 mm. THE ELECTRICAL ISOLATION & CONDUCTIVITY OF PENSTOCK COMPONENTS SHALL BE TESTED PRIOR TO CONCRETING OF SUCH COMPONENTS.
    12.4. UNDER NO CIRCUMSTANCES SHALL LONGITUDINAL REINFORCEMENT FOR HEAVILY REINFORCED BEAMS AND COLUMNS BE DISPLACED TO CLEAR EMBEDDED MATERIALS. IN SUCH CASES, SUBJECT TO THE APPROVAL OF THE ENGINEER, EMBEDDED MATERIALS SHALL BE DISPLACED. TENSION BARS SHALL NOT BE BENT INTO SHARP OFFSETS WITH SLOPES OF MORE THAN 1 LATERAL ON 6 LONGITUDINAL TO CLEAR OBSTRUCTIONS.
    12.5 . REINFORCEMENT SHALL BE ACCURATELY PLACED IN ACCORDANCE WITH THE DRAWINGS AND SHALL BE ADEQUATELY SECURED AGAINST DISPLACEMENT BY USING ANNEALED IRON WIRE TIES OR SUITABLE CLIPS AT INTERSECTIONS AND SHALL BE SUPPORTED BY CONCRETE OR PLASTIC SPACERS.
13. CUTTING OF STEEL REINFORCEMENT
    13.1. UNDER NO CIRCUMSTANCES SHALL DOWELS AND OTHER STEEL REINFORCEMENT BE TERMINATED OR CUT WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER. DOWEL BARS THAT ARE CUT WITHOUT THE ENGINEER'S APPROVAL SHALL BE REPLACED BY THE CONTRACTOR.

CONCRETE:

1. MATERIALS
   1.1. CEMENT - IN ACCORDANCE WITH CSA A5 TYPE 10.
   1.2. AGGREGATES - IN ACCORDANCE WITH CSA A23.1
   1.3. ADMIXTURES - IN ACCORDANCE WITH CSA A23.1
   1.3.1. AIR-ENTRAINING ADMIXTURES WITH ASTM C260
   1.3.2. CHEMICAL ADMIXTURES TO ASTM C494 AND ASTM C1017.
   1.3.3. CALCIUM CHLORIDE ADMIXTURES ARE NOT PERMITTED
2. SPECIFIED CONCRETE COMPRESSIVE STRENGTH
   2.1. C50 - 50 MPa
   2.2. C40 - 40 MPa
   2.3. C35 - 35 MPa
   2.4. C30 - 30 MPa
   2.5. C25 - 25 MPa
   2.6. C15 - 15 MPa
3. GROUTS
   3.1. NON-SHRINK GROUT: CEMENTITIOUS PREMIXED GROUT, 40 MPa SPECIFIED 28 DAY COMPRESSIVE STRENGTH.
   3.2. EPOXY GROUT: HILTI HIT HY150, RE500, HILTI HSE 2421 OR AS INDICATED ON THE DRAWINGS.
4. CONCRETE MIXING, PREPARATION AND PLACEMENT
   4.1. DO NOT ADD ADDITIONAL WATER TO THE CONCRETE AFTER BATCHING AND MIXING IN ACCORDANCE WITH THE MIX DESIGN. THE ENGINEER MAY REJECT ANY CONCRETE TO WHICH ADDITIONAL WATER WAS ADDED WITHOUT FURTHER CAUSE.
   4.2. CONCRETE SHALL NOT BE PLACED IN FORMWORK THAT HAS GOT ICE/SNOW INSIDE OF IT. CONCRETE MAY ONLY BE PLACED AFTER THE INSIDE OF FORMWORK AND EXISTING CONCRETE COMPONENTS IN CONTACT WITH NEW FRESH CONCRETE HAS BEEN CONTINUOUSLY PRE-HEATED FOR 24 HOURS ABOVE 5° CELSIUS DURING COLD WEATHER CONCRETE PLACEMENT.
   4.3. CONCRETE SHALL NOT BE PLACED WITHOUT PRIOR INSPECTION AND ACCEPTANCE OF STEEL REINFORCEMENT, COVER AND FORMWORK BY THE ENGINEER.
   4.4. LOCATE CONSTRUCTION JOINTS AS SHOWN ON THE DRAWINGS. DO NOT MAKE ADDITIONAL CONSTRUCTION JOINTS WITHOUT THE PRIOR WRITTEN APPROVAL OF THE ENGINEER.
   4.5. THE INSIDE OF FORMWORK SHALL BE CLEANED OUT OF ALL DEBRIS, LOOSE TIE WIRES, WATER AND ICE PRIOR TO THE PLACEMENT OF CONCRETE.
   4.6. ROUGHEN ALL VERTICAL AND HORIZONTAL CONSTRUCTION JOINTS TO MINIMUM 5 mm AMPLITUDE BY MEANS OF AIR/WATER JET BLASTING OR BUSH-HAMERING TO REMOVE LAITANCE AND EXPOSE COARSE AGGREGATE. ROUGHENING OF FRESHLY CAST-IN-PLACE CONCRETE SURFACE IS NOT ADEQUATE.
   4.7. DISCHARGE CONCRETE INTO CONCRETE FORMS WITHIN 1 HOUR AFTER CEMENT WAS INTRODUCED INTO THE MIX OR PRIOR TO 300 REVOLUTIONS OF THE TRUCK DRUM. THE ENGINEER MAY ALTER THESE REQUIREMENTS DEPENDING ON CONTRACTOR'S QUALITY CONTROL AND FAVOURABLE CONCRETE STRENGTH RESULTS.
5. FORMWORK REMOVAL AND CURING
   5.1. DO NOT REMOVE WALL FORMWORK BEFORE THE CONCRETE HAS REACHED AT LEAST 40% OF THE REQUIRED 28 DAY COMPRESSIVE STRENGTH IN ORDER TO SUPPORT ITSELF. FORMWORK SHALL REMAIN IN PLACE FOR A MINIMUM PERIOD OF 48 HOURS.
   5.2. SOFFIT/SUPPORTING FORMWORK/FALSEWORK SHALL REMAIN IN PLACE UNTIL THE CONCRETE HAS REACHED AT LEAST 70% OF THE TARGETED COMPRESSIVE STRENGTH. SUSPENDED SLAB COMPONENTS SHALL BE PROPED/SUPPORTED UNTIL THE CONCRETE HAS REACH 100% OF THE TARGET COMPRESSIVE STRENGTH. THE ENGINEER MAY ALLOW DEVIATION FROM THIS REQUIREMENT, FROM CASE TO CASE.
   5.4. COMMENCE WITH CURING OF ALL SURFACES IMMEDIATELY FOLLOWING PLACEMENT AND AFTER STRIPPING OF FORMWORK. THE MINIMUM BASIC CURING PERIOD SHALL BE 7 CONSECUTIVE DAYS FOLLOWING PLACEMENT. CURING METHODS SHALL BE IN ACCORDANCE TO CSA A23.1 SECTION 7.4 AND ANNEX I. CONCRETE SHALL AT ALL TIMES DURING THE SPECIFIED CURING PERIOD BE PROTECTED AGAINST FREEZING AND DRYING OUT OF ALL SURFACES.
   5.5. TEMPERATURE RECORDS SHALL BE KEPT FOR ALL STRUCTURAL CONCRETE COMPONENTS.THE MAXIMUM TEMPERATURE DIFFERENTIAL SHALL NOT EXCEED 20°C FOR ANY STRUCTURAL COMPONENT, AS SPECIFIED IN CSA A23.1 SECTION 7.4 IN ORDER TO REDUCE POTENTIAL THERMAL STRESS CRACKING.

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PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA

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2021-11-15

CIVIL GENERAL NOTES

DRG. NO.	DESCRIPTION
-	-

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	SKC	DDF	DDF

REVISIONS

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	G0006	0

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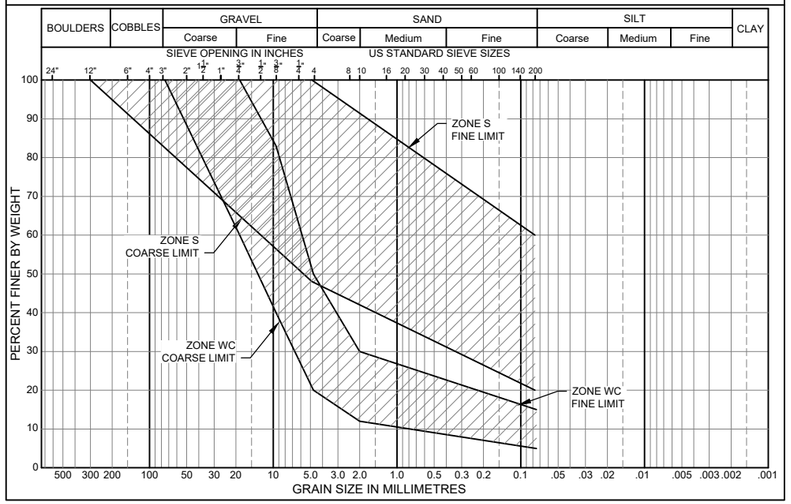
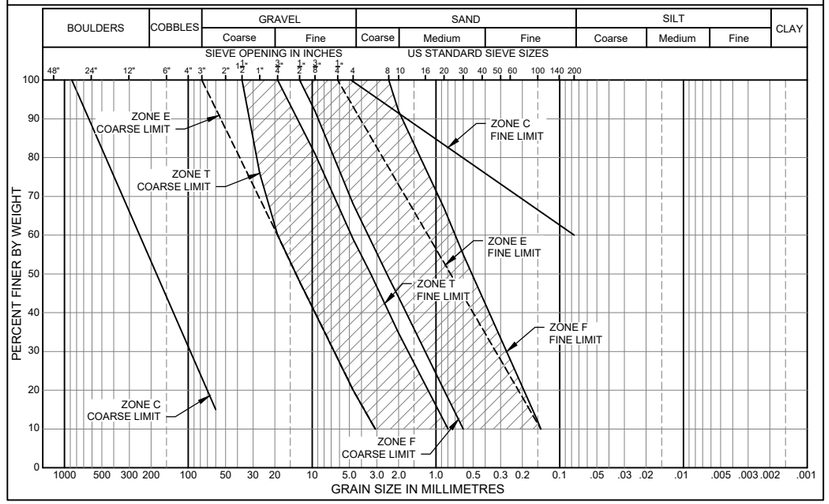
UNIFIED SOIL CLASSIFICATION SYSTEM

ZONE - S, WC



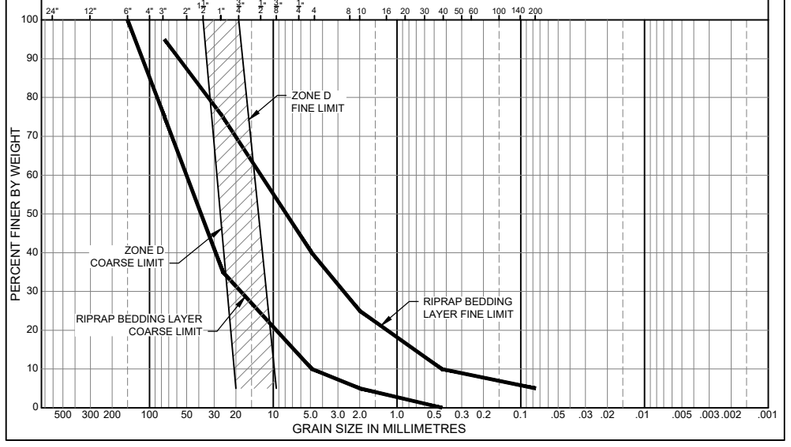
UNIFIED SOIL CLASSIFICATION SYSTEM

ZONE - F, T, E, C



UNIFIED SOIL CLASSIFICATION SYSTEM

ZONE - D, RB



MATERIAL PLACEMENT AND COMPACTION REQUIREMENTS

ZONE	MATERIAL TYPE	LOCATIONS	PLACING AND COMPACTION REQUIREMENTS
S	GLACIAL TILL	SEAL ZONE	PLACED, MOISTURE CONDITIONED AND SPREAD IN MAXIMUM 300 mm THICK LAYERS (AFTER COMPACTION). VIBRATORY COMPACTION TO 95% OF STANDARD PROCTOR MAXIMUM DRY DENSITY OR AS APPROVED BY THE ENGINEER
F	SAND	FILTER ZONE	PLACED AND SPREAD IN MAXIMUM 600 mm THICK LAYERS AND COMPACTED WITH MINIMUM 4 TO 6 PASSES OF 10 TON SMOOTH DRUM VIBRATORY ROLLER, OR AS APPROVED BY THE ENGINEER
T	GRAVEL	TRANSITION ZONE	PLACED AND SPREAD IN MAXIMUM 600 mm THICK LAYERS AND COMPACTED WITH MINIMUM 4 TO 6 PASSES OF 10 TON SMOOTH DRUM VIBRATORY ROLLER, OR AS APPROVED BY THE ENGINEER.
E	ENGINEERED FILL	FOUNDATIONS	PLACED AND SPREAD IN MAXIMUM 150 mm THICK LAYERS. VIBRATORY COMPACTED TO 100% OF STANDARD PROCTOR MAXIMUM DRY DENSITY OR AS APPROVED BY THE ENGINEER.
C	WASTE ROCK OVER BURDEN	SHELL ZONE	PLACE AND SPREAD IN MAXIMUM 1000 mm THICK LAYERS. UNIFORMLY COMPACTED BY SELECTIVE ROUTING OF HAUL TRUCK TRAFFIC ON MAIN FILL AND BY 10 TON SMOOTH DRUM VIBRATORY ROLLER ON THE FILL EDGES.
D	DRAIN ROCK	DRAINS	PLACED AROUND DRAINAGE PIPES AND WRAPPED WITH GEOTEXTILE.
R	RIPRAP	RIPRAP	PLACED WITH EXCAVATOR BUCKET IN INTERLOCKING FASHION WITH MINIMAL COMPACTIVE EFFORT.
RB	RIPRAP BEDDING	RIPRAP	PLACE AND SPREAD IN MAXIMUM 150 mm THICK LAYERS. UNIFORMLY COMPACTED BY BUCKET TAMPING.
WC	WEARING COURSE	ROADS	PLACE AND SPREAD IN MAXIMUM 150 mm THICK LAYERS. EACH LAYER SHALL BE COMPACTED BY A MINIMUM OF 4 PASSES OVER THE ENTIRE SURFACE WITH 10 TON SMOOTH DRUM VIBRATORY ROLLER.

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006.
2. RIPRAP TO BE HARD, DENSE AND DURABLE TO WITHSTAND LONG EXPOSURE TO WEATHERING.
3. RIPRAP STONES SHALL BE ANGULAR IN SHAPE. NO STONE SHALL EXCEED A LENGTH TO BREADTH OR THICKNESS OF 3.
4. SELECTED BC MINISTRY OF TRANSPORTATION RIPRAP CLASSES AND DIMENSIONS SHOWN IN TABLE 1 AND TABLE 2. RIPRAP D50 AND THICKNESS SPECIFIED ON DRAWING G0060.
5. SEE PROJECT TECHNICAL SPECIFICATIONS FOR ADDITIONAL MATERIAL REQUIREMENTS.

GRADATION OF ROCK SIZES IN EACH CLASS OF RIPRAP

CLASS OF RIPRAP (kg)	D50 (mm)	ROCK GRADATION PERCENTAGE SMALLER THAN GIVEN ROCK MASS (kg)		
		15%	50%	85%
5	150	0.5	5	15
50	330	5	50	150
250	565	25	250	750
1000	900	100	1000	3000
2000	1130	200	2000	6000

APPROXIMATE AVERAGE DIMENSION OF EACH SPECIFIED ROCK CLASS MASS (mm) (SG = 2.64)

CLASS OF RIPRAP (kg)	D50 (mm)	APPROXIMATE AVERAGE DIMENSION (mm)		
		15%	50%	85%
5	150	70	150	215
50	330	155	330	475
250	565	260	565	815
1000	900	415	900	1295
2000	1130	525	1130	1630

DETAILED DESIGN

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DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

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REVISIONS

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TION MATERIAL GRADATIONS

2021-11-15

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	G0040	0

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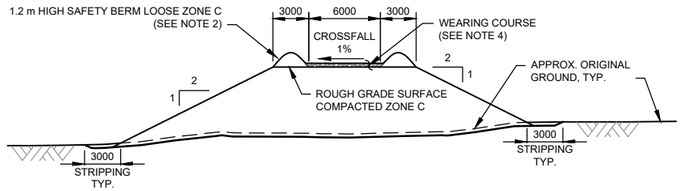
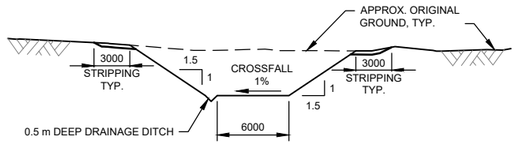
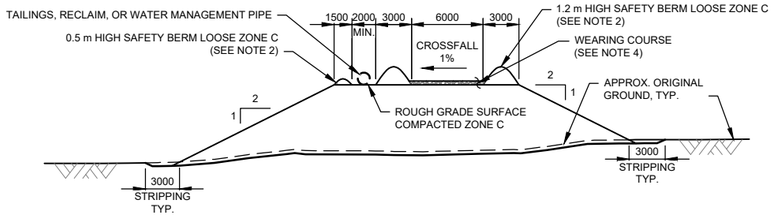


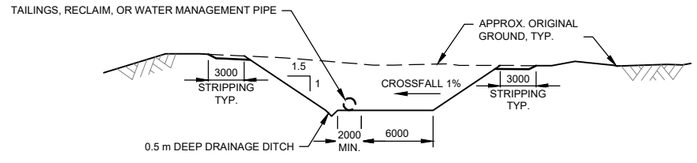
1 - SECTION
ACCESS ROAD
TYPICAL FILL
SCALE A



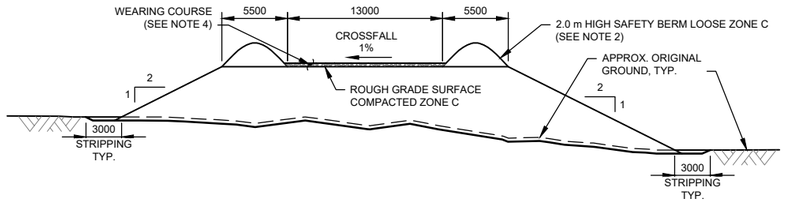
2 - SECTION
ACCESS ROAD
TYPICAL CUT
SCALE A



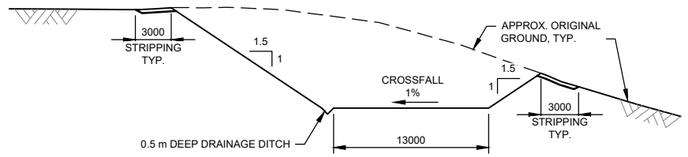
3 - SECTION
ACCESS ROAD WITH PIPE
TYPICAL FILL
SCALE A



4 - SECTION
ACCESS ROAD WITH PIPE
TYPICAL CUT
SCALE A



5 - SECTION
CONSTRUCTION ROAD
TYPICAL FILL
SCALE A



6 - SECTION
CONSTRUCTION ROAD
TYPICAL CUT
SCALE A

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. INSTALL DRAINAGE PATHWAYS THROUGH DOWN TRUCKS, RESPECTFULLY. BERMS AT A MINIMUM OF 150 m INTERVALS ON FILL SECTIONS.
3. ROAD SECTIONS HAVE BEEN DESIGNED AS PER THE MINE CODE. THE DESIGN BASIS VEHICLES FOR THE CONSTRUCTION ROAD AND ACCESS ROAD ARE CAT 777 AND CAT 725 ROCK TRUCKS RESPECTIVELY.
4. WEARING COURSE TO BE ADDED AS REQUIRED FOR ROAD MAINTENANCE.
5. SAFETY BERMS NOT REQUIRED IF ROAD FILL HEIGHT DOES NOT EXCEED 3 METRES.

DETAILED DESIGN

NOT FOR CONSTRUCTION

5 2.5 0 5 10 15 20 25 m
SCALE A

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TYPICAL ROAD SECTIONS

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VA101-457/33	G0050	0

G0006	CIVIL GENERAL NOTES
DRG. NO.	DESCRIPTION

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

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REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
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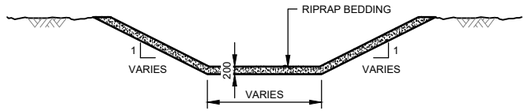
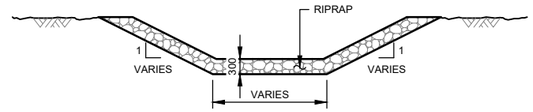
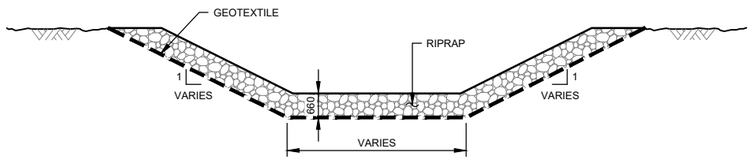
TYPICAL SECTION
TYPE 1 CHANNEL
UNLINED CHANNEL
NTS



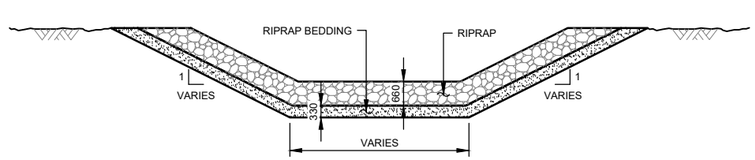
TYPICAL SECTION
TYPE 2 CHANNEL
BEDDING LINED CHANNEL
NTS



TYPICAL SECTION
TYPE 3 CHANNEL
RIPRAP D_{50} = 150 mm, NO BEDDING
NTS



TYPICAL SECTION
TYPE 4 CHANNEL
RIPRAP D_{50} = 330 mm, WITH GEOTEXTILE
NTS



TYPICAL SECTION
TYPE 5 CHANNEL
RIPRAP D_{50} = 330 mm, WITH BEDDING
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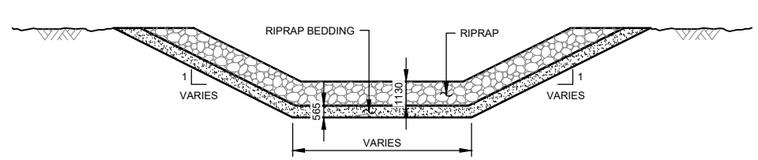

TYPICAL SECTION
TYPE 6 CHANNEL
RIPRAP D_{50} = 565 mm, WITH BEDDING
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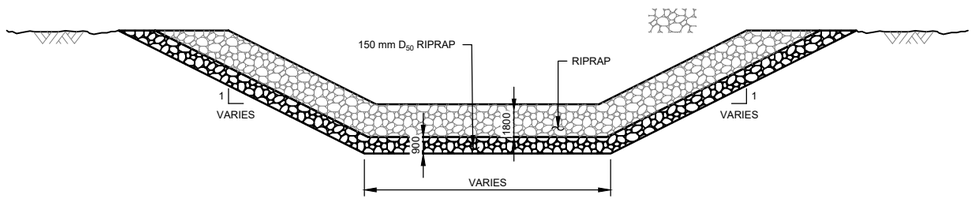
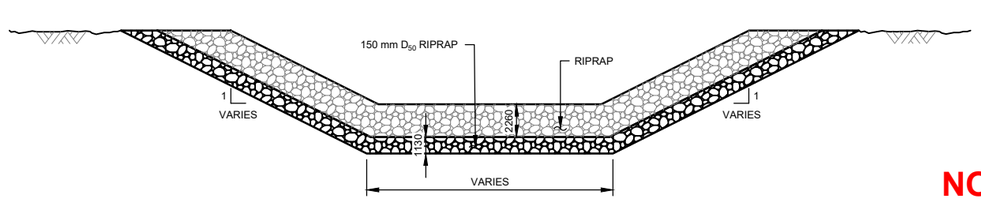


TYPICAL SECTION
TYPE 7 CHANNEL
RIPRAP D_{50} = 900 mm, WITH D_{50} = 150 mm BEDDING
NTS



TYPICAL SECTION
TYPE 8 CHANNEL
RIPRAP D_{50} = 1130 mm, WITH D_{50} = 150 mm BEDDING
NTS

LEGEND:

- RIPRAP
- RIPRAP BEDDING (ZONE RB)
- GEOTEXTILE

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. EXISTING GROUND CONDITIONS TO BE VERIFIED BY THE ENGINEER FOR EACH CHANNEL TYPE.
3. FOR RIPRAP AND BEDDING REQUIREMENTS SEE DWG. G0040.

DETAILED DESIGN

NOT FOR CONSTRUCTION

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BLACKWATER GOLD PROJECT

EROSION PROTECTION
TYPICAL CHANNEL SECTIONS

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA
C. [illegible] <original signed by>
2021-11-15

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	G0060	0

REFERENCE DRAWINGS	
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES

DRG. NO.	DESCRIPTION

REVISIONS								
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	RNM	DDF	DDF

REVISIONS								
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

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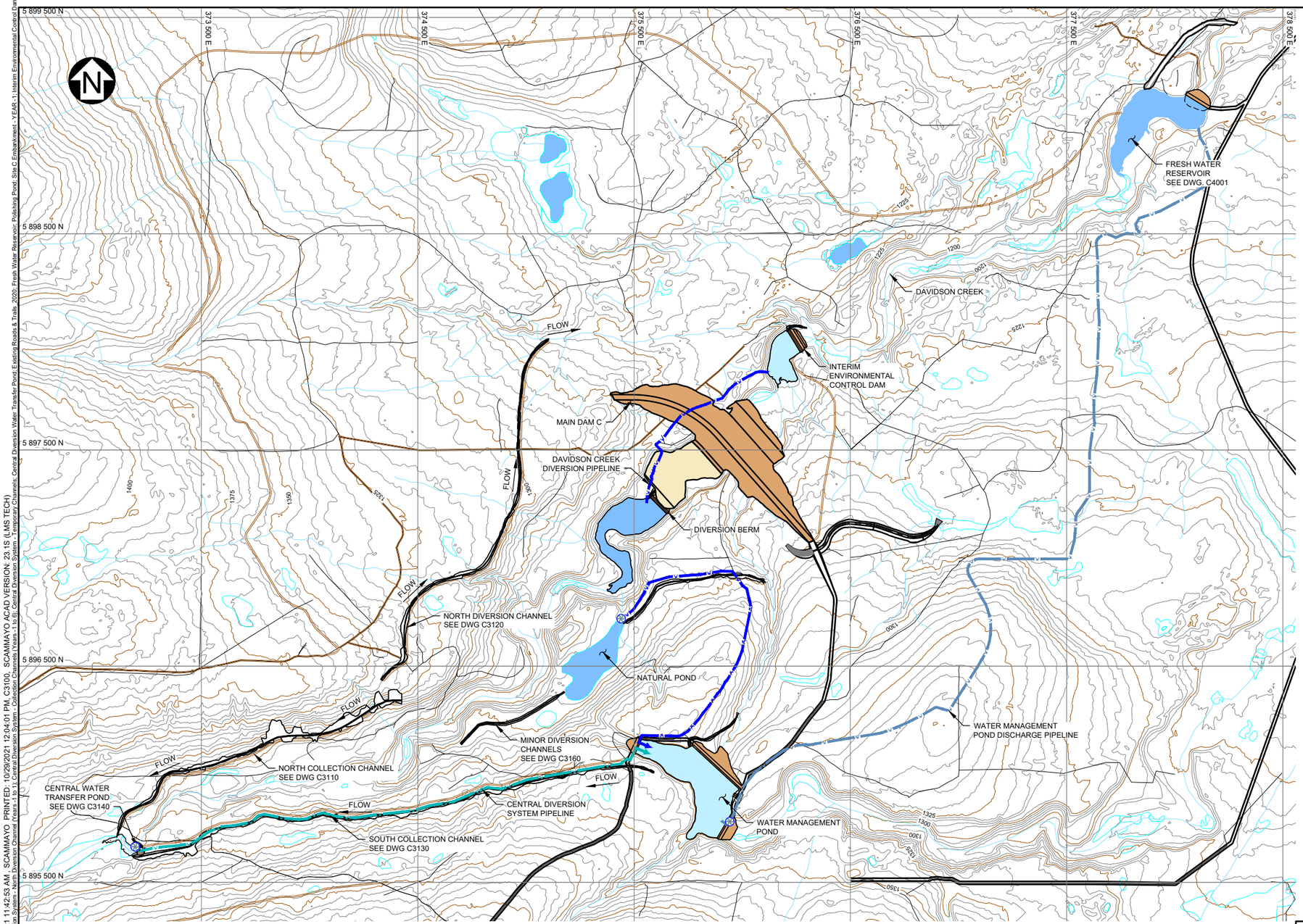

PLAN
SCALE A

LEGEND:

- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- PAG WASTE ROCK
- EXISTING ACCESS TRAILS
- CENTRAL WATER DIVERSION PIPELINE
- WATER MANAGEMENT POND DISCHARGE SYSTEM PIPELINE
- TEMPORARY DIVERSION SYSTEM PIPELINE
- CONSTRUCTION ROAD
- ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. FOR DIVERSION PIPING SYSTEMS GENERAL ARRANGEMENT SEE DWG. M3050.
3. TSF C GENERAL ARRANGEMENT FOR YEAR -1 IS SHOWN. SEE C1000 DRAWING SERIES FOR DETAILS.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE A 200 100 0 200 400 600 800 1000 m

DRG. NO.	DESCRIPTION
M3050	WATER MANAGEMENT - DIVERSION PIPING SYSTEMS - GENERAL ARRANGEMENT YEAR -1
G0006	CIVIL GENERAL NOTES
C4001	FRESH WATER RESERVOIR - EMBANKMENT AND RESERVOIR - GENERAL ARRANGEMENT
C3160	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - MINOR DIVERSION DITCHES
C3140	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND
C3130	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - PLAN AND PROFILE
C3120	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH DIVERSION CHANNEL - PLAN AND PROFILE
C3110	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH COLLECTION CHANNEL - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RM

REVISIONS

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2021-10-29

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WATER MANAGEMENT DIVERSION SYSTEMS GENERAL ARRANGEMENT YEAR -1

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3100	0

SAVED: M:\1\01\00457\33\A\cad\DWGS\C3100\C3100_10/29/2021 11:42:53 AM, SCAMMAYO, PRINTED: 10/29/2021 12:04:01 PM, C3100, SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
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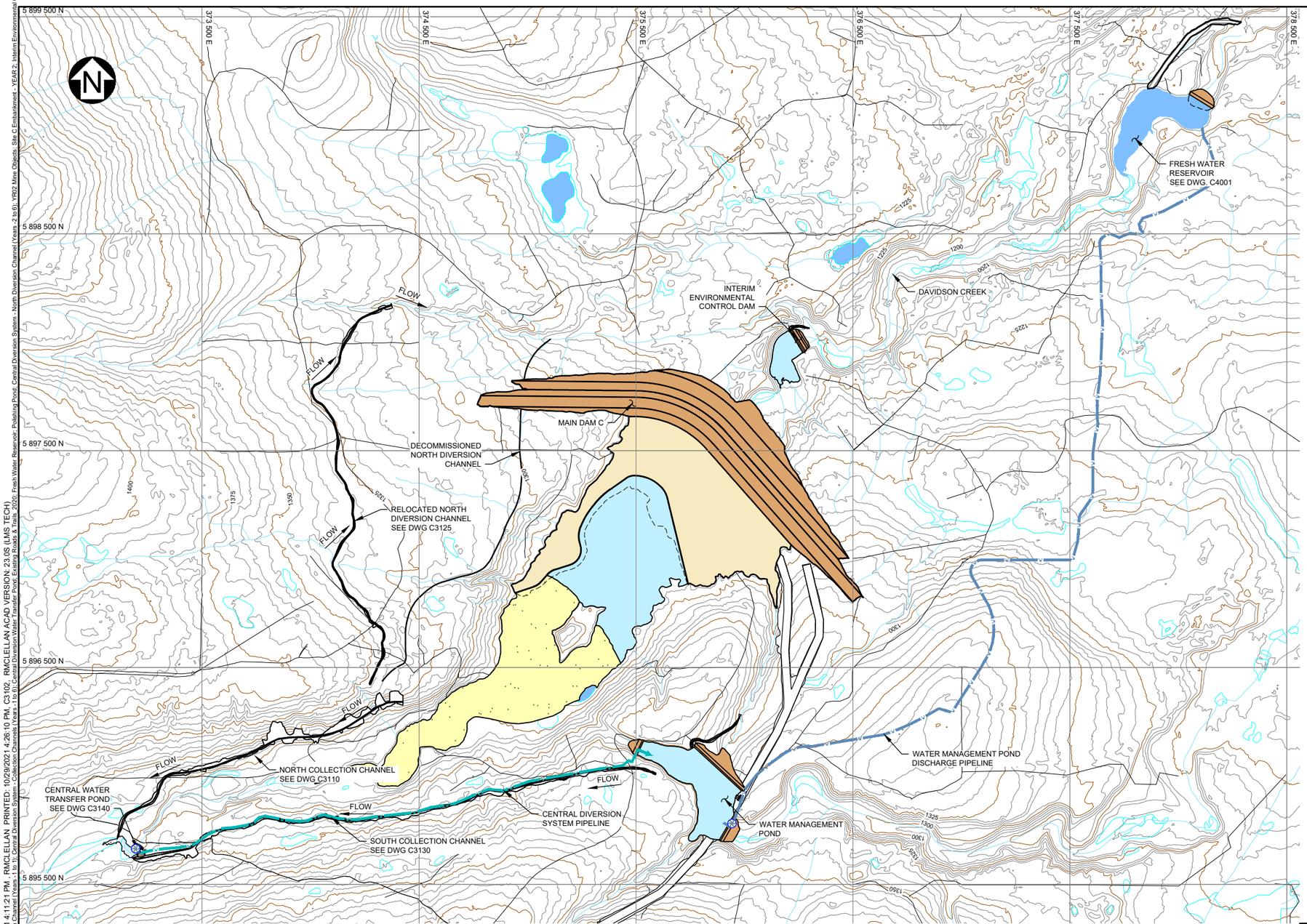

PLAN
SCALE A

LEGEND:

- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- PAG WASTE ROCK
- EXISTING ACCESS TRAILS
- CENTRAL WATER DIVERSION PIPELINE
- WATER MANAGEMENT POND DISCHARGE SYSTEM PIPELINE

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. FOR DIVERSION PIPING SYSTEMS GENERAL ARRANGEMENT SEE DWG. M3050.
3. TSF C GENERAL ARRANGEMENT FOR YEAR 2 IS SHOWN. SEE DRAWING G0022 FOR DETAILS.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE A 200 100 0 200 400 600 800 1000 m

DRG. NO.	DESCRIPTION
G0022	TAILINGS STORAGE FACILITY - GENERAL ARRANGEMENT - YEAR 2
G0006	CIVIL GENERAL NOTES
C4001	FRESH WATER RESERVOIR - EMBANKMENT AND RESERVOIR - GENERAL ARRANGEMENT
C3140	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND - PLAN
C3130	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - PLAN AND PROFILE
C3125	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - RELOCATED NORTH DIVERSION CHANNEL - PLAN, PROFILE AND SECTIONS
C3110	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH COLLECTION CHANNEL - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	APPROVED
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2021-10-29

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT DIVERSION SYSTEMS GENERAL ARRANGEMENT YEAR 2

O.	DRAWING NO.	REVISION
VA101-457/33	C3102	0

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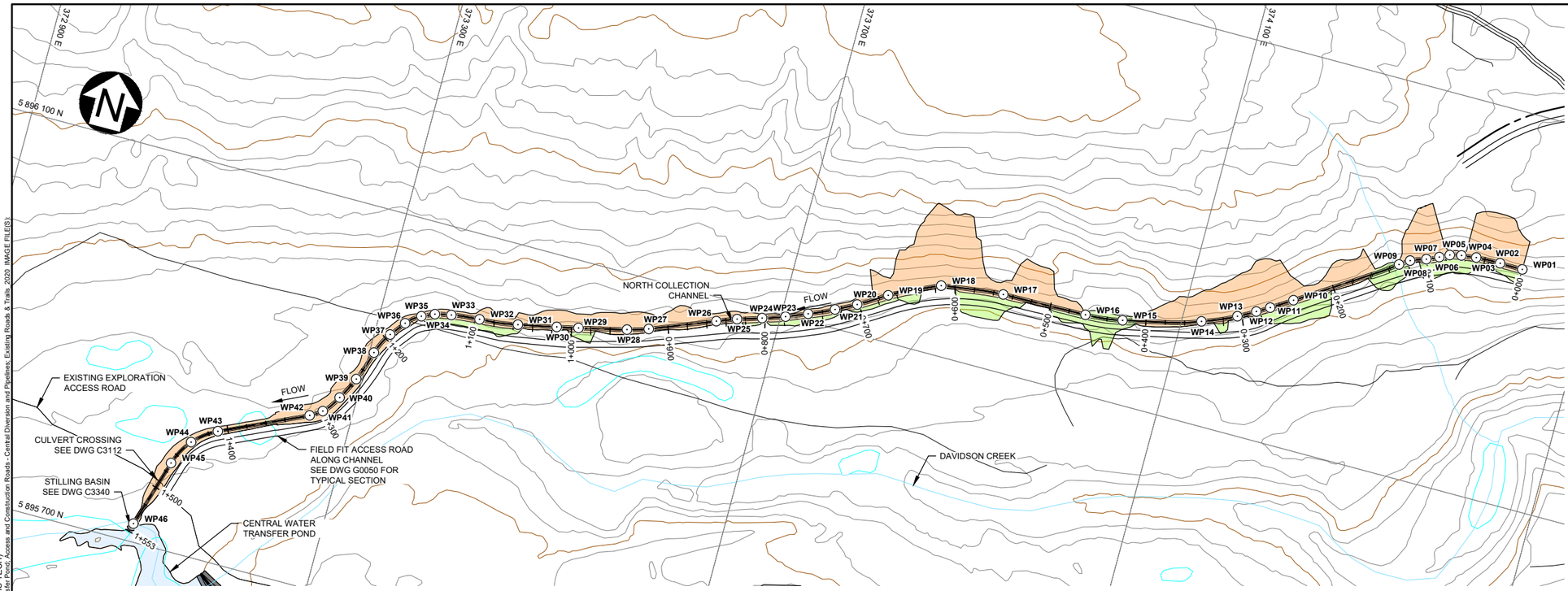
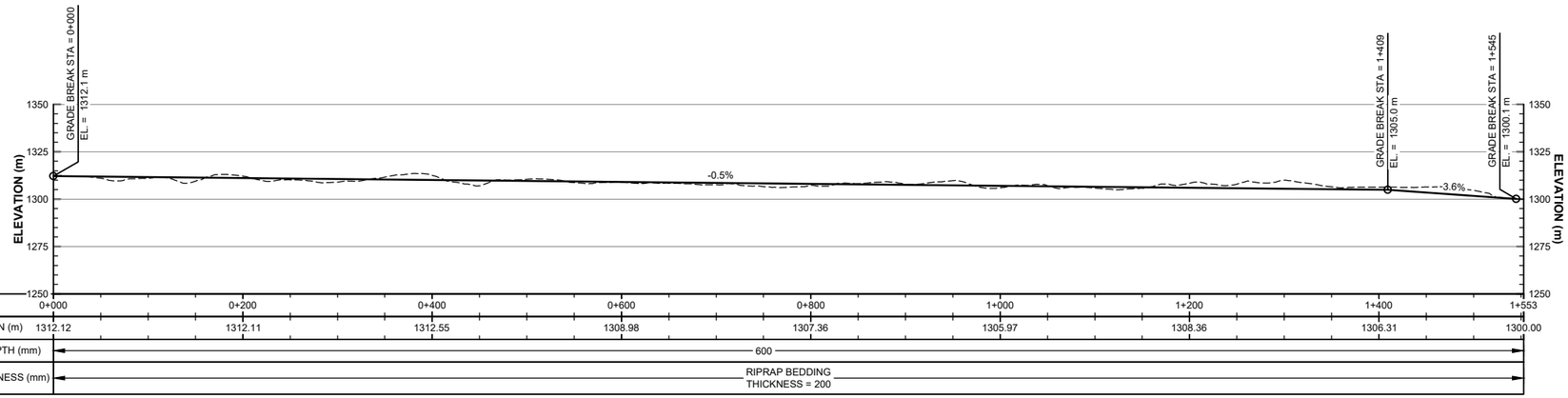


PLAN
SCALE B



PROFILE
HORIZONTAL SCALE A
VERTICAL SCALE C

NORTH COLLECTION CHANNEL WORK POINTS TABLE

POINT NO.	EASTING	NORTHING	ELEVATION (m)
WP01	374425.6	5896342.2	1311.4
WP02	374401.9	5896342.5	1311.3
WP03	374376.7	5896341.9	1311.2
WP04	374361.4	5896340.0	1311.1
WP05	374349.6	5896337.3	1311.0
WP06	374339.8	5896332.4	1311.0
WP07	374327.5	5896326.9	1310.9
WP08	374311.7	5896321.1	1310.8
WP09	374301.7	5896314.3	1310.8
WP10	374206.0	5896250.5	1310.2
WP11	374184.9	5896237.1	1310.0
WP12	374172.1	5896229.4	1310.0
WP13	374154.6	5896219.7	1309.9
WP14	374120.1	5896205.0	1309.7
WP15	374041.3	5896185.0	1309.3
WP16	374003.0	5896180.6	1309.1
WP17	373915.6	5896179.0	1308.6
WP18	373851.6	5896171.1	1308.3
WP19	373801.4	5896147.5	1308.0
WP20	373773.0	5896130.0	1307.8
WP21	373752.2	5896119.1	1307.7
WP22	373726.5	5896107.6	1307.6
WP23	373704.8	5896098.8	1307.5
WP24	373682.1	5896091.0	1307.3
WP25	373657.3	5896083.3	1307.2
WP26	373637.1	5896075.8	1307.1
WP27	373572.0	5896050.1	1306.7
WP28	373550.5	5896043.5	1306.6
WP29	373501.8	5896032.2	1306.4
WP30	373479.8	5896027.4	1306.3
WP31	373440.6	5896019.4	1306.1
WP32	373401.0	5896014.5	1305.9
WP33	373371.9	5896011.3	1305.7
WP34	373355.2	5896007.8	1305.6
WP35	373342.3	5896002.0	1305.6
WP36	373327.9	5895990.7	1305.5
WP37	373316.1	5895975.5	1305.4
WP38	373304.8	5895953.2	1305.2
WP39	373294.2	5895922.0	1305.1
WP40	373282.6	5895899.3	1304.9
WP41	373269.5	5895881.3	1304.8
WP42	373257.5	5895873.4	1304.8
WP43	373170.4	5895833.2	1304.4
WP44	373146.6	5895815.4	1303.4
WP45	373132.1	5895789.1	1302.3
WP46	373111.0	5895718.7	1299.7

LEGEND:

- FILL AREAS
- CUT AREAS
- EXISTING ACCESS TRAILS
- ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES, SEE DWG G0006.
2. SEE DWG C3111 FOR CHANNEL CROSS SECTIONS.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE C: 30 15 0 50 100 150 m
SCALE B: 50 25 0 50 100 150 200 250 m
SCALE A: 60 30 0 100 200 300 m

DRG. NO.	DESCRIPTION
G0050	TYPICAL ROAD SECTIONS
G0006	CIVIL GENERAL NOTES
C3440	WATER MANAGEMENT - STILLING BASIN - TYPICAL SECTIONS AND DETAILS
C3112	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH COLLECTION CHANNEL - DETAILS
C3111	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH COLLECTION CHANNEL - CROSS SECTIONS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RM	

REVISIONS

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BLACKWATER GOLD PROJECT

PROFESSIONAL ENGINEER PROVINCE OF

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WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
NORTH COLLECTION CHANNEL
PLAN AND PROFILE

CONSULTANT NO.	DRAWING NO.	REVISION
VA101-457/33	C3110	0

2021-10-29

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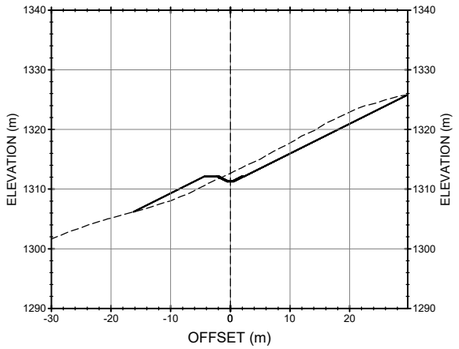

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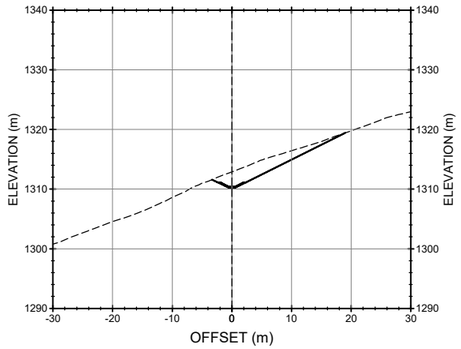

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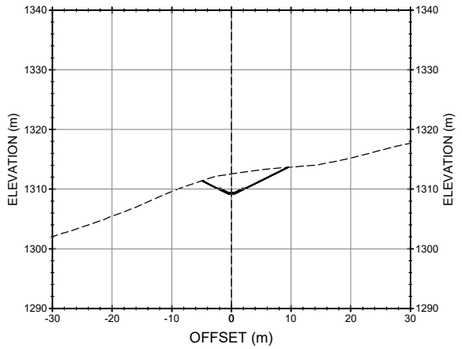

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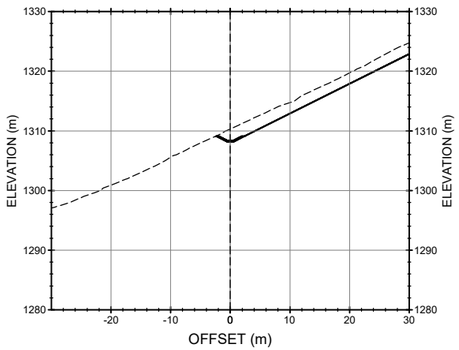

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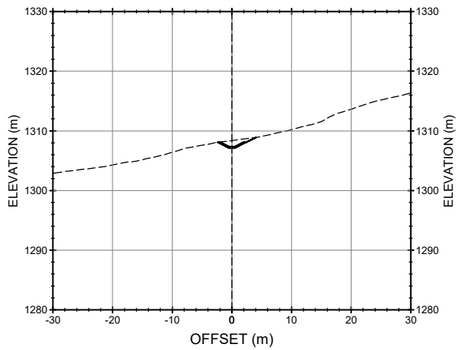

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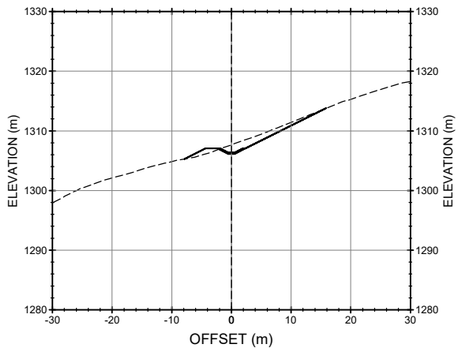

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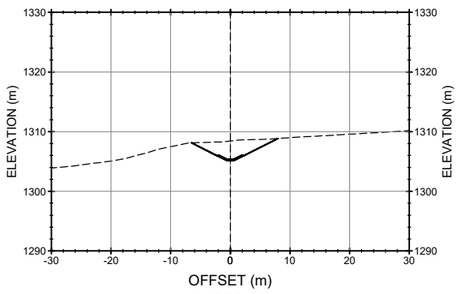

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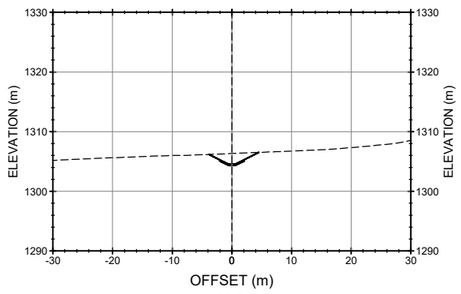

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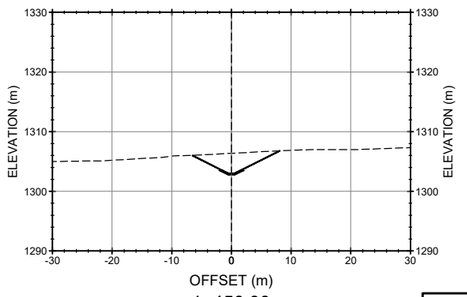

1+450.00

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. NORTH COLLECTION CHANNEL PLAN AND PROFILE SHOWN ON DWG C3110.
3. CROSS SECTION DETAILS EXCLUDE CUT AND FILL REQUIRED FOR ADJACENT FIELD FIT ACCESS ROAD.

DETAILED DESIGN

NOT FOR CONSTRUCTION

SCALE A 10 5 0 10 20 30 40 50 m

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2021-10-29

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
NORTH COLLECTION CHANNEL
CROSS SECTIONS

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3111	0

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
C3110	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH COLLECTION CHANNEL - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RM

REVISIONS

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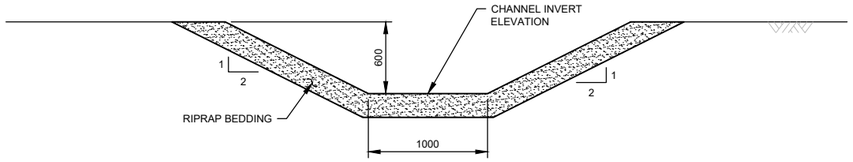
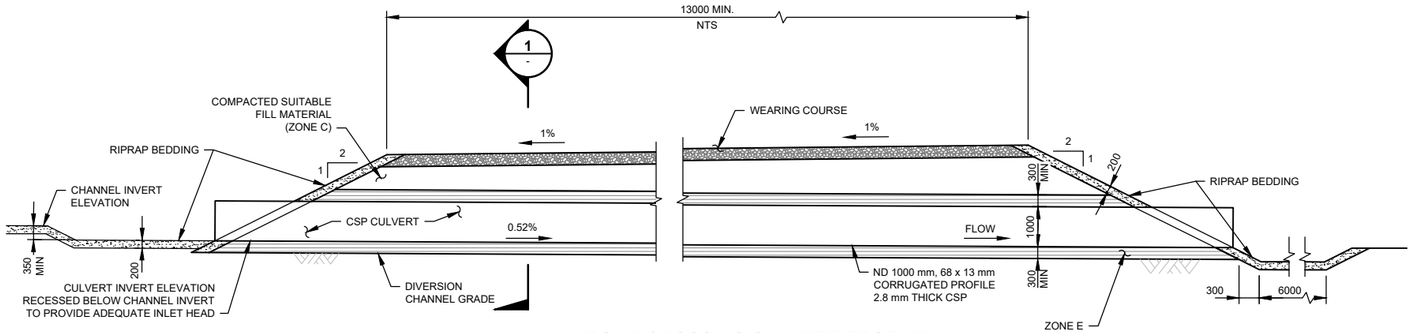
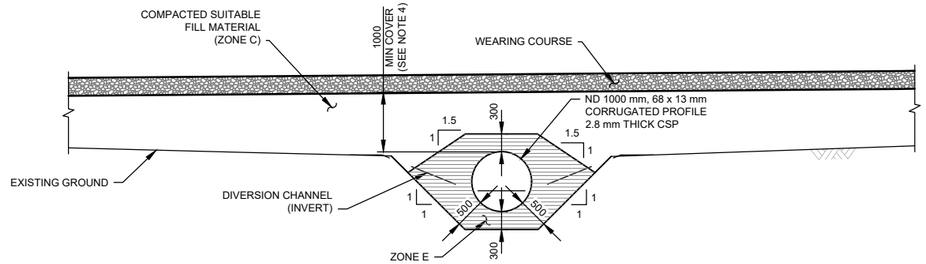


COLLECTION CHANNEL
TYPE 2 CHANNEL
STA 0+000 TO 1+500 m
SCALE C



ROAD CROSSING CULVERT PROFILE
SCALE A



1 SECTION
ROAD CROSSING CULVERT
SCALE B

LEGEND:

- WEARING COURSE
- ZONE C
- ZONE E
- RIPRAP BEDDING

NOTES :

1. FOR GENERAL NOTES SEE DWG G0006.
2. FOR FILL MATERIAL SPECIFICATIONS AND RIPRAP REQUIREMENTS SEE DWG G0040.
3. CULVERT TO BE INSTALLED AT SAME SLOPE OF DIVERSION / COLLECTION DITCHES.
4. REQUIRED COVER FOR DESIGN VEHICLE OF CAT 725.
5. NORTH COLLECTION CHANNEL PLAN AND PROFILE SHOWN ON DWG C3110.
6. TYPICAL CHANNEL SECTIONS SHOWN ON DRAWING G0060.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE C 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m
SCALE B 1 0.5 0 1 2 3 4 5 m
SCALE A 1.5 0.75 0 2.5 5.0 7.5 m

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
NORTH COLLECTION CHANNEL
DETAILS

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3112	0

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

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2021-10-29

DRG. NO.	DESCRIPTION
G0060	EROSION PROTECTION - TYPICAL CHANNEL SECTIONS
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES
C3110	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH COLLECTION CHANNEL - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RM

REVISIONS

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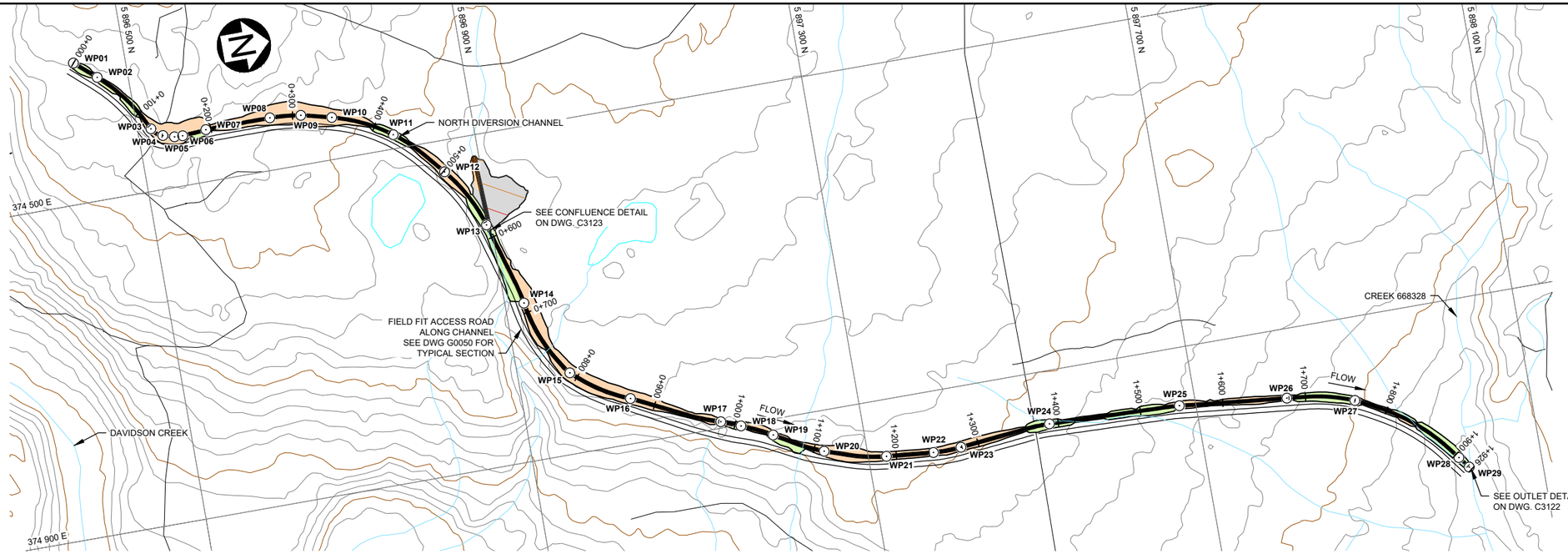
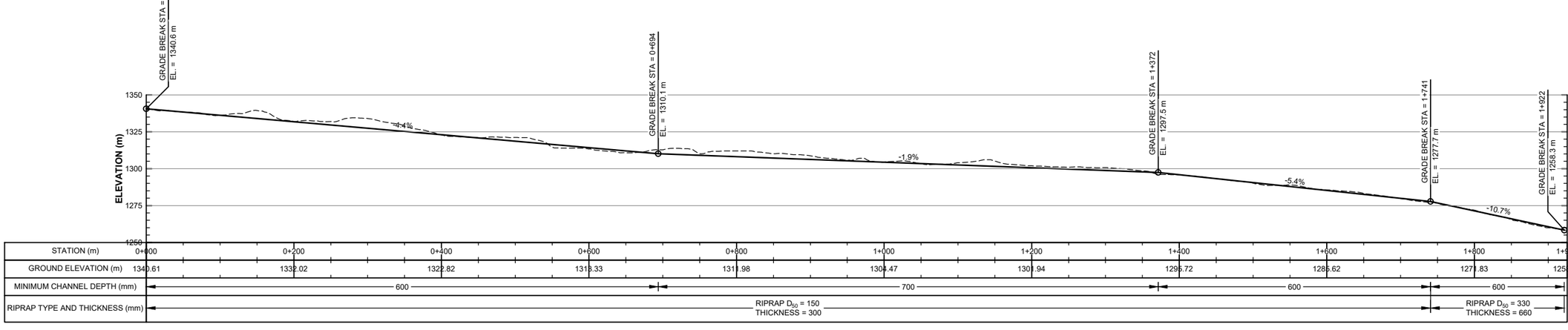


PLAN
SCALE A

NORTH DIVERSION CHANNEL WORK POINTS TABLE			
POINT NO.	EASTING	NORTHING	ELEVATION (m)
WP01	374331.0	5896438.0	1340.0
WP02	374353.1	5896463.3	1338.5
WP03	374425.4	5896516.3	1334.6
WP04	374436.0	5896529.0	1333.8
WP05	374439.8	5896542.5	1333.2
WP06	374440.3	5896552.5	1332.8
WP07	374438.0	5896581.2	1331.5
WP08	374437.3	5896659.9	1328.0
WP09	374440.8	5896697.1	1326.4
WP10	374449.8	5896733.5	1324.7
WP11	374483.1	5896803.0	1321.3
WP12	374537.9	5896856.0	1318.0
WP13	374609.7	5896894.7	1314.4
WP14	374710.5	5896923.0	1309.8
WP15	374802.7	5896962.9	1307.6
WP16	374846.0	5897029.6	1306.1
WP17	374892.5	5897131.9	1304.0
WP18	374901.5	5897155.2	1303.6
WP19	374919.1	5897191.5	1302.8
WP20	374949.0	5897248.8	1301.6
WP21	374968.0	5897321.7	1300.2
WP22	374973.4	5897378.4	1299.1
WP23	374972.9	5897412.1	1298.5
WP24	374963.8	5897522.1	1295.9
WP25	374969.5	5897680.3	1287.4
WP26	374983.0	5897809.5	1280.5
WP27	375000.0	5897889.9	1275.0
WP28	375089.6	5898001.5	1259.5
WP29	375103.1	5898011.8	1257.7



PROFILE
HORIZONTAL SCALE A
VERTICAL SCALE B

SCALE B 30 15 0 50 100 150 m
SCALE A 60 30 0 100 200 300 m

LEGEND:

- FILL AREAS
- CUT AREAS
- EXISTING ACCESS TRAILS
- ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES, SEE DWG G0006.
2. SEE DWG C3121 FOR CHANNEL CROSS SECTIONS.

DETAILED DESIGN
NOT FOR CONSTRUCTION

REFERENCE DRAWINGS	
DRG. NO.	DESCRIPTION
G0050	TYPICAL ROAD SECTIONS
G0006	CIVIL GENERAL NOTES
C3123	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH DIVERSION CHANNEL - DETAILS (SHEET 2 OF 2)
C3122	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH DIVERSION CHANNEL - DETAILS (SHEET 1 OF 2)
C3121	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH DIVERSION CHANNEL - CROSS SECTIONS

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	R		

REVISIONS			
REV	DATE	DESCRIPTION	DESIGNED	D

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M. J. BARRETT

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2021-10-29

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT CENTRAL DIVERSION SYSTEM NORTH DIVERSION CHANNEL PLAN AND PROFILE

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3120	0

SAVED: M:\1\101\00457\33\Acad\DWG\C3120\C3120_10/29/2021 11:55:13 AM_SCAMMAYO_PRINTED: 10/29/2021 12:08:07 PM, C3120_SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
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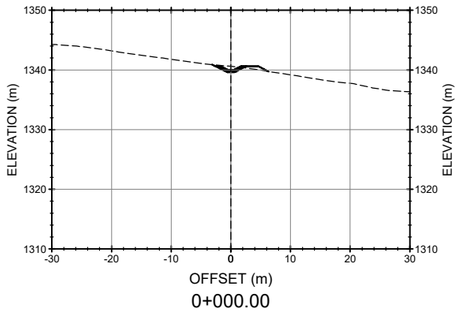

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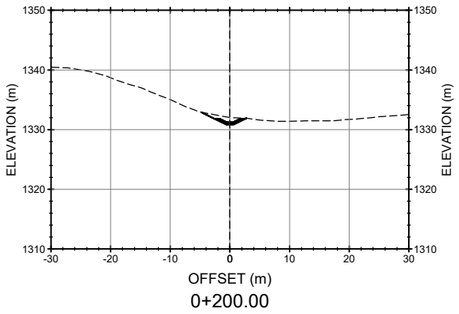

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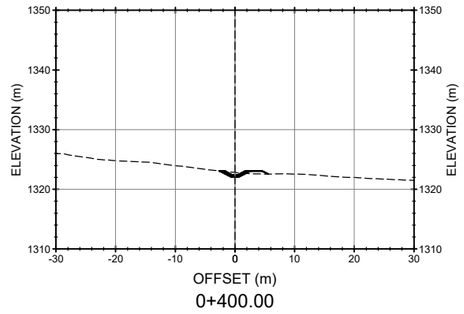

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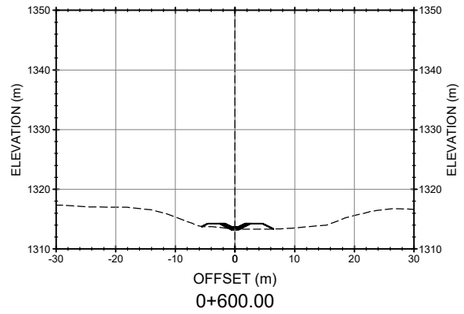

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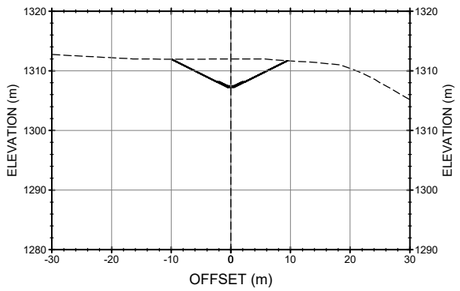

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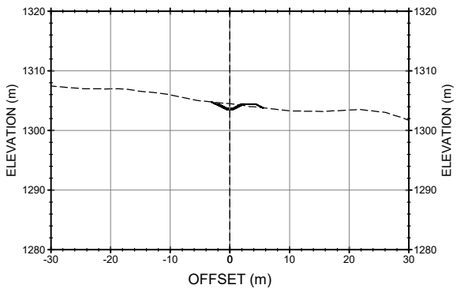

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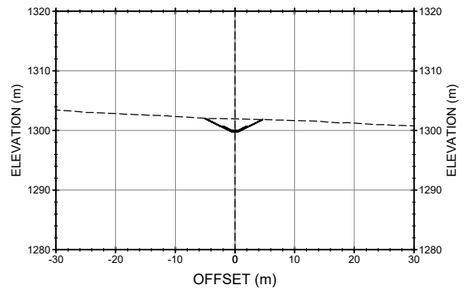

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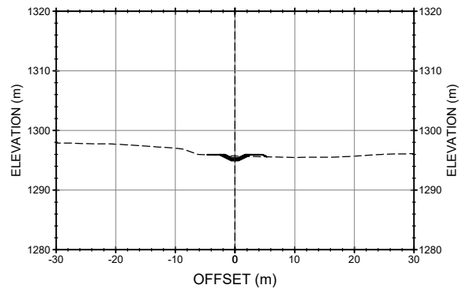

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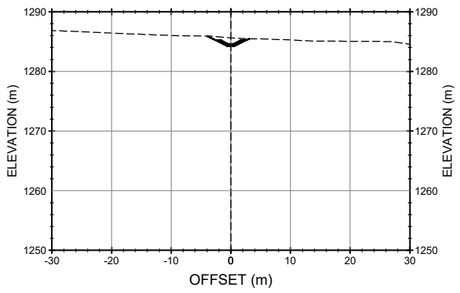

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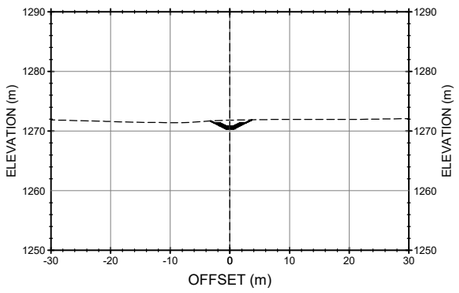

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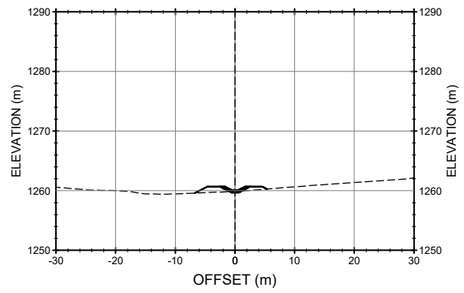

1+900.00

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. NORTH DIVERSION CHANNEL PLAN AND PROFILE SHOWN ON DWG C3120.
3. CROSS SECTION DETAILS EXCLUDE CUT AND FILL REQUIRED FOR ADJACENT FIELD FIT ACCESS ROAD.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE A 10 5 0 10 20 30 40 50 m

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
NORTH DIVERSION CHANNEL
CROSS SECTIONS

PROFESSIONAL ENGINEER PROV INC.

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2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3121	0

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
C3120	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH DIVERSION CHANNEL - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RM

REVISIONS

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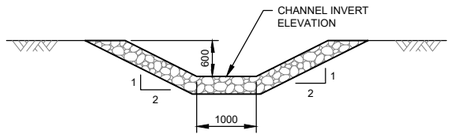
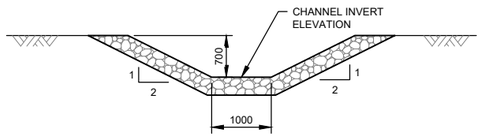
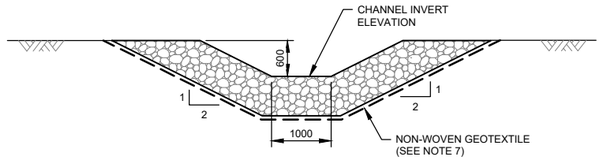


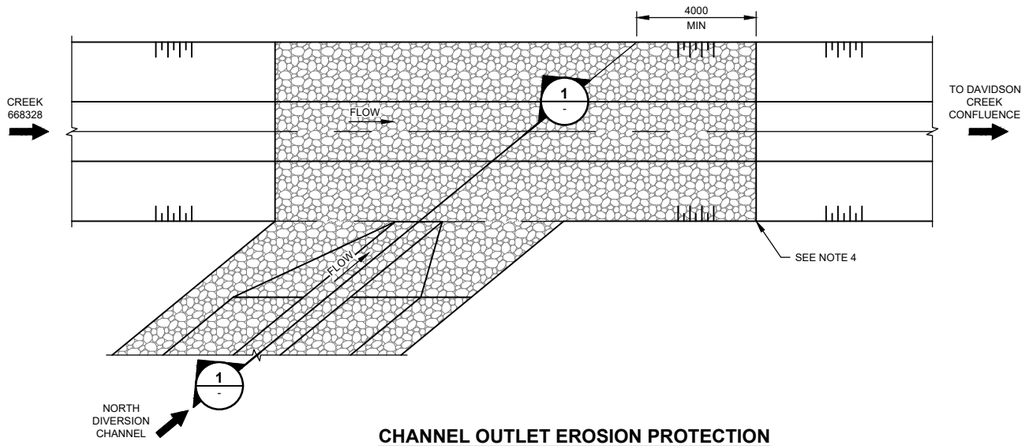
DIVERSION CHANNEL
TYPE 3 CHANNEL
STA 0+000 TO 0+694 m
STA 1+372 TO 1+741 m
SCALE B



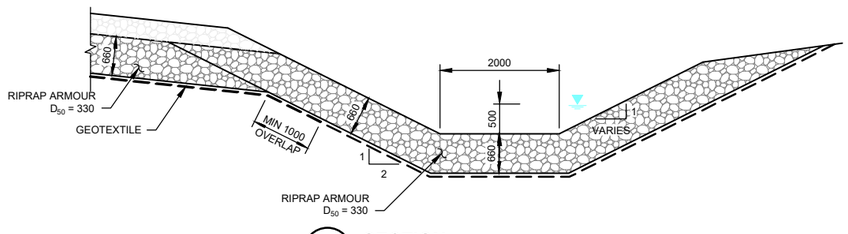
DIVERSION CHANNEL
TYPE 3 CHANNEL
STA 0+694 TO 1+372 m
SCALE B



DIVERSION CHANNEL
TYPE 4 CHANNEL
STA 1+741 TO 1+917 m
SCALE B



CHANNEL OUTLET EROSION PROTECTION
SCALE A



1 - **SECTION**
CHANNEL OUTLET EROSION PROTECTION
SCALE B

LEGEND:

RIPRAP

NON-WOVEN GEOTEXTILE

NOTES :

1. FOR GENERAL NOTES SEE DWG G0006.
2. THE CONTRACTOR SHALL PLACE RIPRAP CAREFULLY SO AS TO AVOID PUNCTURING THE GEOTEXTILE FABRIC.
3. DIMENSIONS AND LAYOUT OF NATURAL STREAM TO BE CONFIRMED BY THE FIELD ENGINEER. TRANSITION BETWEEN NATURAL STREAM BED AND RIPRAP TO BE FIELD FIT.
4. FOR RIPRAP REQUIREMENTS SEE DWG G0040.
5. NORTH DIVERSION CHANNEL PLAN AND PROFILE SHOWN ON DWG C3120.
6. TYPICAL CHANNEL SECTIONS SHOWN ON DRAWING G0060.
7. FOUNDATION MATERIALS TO BE ASSESSED BY ENGINEER TO DETERMINE GEOTEXTILE REQUIREMENT.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE B 1 0.5 0 1 2 3 4 5 m
SCALE A 2 1 0 2 4 6 8 10 m

DRG. NO.	DESCRIPTION
G0060	EROSION PROTECTION - TYPICAL CHANNEL SECTIONS
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES
C3120	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH COLLECTION CHANNEL - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1

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2021-10-29

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
NORTH DIVERSION CHANNEL
DETAILS (SHEET 1 OF 2)

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3122	0

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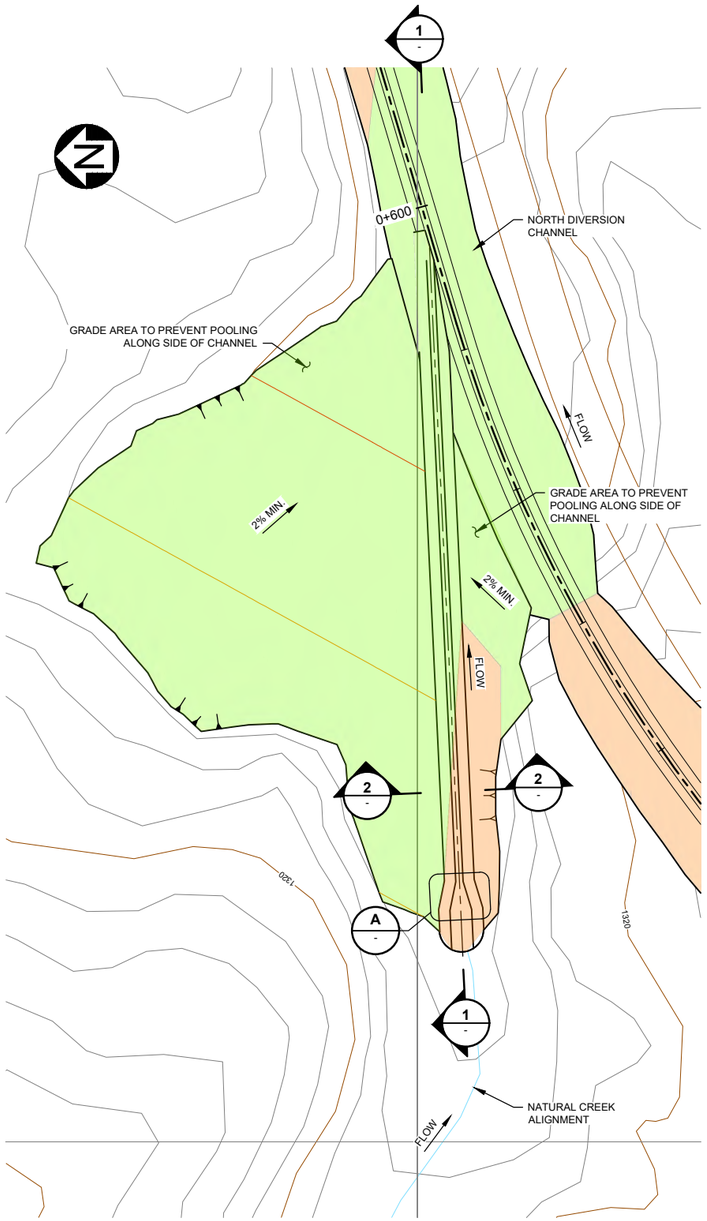
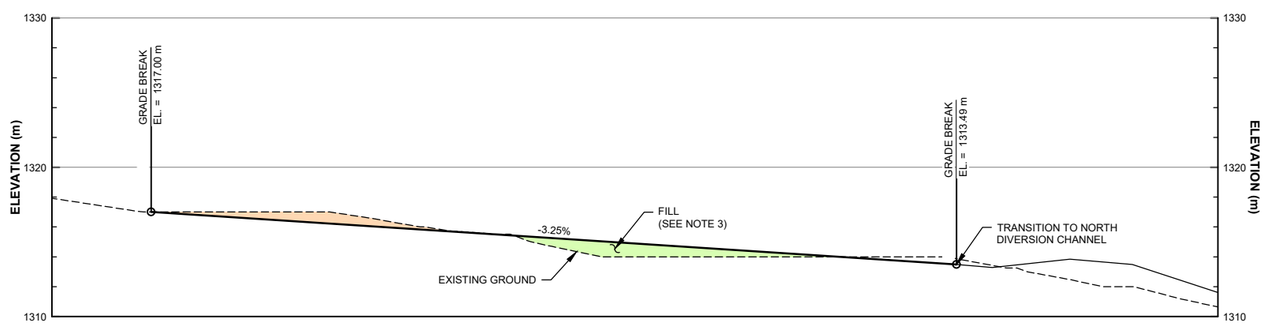
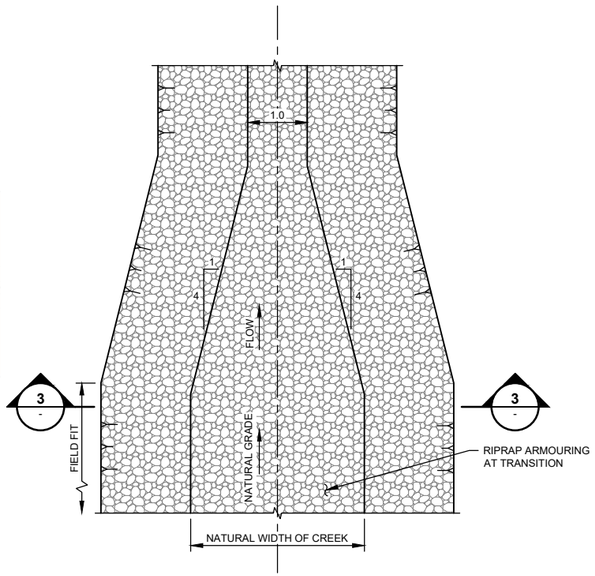


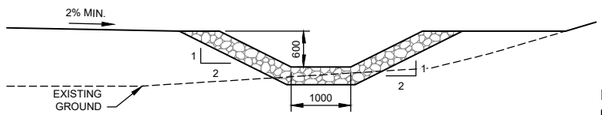
PLAN
SCALE A



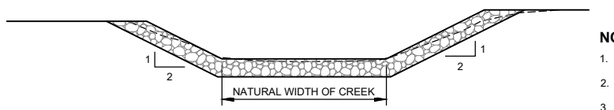
1 - **SECTION**
SCALE A



A - **DETAIL**
CREEK TO CHANNEL TRANSITION
SCALE B



2 - **SECTION**
TYPE 3 CHANNEL
SCALE B



3 - **SECTION**
TYPE 3 CHANNEL
SCALE B

LEGEND:

- FILL AREAS
- CUT AREAS
- RIPRAP
- ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. FOR RIPRAP SPECIFICATIONS SEE DWG G0040.
3. ALL ADDITIONAL FILL NEEDS TO BE MET WITH ZONE C MATERIAL. REMOVE ANY LARGE ROCKS FROM ZONE C FILL PRIOR TO PLACEMENT.
4. NORTH DIVERSION CHANNEL PLAN AND PROFILE SHOWN ON DWG C3120.
5. TYPICAL CHANNEL SECTIONS SHOWN ON DRAWING G0060.

SCALE C: 30 15 0 50 100 150 m
SCALE B: 1 0.5 0 1 2 3 4 5 m
SCALE A: 8 4 0 10 20 30 40 m

DRG. NO.	DESCRIPTION
G0060	EROSION PROTECTION - TYPICAL CHANNEL SECTIONS
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES
C3120	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH DIVERSION CHANNEL - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRA
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RM

REVISIONS

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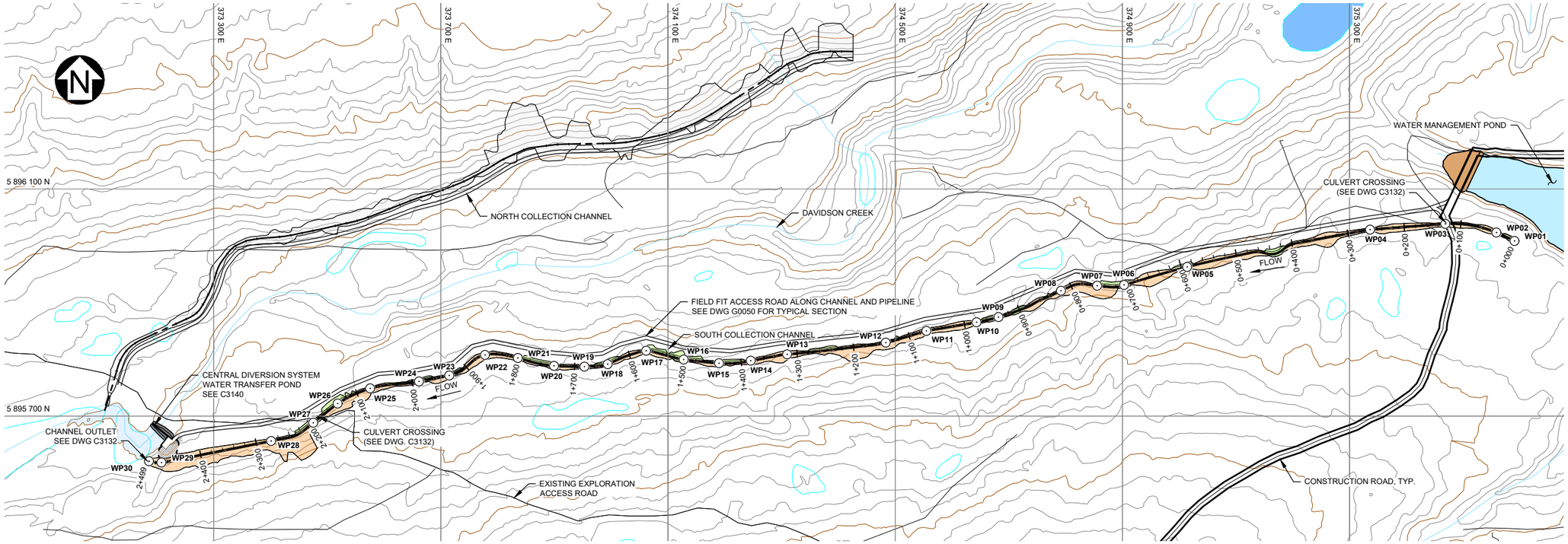
BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
NORTH DIVERSION CHANNEL
DETAILS (SHEET 2 OF 2)

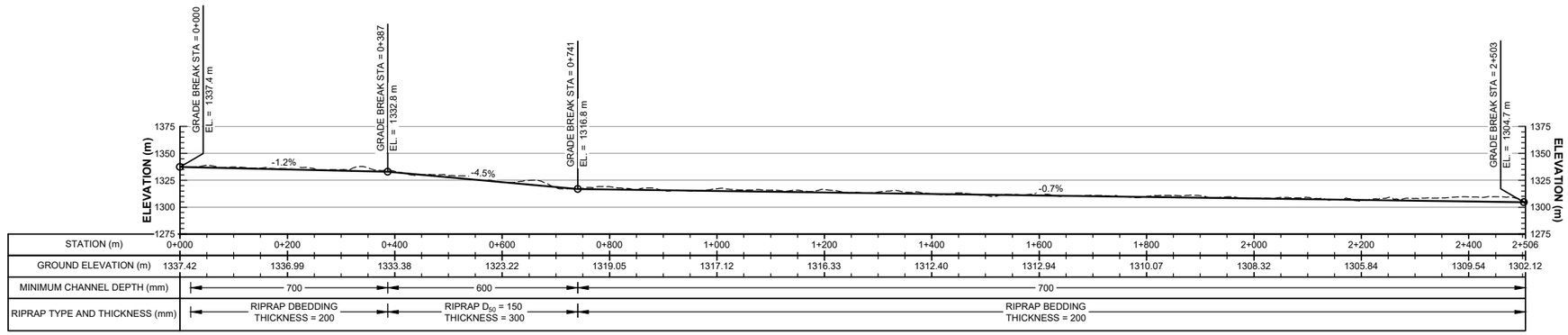
PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA
<original signed by>
2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3123	0

SAVED: M:\101\100457\33\A\cad\DWGS\C3123C3123_10/29/2021 11:59:14 AM, SCAMMAYO PRINTED: 10/29/2021 12:11:24 PM, C3123, SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Hydro: Intake Structure, Option B; Central Diversion Channels; Site C Embankment - YEAR -1 topo 1m contours; Existing Roads & Trails; 2020 Access and Construction Roads - Central Diversion and Pipelines IMAGE FILE(S):



PLAN
SCALE B



PROFILE
HORIZONTAL SCALE A
VERTICAL SCALE C

SOUTH COLLECTION CHANNEL WORK POINTS TABLE

POINT NO.	EASTING	NORTHING	ELEVATION (m)
WP01	375590.5	5896008.3	1336.7
WP02	375558.9	5896023.2	1336.3
WP03	375468.5	5896038.5	1335.2
WP04	375336.4	5896028.4	1333.6
WP05	375014.3	5895962.7	1322.9
WP06	374903.1	5895930.6	1317.6
WP07	374855.9	5895929.3	1316.0
WP08	374792.1	5895920.8	1315.5
WP09	374681.8	5895874.3	1314.7
WP10	374643.2	5895865.0	1314.2
WP11	374555.1	5895849.8	1313.6
WP12	374483.6	5895829.2	1313.1
WP13	374309.9	5895808.6	1312.0
WP14	374245.9	5895797.3	1311.5
WP15	374189.8	5895793.1	1311.3
WP16	374127.7	5895799.5	1310.8
WP17	374061.5	5895815.1	1310.4
WP18	373994.0	5895791.5	1309.9
WP19	373952.8	5895786.8	1309.6
WP20	373899.4	5895788.4	1309.2
WP21	373835.8	5895802.3	1308.8
WP22	373777.7	5895807.4	1308.3
WP23	373714.8	5895771.4	1307.8
WP24	373661.7	5895760.7	1307.4
WP25	373575.6	5895748.8	1306.8
WP26	373518.6	5895722.0	1306.4
WP27	373475.3	5895688.1	1306.1
WP28	373401.3	5895656.0	1305.5
WP29	373208.3	5895617.8	1304.1
WP30	373186.1	5895620.4	1304.0

LEGEND:
- FILL AREAS
- CUT AREAS
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- EXISTING ACCESS TRAILS
- ACCESS ROAD
- CONSTRUCTION ROAD

SCALE B 50 25 0 50 100 150 200 250 m
SCALE B 80 40 0 100 200 300 400 m
SCALE A 100 50 0 100 200 300 400 500 m

NOTES:
1. FOR GENERAL NOTES SEE DWG G0006.
2. SEE DWG C3131 FOR CHANNEL CROSS SECTIONS.
3. SEE DWG M3150 FOR PIPELINE ALIGNMENT AND PROFILE.

DETAILED DESIGN
NOT FOR CONSTRU

M3150	CENTRAL DIVERSION SYSTEM - PIPELINE - PLAN AND PROFILE
G0050	TYPICAL ROADS SECTIONS
G0006	CIVIL GENERAL NOTES
C3140	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND - PLAN
C3132	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - DETAILS
C3131	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - CROSS SECTIONS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RM		

REVISIONS

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2021-10-29

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
SOUTH COLLECTION CHANNEL
PLAN AND PROFILE

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3130	0

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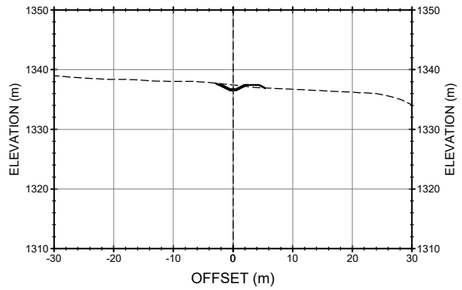
XREF FILES: Hydro; Topo 5m Contours; Intake Structure Option B; Central Diversion System - Collection Channels (Years - 1 to 6); Polishing Pond; Main Dam C - Stage 01; Central Diversion Water Transfer Pond; Existing Roads & Trails_2020; Access and Construction Roads - Central Diversion and Pipelines IMAGE FILE(S):



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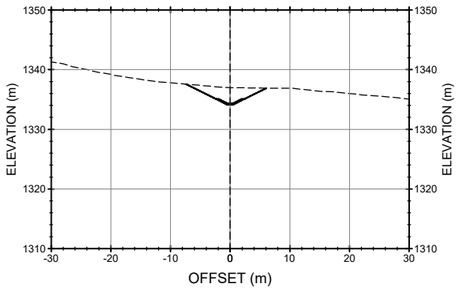

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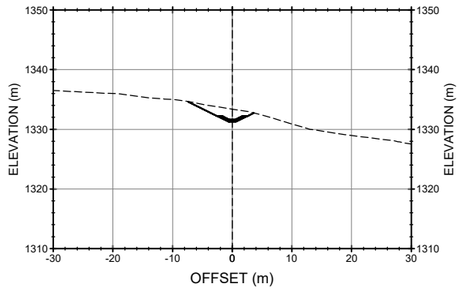

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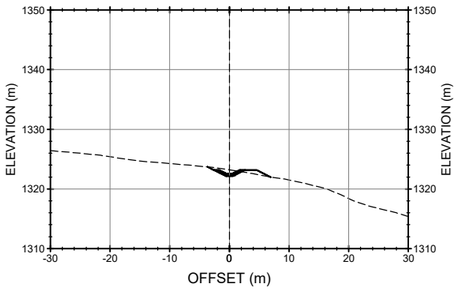

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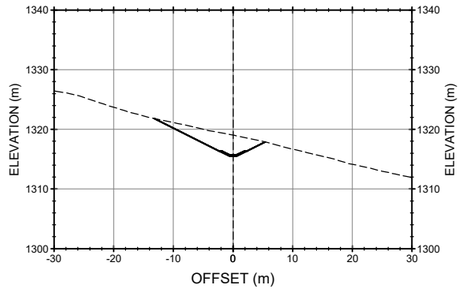

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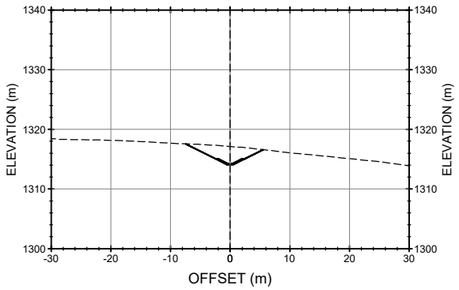

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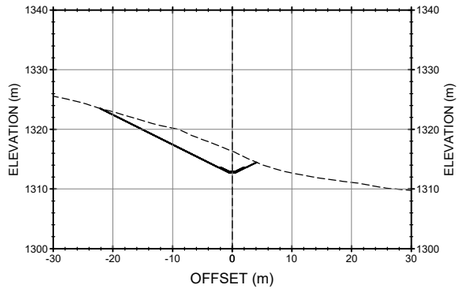

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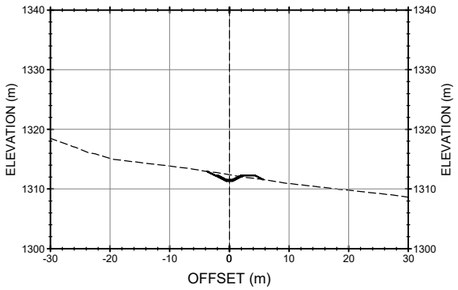

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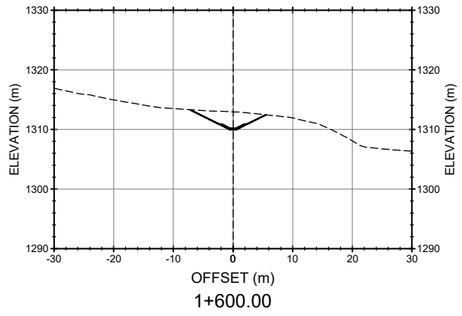

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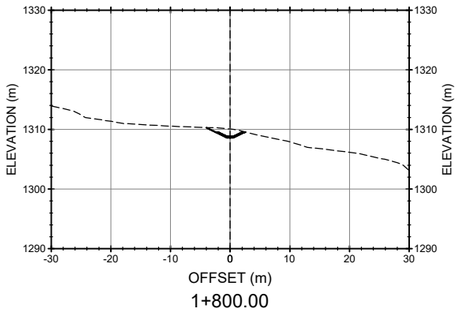

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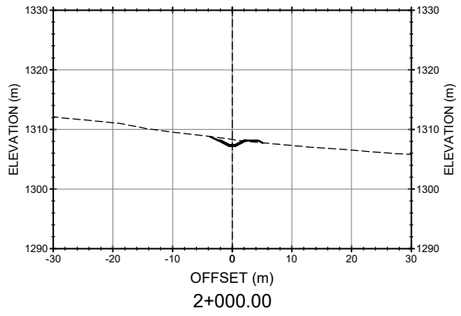

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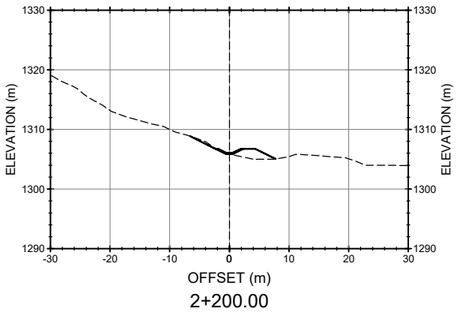

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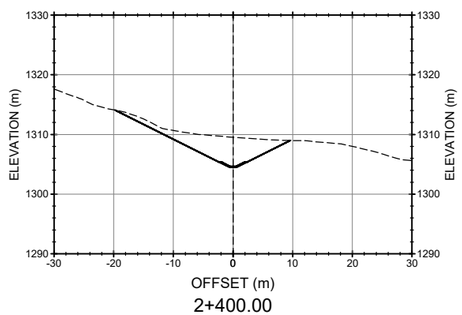

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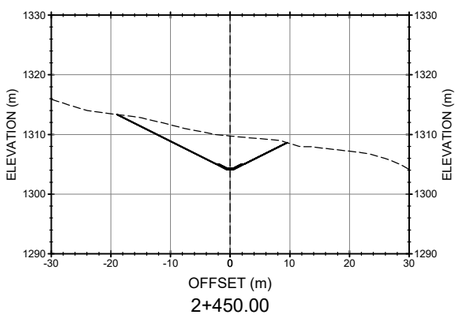

2+450.00

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. SOUTH COLLECTION CHANNEL PLAN AND PROFILE SHOWN ON DWG C3130.
3. CROSS SECTION DETAILS EXCLUDE CUT AND FILL REQUIRED FOR ADJACENT FIELD FIT ACCESS ROAD.

DETAILED DESIGN

NOT FOR CONSTRUCTION

SCALE A 10 5 0 10 20 30 40 50 m

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
SOUTH COLLECTION CHANNEL
CROSS SECTIONS

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

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2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3131	0

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
C3130	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RMM

REVISIONS

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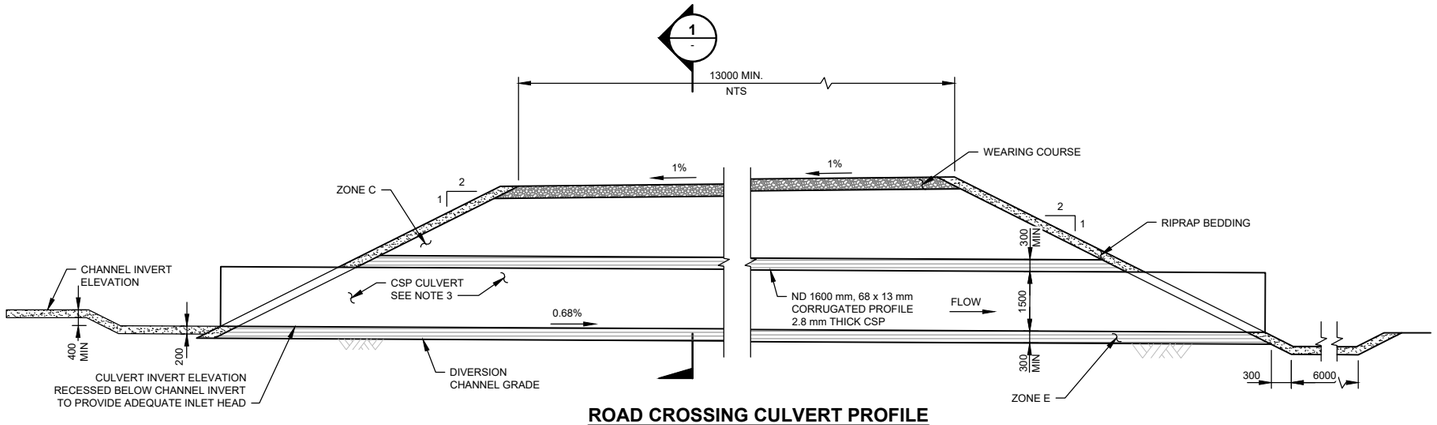
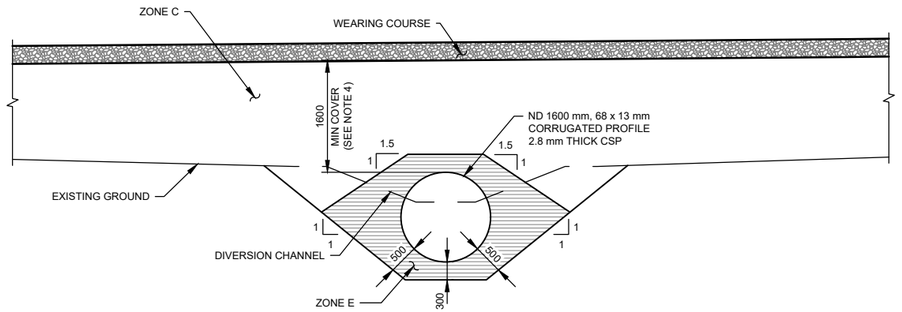
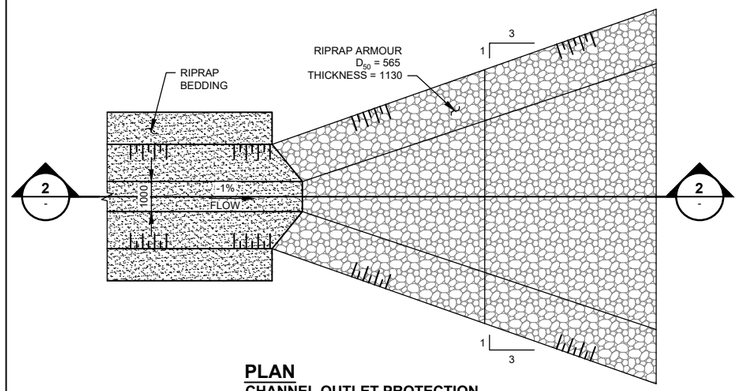


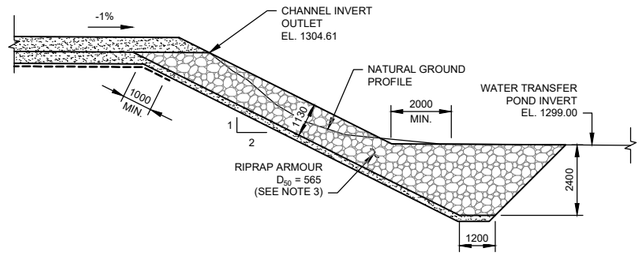
ROAD CROSSING CULVERT PROFILE
SCALE A



1 - **SECTION**
ROAD CROSSING CULVERT
SCALE C



PLAN
CHANNEL OUTLET PROTECTION
SCALE A



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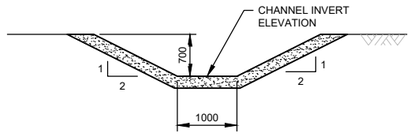
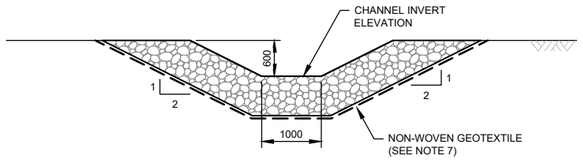
CHANNEL OUTLET PROTECTION PROFILE
SCALE B



COLLECTION CHANNEL
TYPE 2 CHANNEL
STA 0+000 TO 0+386 m
STA 0+708 TO 2+499 m
SCALE C



COLLECTION CHANNEL
TYPE 4 OR 5 CHANNEL
STA 0+386 TO 0+708 m
SCALE C

LEGEND:

- WEARING COURSE
- ZONE C
- ZONE E
- RIPRAP
- RIPRAP BEDDING
- NON-WOVEN GEOTEXTILE

NOTES :

1. FOR GENERAL NOTES SEE DWG G0006.
2. FOR FILL MATERIAL SPECIFICATIONS AND RIPRAP REQUIREMENTS SEE DWG G0040.
3. THE CONTRACTOR SHALL PLACE RIPRAP CAREFULLY SO AS TO AVOID PUNCTURING THE GEOTEXTILE FABRIC.
4. REQUIRED COVER FOR DESIGN VEHICLE OF CAT 777.
5. SOUTH COLLECTION CHANNEL PLAN AND PROFILE SHOWN ON DWG C3130.
6. TYPICAL CHANNEL SECTIONS SHOWN ON DRAWING G0060.
7. FOUNDATION MATERIALS TO BE ASSESSED BY ENGINEER TO DETERMINE GEOTEXTILE REQUIREMENT.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE C: 1 0.5 0 1 2 3 4 5 m
SCALE B: 2 1 0 2 4 6 8 10 m
SCALE A: 1.5 0.75 0 2.5 5.0 7.5 m

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
SOUTH COLLECTION CHANNEL
DETAILS

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3132	0

<original signed by>

PROFESSIONAL ENGINEER

2021-10-29

DRG. NO.	DESCRIPTION
G0060	EROSION PROTECTION - TYPICAL CHANNEL SECTIONS
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES
C3130	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
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REVISIONS

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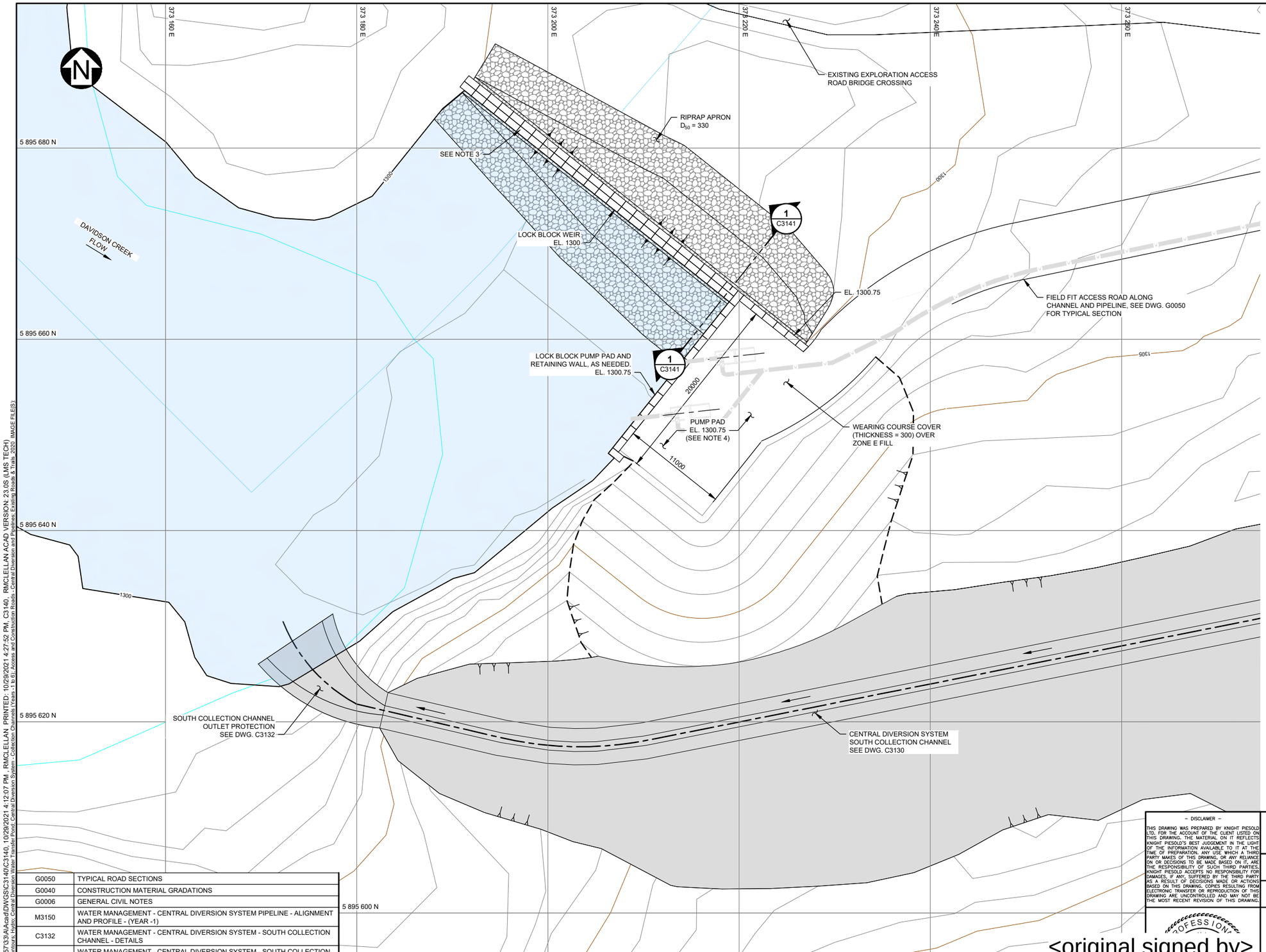
xREF FILE(S): topo 1m contours; Hydro; Central Diversion Water Transfer Pond; Central Diversion System - Collection Channels (Years -1 to 6); Access and Construction Roads - Central Diversion and Pipelines; Existing Roads & Trails, 2020 IMAGE FILE(S):



PLAN
SCALE A

LEGEND:

- RIPRAP
- CENTRAL DIVERSION SYSTEM PIPELINE
- EXISTING ACCESS TRAILS
- ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. LOCK BLOCK RETAINING WALL TO BE BUILT ON LEVEL GROUND AND STABILIZED WITH GEOTEXTILE WHERE MORE THAN 3 ROWS OF BLOCKS ARE REQUIRED.
3. LOCK BLOCK OVERFLOW WEIR TO TIE IN WITH NATURAL GROUND AND FIELD FIT WITH EROSION PROTECTION MEASURES, AS NEEDED.
4. SEE DWG. M3150 FOR PIPELINE PLAN AND PROFILE.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE A 4 2 0 4 8 12 16 20 m

DRG. NO.	DESCRIPTION
G0050	TYPICAL ROAD SECTIONS
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	GENERAL CIVIL NOTES
M3150	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM PIPELINE - ALIGNMENT AND PROFILE - (YEAR -1)
C3132	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - DETAILS
C3130	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - PLAN AND PROFILE
C3141	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND - SECTIONS AND DETAILS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1
R			

REVISIONS

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PROFESSIONAL ENGINEER

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2021-10-29

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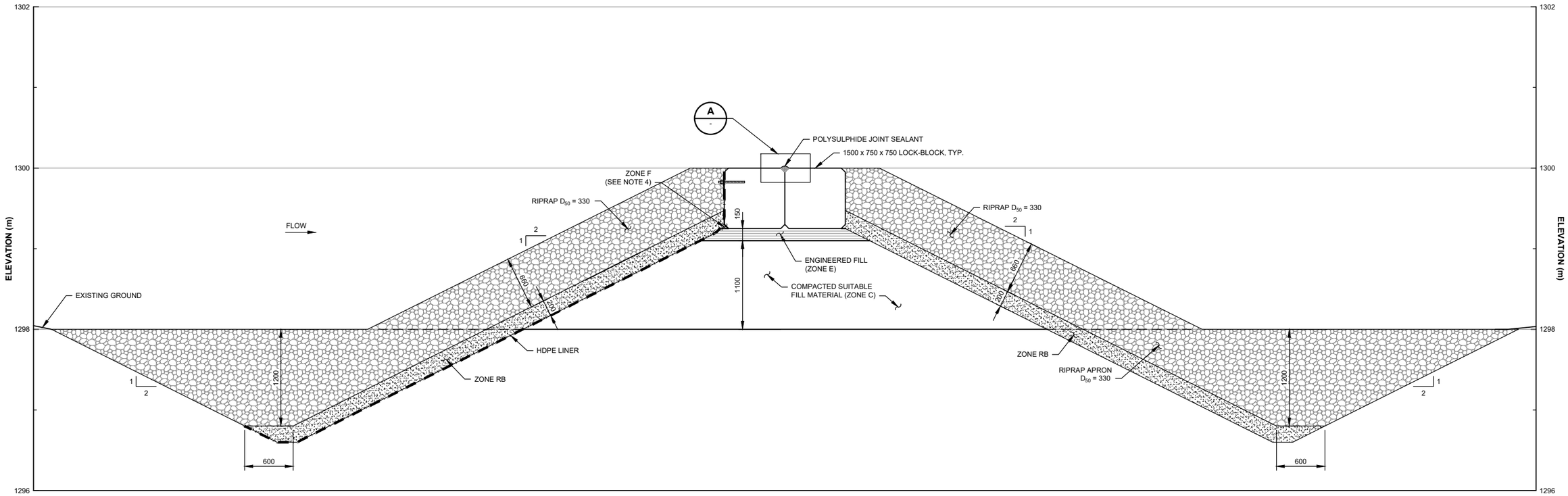
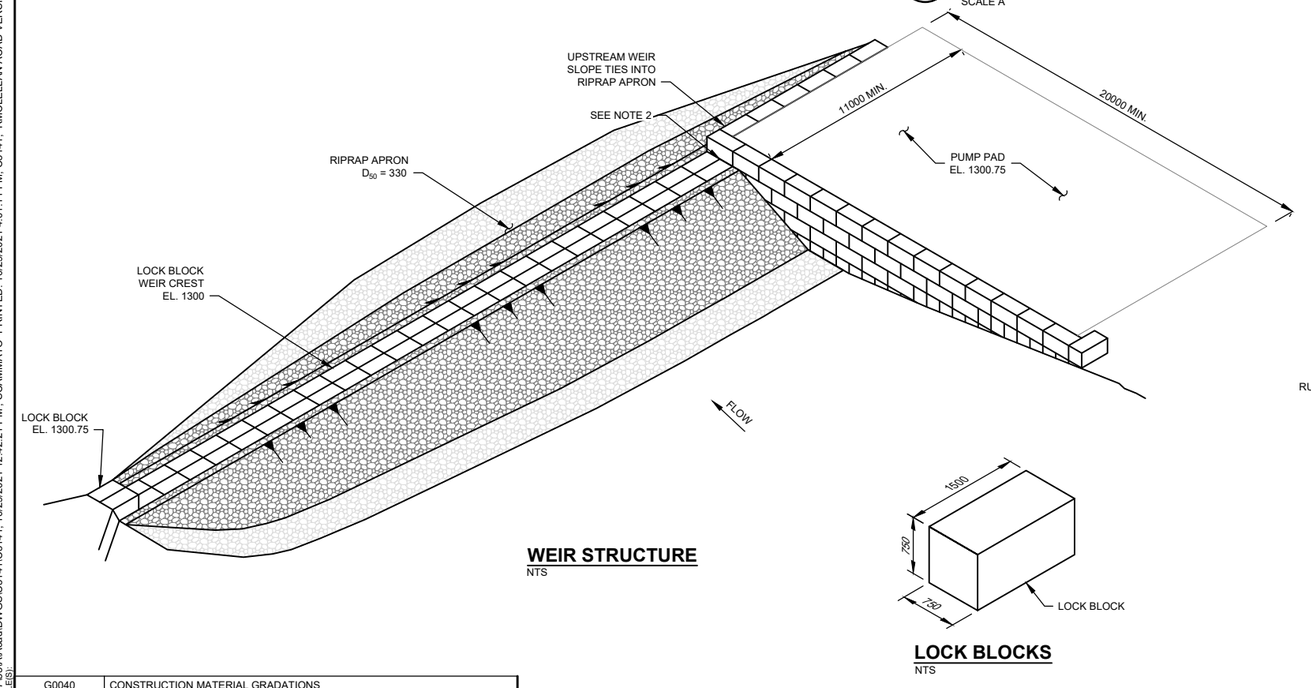
BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
WATER TRANSFER POND
PLAN

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3140	0

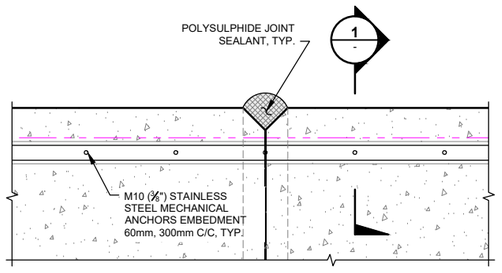


1 C3140 **SECTION**
LOCK-BLOCK WEIR
SCALE A

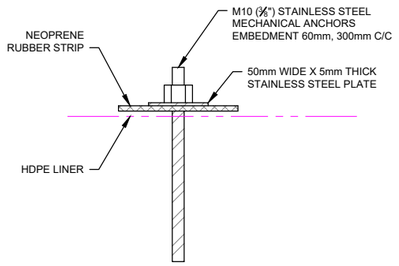


WEIR STRUCTURE
NTS

LOCK BLOCKS
NTS



A - **DETAIL**
SCALE B



1 - **SECTION**
NTS

LEGEND:

- RIPRAP
- ZONE E
- ZONE C
- ZONE F
- ZONE RB
- HDPE LINER

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. LOCK BLOCK WALL TIE IN POINTS SHALL BE INTERLOCKING AS PER SUPPLIER GUIDELINES.
3. FOR FILL MATERIAL SPECIFICATIONS AND RIPRAP REQUIREMENTS SEE DWG G0040.
4. CARE SHALL BE TAKEN DURING PLACEMENT OF HDPE LINER TO PREVENT SHARP BENDS IN LINER TO AVOID CRACKING/DAMAGE DURING PLACEMENT OF RIPRAP. E.G. TIGHTLY PACKED SAND/GRAVEL BACKING AT SHARP CORNERS TO AVOID ABRUPT BENDS.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE A 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m

DRG. NO.	DESCRIPTION
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES
C3140	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND - PLAN

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RMM

REVISIONS

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
WATER TRANSFER POND
SECTIONS AND DETAILS

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

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2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3141	0

SAVED: M:\1\01\00457\33\A\Acad\DWGS\C3141\C3141, 10/29/2021 12:42:21 PM, SCAMMAYO PRINTED: 10/29/2021 4:01:11 PM, C3141, RMCLELLAN ACAD VERSION: 23.0S (LMS TECH)
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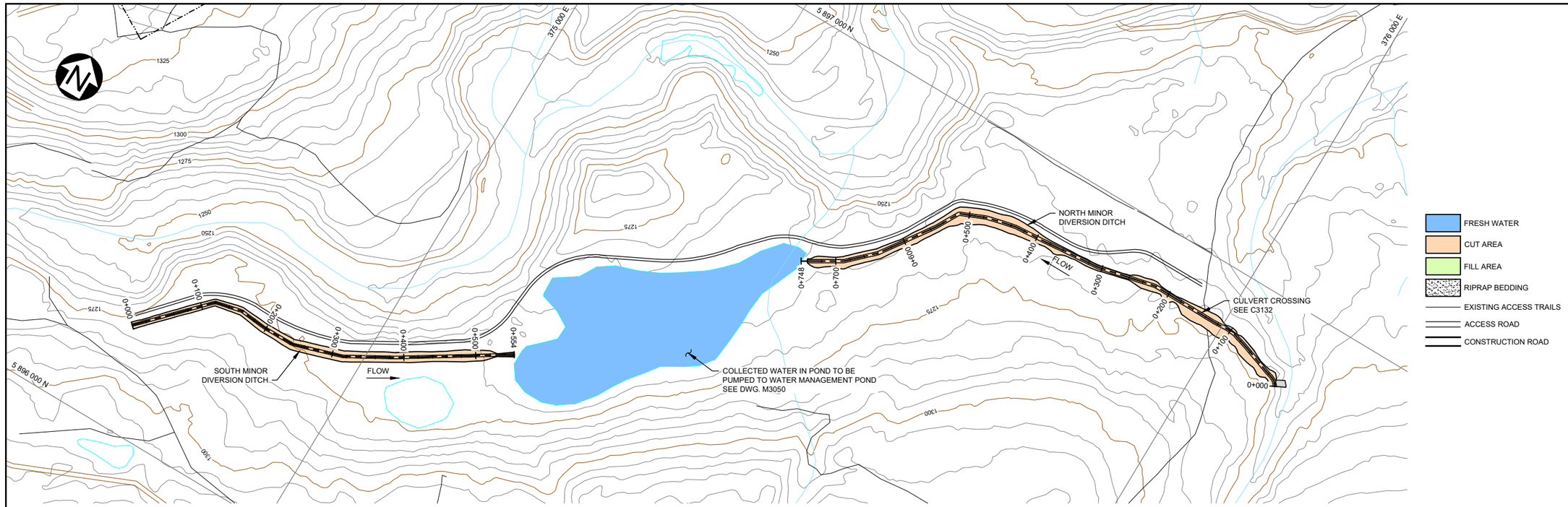
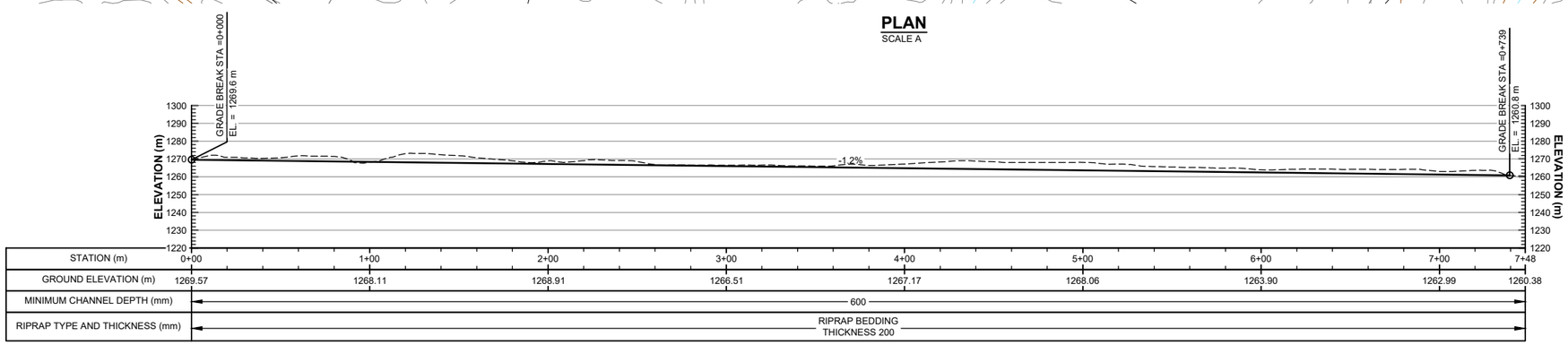
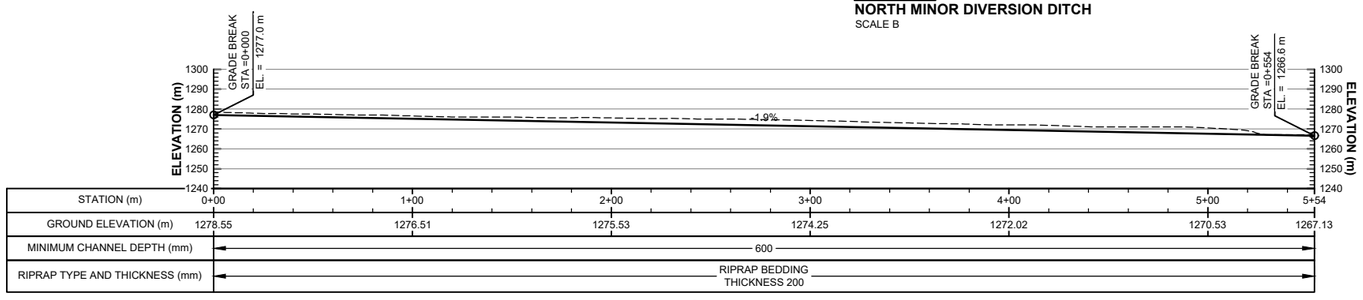


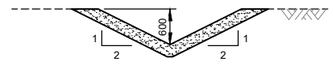
PLAN
SCALE A



PROFILE
NORTH MINOR DIVERSION DITCH
SCALE B



PROFILE
SOUTH MINOR DIVERSION DITCH
SCALE B



TYPICAL CHANNEL SECTION
TYPE 2 CHANNEL
SCALE C

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. FOR RIPRAP REQUIREMENTS SEE DWG G0040.
3. TYPICAL CHANNEL SECTIONS SHOWN ON DRAWING G0060.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE C 1 0.5 0 1 2 3 4 5 m
SCALE B 30 15 0 50 100 150 m
SCALE A 60 30 0 100 200 300 m

DRG. NO.	DESCRIPTION
M3050	WATER MANAGEMENT - DIVERSION PIPING SYSTEMS - GENERAL ARRANGEMENT (YEAR -1)
G0060	EROSION PROTECTION - TYPICAL CHANNEL SECTIONS
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRA
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RM

REVISIONS

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PROFESSIONAL ENGINEER PROVINCE OF

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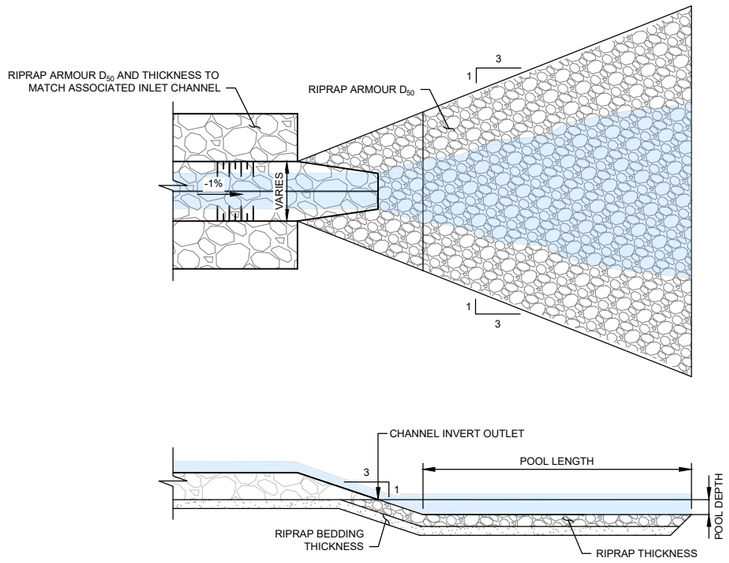
2021-10-29

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
MINOR DIVERSION DITCHES

VA NO.	DRAWING NO.	REVISION
VA101-457/33	C3160	0

SAVED: M:\101\100\457\3\A\acad\DWGS\C3160\C3160, 10/29/2021 12:44:28 PM, SCAMMAYO, PRINTED: 10/29/2021 3:58:08 PM, C3160, RMCLELLAN ACAD VERSION: 23.0S (LMS TECH)
XREF FILE(S): Topo 5m Contours; Hydro; Pedaling Pond, Central Diversion System - Temporary Channels, Existing Roads & Trails 2020; Access and Construction Roads - Central Diversion and Pipelines IMAGE FILE(S):

STILLING BASIN DETAILS						
LOCATION	RIPRAP ARMOUR D_{50}	RIPRAP THICKNESS	RIPRAP BEDDING THICKNESS	POOL LENGTH	POOL DEPTH	INVERT OUTLET EL.
DIVERSION CHANNEL	565	1,130	565	5,000	1,000	1,210
FRESH WATER RESERVOIR	150	300	N/A	40,000	1,200	1,146
LOWER WASTE STOCKPILE	150	300	N/A	9,000	600	1,403
CDS NORTH STILLING BASIN	RB	200	N/A	4,000	50	1,300.1



STILLING BASIN
SCALE A

LEGEND:

RIPRAP

BEDDING

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE A 2 1 0 2 4 6 8 10 m

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PROFESSIONAL ENGINEER
2021-11-15

WATER MANAGEMENT
STILLING BASIN
CAL SECTIONS AND DETAILS

REFERENCE DRAWINGS	
DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ELG	DDF	

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3440	0

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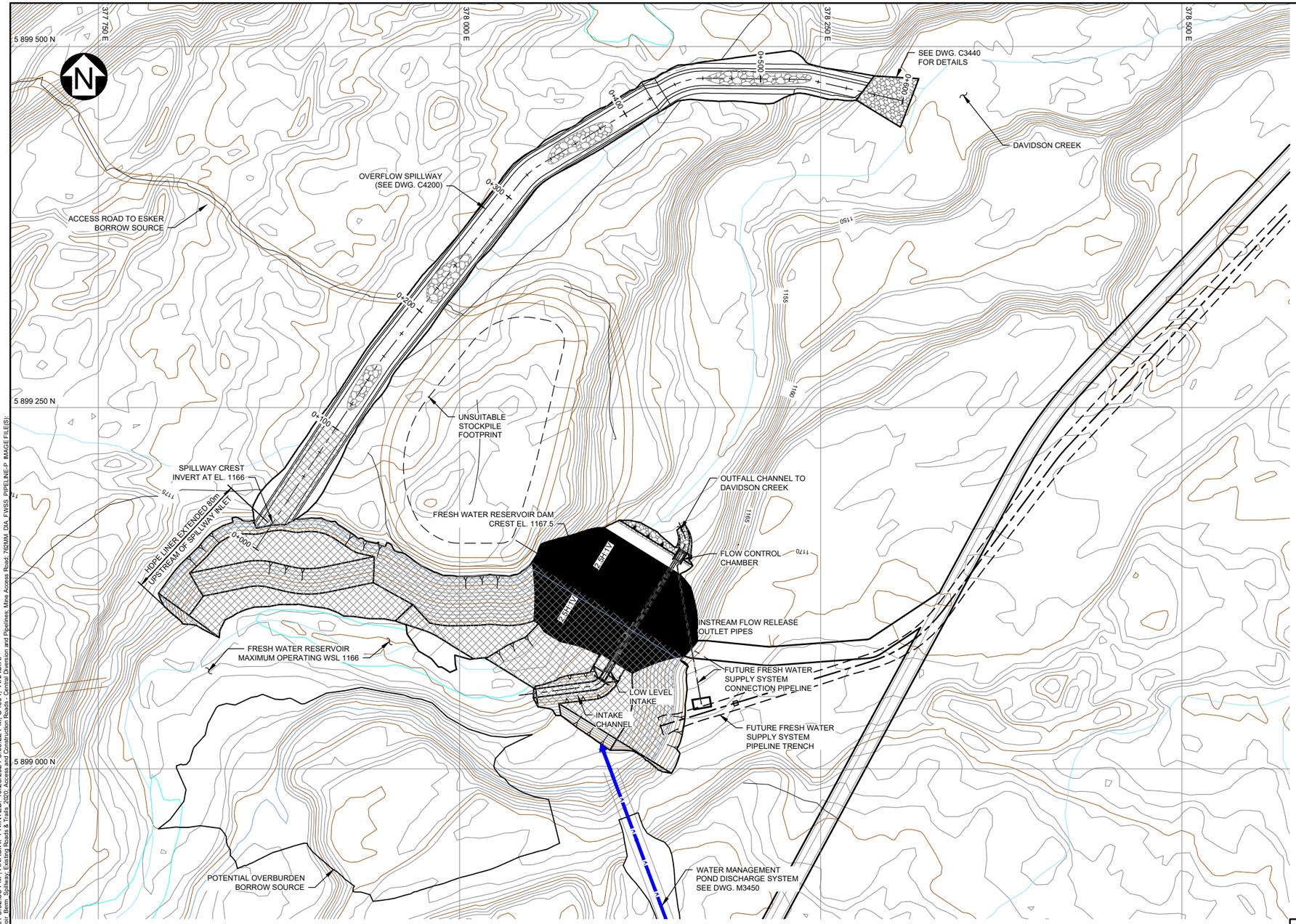

PLAN
SCALE A

LEGEND:

- HDPE LINER
- RIPRAP
- CONSTRUCTION ROAD
- ACCESS ROAD
- WATER DIVERSION PIPELINE
- EXISTING ACCESS TRAILS

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006.
2. FOR FRESH WATER RESERVOIR INSTRUMENTATION SEE DRAWING C1506.

DETAILED DESIGN
NOT FOR CONSTRUCTION

30 15 0 50 100 150 m
SCALE A

REFERENCE DRAWINGS	
DRG. NO.	DESCRIPTION
M3450	WATER MANAGEMENT POND - DISCHARGE SYSTEM - PIPELINE - PLAN AND PROFILE
C4200	FRESH WATER RESERVOIR - OVERFLOW SPILLWAY - PLAN AND PROFILE
C1506	TSF - STAGE 1 INSTRUMENTATION - SECTIONS (SHEET 2 OF 3)
C1440	TSF - CULVERT AND STILLING BASIN - TYPICAL SECTIONS AND DETAILS
G0006	CIVIL GENERAL NOTES

REVISIONS						
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS						
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ELG/ABI		

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BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR EMBANKMENT AND RESERVOIR GENERAL ARRANGEMENT

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA
<original signed by>
2021.11.15

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C4001	0

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PRINTED: 10/29/2021 3:09:22 PM - ANASIRI
XREF FILE(S): Topo 1m Contours; Hydro; TrimRoads_UTM10; Fresh Water Reservoir, Berm, Spillway; Existing Roads & Trails_2020; Access and Construction Roads - Central Diversion and Pipelines; Mine Access Road; 760MM_DIA_FWSS_PIPELINE-P
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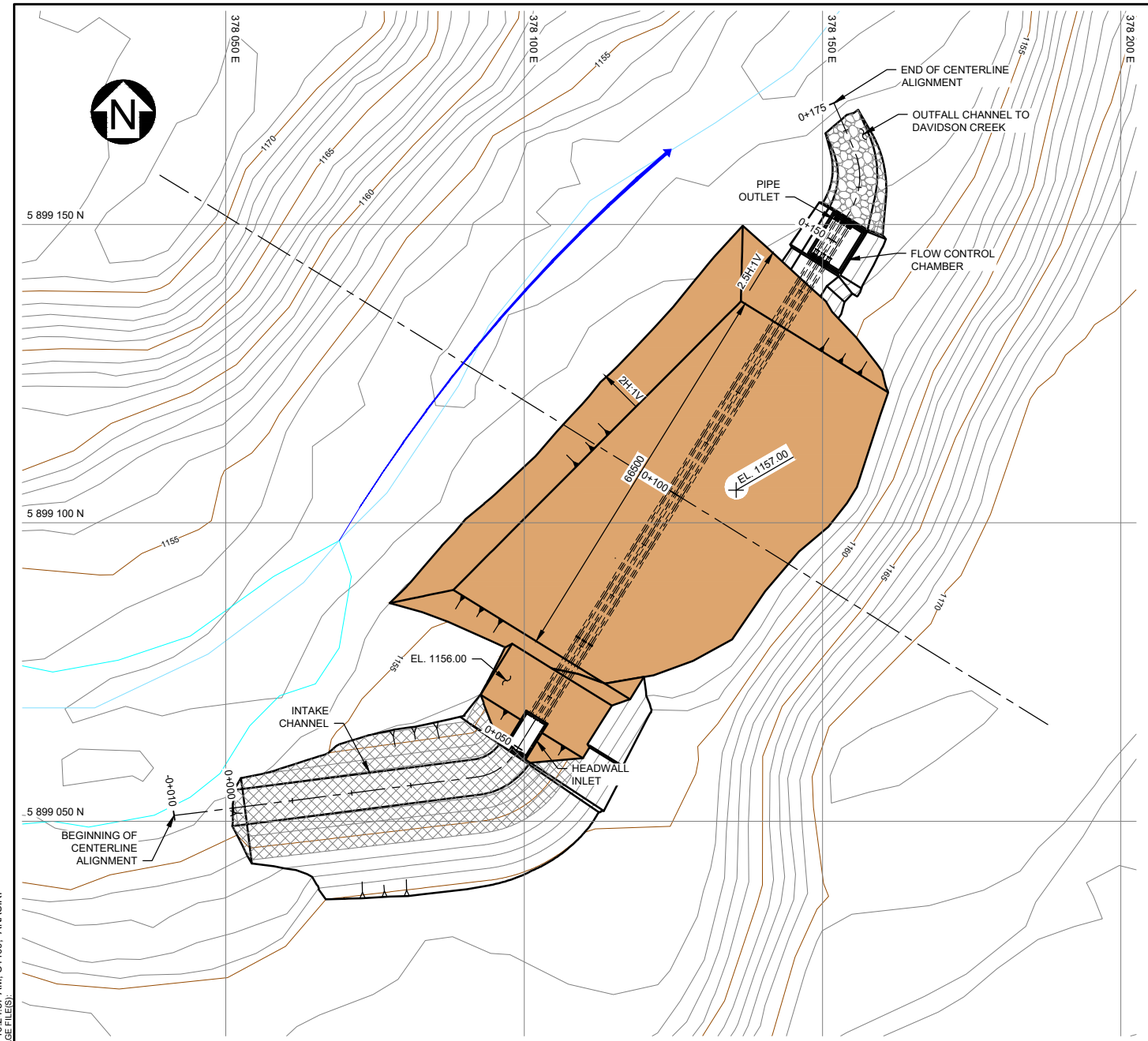
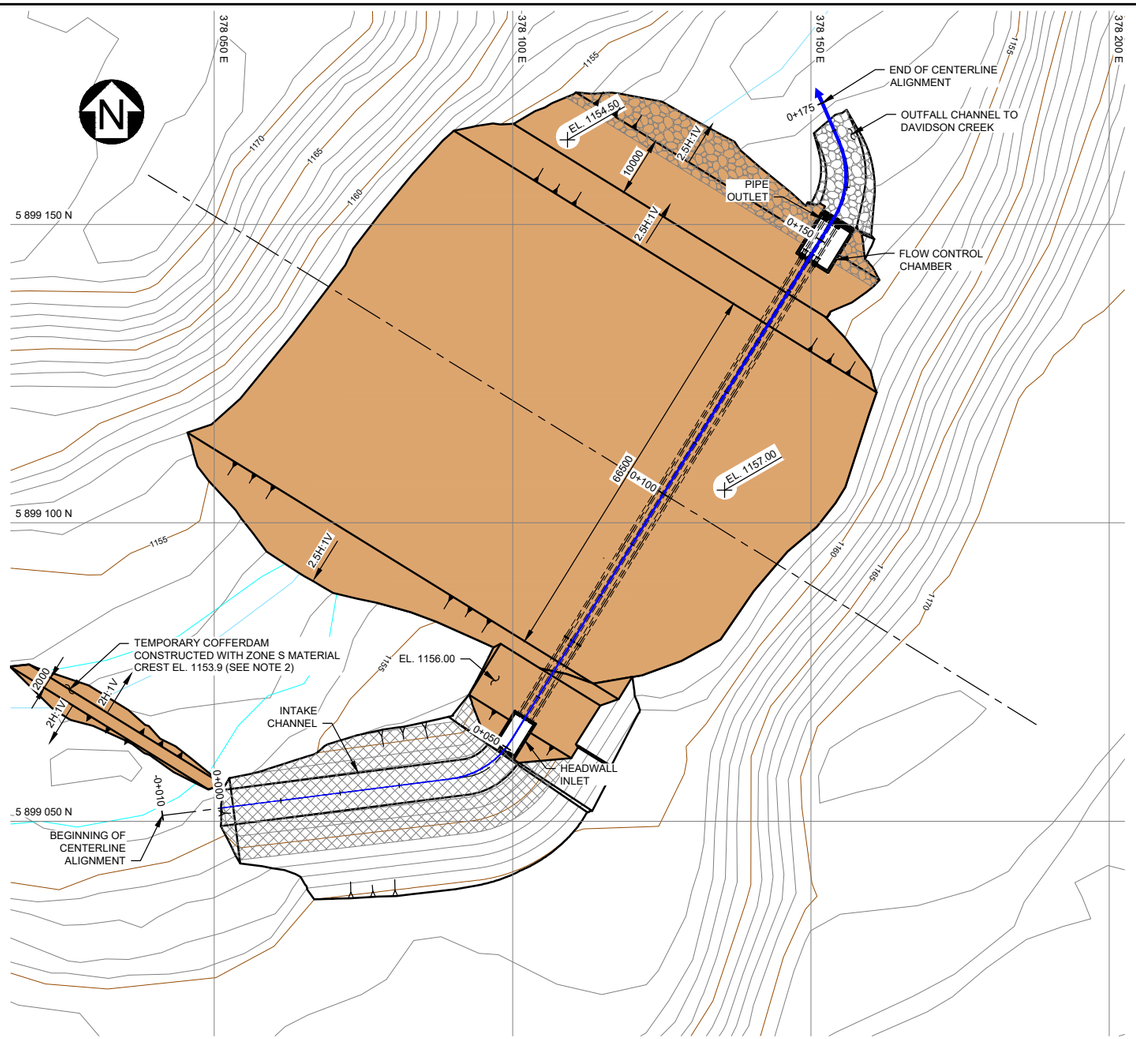


PLAN
PHASE 1 CONSTRUCTION
SCALE A



PLAN
PHASE 2 CONSTRUCTION
SCALE A

LEGEND:

- EMBANKMENT FILL
- RIPRAP
- HDPE LINER
- FLOW

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006.
2. COFFERDAM TO BE SIZED AND LOCATED BY THE ENGINEER BASED ON ACTUAL INLET CHANNEL INVERT ELEVATION.

CONSTRUCTION SEQUENCE NOTES:

PHASE 1:

1. CONSTRUCT LOW LEVEL OUTLET AND FLOW MONITORING CHAMBER.
2. CONSTRUCT EASTERN PORTION OF FRESH WATER RESERVOIR DAM UP TO ELEVATION 1157.0
3. EXCAVATE AND HDPE-LINE INTAKE CHANNEL.
4. INSTALL SURFACE LEVEL OUTLET ELBOW ON UPSTREAM DAM FACE.

PHASE 2:

1. TEMPORARILY RESTRICT INFLOW FROM WATER MANAGEMENT POND AND TSF.
2. DIVERT DAVIDSON CREEK FLOW THROUGH LOW-LEVEL OUTLET.
3. CONSTRUCT WESTERN PORTION OF FRESH WATER RESERVOIR DAM TO EL. 1157.0.

DETAILED DESIGN

NOT FOR CONSTRUCTION

10 5 0 10 20 30 40 50 m
SCALE A

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BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR EMBANKMENT CONSTRUCTION SEQUENCE

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

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2021-11-15

DRAWING NO.	REVISION
VA101-457/33	C4100	0

REFERENCE DRAWINGS	
G0006	CIVIL GENERAL NOTES
DRG. NO.	DESCRIPTION

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ABN		
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	AP

SAVED, M:\101\00457\33\A/cad\DWGS\C4100\C4100, 10/29/2021 10:20:59 AM, ANASIRI, PRINTED, 10/29/2021 10:24:57 AM, C4100, ANASIRI
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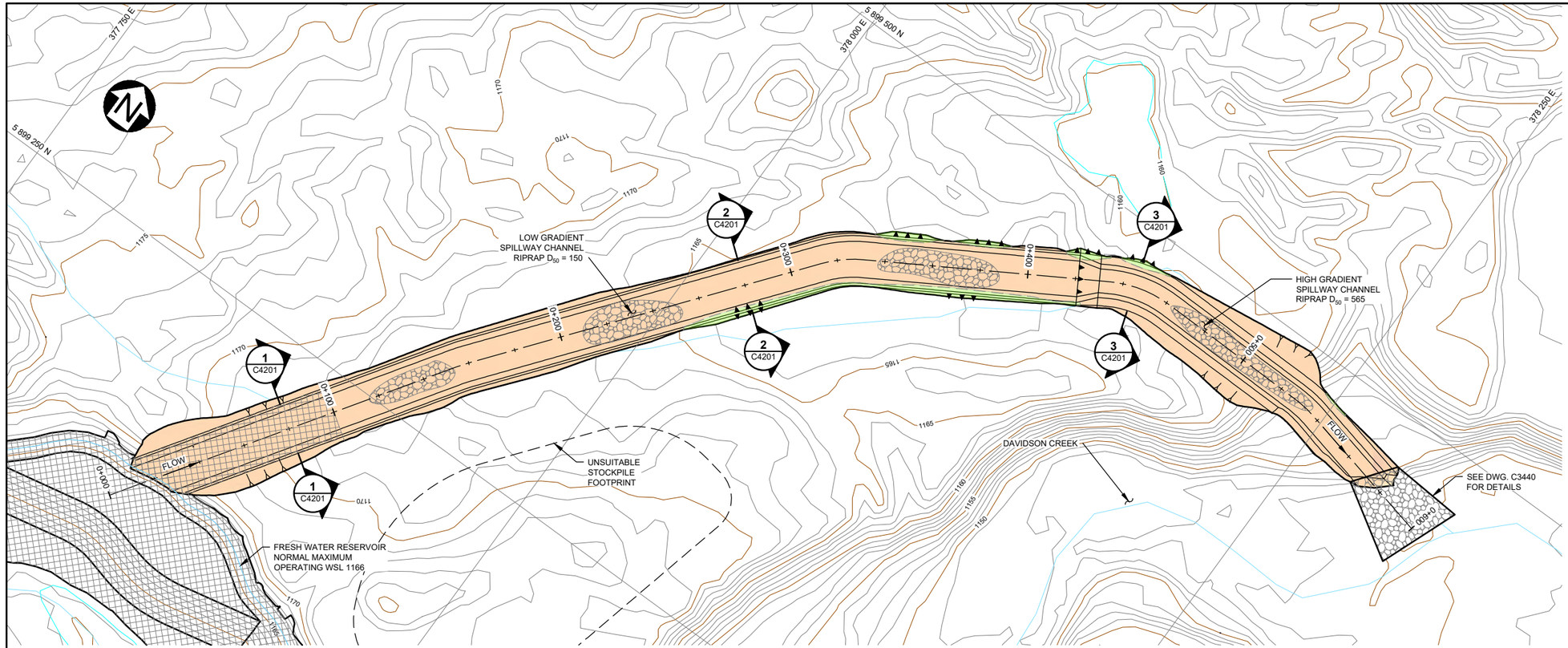
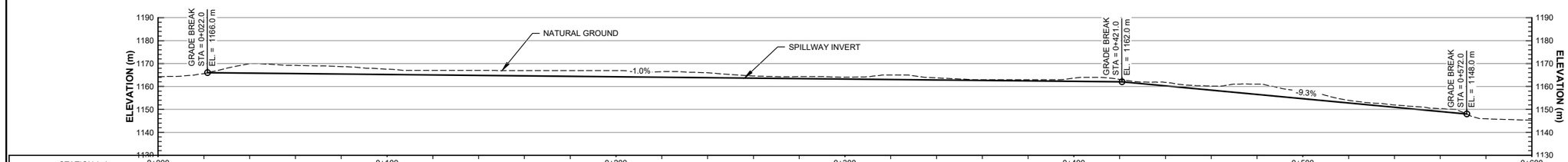


PLAN
SCALE A



STATION (m)	0+000	0+100	0+200	0+300	0+400	0+500	0+600	
GROUND ELEVATION (m)	1164.33	1167.53	1166.95	1164.07	1163.63	1157.92	1145.26	
MINIMUM CHANNEL DEPTH (mm)		1200				1000		
RIPRAP TYPE AND THICKNESS (mm)		RIPRAP ARMOUR D_{50} = 150 300				RIPRAP ARMOUR D_{50} = 565 1130		
HDPE LINER								

PROFILE
SCALE A

LEGEND:
- HDPE LINER
- RIPRAP
- FILL AREAS
- CUT AREAS

NOTES:
1. FOR GENERAL NOTES SEE DRAWING G0006.

SCALE A: 20 10 0 20 40 60 80 100 m

DETAILED DESIGN
NOT FOR CONSTRUCTION

C4201	FRESH WATER RESERVOIR - OVERFLOW SPILLWAY - SECTIONS
C3440	WATER MANAGEMENT - STILLING BASIN - TYPICAL SECTIONS AND DETAILS
G0006	CIVIL GENERAL NOTES

DRG. NO. | DESCRIPTION

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ABN	[redacted]	

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2021-11-15

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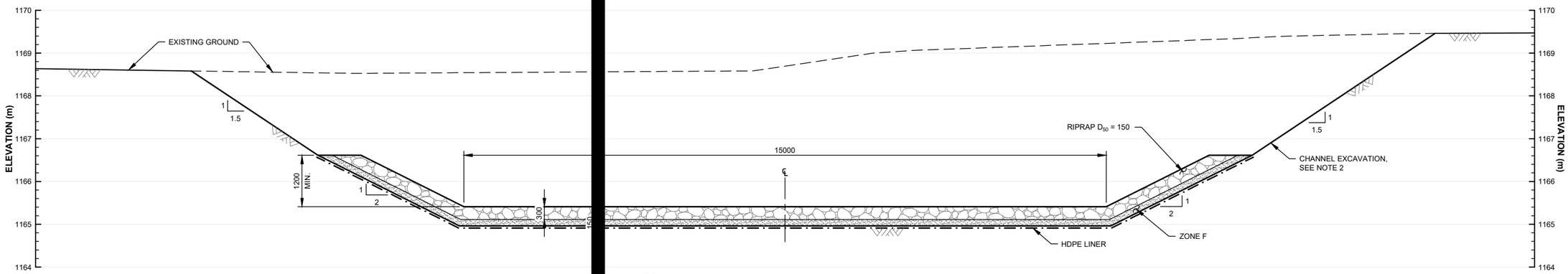
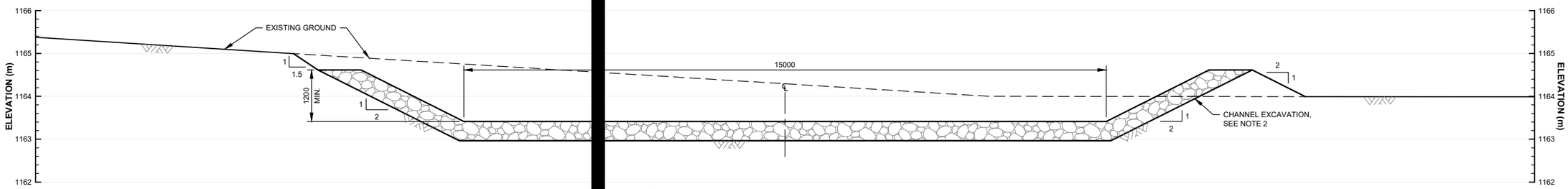
FRESH WATER RESERVOIR OVERFLOW SPILLWAY PLAN AND PROFILE

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C4200	0

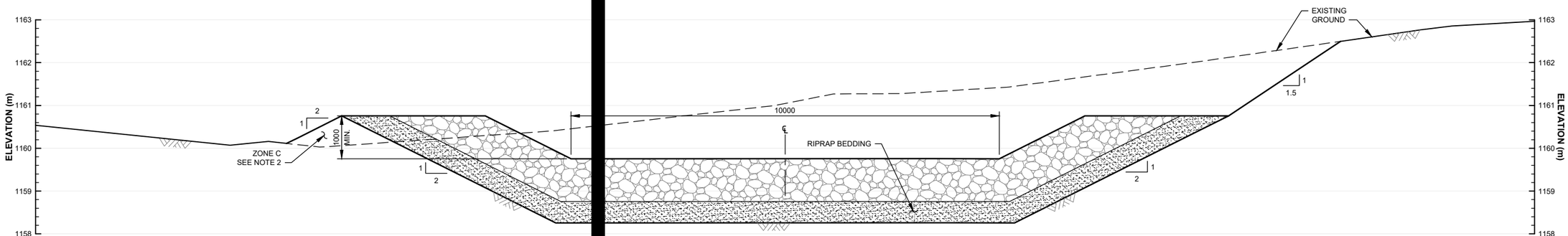
SAVED: M:\101\00457\33\A\acad\DWGS\C4200\C4200_10/29/2021 3:03:47 PM, ANASIRI, PRINTED: 10/29/2021 3:10:08 PM, C4200, ANASIRI
XREF FILE(S): Topo 1m Contours, Hydro, Forestry Roads, Fresh Water Reservoir, Berm, Spillway, IMAGE FILE(S):



1 C4200 SECTION
LOW GRADIENT SECTION (MAXIMUM SLOPE 1%)
SCALE A



2 C4200 SECTION
TYPE 3 CHANNEL
LOW GRADIENT SECTION (MAXIMUM SLOPE 1%)
SCALE A



3 C4200 SECTION
TYPE 6 CHANNEL
HIGH GRADIENT SECTION (AVERAGE SLOPE 9.3%)
SCALE A

SCALE A 1 0.5 0 1 2 3 4 5 m

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006.
2. WHERE SPILLWAY FREEBOARD REQUIREMENTS ARE NOT ACHIEVED WITH EXCAVATED FOOTPRINT AS SHOWN, CHANNEL SIDE SLOPES SHALL BE BUILT UP AND LINED AS NECESSARY.
3. TYPICAL CHANNEL SECTIONS SHOWN ON DRAWING G0060.
4. FOR CONSTRUCTION MATERIAL GRADATIONS AND SPECIFICATIONS SEE DRAWING G0040.

LEGEND:

- RIPRAP
- ZONE C
- RIPRAP BEDDING
- ZONE F
- HDPE LINER

DETAILED DESIGN

NOT FOR CONSTRUCTION

DRG. NO.	DESCRIPTION
C4200	FRESH WATER RESERVOIR - OVERFLOW SPILLWAY - PLAN AND PROFILE
G0060	EROSION PROTECTION TYPICAL CHANNEL SECTIONS
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ABN		

REVISIONS

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PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

<original signed by>

2021-11-15

Knight Piésold CONSULTING

BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR OVERFLOW SPILLWAY SECTIONS

VA101-457/33 | DRAWING NO. C4201 | REVISION 0

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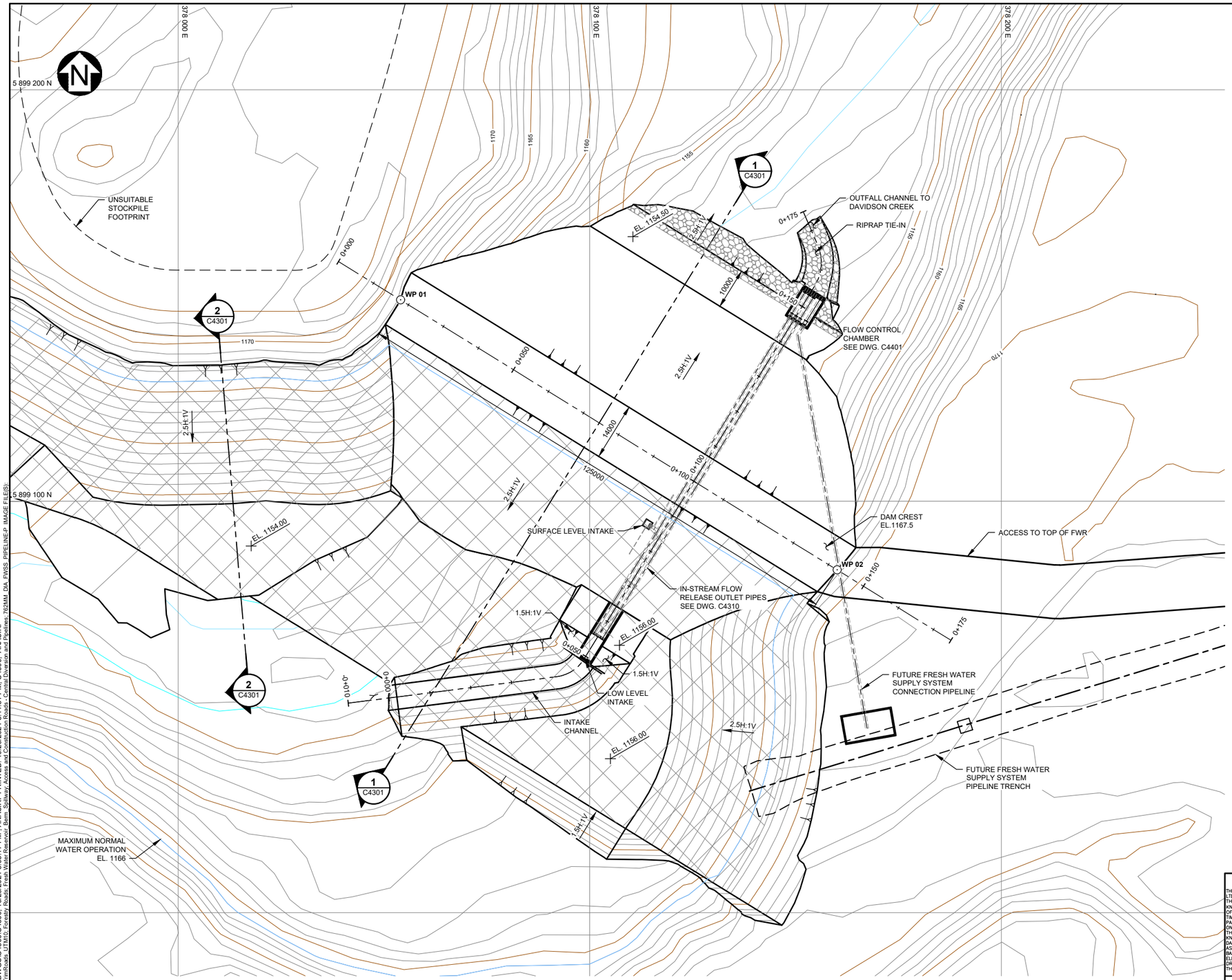

PLAN
SCALE A

EMBANKMENT WORK POINTS TABLE

WORK POINT NO.	EASTING	NORTHING	ELEVATION (m)
WP 01	378054.0	5899148.9	1,167.5
WP 02	378160.1	5899083.3	1,167.5

KEY STATIONS OF OUTLET PIPES CENTERLINE

STATIONS	EASTING	NORTHING	DESCRIPTION
-0+010	378,041.3	5,899,050.9	BEGINNING OF CENTERLINE ALIGNMENT
0+000	378,051.2	5,899,052.2	BEGINNING OF INTAKE CHANNEL
0+041.1	378,092.0	5,899,057.4	BEGINNING OF CURVE
0+049.1	378,098.6	5,899,061.7	END OF CURVE
0+049.2	378,098.6	5,899,061.7	BEGINNING OF HEADWALL STRUCTURE
0+056.0	378,102.2	5,899,067.4	END OF HEADWALL STRUCTURE
0+146.0	378,149.5	5,899,144.0	BEGINNING OF CHAMBER
0+154.0	378,153.7	5,899,150.8	END OF CHAMBER
0+154.5	378,154.0	5,899,151.2	PIPE OUTLET
0+155.71	378,154.6	5,899,152.2	BEGINNING OF CURVE
0+166.29	378,155.4	5,899,162.4	END OF CURVE
0+175	378,151.9	5,899,170.4	END OF CENTERLINE ALIGNMENT

LEGEND:

- HDPE LINER
- RIPRAP
- CONSTRUCTION ROAD
- ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006.

DETAILED DESIGN

NOT FOR CONSTRUCTION

SCALE A 10 5 0 10 20 30 40 50 m

DRG. NO.	DESCRIPTION
C4401	FRESH WATER RESERVOIR - FLOW CONTROL CHAMBER - PLAN, SECTION AND DETAIL
C4310	FRESH WATER RESERVOIR - EMBANKMENT OUTLET PIPES - PROFILE AND SECTION
C4301	FRESH WATER RESERVOIR - EMBANKMENT - PROFILE AND SECTION
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ABN	[redacted]	[redacted]

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR EMBANKMENT PLAN

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

<original signed by>

2021-11-15

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C4300	0

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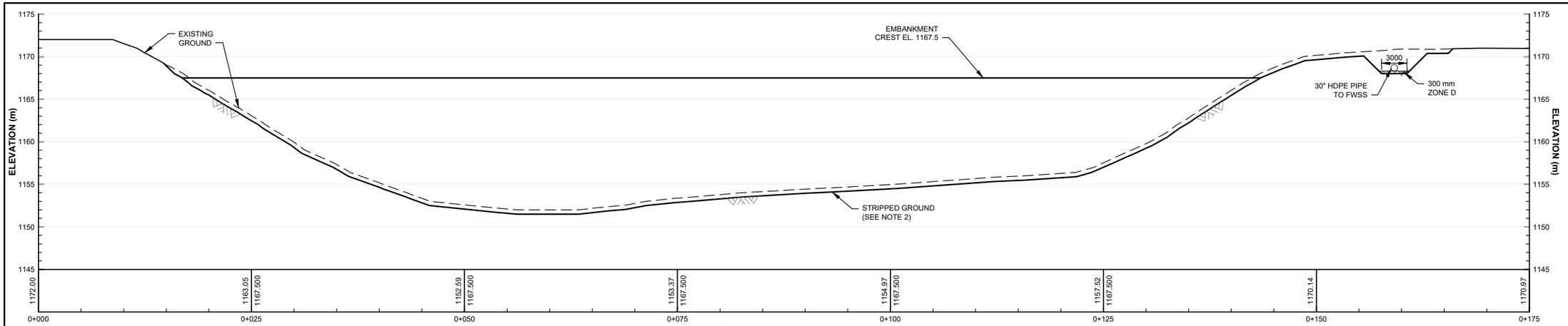
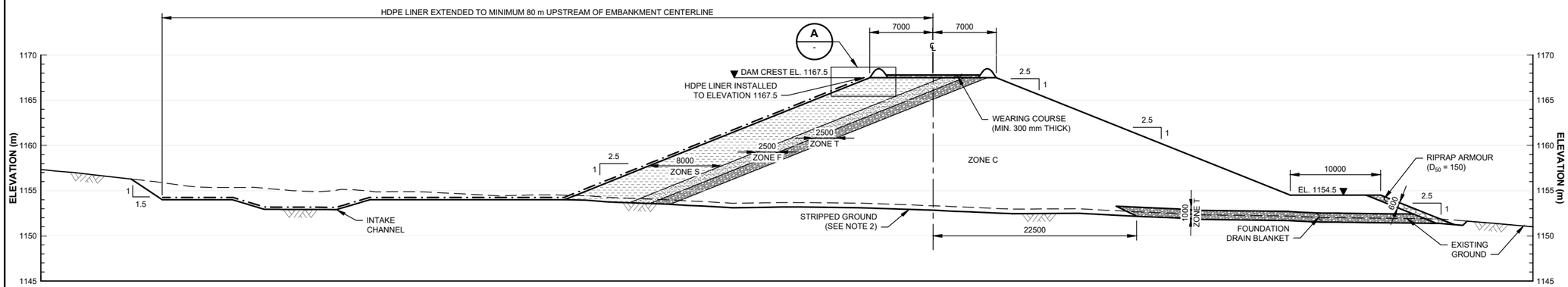


PROFILE
FRESH WATER RESERVOIR EMBANKMENT
SCALE A



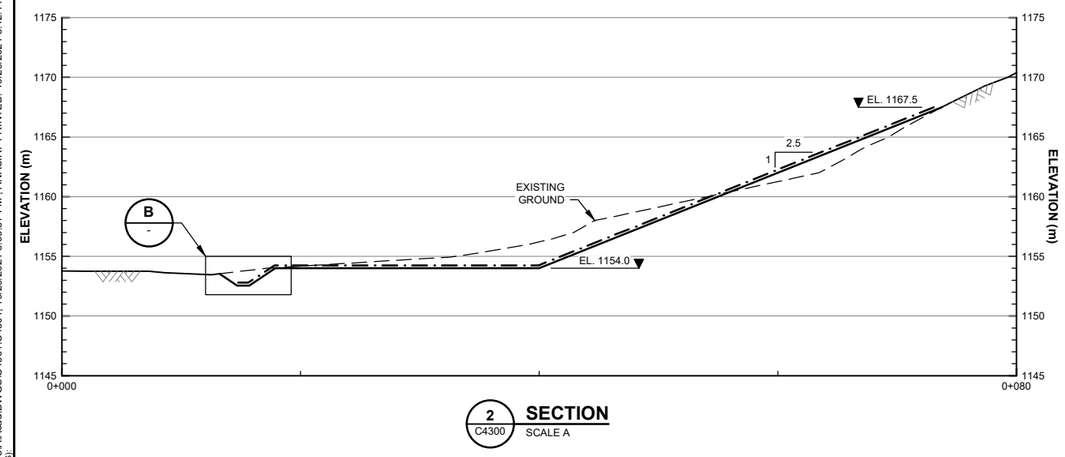
LEGEND:
- WEARING COURSE
- RIPRAP
- ZONE C
- ZONE F
- ZONE S
- ZONE T
- HDPE LINER

NOTES:
1. FOR GENERAL NOTES SEE DRAWING G0006.
2. EXCAVATE ORGANICS AND UNSUITABLE MATERIAL TO ENGINEER APPROVED SUBGRADE.
3. FOR CONSTRUCTION MATERIAL GRADATIONS SEE DRAWING G0040.

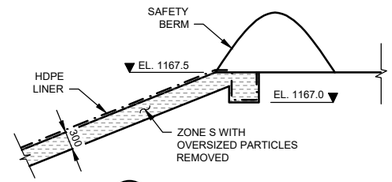
DETAILED DESIGN

NOT FOR CONSTRUCTION

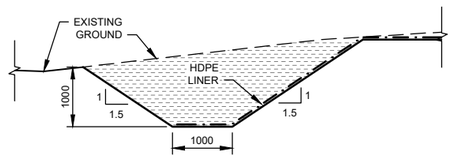
1 C4300 **SECTION**
SCALE A



2 C4300 **SECTION**
SCALE A



A - **TYPICAL DETAIL**
ANCHOR TRENCH IN BERM
SCALE B



B - **TYPICAL DETAIL**
ANCHOR TRENCH
SCALE B

1 0.5 0 1 2 3 4 5 m
SCALE B

5 2.5 0 5 10 15 20 25 m
SCALE A

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BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR EMBANKMENT PROFILE AND SECTION

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

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2021-11-15

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C4301	0

DRG. NO.	DESCRIPTION
C4300	FRESH WATER RESERVOIR - EMBANKMENT - PLAN
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ABN		

REVISIONS

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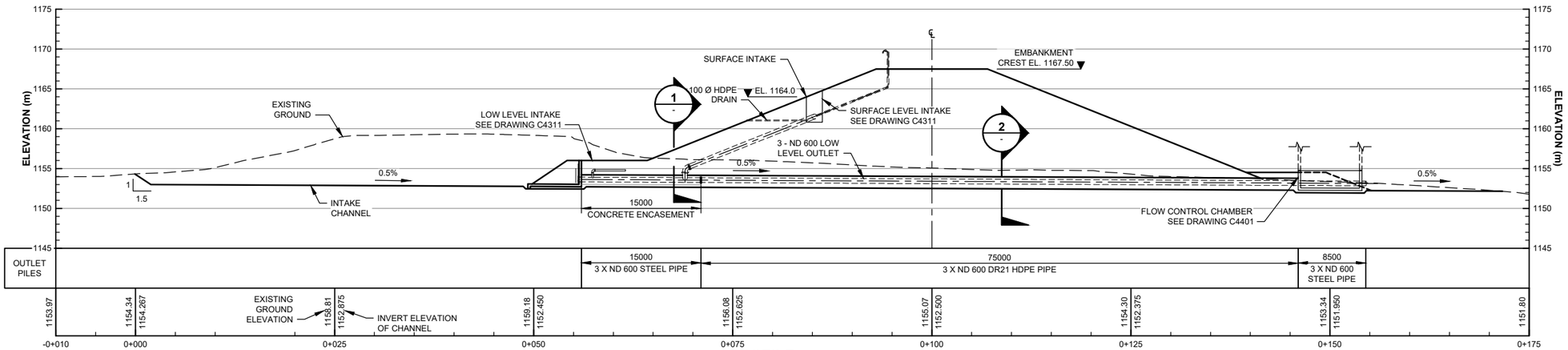
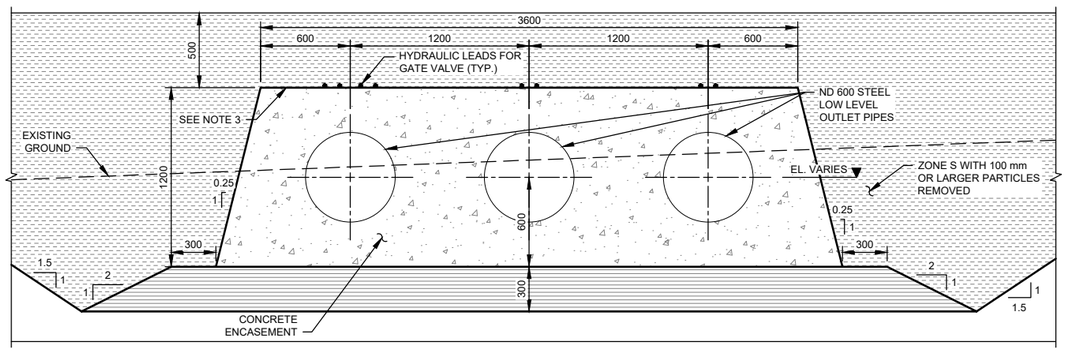
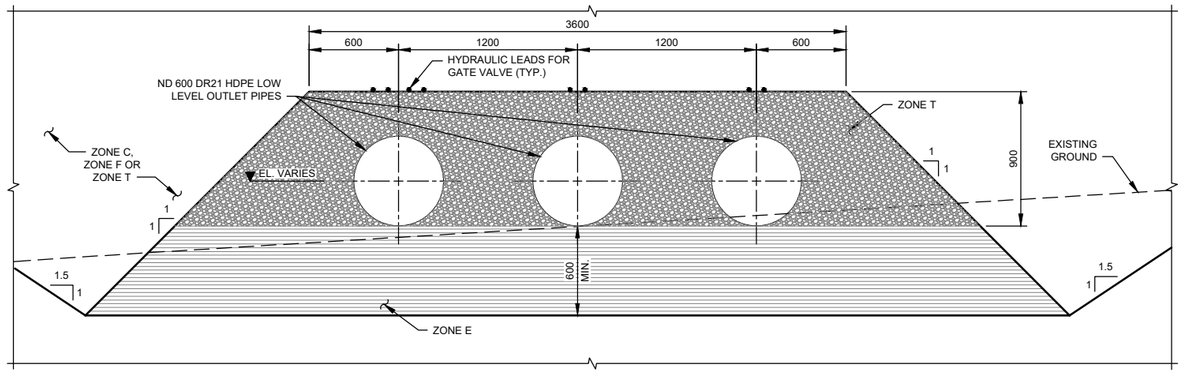


PROFILE
OUTLET PIPES
SCALE A



1 - SECTION
LOW LEVEL OUTLET THROUGH ZONE S AND ZONE F
SCALE B



2 - SECTION
LOW LEVEL OUTLET THROUGH ZONE C OR ZONE T
SCALE B

LEGEND:

- CONCRETE
- ZONE E
- ZONE S
- ZONE C
- ZONE T

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006.
2. FOR CONSTRUCTION MATERIAL GRADATIONS SEE DRAWING G0040.

DETAILED DESIGN

NOT FOR CONSTRUCTION

SCALE B 0.4 0.2 0 0.4 0.8 1.2 1.6 2.0 m
SCALE A 6 3 0 10 20 30 m

DRG. NO.	DESCRIPTION
C4401	FRESH WATER RESERVOIR - FLOW CONTROL CHAMBER - PLAN, SECTION AND DETAIL
C4311	FRESH WATER RESERVOIR - EMBANKMENT - LOW LEVEL AND SURFACE LEVEL INTAKES - PLAN AND SECTION
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
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BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR
EMBANKMENT OUTLET PIPES PROFILE AND SECTIONS

PROFESSIONAL ENGINEER BOVINA
<original signed by>
2021-11-15

VA101-457/33 | DRAWING NO. C4310 | REVISION 0

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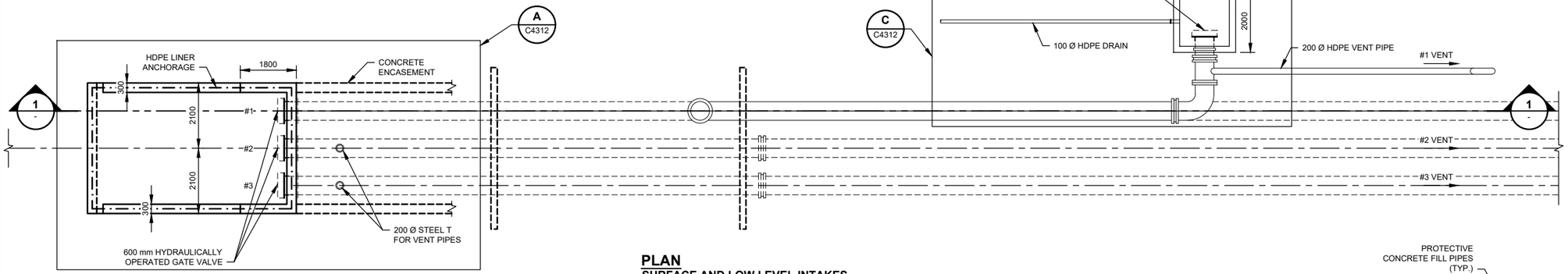
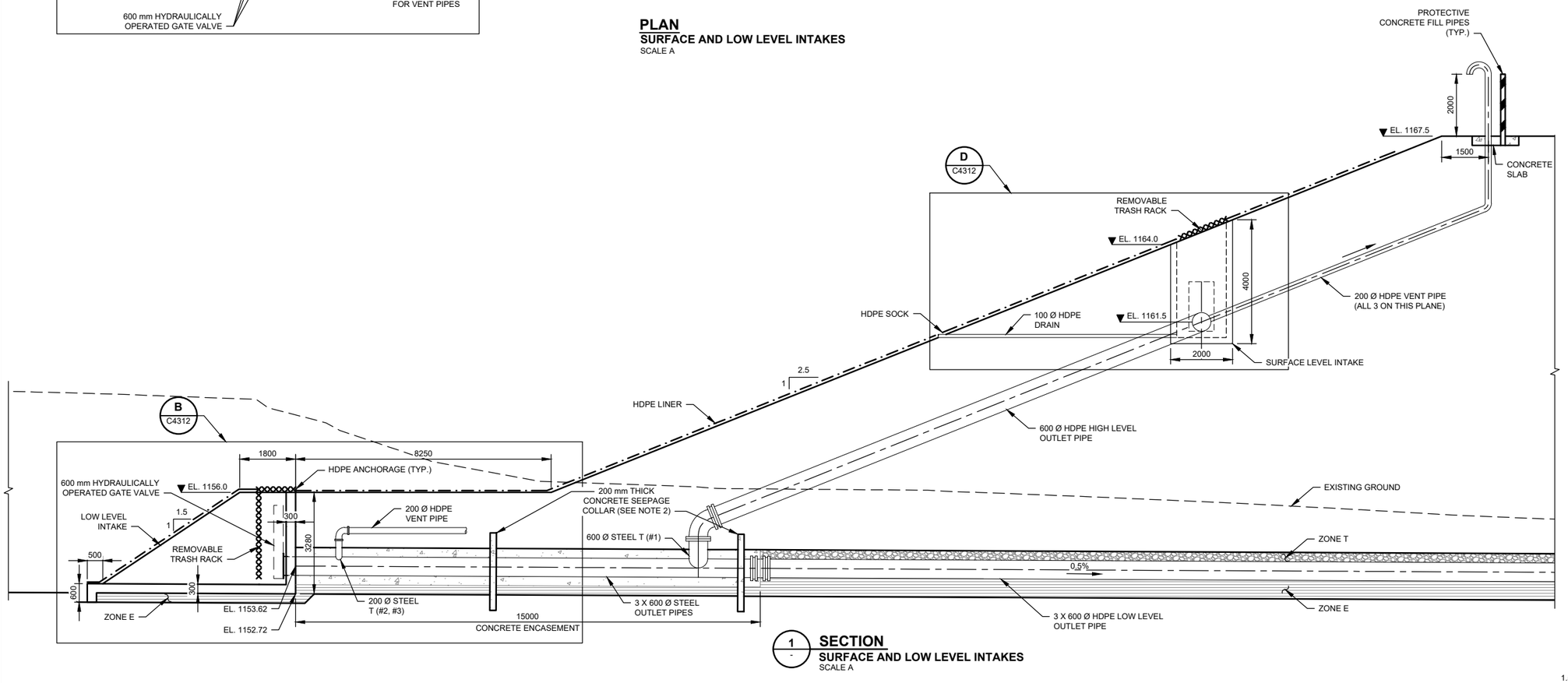


PLAN
SURFACE AND LOW LEVEL INTAKES
SCALE A



1 - SECTION
SURFACE AND LOW LEVEL INTAKES
SCALE A

LEGEND:

- ZONE E
- ZONE T
- CONCRETE
- HDPE LINER

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006.
2. SEEPAGE COLLARS TO EXTEND 500 mm PAST CONCRETE ENCASEMENT.
3. FOR CONSTRUCTION MATERIAL GRADATIONS SEE DRAWING G0040.

1.5 0.75 0 2.5 5.0 7.5 m
SCALE A

DETAILED DESIGN

NOT FOR CONSTRUCTION

DRG. NO.	DESCRIPTION
C4312	FRESH WATER RESERVOIR - EMBANKMENT - LOW LEVEL AND SURFACE LEVEL INTAKES DETAILS
C4310	FRESH WATER RESERVOIR - OUTLET PIPELINE - PROFILE
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	AP
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ABN		

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BLACKWATER GOLD PROJECT

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

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FRESH WATER RESERVOIR EMBANKMENT EVEL AND SURFACE LEVEL INTAKES PLAN AND SECTION

2021-11-15

DRAWING NO.	REVISION
VA101-457/33	C4311	0

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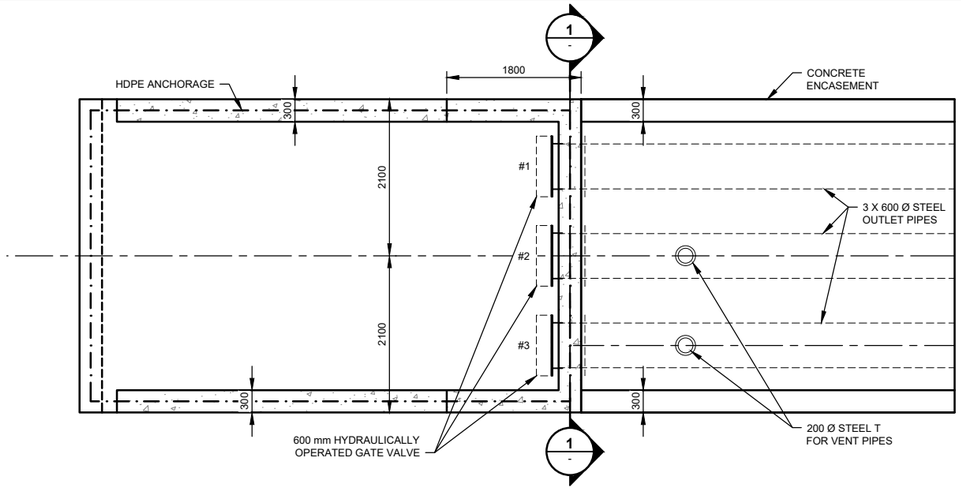
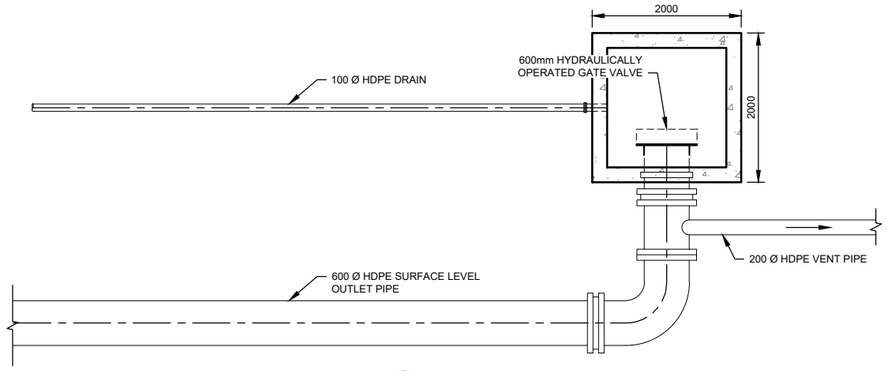
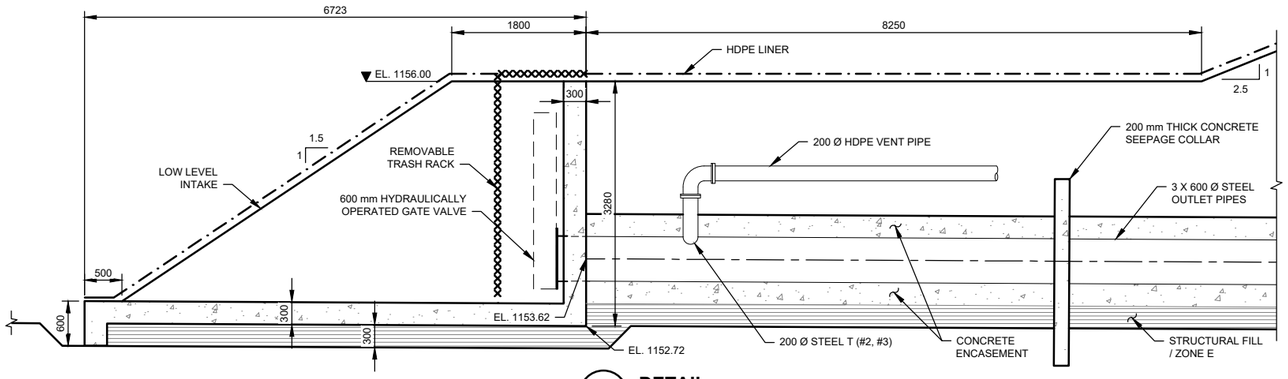


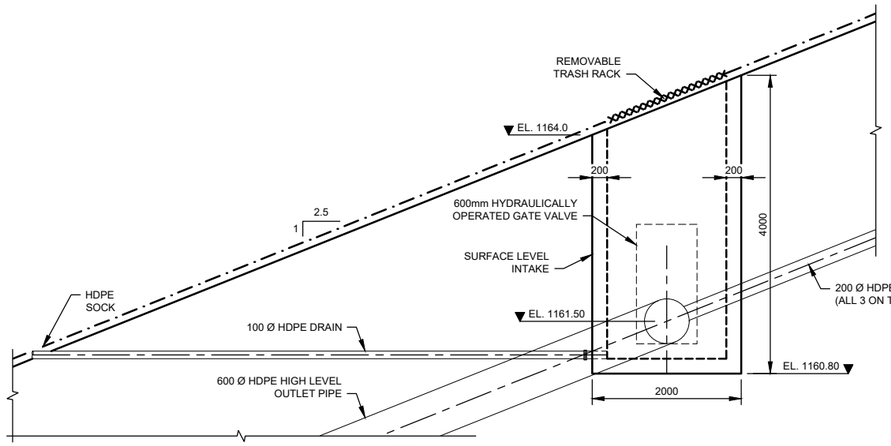
A C4311 **DETAIL** SCALE A



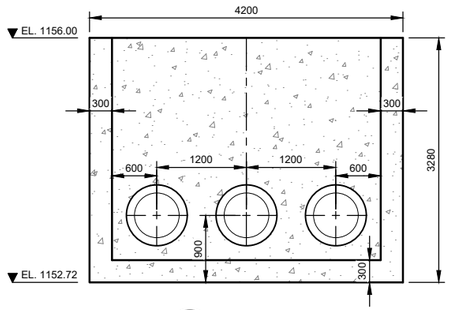
C C4311 **DETAIL** SCALE A



B C4311 **DETAIL** SCALE A



D C4311 **DETAIL** SCALE A



1 - **SECTION** SCALE A

LEGEND:

- ZONE E
- ZONE T
- CONCRETE
- HDPE LINER

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006.
2. FLOW METER TO BE INSTALLED A MINIMUM DISTANCE UPSTREAM FROM FLOW CONTROL EQUIPMENT (VALVES), AS PER MANUFACTURER'S RECOMMENDATION.
3. EACH OUTLET PIPE TO BE FITTED WITH A MAIN VALVE AND A MAINTENANCE VALVE.

DETAILED DESIGN

NOT FOR CONSTRUCTION

SCALE A 0.8 0.4 0 1 2 3 4 m

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR EMBANKMENT EVEL AND SURFACE LEVEL INTAKES DETAILS

PROFESSIONAL ENGINEER

<original signed by>

C1

BRITISH COLUMBIA ENGINEER

2021-11-15

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C4312	0

DRG. NO.	DESCRIPTION
C4311	FRESH WATER RESERVOIR - EMBANKMENT - LOW LEVEL AND SURFACE LEVEL INTAKES - PLAN AND SECTION
C4310	FRESH WATER RESERVOIR - OUTLET PIPELINE - PROFILE
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ABN		

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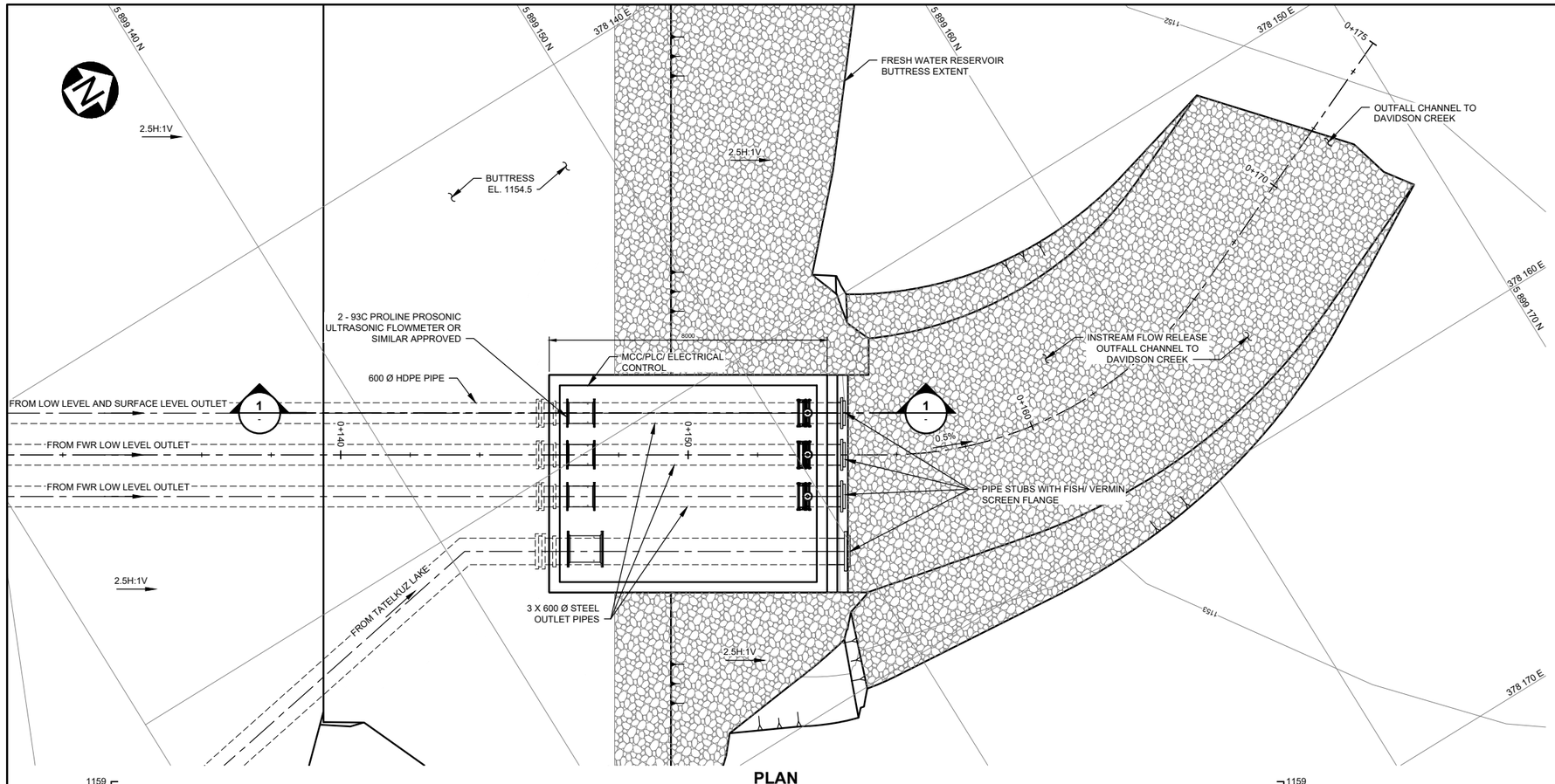
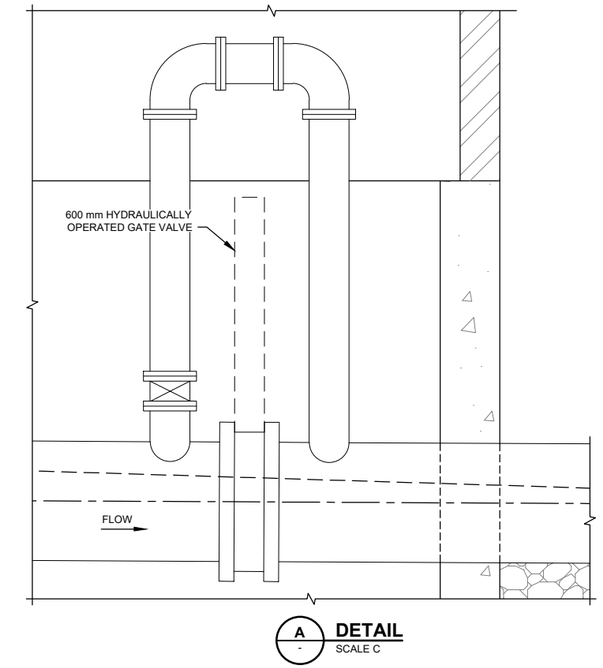
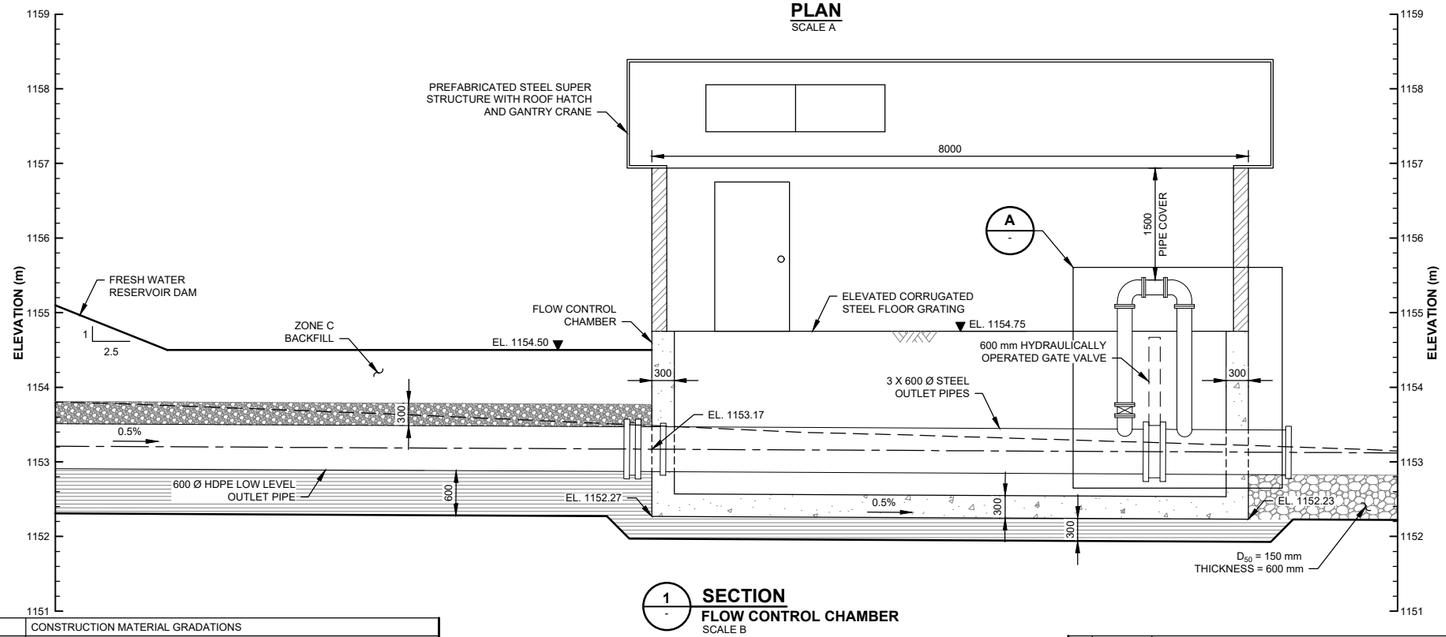


PLAN
SCALE A



DETAIL
SCALE C



SECTION
FLOW CONTROL CHAMBER
SCALE B

LEGEND:

- CONCRETE
- ZONE E
- ZONE C
- ZONE T
- RIPRAP

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006..
2. FLOW METER TO INSTALLED A MINIMUM DISTANCE UPSTREAM FROM FLOW CONTROL EQUIPMENT (VALVES), AS PER MANUFACTURER'S RECOMMENDATION.
3. FOR CONSTRUCTION MATERIAL GRADATIONS SEE DRAWING G0040.

DETAILED DESIGN

NOT FOR CONSTRUCTION

SCALE C: 0.3 0.15 0 0.5 1.0 1.5 m
SCALE B: 0.8 0.4 0 1 2 3 4 m
SCALE A: 1.5 0.75 0 2.5 5.0 7.5 m

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER RESERVOIR
FLOW CONTROL CHAMBER
PLAN, SECTION AND DETAIL

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA

<original signed by>

2021-11-15

DRG. NO.	DESCRIPTION
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

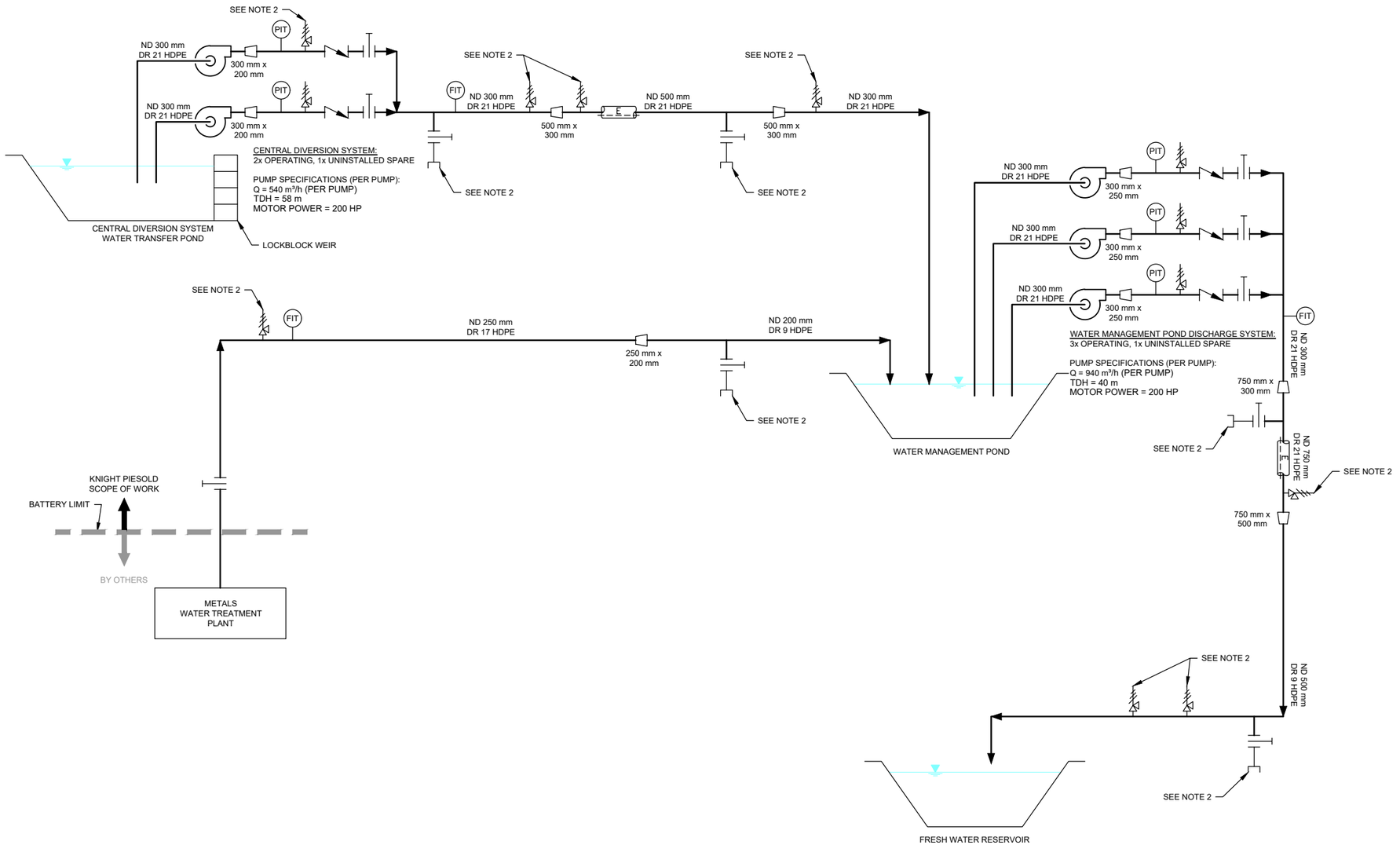
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ABN		

REVISIONS

VA101-457/33	DRAWING NO. C4401	REVISION 0

SAVED: M:\101\00457\33\A\acad\DWGS\C4401\C4401, 10/29/2021 3:07:50 PM, ANASIRI, PRINTED: 10/29/2021 3:14:01 PM, C4401, ANASIRI
XREF FILE(S): Topo 1m Contours; Hydro; Fresh Water Reservoir, Berm, Spillway; Existing Roads & Trails_2020; 7624M, DIA, FWSS, PIPELINE-P (IMAGE FILE(S):

SAVED: M:\1\01\00045713\A\acad\DWGS\M3050\M3050_10/29/2021 1:24:21 PM - RMCLELLAN PRINTED: 10/29/2021 3:21:36 PM - RMCLELLAN
XREF FILE(S): Topo 5m Contours; Fresh Water Reservoir; Hydro; Mine Access Road; PropertyBoundary; Intake Structure_Option B; Interim Environmental Control Dam; Polishing Pond; YR-1 Mine Objects; Central Diversion Water Transfer Pond; Stage 1 diversion berm - Spillway EL 1230; Site C Embankment - YEAR -1; Access and Construction Roads - Central Diversion and Pipelines; Existing Roads & Trails_2020; YR03



LEGEND:

- CENTRIFUGAL PUMP
- KNIFE GATE VALVE
- CHECK VALVE
- AIR/VACUUM RELIEF COMBINATION VALVE
- CONCENTRIC REDUCER
- PIPE FLOW
- MALE CAMLOCK FITTING
- PRESSURE INDICATOR TRANSMITTER
- FLOW INDICATOR TRANSMITTER
- INSULATION AND ELECTRIC HEAT TRACE
- FREE SURFACE
- BY OTHERS / BATTERY LIMIT / KNIGHT PIESOLD SCOPE OF WORK

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. REFER TO DRAWING M3150, M3450 AND M3650 FOR AIR/VACUUM RELIEF COMBINATION VALVE AND DRAIN POINTS LOCATIONS AND DETAILS.

DETAILED DESIGN
NOT FOR CONSTRUCTION

G0006	CIVIL GENERAL NOTES
M3150	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - PIPELINE - PLAN AND PROFILE
M3450	WATER MANAGEMENT - WMP DISCHARGE SYSTEM - PIPELINE - PLAN & PROFILE
M3650	WATER MANAGEMENT - METAL WATER TREATMENT PLANT - DISCHARGE SYSTEM - ALIGNMENT AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RMM		

REVISIONS

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
DIVERSION PIPING SYSTEMS
PIPING AND INSTRUMENTATION DIAGRAM
YEAR -1

PROFESSIONAL ENGINEER

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2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3060	0

SAVED: M:\101\00457\33\Acad\DWGS\M3060\M3060, 10/29/2021 1:25:29 PM , SCAMMAYO PRINTED: 10/29/2021 3:08:02 PM, M3060, RMCLELLAN ACAD VERSION: 23.0S (LMS TECH)
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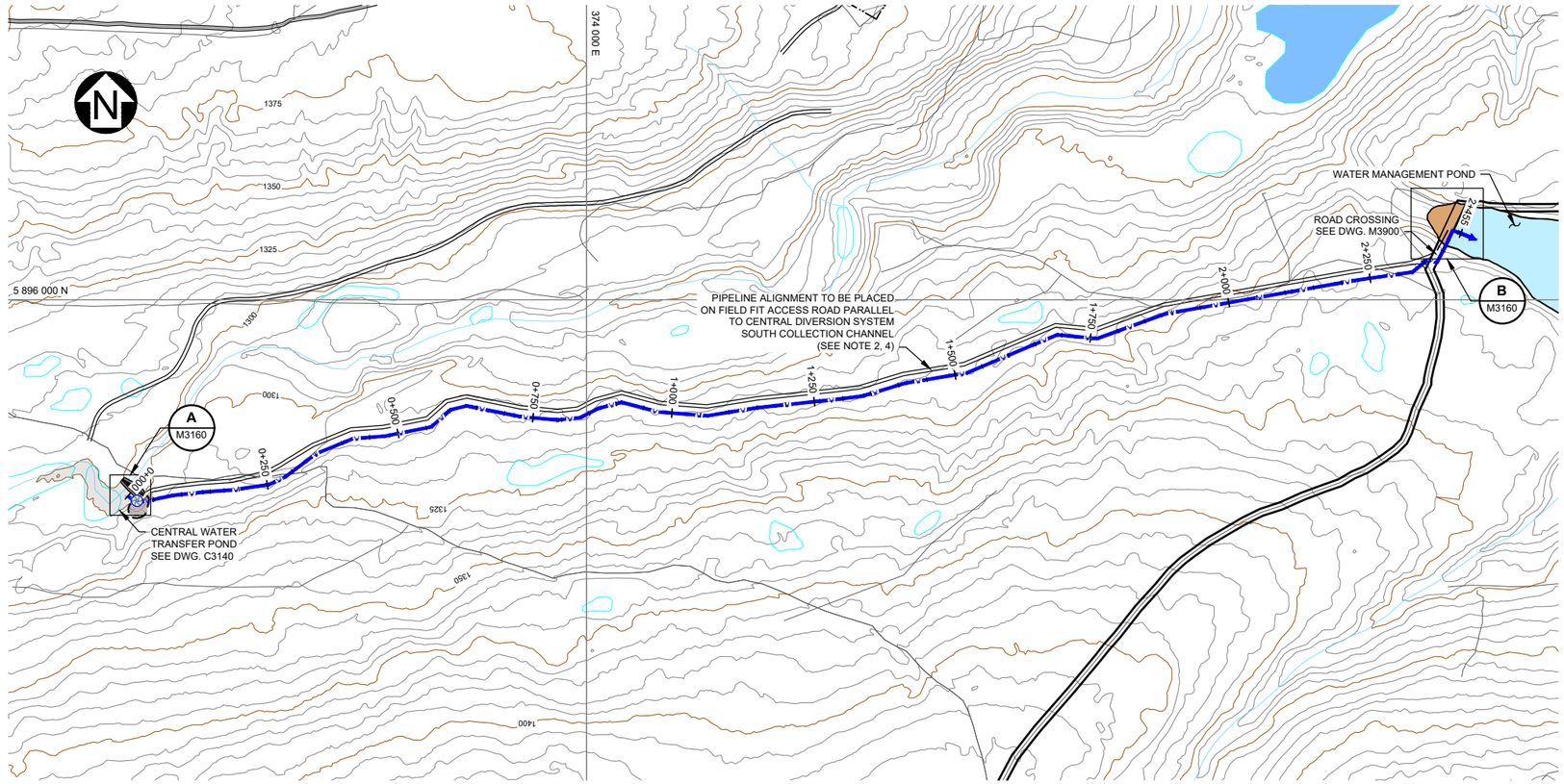
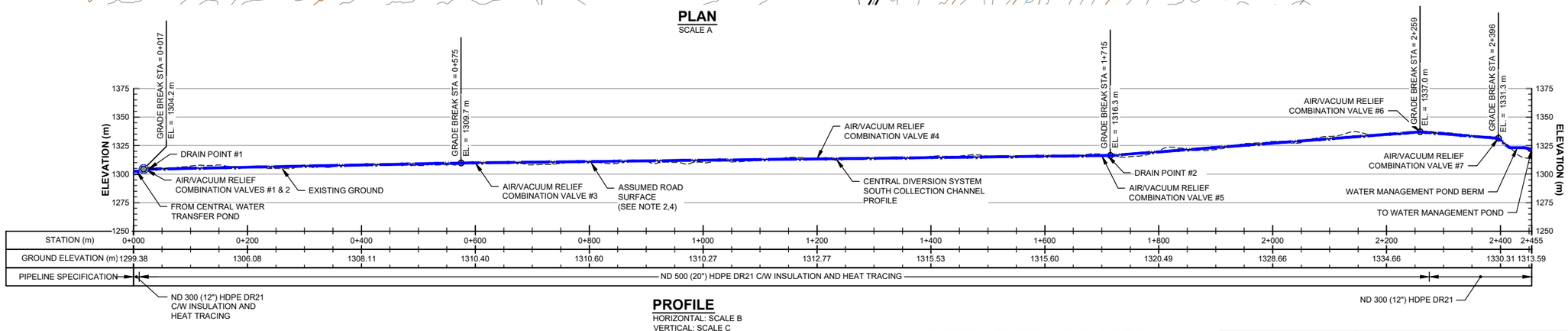


PLAN
SCALE A



PROFILE
HORIZONTAL: SCALE B
VERTICAL: SCALE C

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- PUMP STATION
- MINE ACCESS ROAD
- CENTRAL WATER DIVERSION PIPELINE
- EXISTING ACCESS TRAILS
- ACCESS ROAD
- CONSTRUCTION ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. FOR TYPICAL ROAD SECTIONS SEE DWG G0050.
3. SOUTH COLLECTION CHANNEL NOT SHOWN FOR CLARITY, SEE DWG C3130 FOR PLAN AND PROFILE.
4. PIPELINE ACCESS ROAD TO BE GRADED TO ELIMINATE LOCALIZED HIGH/LOW POINTS TO ENCOURAGE FREE DRAINAGE.
5. THE LOCATION OF ALL AIR/VACUUM COMBINATION RELIEF VALVES AND DRAIN POINTS ARE INDICATIVE ONLY. ADDITIONAL VALVE AND DRAIN POINTS MAY BE REQUIRED. AIR/VACUUM RELIEF COMBINATION VALVES ARE REQUIRED AT ALL HIGH POINTS ALONG THE THE PIPELINE ALIGNMENT OR AT A MAXIMUM SPACING OF 600 m. DRAIN POINTS ARE REQUIRED AT ALL LOW POINTS ALONG THE PIPELINE ALIGNMENT. LOCATIONS TO BE CONFIRMED IN THE FIELD.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE C: 40 20 0 40 80 120 160 200 m
SCALE B: 80 40 0 100 200 300 400 m
SCALE A: 100 50 0 100 200 300 400 500 m

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
G0050	TYPICAL ROAD SECTIONS
C3130	CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - PLAN AND PROFILE
C3140	CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND - PLAN
M3160	CENTRAL DIVERSION SYSTEM - PIPELINE - SECTIONS AND DETAILS
M3900	WATER MANAGEMENT - PIPELINE ROAD CROSSING - TYPICAL DETAILS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	R
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RMM	

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2021-10-29

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WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
PIPELINE
PLAN AND PROFILE

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3150	0

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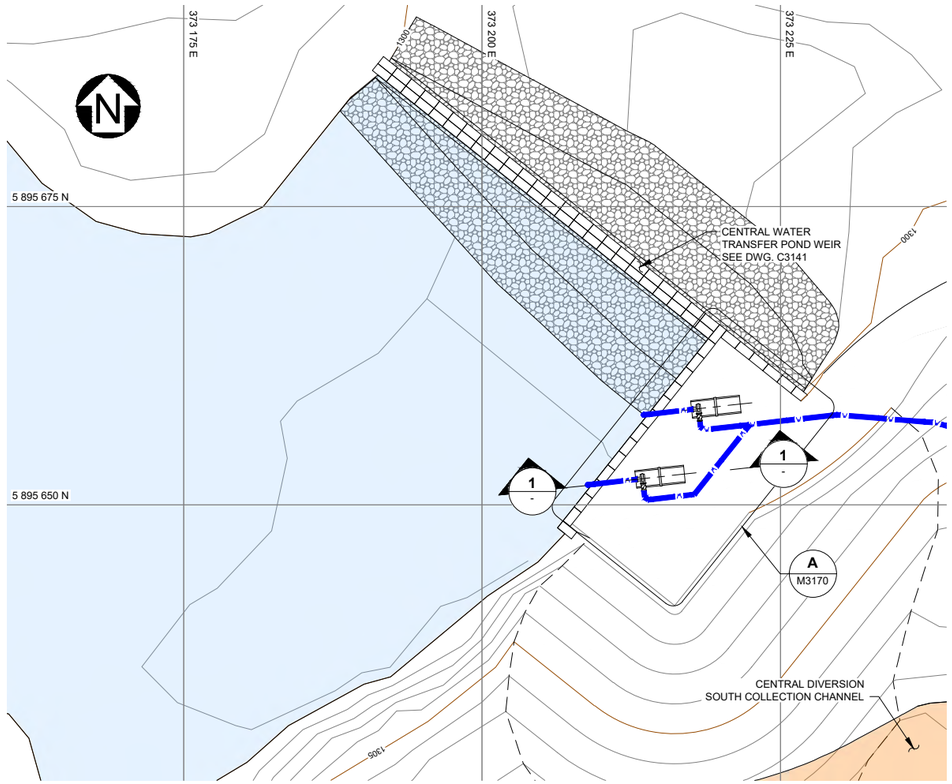
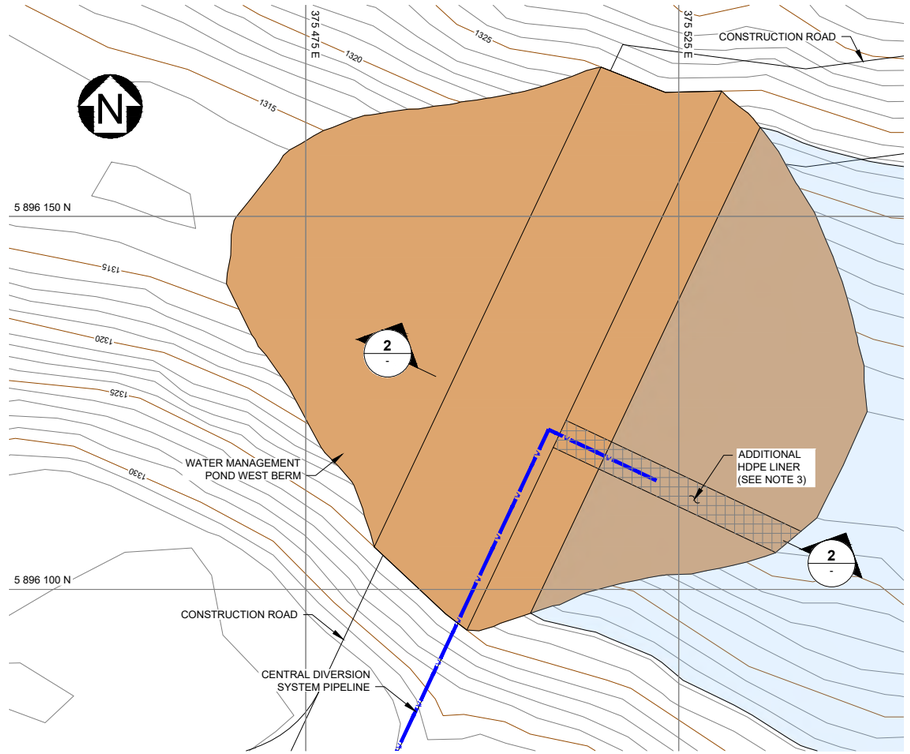
XREF FILE(S): Topo 5m Contours; Fresh Water Reservoir; Hydro; Mine Access Road; Property/Boundary; Intake Structure_Option B; Interim Environmental Control Dam; Polishing Pond; Existing Roads & Trails_2020; Central Diversion Water Transfer Pond, Access and Construction Roads - Central Diversion and Pipelines. IMAGE FILE(S):



A M3150 DETAIL
CENTRAL DIVERSION SYSTEM INTAKE
SCALE C



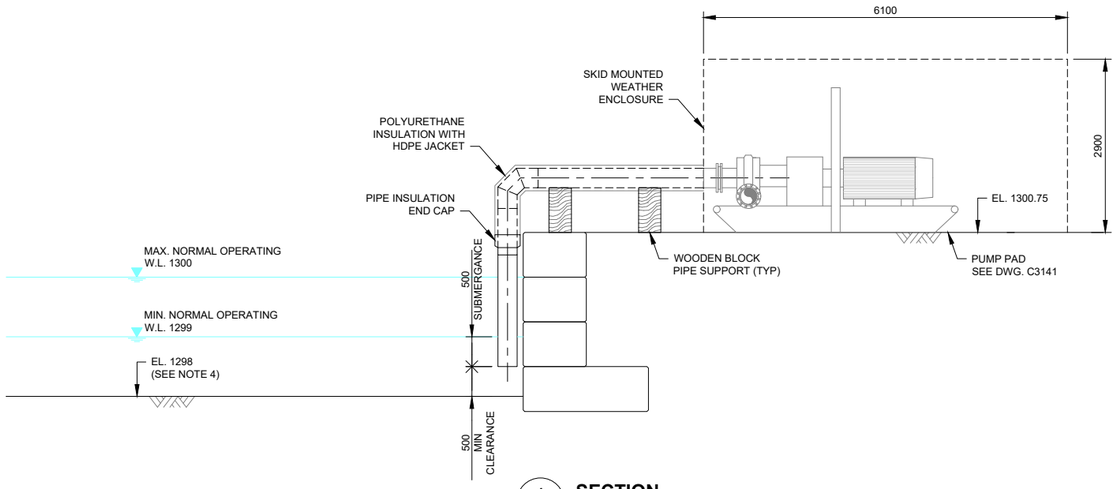
B M3150 DETAIL
CENTRAL DIVERSION SYSTEM OUTLET
SCALE A

LEGEND:

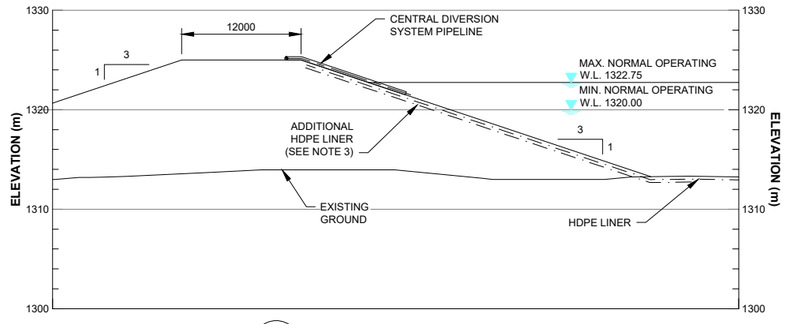
- CENTRAL DIVERSION SYSTEM PIPELINE
- HDPE LINER
- WATER
- HDPE LINER
- EMBANKMENT FILL
- ACCESS ROAD
- CONSTRUCTION ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. PIPE ANCHORS TO COUNTERACT BUOYANCY FORCES ON THE PIPE DURING CONSTRUCTION, COMMISSIONING AND OPERATIONS.
3. ADDITIONAL HDPE LINER WEAR SHEET UNDER DISCHARGE PIPE TO BE WELDED TO PRIMARY LINER.
4. POND BED TO BE EXCAVATED AND/OR DREDGED AS NEEDED TO MAINTAIN SUFFICIENT CLEARANCE FROM SUCTION LINES.



1 - SECTION
SCALE D



2 - SECTION
WATER MANAGEMENT POND WEST BERM
SCALE B

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE D: 1 0.5 0 1 2 3 4 5 m
SCALE C: 5 2.5 0 5 10 15 20 25 m
SCALE B: 6 3 0 10 20 30 m
SCALE A: 8 4 0 10 20 30 40 m

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
C3141	CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND - SECTIONS AND DETAILS
M3141	CENTRAL DIVERSION SYSTEM - PUMP STATION - SECTION AND DETAIL
M3150	CENTRAL DIVERSION SYSTEM - PIPELINE - PLAN AND PROFILE
M3170	CENTRAL DIVERSION SYSTEM - PUMP STATION - SECTION AND DETAIL

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
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PROFESSIONAL ENGINEER
PROVINCE OF
M. J. BARRETT

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2021-10-29

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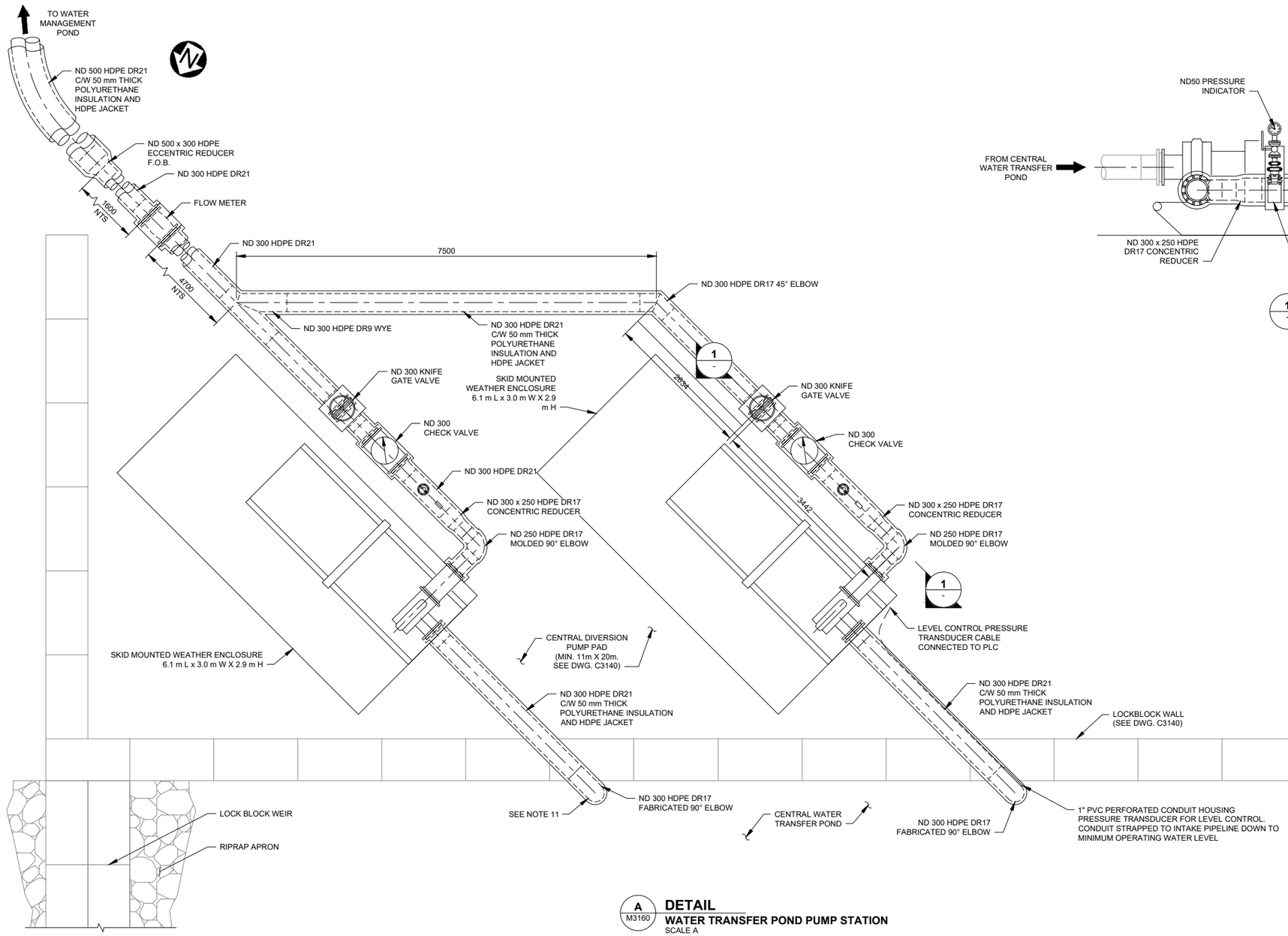
BLACKWATER GOLD PROJECT

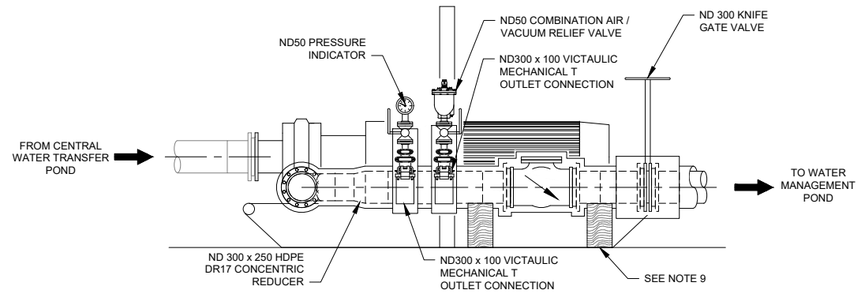
WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM PIPELINE
SECTIONS AND DETAILS

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3160	0

SAVED: M:\1\101\00457\33\A\acad\DWG\SM3160\M3160_10/29/2021 1:03:18 PM - SCAMMAYO, PRINTED: 10/29/2021 1:05:09 PM, M3160_SCAMMAYO.ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): topo 1m contours, Polishing Pond, Central Diversion System - Collection Channels (Years -1 to 6), Central Diversion Water Transfer Pond, Access and Construction Roads - Central Diversion and Pipelines, IMAGE FILE(S):



A M3160 **DETAIL**
WATER TRANSFER POND PUMP STATION
SCALE A



1 - **SECTION**
SCALE B

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. ALL VALVES AND FITTINGS ARE CLASS 150 UNLESS SPECIFIED OTHERWISE.
3. MATERIAL PRESSURE RATING IS THE MINIMUM REQUIRED.
4. ALL HDPE MATERIALS ARE TO BE PE4710 AS PER ASTM D3350-06 UNLESS NOTED OTHERWISE.
5. HDPE FLANGE ASSEMBLY INCLUDES: FLANGE ADAPTER & BACK-UP RING.
6. ALL BOLTS ARE TO BE ASTM F3125 GRADE A325 UNLESS NOTED OTHERWISE.
7. ALL NUTS ARE TO BE AS PER ASTM A563A UNLESS NOTED OTHERWISE.
8. ALL GASKETS FOR HDPE ADAPTER FLANGES ARE TO BE INSTALLED AS PER MANUFACTURERS RECOMMENDATIONS.
9. WOODEN SUPPORT BLOCKS TO PROVIDE CLEARANCE FOR FLANGE INSTALLATION/MAINTENANCE.
10. REGRADING AS REQUIRED TO PROVIDE CLEARANCE FOR FLANGE INSTALLATION/MAINTENANCE.
11. SUCTION LINES TO BE EQUIPPED WITH FLOAT MOUNTED DE-ICER.
12. ALL LINES AND FITTINGS OT BE INSULATED AND HEAT TRACED.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE B 0.6 0.3 0 1 2 3 m
SCALE A 0.8 0.4 0 1 2 3 4 m

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
CENTRAL DIVERSION SYSTEM
PUMP STATION
SECTION AND DETAIL

PROFESSIONAL ENGINEER PROVINCE OF

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2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3170	0

REFERENCE DRAWINGS	
M3160	CENTRAL DIVERSION SYSTEM - PIPELINE - SECTIONS AND DETAILS
C3140	CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND - PLAN
G0006	CIVIL GENERAL NOTES

DRG. NO.	DESCRIPTION

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1			

REVISIONS			
REV	DATE	DESCRIPTION	DESIGNED

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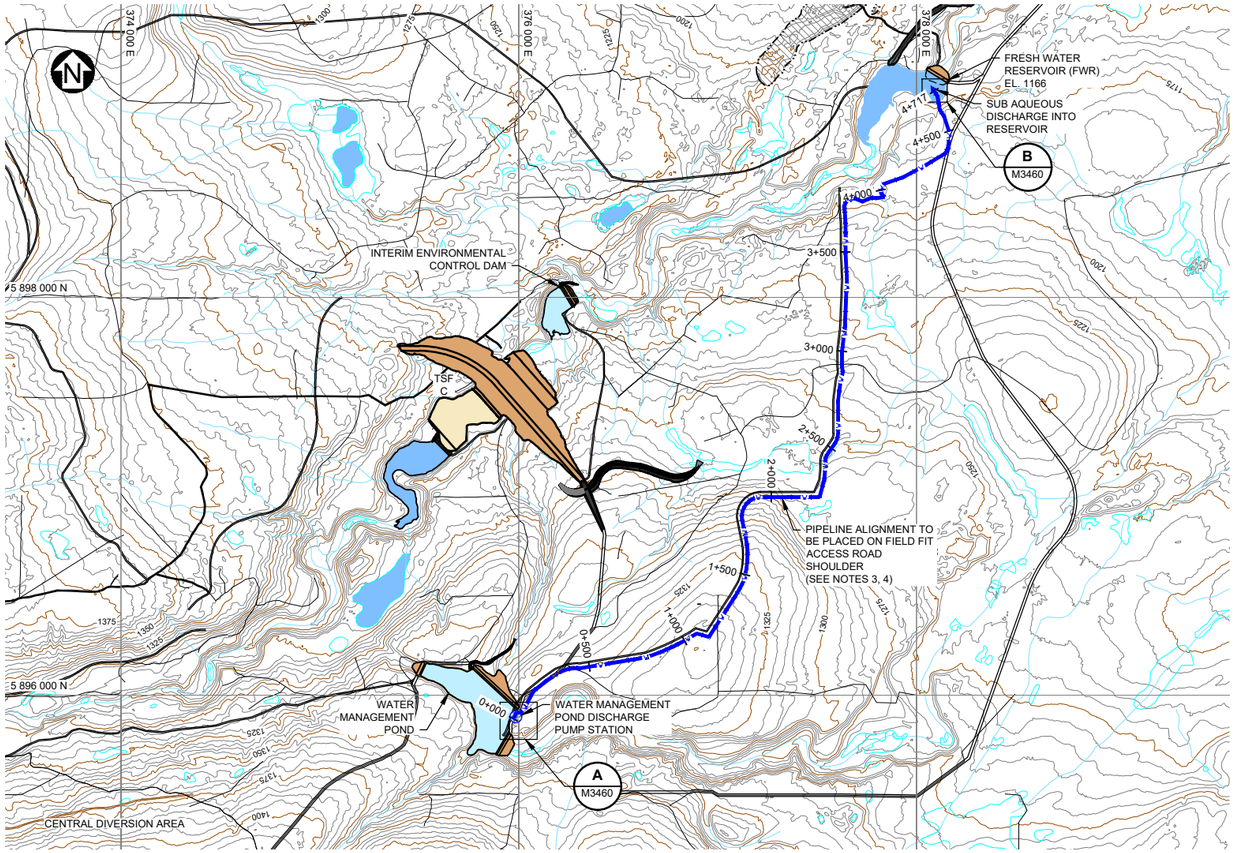
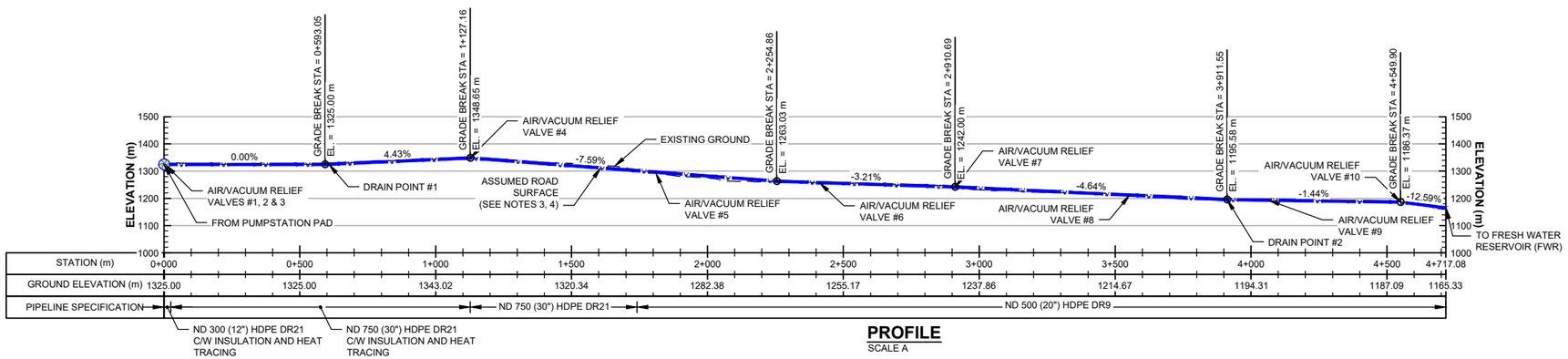


PLAN
SCALE A



PROFILE
SCALE A

LEGEND:

- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- TAILINGS
- PAG WASTE
- PUMP STATION
- WATER MANAGEMENT POND DISCHARGE PIPELINE
- EXISTING ACCESS TRAILS
- ACCESS ROAD
- CONSTRUCTION ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. FOR TYPICAL ROAD SECTIONS SEE DWG G0050.
3. PIPELINE ACCESS ROAD TO BE GRADED TO ELIMINATE LOCALIZED HIGH/LOW POINTS TO ENCOURAGE FREE DRAINING.
4. AIR/VACUUM RELIEF COMBINATION VALVES ARE REQUIRED AT ALL HIGH POINTS ALONG THE PIPELINE ALIGNMENT OR AT A MAXIMUM SPACING OF 600 m. DRAIN POINTS ARE REQUIRED AT LOW POINTS ALONG THE PIPELINE ALIGNMENT.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE B 200 100 0 200 400 600 800 1000 m
SCALE A 300 150 0 500 1000 1500 m

DRG. NO.	DESCRIPTION
M3460	WATER MANAGEMENT POND - DISCHARGE SYSTEM - PIPELINE - SECTIONS AND DETAILS
G0050	TYPICAL ROADS SECTIONS
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1

REVISIONS

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2021-10-29

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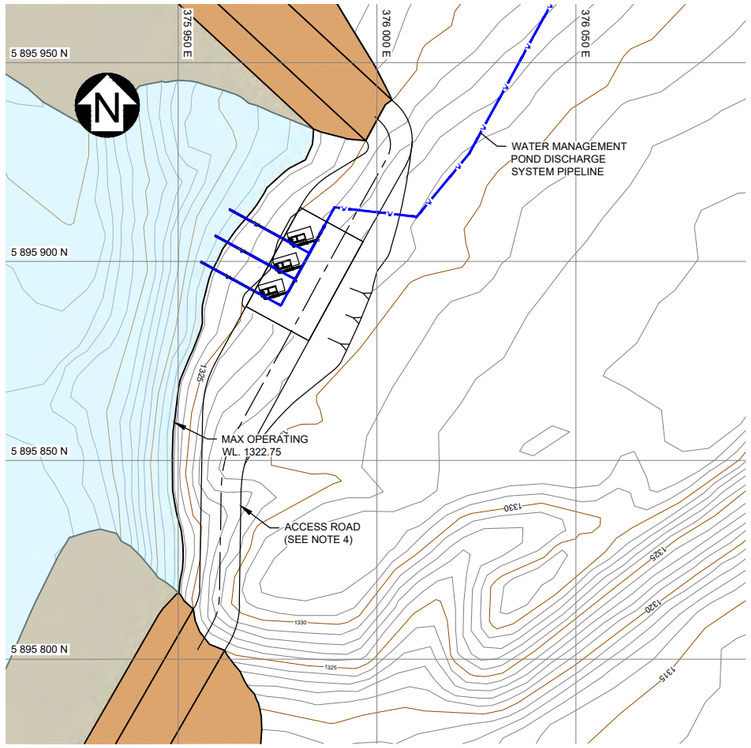
BLACKWATER GOLD PROJECT

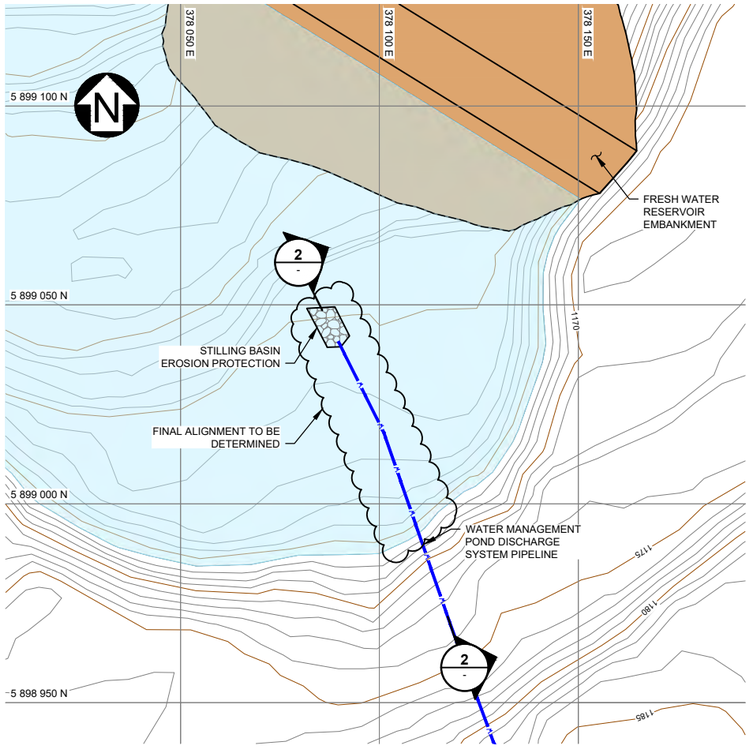
WATER MANAGEMENT WMP DISCHARGE SYSTEM PIPELINE PLAN AND PROFILE

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3450	0

SAVED: M:\101\00457\33\A\cad\4\DWGS\M3450\M3450_10-29-2021 3:20:43 PM. ELEE PRINTED: 10-29-2021 3:35:01 PM. M3450. ELEE ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Topo 5m Contours; Fresh Water Reservoir; Hydro; Mine Access Road; PropertyBoundary; Intake Structure_Option B; Interim Environmental Control Dam; Polishing Pond; YR08 Mine Objects; Site C Embankment - YEAR -1; Site C PAG - Year -1; Stage 1 diversion berm - Spillway EL 1230; Existing Roads & Trails_2020; Access and Construction Roads - Central Diversion and Pipelines IMAGE FILE(S):



PLAN
WATER MANAGEMENT POND INTAKE PUMPS
SCALE A



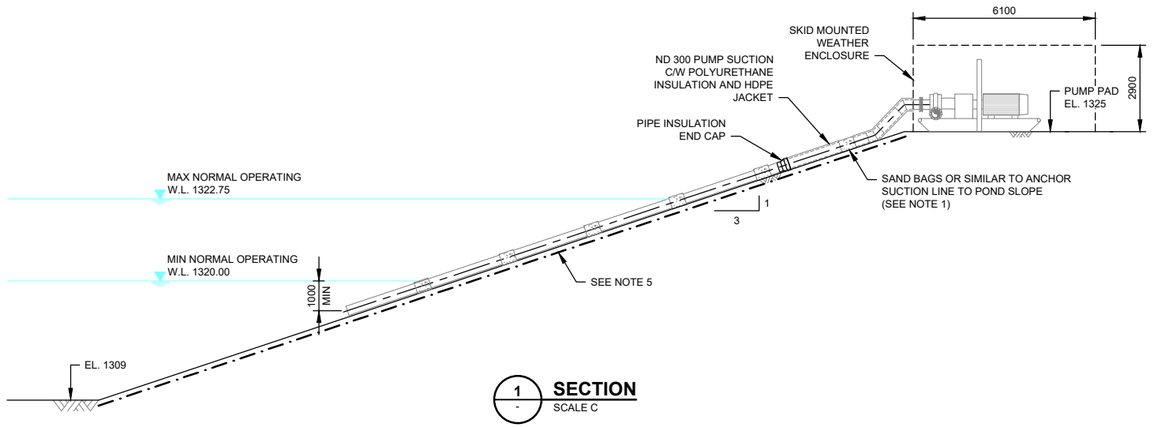
PLAN
FRESH WATER RESERVOIR
SCALE A

LEGEND:

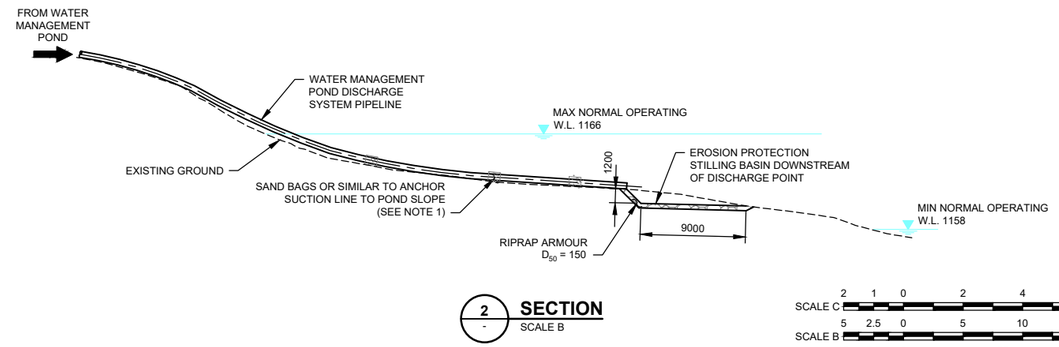
- WATER MANAGEMENT POND DISCHARGE SYSTEM PIPELINE
- WATER
- EMBANKMENT FILL
- RIPRAP
- HDPE LINER

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. PIPE ANCHORS TO COUNTERACT BUOYANCY FORCES ON THE PIPE DURING CONSTRUCTION, COMMISSIONING AND OPERATIONS.
3. CONTOUR INTERVAL IS 1 METRE.
4. SCHEMATIC REPPRESENTATION OF ACCESS ROAD ONLY. ROAD DESIGN TO BE DETERMINED. SEE DRAWING G0050 FOR TYPICAL ROAD SECTIONS.
5. ADDITION OF HDPE LINER SECURED WITH STAKES AS REQUIRED TO PREVENT EROSION OF SLOPE.



1 SECTION
SCALE C



2 SECTION
SCALE B

SCALE C: 2 1 0 2 4 6 8 10 m
SCALE B: 5 2.5 0 5 10 15 20 25 m
SCALE A: 15 7.5 0 25 50 75 m

M3470	WATER MANAGEMENT - WMP DISCHARGE SYSTEM - PUMP STATION - SECTION AND DETAIL
G0050	TYPICAL ROAD SECTIONS
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RMM

REVISIONS

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DETAILED DESIGN
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

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2021-10-29

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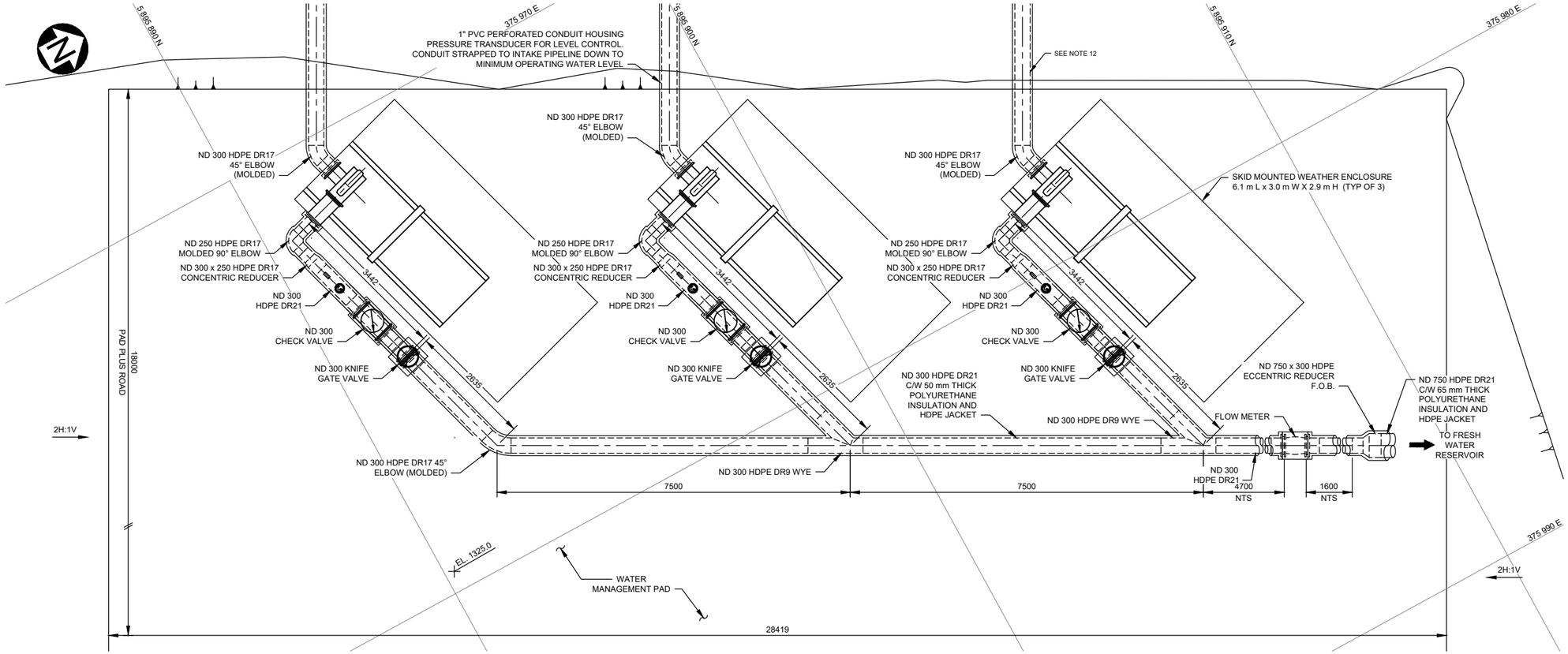
BLACKWATER GOLD PROJECT

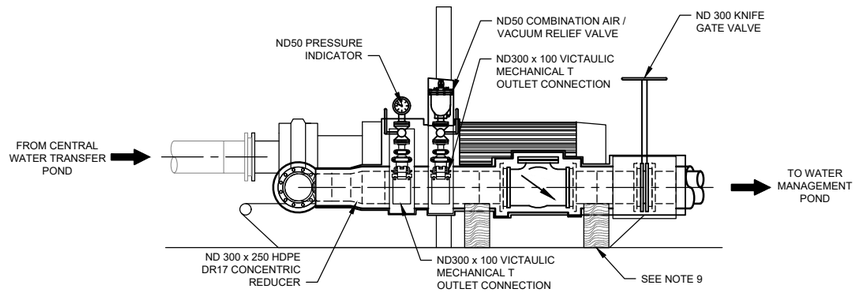
WATER MANAGEMENT WMP DISCHARGE SYSTEM PIPELINE SECTIONS AND DETAILS

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3460	0

SAVED: M:\101\100\457\3\A\cad\DWGS\M3460\M3460_10/29/2021 3:46:34 PM - RMCLELLAN PRINTED: 10/29/2021 3:56:36 PM, M3460, RMCLELLAN ACAD VERSION: 23.0S (LMS TECH)
XREF FILE(S): topo 1m contours; Polishing Pond; Central Diversion System - Collection Channels (Years -1 to 6); Fresh Water Reservoir (IMAGE FILE(S):



A M3160 **DETAIL**
WATER MANAGEMENT POND
DISCHARGE PUMP STATION
SCALE A



1 - **SECTION**
SCALE B

NOTES:

1. SEE DWG. G0006 FOR GENERAL NOTES.
2. ALL VALVES AND FITTINGS ARE CLASS 150 UNLESS SPECIFIED OTHERWISE.
3. MATERIAL PRESSURE RATING IS THE MINIMUM REQUIRED.
4. ALL HDPE MATERIALS ARE TO BE PE4710 AS PER ASTM D3350-06 UNLESS NOTED OTHERWISE.
5. HDPE FLANGE ASSEMBLY INCLUDES: FLANGE ADAPTER & BACK-UP RING.
6. ALL BOLTS ARE TO BE ASTM F3125 GRADE A325 UNLESS NOTED OTHERWISE.
7. ALL NUTS ARE TO BE AS PER ASTM A563A UNLESS NOTED OTHERWISE.
8. ALL GASKETS FOR HDPE ADAPTER FLANGES ARE TO BE INSTALLED AS PER MANUFACTURERS RECOMMENDATIONS.
9. WOODEN SUPPORT BLOCKS TO PROVIDE CLEARANCE FOR FLANGE INSTALLATION/MAINTENANCE.
10. REGRADING AS REQUIRED TO PROVIDE CLEARANCE FOR FLANGE INSTALLATION/MAINTENANCE.
11. SUCTION LINES TO BE EQUIPPED WITH FLOAT MOUNTED DE-ICERS.
12. ALL LINES AND FITTINGS TO BE INSULATED AND HEAT TRACED.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE B 0.6 0.3 0 1 2 3 m
SCALE A 1 0.5 0 1 2 3 4 5 m

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
WMP DISCHARGE SYSTEM
PUMP STATION
SECTION AND DETAIL

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3470	0

DRG. NO.	DESCRIPTION
M3160	CENTRAL DIVERSION SYSTEM - PIPELINE - SECTIONS AND DETAILS
G0006	CIVIL GENERAL NOTES

REFERENCE DRAWINGS

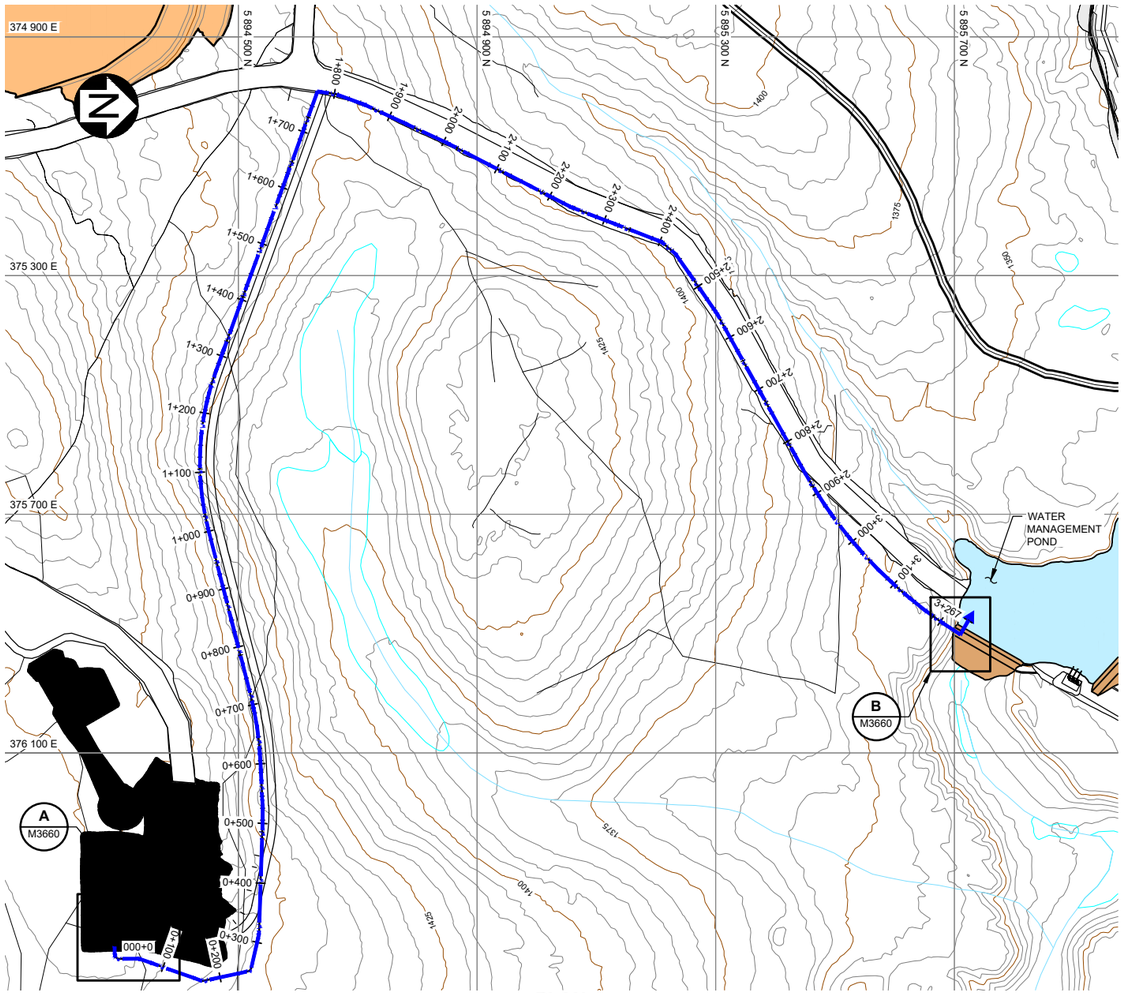
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

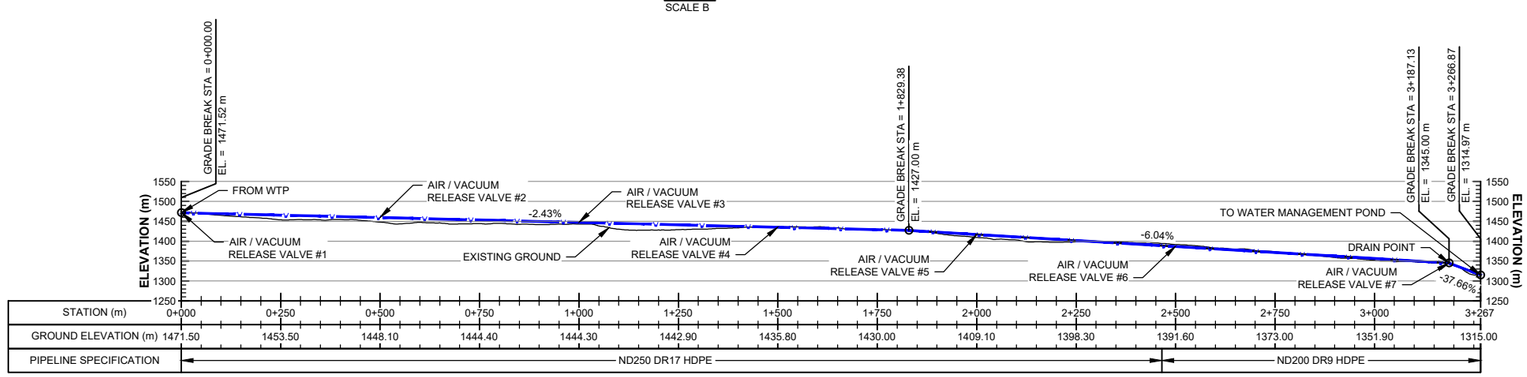
REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RMM

REVISIONS

SAVED: M:\101\00457\33\A\acad\DWG\SM3470\M3470, 10/29/2021 1:10:18 PM, SCAMMAYO PRINTED: 10/29/2021 1:10:33 PM, M3470, SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): | Polishing Pond IMAGE FILE(S):



PLAN
SCALE B



PROFILE
SCALE A

LEGEND:

- FRESH WATER
- EMBANKMENT FILL
- WTP DISCHARGE SYSTEM PIPELINE
- EXISTING ACCESS TRAILS
- ACCESS ROAD
- CONSTRUCTION ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG G0006.
2. FOR TYPICAL ROAD SECTIONS SEE DWG G0050.
3. PIPELINE ACCESS ROAD TO BE GRADED TO ELIMINATE LOCALIZED HIGH/LOW POINTS TO ENCOURAGE FREE DRAINING.
4. THE LOCATIONS OF ALL AIR/VACUUM RELIEF VALVES AND DRAIN POINTS ARE INDICATIVE ONLY. ADDITIONAL VALVES AND DRAIN POINTS MAY BE REQUIRED. AIR/VACUUM RELIEF COMBINATION VALVES ARE REQUIRED AT ALL HIGH POINTS ALONG THE PIPELINE ALIGNMENT OR AT A MAXIMUM SPACING OF 600 m. DRAIN POINTS ARE REQUIRED AT ALL LOW POINTS ALONG THE PIPELINE ALIGNMENT. LOCATIONS TO BE CONFIRMED IN THE FIELD.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE B: 100 50 0 100 200 300 400 500 m
SCALE A: 150 75 0 250 500 750 m

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT METALS WATER TREATMENT PLANT DISCHARGE SYSTEM ALIGNMENT AND PROFILE

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2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3650	0

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
G0050	TYPICAL ROADS SECTIONS
M3660	WATER MANAGEMENT - WATER TREATMENT PLANT - DISCHARGE SYSTEM - ALIGNMENT AND PROFILE
M3900	WATER MANAGEMENT - PIPELINE ROAD CROSSING - TYPICAL DETAILS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	EL

REVISIONS

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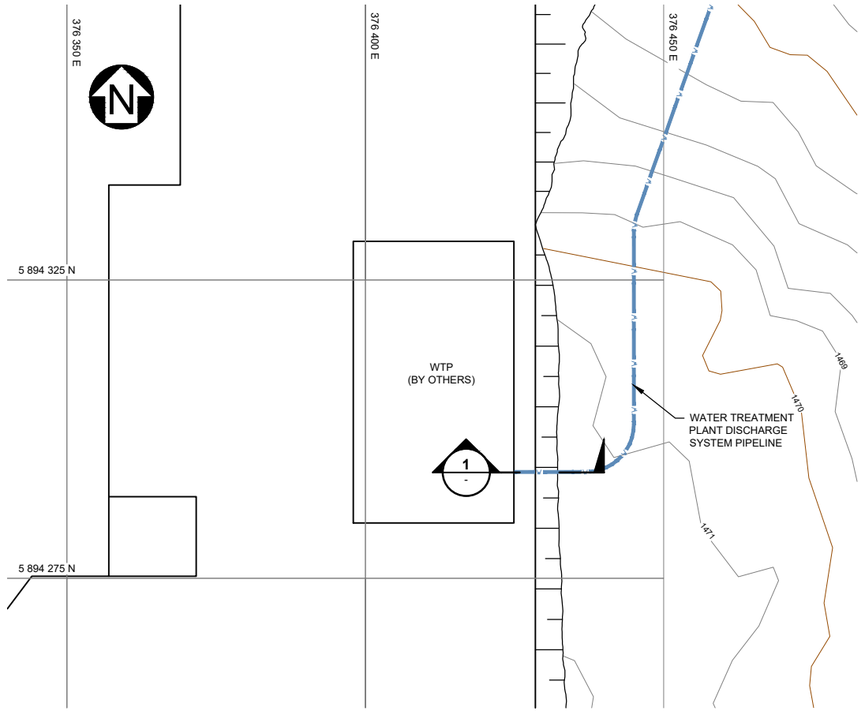
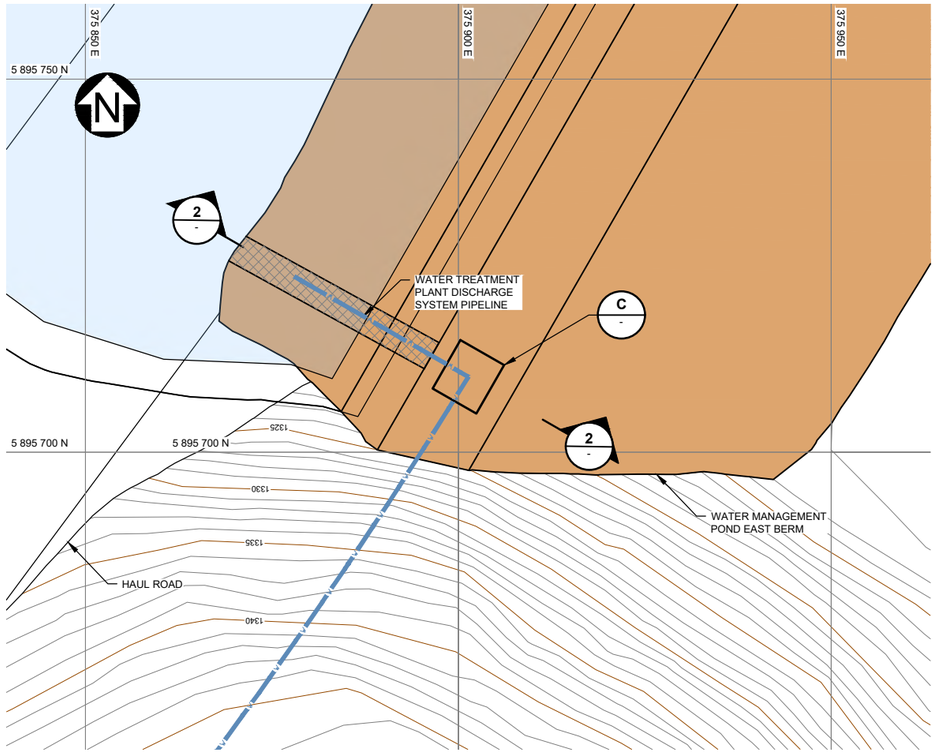
XREF FILE(S): Topo 5m Contours; Central Diversion System - Collection Channels (Years 1 to 6); Polishing Pond; YR09 Mine Objects; Hydro; Access and Construction Roads - Central Diversion and Pipelines; Existing Roads & Trails 2020 IMAGE FILE(S): BW Process Plant General Arrangement17893e7b



A M3650 **DETAIL**
WATER TREATMENT PLANT DISCHARGE
SCALE A



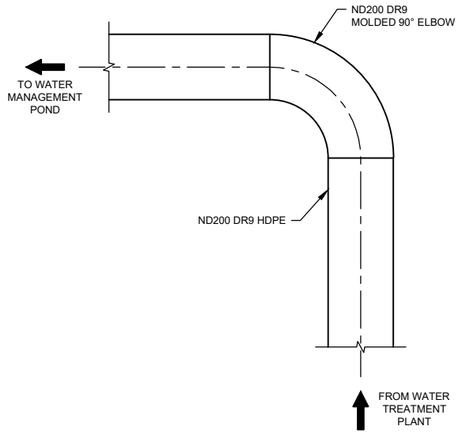
B M3650 **DETAIL**
WATER MANAGEMENT POND BERM
SCALE A

LEGEND:

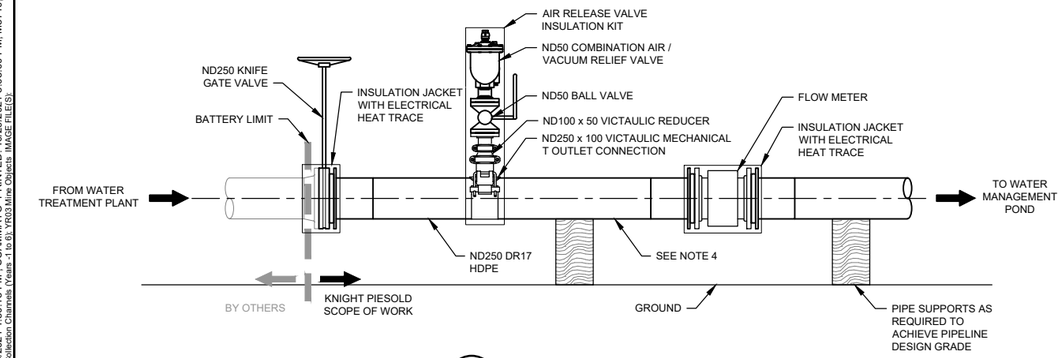
- CENTRAL DIVERSION SYSTEM PIPELINE
- HDPE LINER
- WATER
- HDPE LINER
- EMBANKMENT

NOTES:

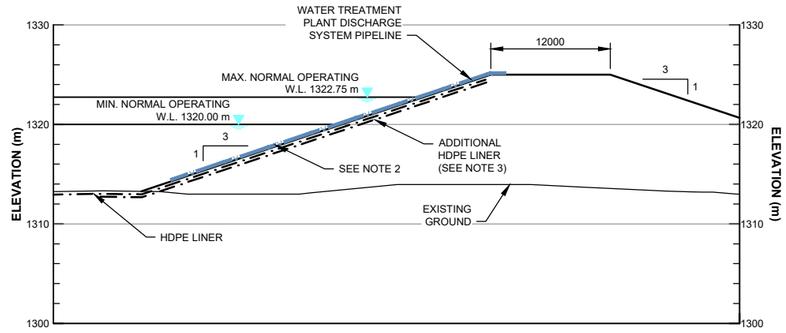
1. FOR GENERAL NOTES SEE DWG G0006.
2. PIPE ANCHORS TO COUNTERACT BUOYANCY FORCES ON THE PIPE DURING CONSTRUCTION, COMMISSIONING AND OPERATIONS.
3. ADDITIONAL HDPE LINER WEAR SHEET UNDER DISCHARGE PIPE TO BE WELDED TO PRIMARY LINER.
4. PIPELINE TO BE GRADED AS PER DRAWING M3650 TO MEET MINIMUM GRAVITY FLOW CAPACITY REQUIREMENTS.



C - **DETAIL**
DISCHARGE POINT ELBOW
SCALE D



1 - **SECTION**
SCALE C



2 - **DETAIL**
WATER MANAGEMENT POND EAST BERM
SCALE B

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE D 0.2 0.1 0 0.2 0.4 0.6 0.8 1 m
SCALE C 0.4 0.2 0 0.4 0.8 1.2 1.6 2.0 m
SCALE B 1 0.5 0 1 2 3 4 5 m
SCALE A 8 4 0 10 20 30 40 m

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

WATER MANAGEMENT
METALS WATER TREATMENT PLANT
DISCHARGE SYSTEM
SECTIONS AND DETAILS

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2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3660	0

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
M3650	WATER MANAGEMENT - WATER TREATMENT PLANT - DISCHARGE SYSTEM - ALIGNMENT AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

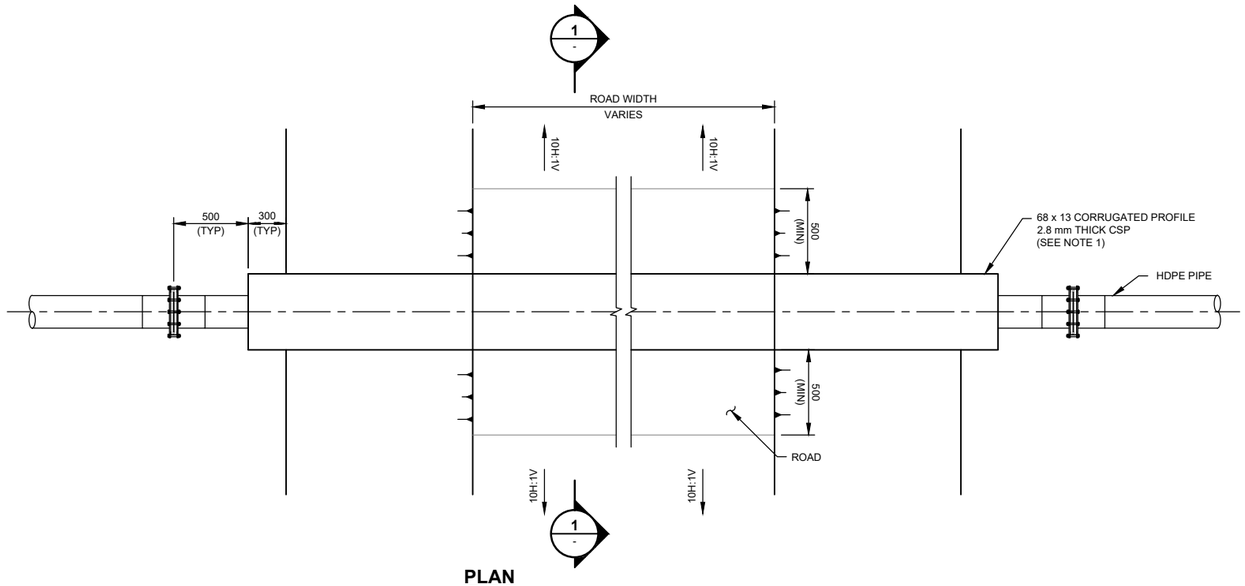
REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
0	29OCT'21	ISSUED FOR PERMITTING	MJB1

REVISIONS

SAVED: M:\101\00457\33\A\acad\DWG\M3660\M3660_10/29/2021 1:30:13 PM, SCAMMAYO, PRINTED: 10/29/2021 3:03:00 PM, M3710, RMCLELLAN ACAD VERSION: 23.0S (LMS TECH)
XREF FILE(S): topo 1m contours, Polishing Pond, Central Diversion System - Collection Channels (Yeas -1 to 6), YR03 Mine Objects, IMAGE FILE(S):

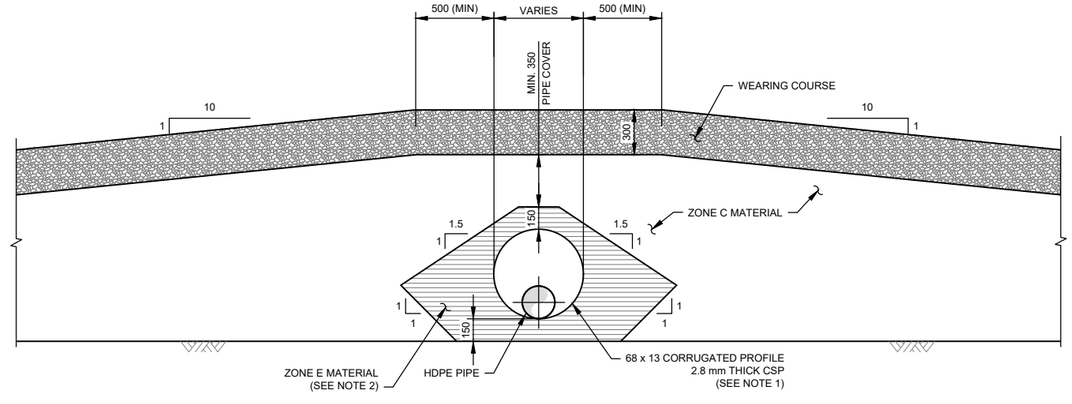
CULVERT DETAILS		
PIPELINE	CHAINAGE	DIAMETER (mm)
CENTRAL DIVERSION SYSTEM (PHASE 1)	0+300	900
CENTRAIL DIVERSION SYSTEM (PHASE 1)	2+300	900
WATER MANAGEMENT POND DISCHARGE SYSTEM	1+250	1,200



PLAN
TYPICAL ROAD CROSSING (A)
PERPENDICULAR TO ROAD ALIGNMENT
SCALE A

LEGEND:

- WEARING COURSE
- ZONE E
- ZONE C



1 - **SECTION**
TYPICAL ROAD CROSSING
SCALE A

NOTES:

1. WHEN TWO PIPELINES CROSS THE ROAD AT THE SAME LOCATION, THE MINIMUM ALLOWABLE SPACING BETWEEN CULVERTS IS 500 mm.
2. FILL MATERIAL NOT TO EXCEED MAXIMUM PARTICLE DIAMETER OF 75 mm. BACKFILL AROUND SIDES AND TOP OF PIPE WITH COVER FILL, COMPACTED IN PLACE WITH HAND-OPERATED PLATE COMPACTOR OR SIMILAR TO AVOID DAMAGING THE PIPE.
3. DESIGN VEHICLE FOR ACCESS ROADS IS CAT 725. DESIGN VEHICLE FOR CONSTRUCTION ROADS IS CAT 777. SEE DWG G0050 FOR TYPICAL ROAD SECTIONS.

DETAILED DESIGN
NOT FOR CONSTRUCTION

400 200 0 400 800 1200 1600 2000 mm
SCALE A

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BLACKWATER GOLD PROJECT

WATER MANAGEMENT
PIPELINE ROAD CROSSING
TYPICAL DETAILS

PROFESSIONAL ENGINEER PROVINCE OF

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2021-10-29

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M3900	0

REFERENCE DRAWINGS		
DRG. NO.	DESCRIPTION	
G0050	TYPICAL ROADS SECTIONS	

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED	

REVISIONS				
REV	DATE	DESCRIPTION	DESIGNED	D
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	

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XREF FILE(S): infrastructure; Roads (IMAGE FILE(S):

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TABLE D.1

BW GOLD LTD.
BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM DESIGN REPORT
DRAWING LIST

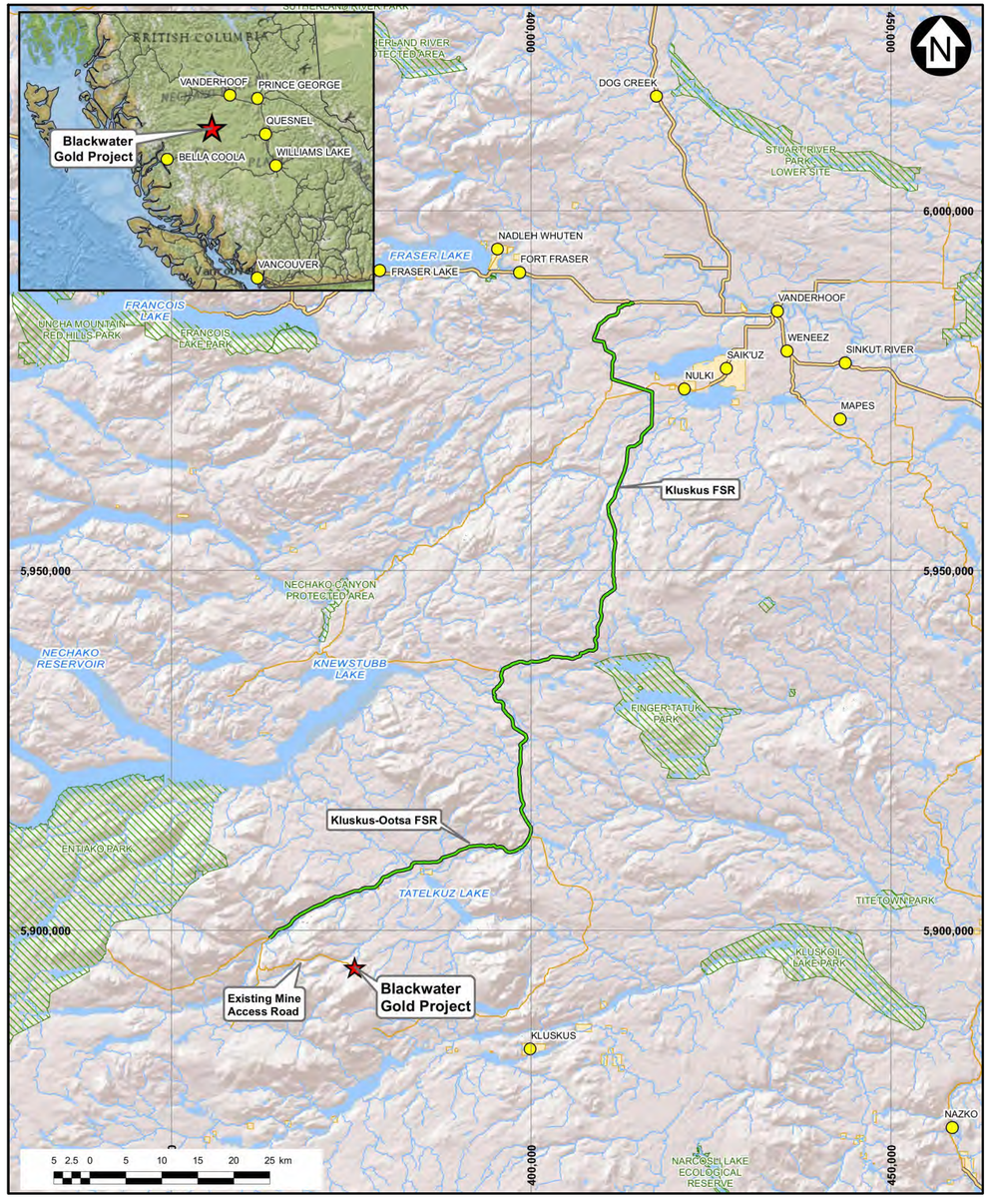
KP DWG No.	Rev.	Revision Date	Package	Drawing Title
G0001	0	29OCT'21	FWSS	Title Sheet
G0005	0	29OCT'21	FWSS	Legend, Symbols, and Abbreviations
G0006	0	29OCT'21	FWSS	Civil General Notes
G0040	0	29OCT'21	FWSS	Construction Material Gradations
C5050	0	04NOV'21	FWSS	Fresh Water Supply System - Flow Diagram
C5300	0	04NOV'21	FWSS	Fresh Water Supply System - Intake Structure - Overview
C5310	0	04NOV'21	FWSS	Fresh Water Supply System - Intake Structure - Plan and Section
C5410	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance - Plan and Profile
C5411	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance - Plan and Profile (Sheet 1 of 8)
C5412	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance - Plan and Profile (Sheet 2 of 8)
C5413	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance - Plan and Profile (Sheet 3 of 8)
C5414	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance - Plan and Profile (Sheet 4 of 8)
C5415	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance - Plan and Profile (Sheet 5 of 8)
C5416	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance - Plan and Profile (Sheet 6 of 8)
C5417	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance - Plan and Profile (Sheet 7 of 8)
C5418	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance - Plan and Profile (Sheet 8 of 8)
C5420	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance Pipeline - Alternative Sections for Frost Protection - 1 of 3
C5421	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance Pipeline - Alternative Sections for Frost Protection - 2 of 3
C5422	0	04NOV'21	FWSS	Fresh Water Supply System - Water Conveyance Pipeline - Alternative Sections for Frost Protection - 3 of 3
M5005	0	04NOV'21	FWSS	Fresh Water Supply System - Piping and Instrumentation Diagram
M5050	0	04NOV'21	FWSS	Fresh Water Supply System - Pipeline - Plan and Profile
M5060	0	04NOV'21	FWSS	Fresh Water Supply System - Water Pump Station - Plan and Section
M5070	0	04NOV'21	FWSS	Fresh Water Supply System - Booster Station - Plan

BW GOLD LTD.

BLACKWATER GOLD PROJECT

PERMITTING LEVEL DESIGN

DRAWING PACKAGE



LEGEND:

- PROJECT LOCATION
- CITY/TOWN
- KLUSKUS FSR
- PAVED ROAD
- GRAVEL ROAD
- RIVER/CREEK
- LAKE
- FIRST NATION RESERVE

NOTES:

1. COORDINATE GRID IS NAD 1983 UTM ZONE 10N
2. BASE MAP: ESRI ARCGIS ONLINE SHADED RELIEF MAPPING.

DETAILED DESIGN

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BLACKWATER GOLD PROJECT

TITLE SHEET

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

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DDF

2021-11-15

DRG. NO.	DESCRIPTION
-	-

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	SKC	DDF	

REVISIONS

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	G0001	0

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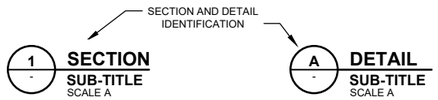
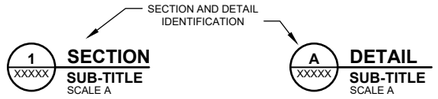
XREF FILE(S): IMAGE FILE(S):

SECTIONAL VIEW AND DETAIL IDENTIFICATION

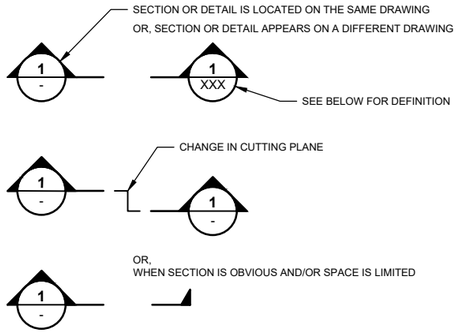
SECTION OR DETAIL APPEARS ON THE SAME DRAWING:



SECTION OR DETAIL APPEARS ON A DIFFERENT DRAWING:

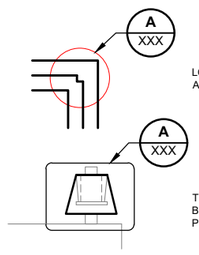


SECTION LOCATION ARROWS



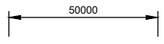
XXX =	"C2110"	NUMBER REFERS TO THE DRAWING FROM WHICH THE SECTION OR DETAIL IS CALLED UP IN DIFFERENT FACILITY.

DETAIL REFERENCE



LOCATED AND IDENTIFIED THUS, THE DETAIL ENLARGEMENT WILL BE IN THE SAME ATTITUDE AND POSITION RELATIVE TO THE DRAWING AS THE PART CIRCLED.

THIS IS A REFERENCE ONLY, TO A DETAIL WHICH, IN ITS ENLARGED FORM, MAY OR MAY NOT BE IN THIS PARTICULAR ATTITUDE. IT WILL, HOWEVER, CONTRIBUTE SOME ADDITIONAL PERTINENT INFORMATION TO THIS VIEW.

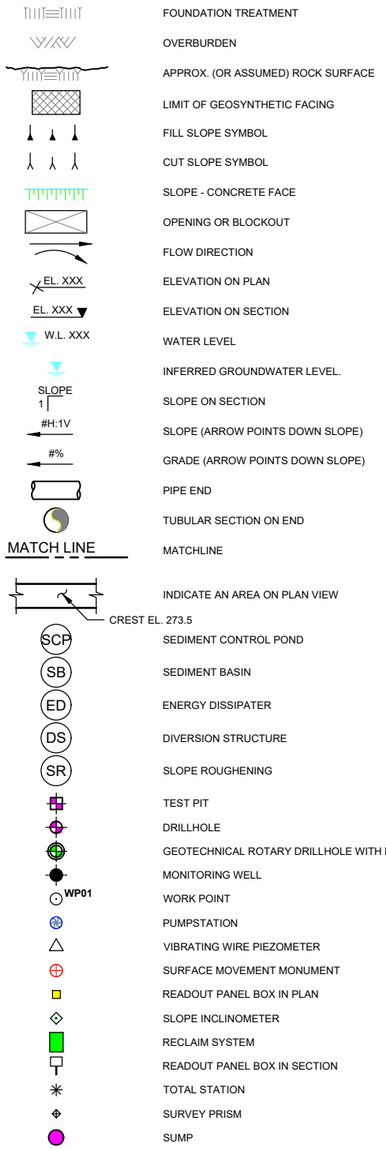


DIMENSIONS IN MILLIMETRES

CENTERLINE ON SECTION

NORTH SYMBOL

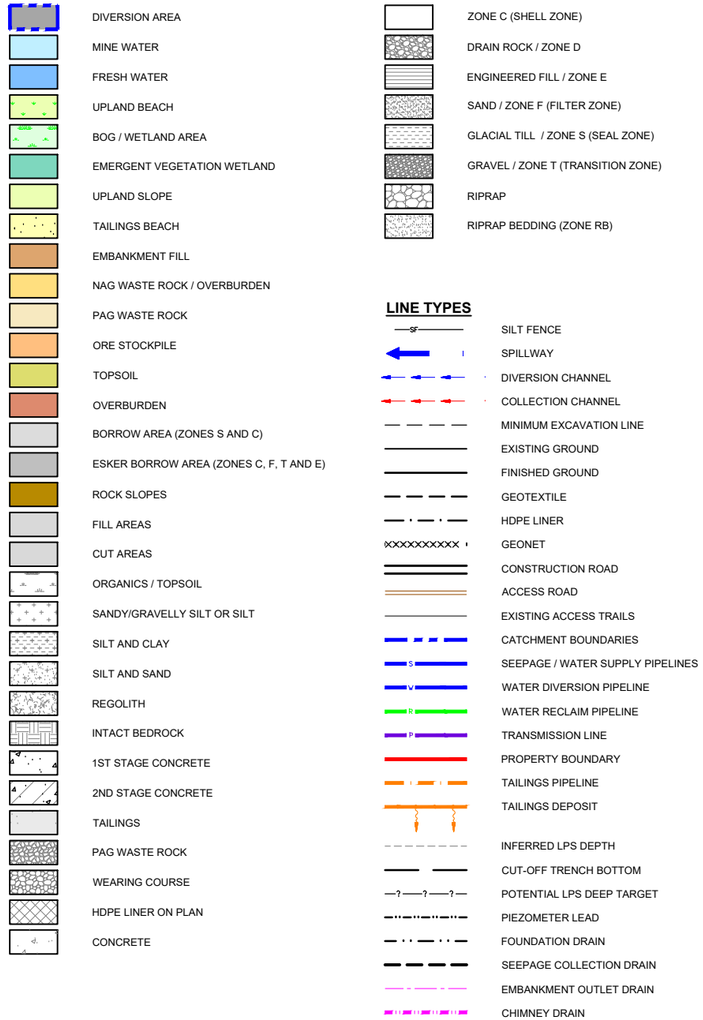
SYMBOLS



ABBREVIATIONS

UNO	UNLESS NOTED OTHERWISE
C/C	CENTER TO CENTER
EL.	ELEVATION IN METRES
EQ.	EQUAL
SP	SPACING
NTS	NOT TO SCALE
DN	DOWN
OPN'G	OPENING
REQ'D	REQUIRED
OD	OUTSIDE DIAMETER
ID	INSIDE DIAMETER
DIA. OR Ø	DIAMETER
R	RADIUS
m	METRE
mm	MILLIMETRE
CTR	CENTER
EA.	EACH
EMBK.	EMBANKMENT
CJ	CONSTRUCTION JOINT
CONTR. JT.	CONTRACTION JOINT
EXP. JT.	EXPANSION JOINT
APPROX.	APPROXIMATE
TYP.	TYPICAL
W/S	WATERSTOP
W/	WITH
BTW	BETWEEN
CONC.	CONCRETE
COL.	COLUMN
BM	BEAM
SOL	SETTING OUT LINE
NA	NOT APPLICABLE
CSP	CORRUGATED STEEL PIPE
SR	SHORT RADIUS
XXS	STEEL PIPE WEIGHT
TSF	TAILING STORAGE FACILITY
GW	GROUND WATER
STA.	STATION
EOH	END OF HOLE
DWG	DRAWING
E	EAST
N	NORTH
masl	METERS ABOVE SEA LEVEL
WP	WORK POINT
BLDG	BUILDING
CHK	CHECKED
CL	CENTERLINE
EG	EXISTING GROUND
FG	FINISHED GROUND
IE	INVERT ELEVATION
HORIZ, H	HORIZONTAL
VERT, V	VERTICAL
NO	NUMBER
NTS	NOT TO SCALE
REV	REVISION
TOC	TOP OF CONCRETE
TYP	TYPICAL

LEGEND:



LINE TYPES

DETAILED DESIGN

NOT FOR CONSTRUCTION

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Knight Piésold CONSULTING

BW GOLD LTD.

BLACKWATER GOLD PROJECT

ND, SYMBOLS, AND ABBREVIATIONS

<original signed by>

2021-11-15

DRG. NO.	DESCRIPTION
-	-

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	ABN		

REVISIONS

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	G0005	0

SAVED: M:\101\00457\33\AAcad\DWGS\G0005\G0005, 10/29/2021 1:27:17 PM, ANASIRI PRINTED: 10/29/2021 1:38:33 PM, G0005, ANASIRI ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): IMAGE FILE(S):

GENERAL:

1. COORDINATE GRID IS UTM NAD 83 ZONE 10U.
2. GROUND TOPOGRAPHY BASED ON INFORMATION PROVIDED BY EAGLE MAPPING ON AUGUST 8 AND 9, 2011.
3. ALL DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. DRAWINGS WILL BE READ IN CONJUNCTION WITH THE PROJECT TECHNICAL SPECIFICATIONS. THE DRAWINGS WILL TAKE PRECEDENCE IN THE CASE OF A DISCREPANCY.
5. CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER UPON ANY DISCOVERY OF DISCREPANCIES BETWEEN THE ISSUED DRAWING SET AND/OR CONSTRUCTED WORKS.
6. CONTRACTOR SHALL BE RESPONSIBLE TO MAINTAIN SURVEY CONTROL ON ALL ASPECTS OF THE WORKS. THE CONTRACTOR SHALL VERIFY ALL LINES, GRADES, LOCATIONS AND TIE-IN POINTS PRIOR TO COMMENCEMENT OF THE WORKS AND SHALL NOTIFY THE ENGINEER IMMEDIATELY OF ANY DISCREPANCY.
7. PIPELINE ALIGNMENTS TO BE CONFIRMED BY THE CONTRACTOR IN THE FIELD TO ENSURE PIPELINE INSTALLATION AND OPERATION DO NOT INTERFERE WITH OTHER INFRASTRUCTURE/OPERATING ACTIVITIES.
8. CONTRACTOR TO CONFIRM THE LOCATION OF ALL HIGH AND LOW POINTS ALONG THE PIPELINE ALIGNMENT, FOR THE INSTALLATION OF COMBINATION AIR/VACUUM RELEASE VALVES AND DRAIN POINTS, RESPECTIVELY.
9. PIPE FOUNDATION SHALL BE INSPECTED BY THE ENGINEER PRIOR TO LAYING OF THE PIPE. ANY SOFT OR HARD SPOTS, SUCH AS A ROCK OUTCROPS NOT EXPECTED, SHALL BE SURVEYED AND REPORTED TO THE ENGINEER FOR CHECKING AND INSTRUCTIONS.
10. CONTRACTOR TO CONFIRM THE LOCATION OF ALL ROAD AND PIPE CROSSINGS.
11. ALL MATERIALS USED WILL BE THE BEST SUITED FOR THE APPLICATION BASED ON SUPPLIER SPECIFICATIONS.

DESIGN CHANGE MANAGEMENT:

1. MATERIALS OR PRODUCTS USED WILL BE AS SPECIFIED ON THE DESIGN DRAWINGS OR EQUIVALENT AS APPROVED BY THE ENGINEER.

INSTRUMENTATION:

1. ALL WATER LEVEL, PORE PRESSURE, SURFACE AND SUBSURFACE DEFORMATION INSTRUMENTATION ARE TO BE INSTALLED WITH WIRELESS CAPABILITIES TO AUTOMATICALLY COLLECT AND TRANSMIT DATA.
2. FLOW MONITORING INSTRUMENTATION SHALL BE SURVEILLED AUTOMATICALLY OR MANUALLY DEPENDING ON THE LOCATION AND MONITORING SETUP, AS DETERMINED BY THE ENGINEER. FLOW MONITORING INSTRUMENTATION SHALL BE COMPRISED OF THE FOLLOWING:
   - V-NOTCH WEIRS AT THE END OF PERMANENT INLET AND OUTLET PIPES OR
   - FLOW METERS ON PERMANENT PUMPS.
3. DATA LOGGERS WITH CELLULAR TRANSMITTING CAPABILITIES ARE TO BE INSTALLED AT THE TOE OF MAIN DAM C AT EACH INSTRUMENTATION SECTION.
4. DAM CREST SURFACE DISPLACEMENT TO BE AUTOMATICALLY MONITORED BY TOTAL STATION AND SURVEY PRISMS.
5. SURVEY PRISMS INSTALLED AT 100 METER INTERVALS ON MAIN DAM C CREST.
6. AUTOMATIC TOTAL STATIONS TO SCAN SURVEY PRISMS AT A MINIMUM ONCE DAILY. AUTOMATIC MONITORING TO COMMENCE AT SUBSTANTIAL COMPLETION.

FOUNDATIONS:

1. THE FOUNDATION LEVELS GIVEN ON THE DRAWINGS ARE ANTICIPATED LEVELS. THE FINAL FOUNDATION LEVELS WILL BE DETERMINED BY THE ENGINEER BASED ON ACTUAL SITE CONDITIONS.
2. EXCAVATIONS WITH SIGNIFICANT WATER SEEPAGE MAY REQUIRE REDUCED EXCAVATION SLOPES THAN WHAT IS SHOWN ON THE EXCAVATION DRAWINGS AND WILL REQUIRE DEWATERING. CONTRACTOR TO ALLOW FOR SUCH DEWATERING SYSTEM.
3. BLINDING CONCRETE / LEAN MIX CONCRETE MUDSLAB MAY BE REQUIRED IN THE BOTTOM OF SOME FOUNDATION EXCAVATIONS. MINIMUM THICKNESS OF BLINDING CONCRETE SHALL BE 50 mm WITH A MAXIMUM NOMINAL THICKNESS OF 200 mm. THE BLINDING CONCRETE SHALL NOT BE THICKER THAN 400 mm AT DEEP INFILL AREAS SUCH AS ROCK EXCAVATION OVER-BREAK.
4. BLINDING CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF AT LEAST 15 MPa AT 28 DAYS.
5. FOR BLINDING LAYER CONCRETE THICKER THAN NOMINAL 200 mm USE CONVENTIONAL TYPE C25 CONCRETE UP TO DESIGN GRADE AND ELEVATION, FROM WHERE THE SPECIFIED CONCRETE STRENGTH FOR THE STRUCTURAL MEMBER SHOULD BE USED.
6. PRIOR TO PLACING BLINDING CONCRETE, REMOVE AND REPLACE ALL AREAS OF LOOSE OR SOFT MATERIAL OR COMPACT SUB GRADE SOILS AS SPECIFIED.
7. FREEZING OF BLINDING LAYER CONCRETE AND/OR EXPOSED FOUNDATION MATERIAL SHALL NOT BE ALLOWED AND WILL BE REJECTED BY THE ENGINEER.
8. ALL EXCAVATIONS AND FOUNDATION MATERIAL ARE TO BE INSPECTED AND ACCEPTED BY THE ENGINEER PRIOR TO PLACING BLINDING CONCRETE, FORMWORK OR ANY REINFORCEMENT. HOLD EXCAVATION FOR INSPECTION AND APPROVAL BY ENGINEER.
9. ALL EXCAVATIONS SHALL BE KEPT FREE OF STANDING WATER AT ALL TIMES.

TEMPORARY STRUCTURES:

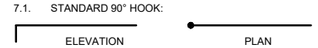
1. THE CONTRACTOR SHALL DESIGN AND DETAIL ALL TEMPORARY STRUCTURES USED FOR THE CONSTRUCTION OF THE PERMANENT WORKS.
2. MAINTAIN ALL STRUCTURES IN A STABLE CONDITION DURING CONSTRUCTION AND ENSURE AT ALL TIMES THAT NO PART OF THE STRUCTURE IS OVER STRESSED DUE TO THE CONSTRUCTION ACTIVITIES.
3. PERMANENT WORKS SHALL NOT BE ALLOWED TO BE UNDERCUT OR UNDERMINED BY ANY CONSTRUCTION ACTIVITIES.

FORMWORK:

1. DESIGN
   1.1. ALL FORMWORK AND FALSEWORK SHALL COMPLY WITH CAN/CSA S269.1 AND CAN/CSA S269.3 OR ACI 347. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF FORMWORK. FORMWORK AND FALSEWORK SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER.
2. FORMED FINISHED SURFACES
   2.1. FINISH F1: FORMS BUILT OF STANDARD FORM PLY WITH A MINIMUM AMOUNT OF REFINEMENT.
   2.2. FINISH F2: FORMS FOR GENERAL APPLICATION FOR SURFACES EXPOSED TO VIEW WITHOUT STRINGENT AESTHETIC REQUIREMENTS; OF PLYWOOD, STEEL OR FORM LINER OF PRE-APPROVED MATERIAL.
   2.3. FINISH F3: FORMS FOR SURFACES WHERE AESTHETIC OR MECHANICAL PERFORMANCE REQUIRES A HIGH QUALITY FINISH; OF PLYWOOD, STEEL OR FORM LINER OF PRE-APPROVED MATERIAL. PATTERN FROM THE FORMS LEFT IN THE CONCRETE SURFACE MUST HARMONIZE WITH THE STRUCTURE AND ITS FUNCTION. ALL JOINTS SHALL BE HORIZONTAL OR VERTICAL.
   2.4. FINISH F4: SEVERE TOLERANCE LIMIT; OF SMOOTH SANDED UNLINED AND UNCOATED PLYWOOD.
3. UNFORMED FINISHES
   3.1. FINISH U1: EVEN, UNIFORM FINISH; CONSOLIDATED, LEVEL AND SCREEDED.
   3.2. FINISH U2: WOOD FLOAT FINISH.
   3.3. FINISH U3: STEEL TOWELLED FINISH.
   3.4. FINISH U4: HARD, STEEL TOWELLED FINISH - BURNISHED.
   3.5. FINISH U5: BROOM FINISH.
   3.6. FINISH U6: HARDENED FINISH; APPLY FLOOR HARDENER PER MANUFACTURER'S INSTRUCTIONS.
4. CHAMFERS
   4.1. FORM ALL EXPOSED CONCRETE CORNERS AND EDGES WITH 20 mm or 25 mm CHAMFER. ALL CONCRETE CORNERS SHALL HAVE A 25 mm CHAMFER TO PREVENT CONCRETE CHIPPING.
5. SPECIFIED CONCRETE FINISH FOR PARTICULAR APPLICATION/EXPOSURE
   5.1. SURFACES EXPOSED TO VIEW (EXTERIOR) - F2, U2
   5.2. SURFACES EXPOSED TO VIEW (INTERIOR) - F3, U3
   5.3. SURFACES AGAINST BACKFILL - F1, U1
   5.4. SURFACES EXPOSED TO WATER OR WATER PASSAGE - F4, U3

STEEL REINFORCEMENT:

1. MATERIALS
   1.1. REINFORCEMENT STEEL SHALL BE DEFORMED BAR REINFORCEMENT FOR STRUCTURAL CONCRETE IN ACCORDANCE TO CSA G30.18 - GRADE 400 R (OR GRADE 400 W WHERE SPECIFIED).
   1.2. WELDED WIRE FABRIC SHALL BE IN ACCORDANCE WITH CSA G30.15M.
   1.3. MINIMUM YIELD STRENGTHS FOR REINFORCEMENT:
   1.3.1. DEFORMED BAR FY = 400 MPA
   1.3.2. WELDED WIRE FABRIC FY = 280 MPA
2. MINIMUM CONCRETE COVER TO REINFORCEMENT
   2.1. EXTERNAL FACES CAST ON/AGAINST SOIL, ROCK OR CONCRETE BLINDING - 75 mm
   2.2. EXTERNAL FACES EXPOSED TO FLOWING WATER:
   2.2.1. PRIMARY REINFORCEMENT - 75 mm
   2.2.2. STIRRUPS, TIES AND SPIRALS - 60 mm
   2.3. EXTERNAL FACES EXPOSED TO WEATHER, STANDING WATER & SOIL BACKFILL:
   2.3.1. PRIMARY REINFORCEMENT - 50 mm
   2.3.2. STIRRUPS, TIES AND SPIRALS - 40 mm
   2.4. INTERNAL FACES EXPOSED TO FLOWING WATER:
   2.4.1. PRIMARY REINFORCEMENT - 75 mm
   2.4.2. STIRRUPS, TIES AND SPIRALS - 60 mm
   2.5. INTERNAL FACES EXPOSED TO AIR & STANDING WATER:
   2.5.1. PRIMARY REINFORCEMENT - 40 mm
   2.5.2. STIRRUPS, TIES AND SPIRALS - 30 mm
   2.6. EXTERNAL SLAB SURFACES EXPOSED TO TRAFFIC - 50 mm
   2.7. INTERNAL SLAB SURFACES EXPOSED TO TRAFFIC - 40 mm
3. EXPOSURE CLASS
   3.1. ALL CONCRETE SHALL BE REGARDED TO HAVE AN EXPOSURE CLASS OF F-2 IN ACCORDANCE WITH CSA A23.3, EXCEPT CONCRETE EXPOSED TO WATER.
   3.2. ALL CONCRETE SURFACES IN CONTACT WITH WATER SHALL BE REGARDED TO HAVE AND EXPOSURE CLASS F-1 IN ACCORDANCE TO CASE A23.3.
4. TOLERANCES
   4.1. ON COVER- -0 mm, +10 mm
   4.2. ON EFFECTIVE DEPTH (FROM FACE OPPOSITE REBAR) - -10 mm, +10 mm
   4.3. ON EMBEDMENT AND LAP LENGTHS- -0 mm, NO UPPER LIMIT
   4.4. ON STANDARD HOOK DIMENSIONS- -0 mm, NO UPPER LIMIT
   4.5. ON LOCATION OF INSERTS, OPENINGS & EMBEDS- -5 mm, +5 mm
   4.6. ON LATERAL SPACING OF REBAR- -15 mm, +15 mm
   4.7. ON REBAR DIMENSION LENGTHS- -25 mm, +25 mm
   4.8. ON OVERALL TIE BAR AND STIRRUP DIMENSIONS - -5 mm, +5 mm
5. SPLICES
   5.1. ALL SPLICE LENGTHS NOT INDICATED EXPLICITLY ON DRAWINGS ARE CLASS B, AS DEFINED BY CLAUSE 12.15.1 OF CSA A23.3.
   5.2. LOCATE STEEL REINFORCEMENT SPLICES ONLY WHERE SHOWN ON THE DRAWINGS. ALTERNATE REINFORCEMENT SPLICES IN SLABS AND WALLS WHERE POSSIBLE TO AVOID SINGLE SPLICE LOCATION LINE THROUGH COMPONENTS. NO SUPPLEMENTARY SPLICES ARE ALLOWED WITHOUT THE PRIOR WRITTEN APPROVAL OF THE ENGINEER.
   5.3. WELDING OF OR TO STEEL REINFORCEMENT IS NOT PERMITTED FOR ANY PURPOSE EXCEPT, IF EXPLICITLY SHOWN ON THE DRAWINGS OR WITH WRITTEN APPROVAL BY THE ENGINEER.
6. FABRICATION AND DETAILING
   6.1. FABRICATE BENDS AND HOOKS OF BARS TO CLAUSE 12.2 OF A23.1 UNLESS OTHERWISE DIMENSIONED ON THE DRAWINGS.
   6.2. ALL STEEL REINFORCEMENT SHALL BE BENT COLD. THE MINIMUM BAR BEND DIAMETER SHALL NOT BE LESS THAN THE VALUES PROVIDED IN CSA A23.1 - TABLE 16.
7. GENERAL REINFORCEMENT DRAWING SYMBOLS
   7.1. STANDARD 90° HOOK:



   7.2 STANDARD 90° HOOK:

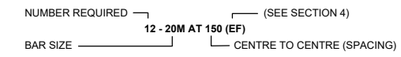
   7.3 LAPPED SPLICE

   7.4 TOP AND NEAR FACE BARS

   7.5 BOTTOM OR FAR FACE BAR

STEEL REINFORCEMENT (CONT'D):

8. REINFORCEMENT SPACING
   8.1. UNLESS OTHERWISE SHOWN, THE FIRST AND LAST BARS IN SLABS AND WALLS, STIRRUPS IN BEAMS, AND TIES IN COLUMNS SHALL BE PLACED AT A MAXIMUM OF HALF THE SPECIFIED SPACING OF ADJACENT BARS FROM THE ENDS OF THE MEMBER. THE MINIMUM CLEAR DISTANCE BETWEEN PARALLEL BARS, OTHER THAN AT SPLICES, SHALL BE THE NOMINAL DIAMETER OF THE BARS IN BEAMS OR ONE AND ONE-HALF TIMES THE NOMINAL DIAMETER IN COLUMNS; BUT IN NO CASE LESS THAN 1.5 X THE MAXIMUM COARSE AGGREGATE SIZE OF 25 mm IN BEAMS OR 40 mm IN COLUMNS.
9. TYPICAL REINFORCEMENT BAR DESIGNATION



10. REINFORCEMENT DOWELS
    10.1. THE MINIMUM PROJECTION AND EMBEDMENT OF ALL DOWELS SHALL COMPLY WITH THE MINIMUM SPECIFIED SPLICE AND EMBEDMENT LENGTHS RESPECTIVELY, UNLESS NOTED OTHERWISE ON THE REINFORCEMENT DRAWINGS. DOWEL PROJECTION INTO CONSECUTIVE CONCRETE POURS SHALL NOT BE LESS THAN 50 X BAR DIAMETER.
11. WELDING TO REINFORCEMENT
    11.1. WELDING OF REINFORCEMENT SHALL NOT BE PERMITTED EXCEPT WHERE REQUIRED FOR SPECIAL END ANCHORAGE OR OTHER REQUIREMENTS AS SHOWN ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER. GRADE 400W REINFORCEMENT STEEL SHALL BE USED AT THESE LOCATIONS. TACK WELDING OF BARS INTO CAGES SHALL NOT BE PERMITTED. TACK-WELDING OF REINFORCEMENT IN LIEU OF WIRE TYING OR FOR ATTACHING EMBEDDED ITEMS TO REINFORCEMENT SHALL NOT BE PERMITTED. ADDITIONAL NON-STRUCTURAL ERECTION BARS OR FRAMES SHALL BE PROVIDED FOR SUCH ELEMENT REQUIRING WELDING OR EMBEDDED ELEMENTS, TO ENSURE THAT NO ACCIDENTAL WELDING OCCURS TO ANY STRUCTURAL REINFORCEMENT STEEL.
    11.2. CAD WELDING OF EMBEDDED COPPER ELEMENTS FOR GROUNDING GRID TO REINFORCEMENT IN VARIOUS CONCRETE STRUCTURES, MAY BE REQUIRED TO FORM AN ELECTRICAL GRID, AS INDICATED ON DRAWINGS. WELDING OF REINFORCING BARS SHALL CONFORM TO CSA STANDARD W186.
12. REINFORCEMENT PLACEMENT
    12.1. REINFORCEMENT MAY BE RELOCATED BY UP TO 50 mm TO CLEAR PIPES, SEALS, WATERSTOPS, RECESSES, EMBEDDED METALWORK AND CONDUITS, EXCEPT AS NOTED BELOW. WHERE POSSIBLE, A MINIMUM CLEARANCE OF AT LEAST 25 mm SHALL BE MAINTAINED BETWEEN REINFORCEMENT AND EMBEDDED MATERIALS.
    12.2. THE MINIMUM CLEARANCE BETWEEN REINFORCEMENT AND POWER CONDUITS SHALL BE 100 mm.
    12.3. THE MINIMUM CLEARANCE BETWEEN REINFORCEMENT AND ANY PART OF EMBEDDED STEEL PENSTOCK COMPONENTS SHALL BE 100 mm. THE ELECTRICAL ISOLATION & CONDUCTIVITY OF PENSTOCK COMPONENTS SHALL BE TESTED PRIOR TO CONCRETING OF SUCH COMPONENTS.
    12.4. UNDER NO CIRCUMSTANCES SHALL LONGITUDINAL REINFORCEMENT FOR HEAVILY REINFORCED BEAMS AND COLUMNS BE DISPLACED TO CLEAR EMBEDDED MATERIALS. IN SUCH CASES, SUBJECT TO THE APPROVAL OF THE ENGINEER, EMBEDDED MATERIALS SHALL BE DISPLACED. TENSION BARS SHALL NOT BE BENT INTO SHARP OFFSETS WITH SLOPES OF MORE THAN 1 LATERAL ON 6 LONGITUDINAL TO CLEAR OBSTRUCTIONS.
    12.5 . REINFORCEMENT SHALL BE ACCURATELY PLACED IN ACCORDANCE WITH THE DRAWINGS AND SHALL BE ADEQUATELY SECURED AGAINST DISPLACEMENT BY USING ANNEALED IRON WIRE TIES OR SUITABLE CLIPS AT INTERSECTIONS AND SHALL BE SUPPORTED BY CONCRETE OR PLASTIC SPACERS.
13. CUTTING OF STEEL REINFORCEMENT
    13.1. UNDER NO CIRCUMSTANCES SHALL DOWELS AND OTHER STEEL REINFORCEMENT BE TERMINATED OR CUT WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER. DOWEL BARS THAT ARE CUT WITHOUT THE ENGINEER'S APPROVAL SHALL BE REPLACED BY THE CONTRACTOR.

CONCRETE:

1. MATERIALS
   1.1. CEMENT - IN ACCORDANCE WITH CSA A5 TYPE 10.
   1.2. AGGREGATES - IN ACCORDANCE WITH CSA A23.1
   1.3. ADMIXTURES - IN ACCORDANCE WITH CSA A23.1
   1.3.1. AIR-ENTRAINING ADMIXTURES WITH ASTM C260
   1.3.2. CHEMICAL ADMIXTURES TO ASTM C494 AND ASTM C1017.
   1.3.3. CALCIUM CHLORIDE ADMIXTURES ARE NOT PERMITTED
2. SPECIFIED CONCRETE COMPRESSIVE STRENGTH
   2.1. C50 - 50 MPa
   2.2. C40 - 40 MPa
   2.3. C35 - 35 MPa
   2.4. C30 - 30 MPa
   2.5. C25 - 25 MPa
   2.6. C15 - 15 MPa
3. GROUTS
   3.1. NON-SHRINK GROUT: CEMENTITIOUS PREMIXED GROUT, 40 MPa SPECIFIED 28 DAY COMPRESSIVE STRENGTH.
   3.2. EPOXY GROUT: HILTI HIT HY150, RE500, HILTI HSE 2421 OR AS INDICATED ON THE DRAWINGS.
4. CONCRETE MIXING, PREPARATION AND PLACEMENT
   4.1. DO NOT ADD ADDITIONAL WATER TO THE CONCRETE AFTER BATCHING AND MIXING IN ACCORDANCE WITH THE MIX DESIGN. THE ENGINEER MAY REJECT ANY CONCRETE TO WHICH ADDITIONAL WATER WAS ADDED WITHOUT FURTHER CAUSE.
   4.2. CONCRETE SHALL NOT BE PLACED IN FORMWORK THAT HAS GOT ICE/SNOW INSIDE OF IT. CONCRETE MAY ONLY BE PLACED AFTER THE INSIDE OF FORMWORK AND EXISTING CONCRETE COMPONENTS IN CONTACT WITH NEW FRESH CONCRETE HAS BEEN CONTINUOUSLY PRE-HEATED FOR 24 HOURS ABOVE 5° CELSIUS DURING COLD WEATHER CONCRETE PLACEMENT.
   4.3. CONCRETE SHALL NOT BE PLACED WITHOUT PRIOR INSPECTION AND ACCEPTANCE OF STEEL REINFORCEMENT, COVER AND FORMWORK BY THE ENGINEER.
   4.4. LOCATE CONSTRUCTION JOINTS AS SHOWN ON THE DRAWINGS. DO NOT MAKE ADDITIONAL CONSTRUCTION JOINTS WITHOUT THE PRIOR WRITTEN APPROVAL OF THE ENGINEER.
   4.5. THE INSIDE OF FORMWORK SHALL BE CLEANED OUT OF ALL DEBRIS, LOOSE TIE WIRES, WATER AND ICE PRIOR TO THE PLACEMENT OF CONCRETE.
   4.6. ROUGHEN ALL VERTICAL AND HORIZONTAL CONSTRUCTION JOINTS TO MINIMUM 5 mm AMPLITUDE BY MEANS OF AIR/WATER JET BLASTING OR BUSH-HAMERING TO REMOVE LAITANCE AND EXPOSE COARSE AGGREGATE. ROUGHENING OF FRESHLY CAST-IN-PLACE CONCRETE SURFACE IS NOT ADEQUATE.
   4.7. DISCHARGE CONCRETE INTO CONCRETE FORMS WITHIN 1 HOUR AFTER CEMENT WAS INTRODUCED INTO THE MIX OR PRIOR TO 300 REVOLUTIONS OF THE TRUCK DRUM. THE ENGINEER MAY ALTER THESE REQUIREMENTS DEPENDING ON CONTRACTOR'S QUALITY CONTROL AND FAVOURABLE CONCRETE STRENGTH RESULTS.
5. FORMWORK REMOVAL AND CURING
   5.1. DO NOT REMOVE WALL FORMWORK BEFORE THE CONCRETE HAS REACHED AT LEAST 40% OF THE REQUIRED 28 DAY COMPRESSIVE STRENGTH IN ORDER TO SUPPORT ITSELF. FORMWORK SHALL REMAIN IN PLACE FOR A MINIMUM PERIOD OF 48 HOURS.
   5.2. SOFFIT/SUPPORTING FORMWORK/FALSEWORK SHALL REMAIN IN PLACE UNTIL THE CONCRETE HAS REACHED AT LEAST 70% OF THE TARGETED COMPRESSIVE STRENGTH. SUSPENDED SLAB COMPONENTS SHALL BE PROPED/SUPPORTED UNTIL THE CONCRETE HAS REACH 100% OF THE TARGET COMPRESSIVE STRENGTH. THE ENGINEER MAY ALLOW DEVIATION FROM THIS REQUIREMENT, FROM CASE TO CASE.
   5.4. COMMENCE WITH CURING OF ALL SURFACES IMMEDIATELY FOLLOWING PLACEMENT AND AFTER STRIPPING OF FORMWORK. THE MINIMUM BASIC CURING PERIOD SHALL BE 7 CONSECUTIVE DAYS FOLLOWING PLACEMENT. CURING METHODS SHALL BE IN ACCORDANCE TO CSA A23.1 SECTION 7.4 AND ANNEX I. CONCRETE SHALL AT ALL TIMES DURING THE SPECIFIED CURING PERIOD BE PROTECTED AGAINST FREEZING AND DRYING OUT OF ALL SURFACES.
   5.5. TEMPERATURE RECORDS SHALL BE KEPT FOR ALL STRUCTURAL CONCRETE COMPONENTS.THE MAXIMUM TEMPERATURE DIFFERENTIAL SHALL NOT EXCEED 20°C FOR ANY STRUCTURAL COMPONENT, AS SPECIFIED IN CSA A23.1 SECTION 7.4 IN ORDER TO REDUCE POTENTIAL THERMAL STRESS CRACKING.

DETAILED DESIGN

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

<original signed by>

2021-11-15

CIVIL GENERAL NOTES

DRG. NO.	DESCRIPTION
-	-

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	SKC	~~DDI~~	~~DDI~~

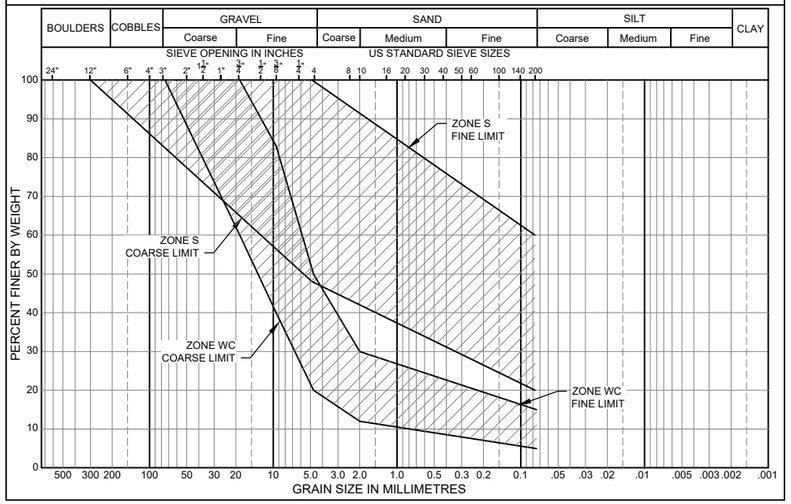
REVISIONS

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	G0006	0

SAVED: M:\101\00457\33\A\Acad\DWGS\G0006\G0006, 10/29/2021 1:27:30 PM , ANASIRI PRINTED: 10/29/2021 1:29:20 PM, G0006, ANASIRI ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): IMAGE FILE(S):

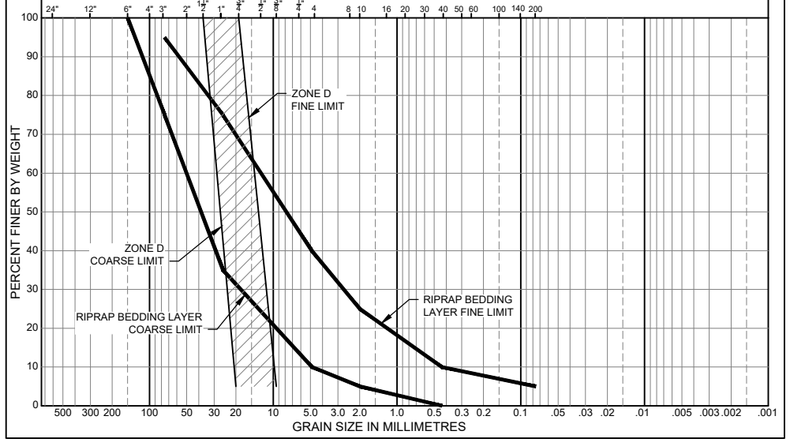
UNIFIED SOIL CLASSIFICATION SYSTEM

ZONE - S, WC



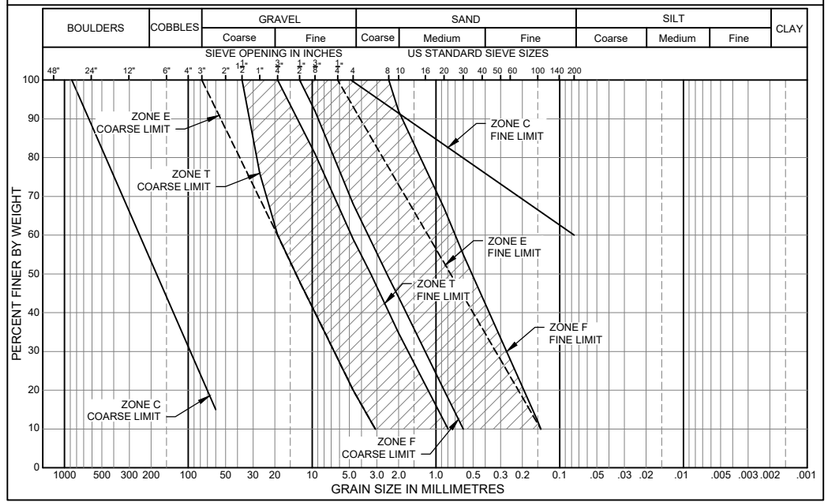
UNIFIED SOIL CLASSIFICATION SYSTEM

ZONE - D, RB



UNIFIED SOIL CLASSIFICATION SYSTEM

ZONE - F, T, E, C



MATERIAL PLACEMENT AND COMPACTION REQUIREMENTS

ZONE	MATERIAL TYPE	LOCATIONS	PLACING AND COMPACTION REQUIREMENTS
S	GLACIAL TILL	SEAL ZONE	PLACED, MOISTURE CONDITIONED AND SPREAD IN MAXIMUM 300 mm THICK LAYERS (AFTER COMPACTION). VIBRATORY COMPACTION TO 95% OF STANDARD PROCTOR MAXIMUM DRY DENSITY OR AS APPROVED BY THE ENGINEER
F	SAND	FILTER ZONE	PLACED AND SPREAD IN MAXIMUM 600 mm THICK LAYERS AND COMPACTED WITH MINIMUM 4 TO 6 PASSES OF 10 TON SMOOTH DRUM VIBRATORY ROLLER, OR AS APPROVED BY THE ENGINEER
T	GRAVEL	TRANSITION ZONE	PLACED AND SPREAD IN MAXIMUM 600 mm THICK LAYERS AND COMPACTED WITH MINIMUM 4 TO 6 PASSES OF 10 TON SMOOTH DRUM VIBRATORY ROLLER, OR AS APPROVED BY THE ENGINEER.
E	ENGINEERED FILL	FOUNDATIONS	PLACED AND SPREAD IN MAXIMUM 150 mm THICK LAYERS. VIBRATORY COMPACTED TO 100% OF STANDARD PROCTOR MAXIMUM DRY DENSITY OR AS APPROVED BY THE ENGINEER.
C	WASTE ROCK OVER BURDEN	SHELL ZONE	PLACE AND SPREAD IN MAXIMUM 1000 mm THICK LAYERS. UNIFORMLY COMPACTED BY SELECTIVE ROUTING OF HAUL TRUCK TRAFFIC ON MAIN FILL AND BY 10 TON SMOOTH DRUM VIBRATORY ROLLER ON THE FILL EDGES.
D	DRAIN ROCK	DRAINS	PLACED AROUND DRAINAGE PIPES AND WRAPPED WITH GEOTEXTILE.
R	RIPRAP	RIPRAP	PLACED WITH EXCAVATOR BUCKET IN INTERLOCKING FASHION WITH MINIMAL COMPACTIVE EFFORT.
RB	RIPRAP BEDDING	RIPRAP	PLACE AND SPREAD IN MAXIMUM 150 mm THICK LAYERS. UNIFORMLY COMPACTED BY BUCKET TAMPING.
WC	WEARING COURSE	ROADS	PLACE AND SPREAD IN MAXIMUM 150 mm THICK LAYERS. EACH LAYER SHALL BE COMPACTED BY A MINIMUM OF 4 PASSES OVER THE ENTIRE SURFACE WITH 10 TON SMOOTH DRUM VIBRATORY ROLLER.

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006.
2. RIPRAP TO BE HARD, DENSE AND DURABLE TO WITHSTAND LONG EXPOSURE TO WEATHERING.
3. RIPRAP STONES SHALL BE ANGULAR IN SHAPE. NO STONE SHALL EXCEED A LENGTH TO BREADTH OR THICKNESS OF 3.
4. SELECTED BC MINISTRY OF TRANSPORTATION RIPRAP CLASSES AND DIMENSIONS SHOWN IN TABLE 1 AND TABLE 2. RIPRAP D50 AND THICKNESS SPECIFIED ON DRAWING G0060.
5. SEE PROJECT TECHNICAL SPECIFICATIONS FOR ADDITIONAL MATERIAL REQUIREMENTS.

GRADATION OF ROCK SIZES IN EACH CLASS OF RIPRAP

CLASS OF RIPRAP (kg)	D50 (mm)	ROCK GRADATION PERCENTAGE SMALLER THAN GIVEN ROCK MASS (kg)		
		15%	50%	85%
5	150	0.5	5	15
50	330	5	50	150
250	565	25	250	750
1000	900	100	1000	3000
2000	1130	200	2000	6000

APPROXIMATE AVERAGE DIMENSION OF EACH SPECIFIED ROCK CLASS MASS (mm) (SG = 2.64)

CLASS OF RIPRAP (kg)	D50 (mm)	APPROXIMATE AVERAGE DIMENSION (mm)		
		15%	50%	85%
5	150	70	150	215
50	330	155	330	475
250	565	260	565	815
1000	900	415	900	1295
2000	1130	525	1130	1630

DETAILED DESIGN

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

CTION MATERIAL GRADATIONS

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

<original signed by>

2021-11-15

VA101-457/33 | DRAWING NO. G0040 | REVISION 0

G0006	CIVIL GENERAL NOTES
DRG. NO.	DESCRIPTION

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	29OCT'21	ISSUED FOR PERMITTING	CBN	SKC	DC	

REVISIONS

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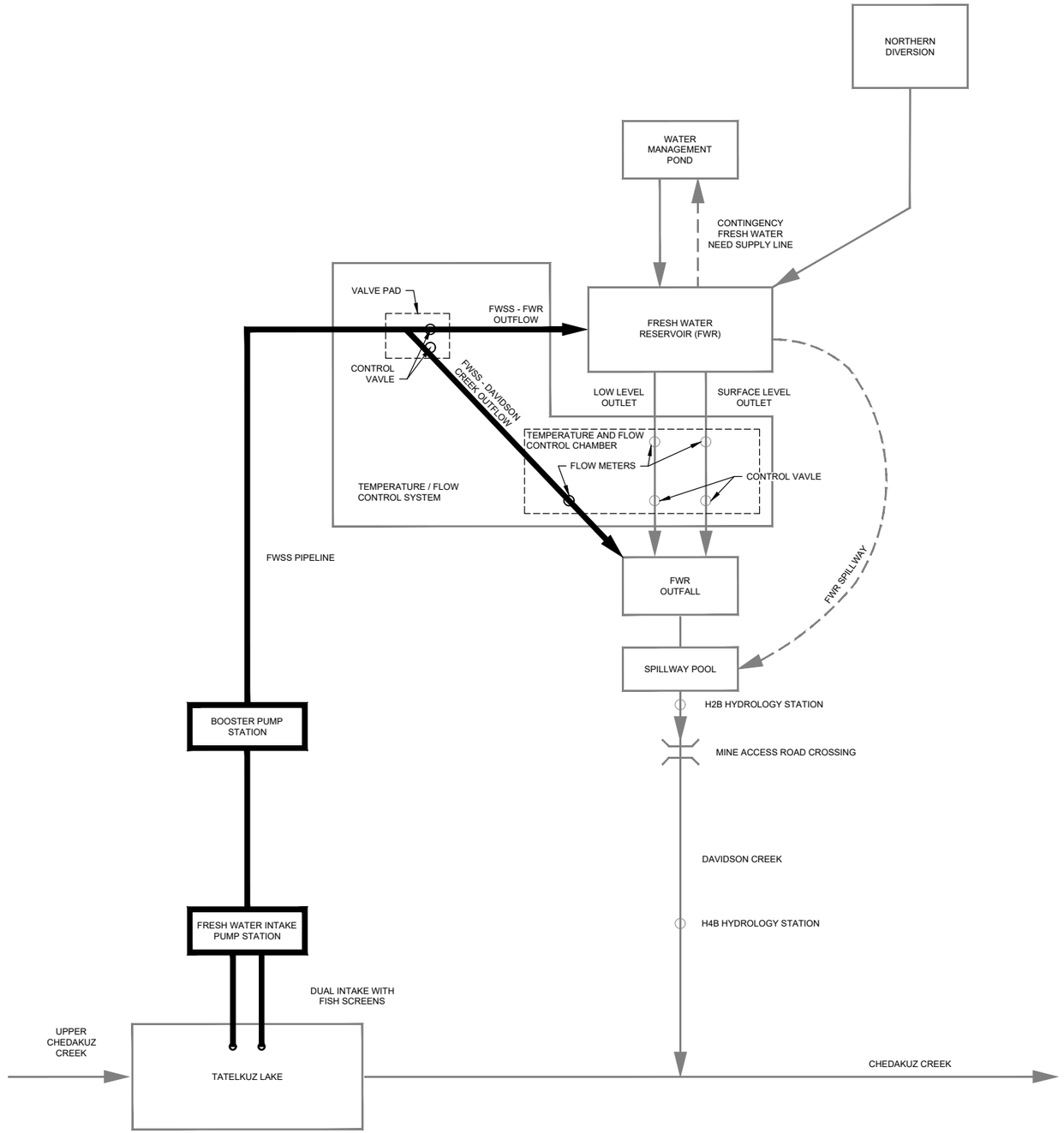

NOTES:

1. SOLID LINE TYPES INDICATE NORMAL OPERATING CONDITIONS.
2. DASHED LINE TYPES INDICATE ALTERNATIVE OPERATING CONDITIONS
3. BOLD LINE TYPES INDICATE FRESH WATER SUPPLY SYSTEM COMPONENTS.

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BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM FLOW DIAGRAM

REFA NO.	DRAWING NO.	REVISION
-05 **VA101-457/33**	**C5050**	**0**

DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
REVISIONS						

REV	DATE	DESCRIPTION	DESIGNED	D
0	04NOV'21	ISSUED FOR PERMITTING	BXF	
REVISIONS				

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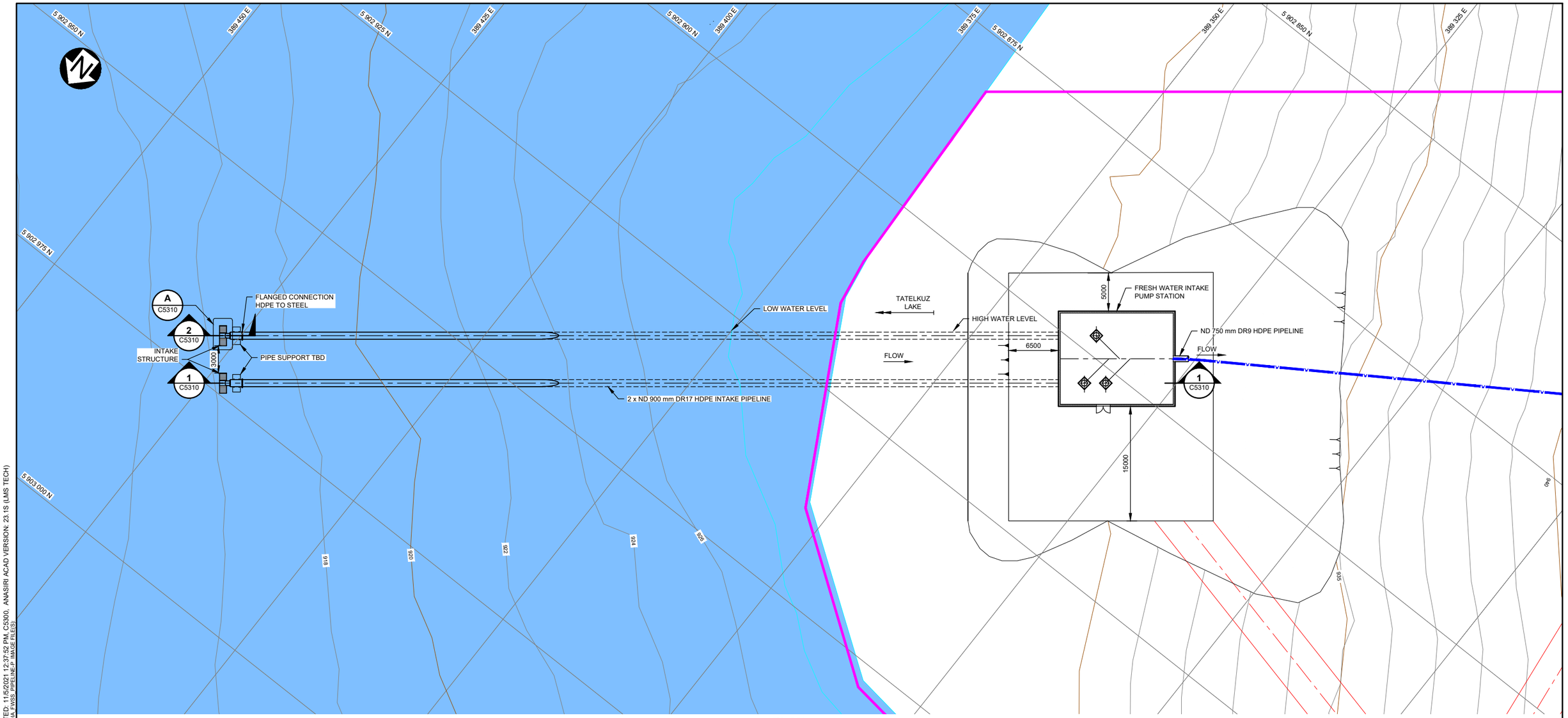

PLAN
SCALE A

5 2.5 0 5 10 15 20 25 m
SCALE A

LEGEND:

- WATER CONVEYANCE PIPELINE
- FWSS PIPELINE ACCESS ROAD
- CERTIFIED PROJECT DESCRIPTION BOUNDARY

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.

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PROFESSIONAL ENGINEER
PROVINCE OF
B. S. FICHOT
30575

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BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
INTAKE STRUCTURE
OVERVIEW

DRAWING NO.	REVISION
C5300	0

VA101-457/33

REFERENCE DRAWINGS							
DRG. NO.	DESCRIPTION						
C5310	FRESH WATER SUPPLY SYSTEM - INTAKE STRUCTURE - PLAN AND SECTION						

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED	

REVISIONS				
REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	04NOV'21	ISSUED FOR PERMITTING	BXF	SKC

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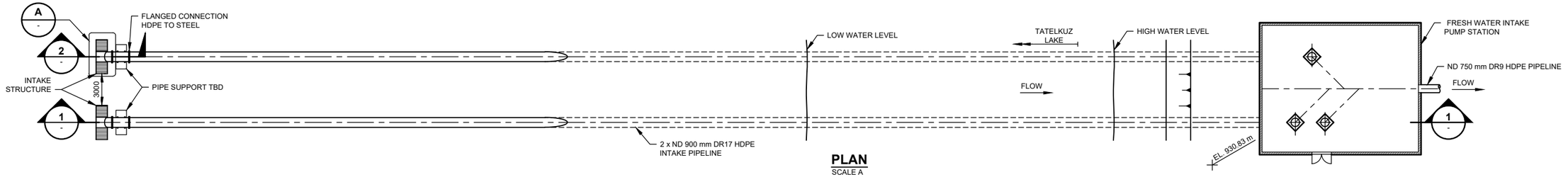
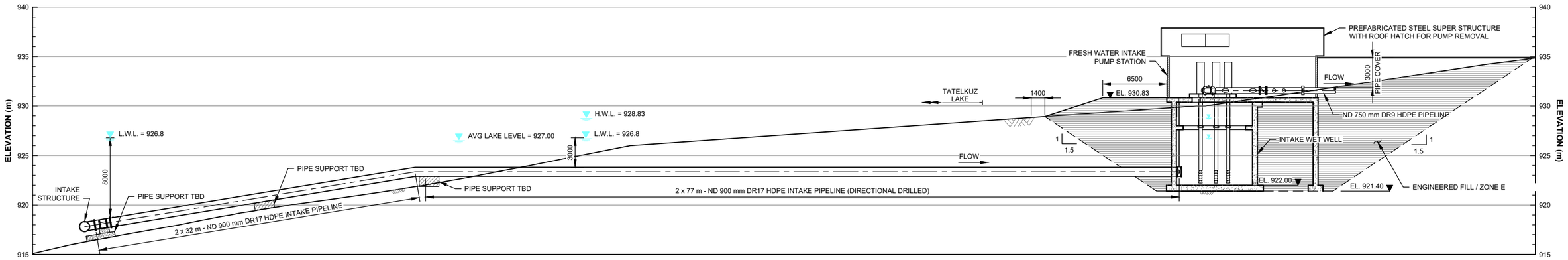


PLAN
SCALE A



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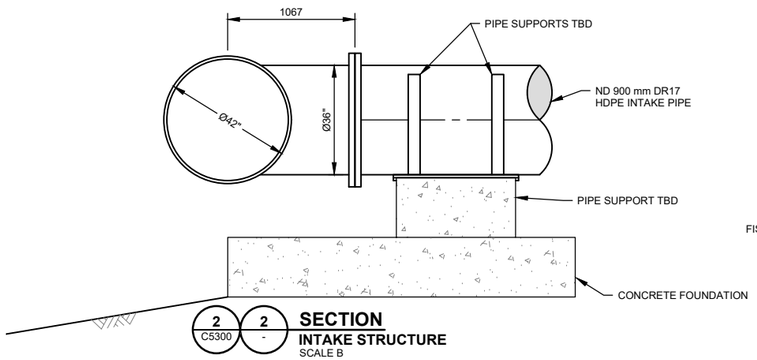

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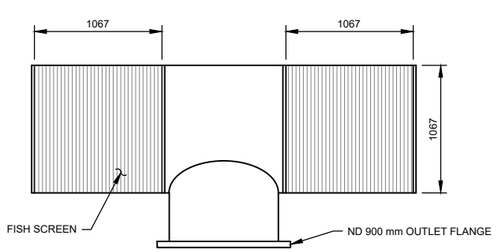
INTAKE STRUCTURE
SCALE B



A C5300 / A - **DETAIL**
INTAKE STRUCTURE - PLAN
SCALE B

LEGEND:

REINFORCED CONCRETE

ENGINEERED FILL / ZONE E

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006
2. EXCAVATION SLOPE TO BE ADJUSTED BASED ON ENCOUNTERED SOIL AND GROUNDWATER CONDITIONS.
3. FOR FILL MATERIAL SPECIFICATIONS SEE DRAWING G0040.
4. EXCAVATION INVERT ELEVATION MAY BE MODIFIED DEPENDING ON GROUND CONDITIONS ENCOUNTERED.

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SCALE B: 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m
SCALE A: 4 2 0 4 8 12 16 20 m

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PROFESSIONAL ENGINEER
PROVINCE OF
B. S. FICHOT

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
INTAKE STRUCTURE
PLAN AND SECTION

PIA NO.	DRAWING NO.	REVISION
-05 VA101-457/33	C5310	0

DRG. NO.	DESCRIPTION
G0040	CONSTRUCTION MATERIAL GRADATIONS
G0060	CIVIL GENERAL NOTES
C5300	FRESH WATER SUPPLY SYSTEM - INTAKE STRUCTURE - OVERVIEW

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
0	04NOV'21	ISSUED FOR PERMITTING	BXF

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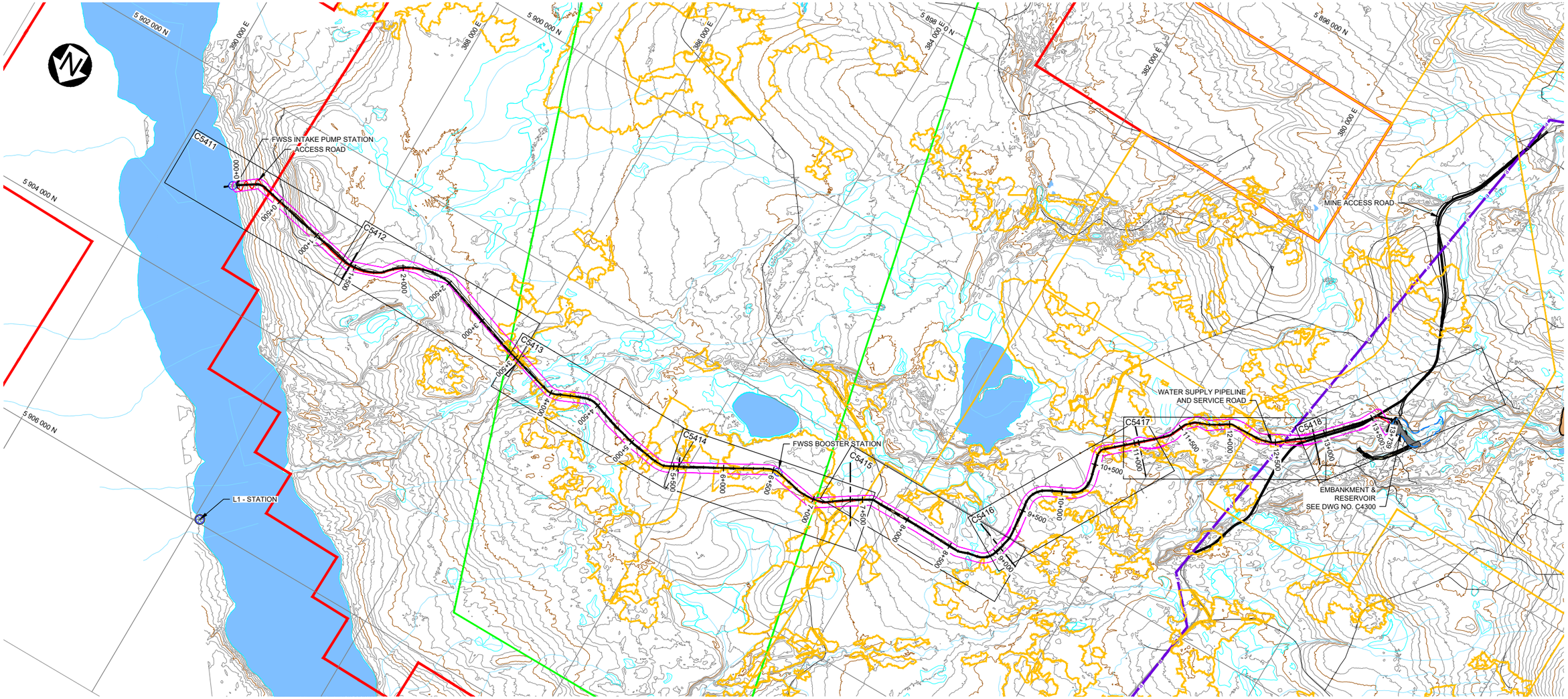

PLAN
SCALE A

DRG. NO.	DESCRIPTION
C5418	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - PLAN & PROFILE (SHEET 8 OF 8)
C5417	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - PLAN & PROFILE (SHEET 7 OF 8)
C5416	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - PLAN & PROFILE (SHEET 6 OF 8)
C5415	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - PLAN & PROFILE (SHEET 5 OF 8)
C5414	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - PLAN & PROFILE (SHEET 4 OF 8)
C5413	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - PLAN & PROFILE (SHEET 3 OF 8)
C5412	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - PLAN & PROFILE (SHEET 2 OF 8)
C5411	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - PLAN & PROFILE (SHEET 1 OF 8)
C4300	FRESH WATER RESERVOIR - EMBANKMENT - PLAN
G0006	CIVIL GENERAL NOTES
M5050	FRESH WATER SUPPLY SYSTEM - PIPELINE - PLAN AND PROFILE

REFERENCE DRAWINGS

LEGEND:

- PUMP STATION
- MINE ACCESS ROAD
- TRANSMISSION LINE
- EXISTING ACCESS TRAILS
- PROPERTY BOUNDARY
- CERTIFIED PROJECT DESCRIPTION BOUNDARY
- FOREST TENURES
- SUNFIELD ENERGY INVESTIGATIVE LICENSE
- FWSS PIPELINE ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. REFER TO DRAWING M5050 FOR PIPELINE SPECIFICATIONS.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
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SCALE A 400 200 0 400 800

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PROFESSIONAL ENGINEER
PROVINCE OF
B. S. FICHOT

Knight Piésold CONSULTING

BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE
GENERAL ARRANGEMENT

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NO.	DRAWING NO.	REVISION
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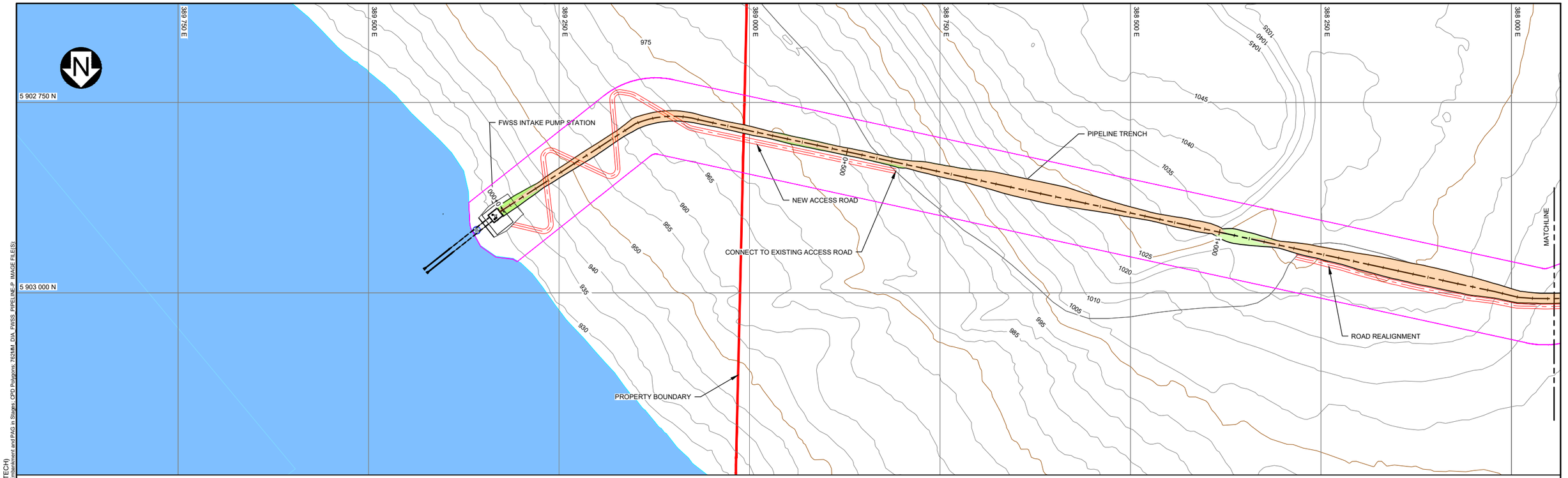

PLAN
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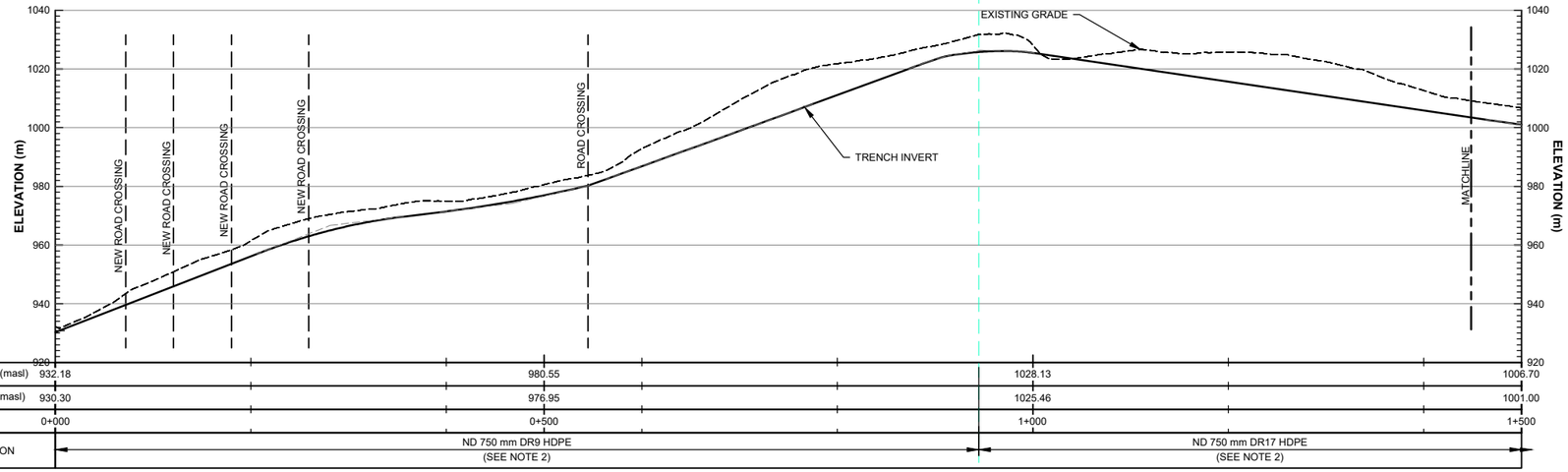

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TRENCH INVERT (masl)	930.30	976.95	1025.46	1001.00
STATION (m)	0+000	0+500	1+000	1+500
PIPE SPECIFICATION	ND 750 mm DR9 HDPE (SEE NOTE 2)		ND 750 mm DR17 HDPE (SEE NOTE 2)	

PROFILE
HORIZONTAL: SCALE B
VERTICAL: SCALE C

LEGEND:
- FILL AREAS
- CUT AREAS
- PUMP STATION
- EXISTING ACCESS TRAILS
- PROPERTY BOUNDARY
- CERTIFIED PROJECT DESCRIPTION BOUNDARY
- FOREST TENURES
- SUNFIELD ENERGY INVESTIGATIVE LICENSE
- FWSS PIPELINE ACCESS ROAD

NOTES:
1. FOR GENERAL NOTES SEE DWG. G0006.
2. REFER TO DRAWING M5050 FOR PIPELINE DETAILS.

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE C: 20 10 0 20 40 60 80 100 m
SCALE B: 60 30 0 100 200 300 m
SCALE A: 50 25 0 50 100 150

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PROFESSIONAL ENGINEER
PROVINCE OF
B. S. FICHOT

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Knight Piésold CONSULTING

BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE
PLAN AND PROFILE (SHEET 1 OF 8)

PIA NO.	DRAWING NO.	REVISION
11-05 VA101-457/33	C5411	0

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
C5410	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - GENERAL ARRANGMENT
M5050	FRESH WATER SUPPLY SYSTEM - PIPELINE - PLAN AND PROFILE

REFERENCE DRAWINGS

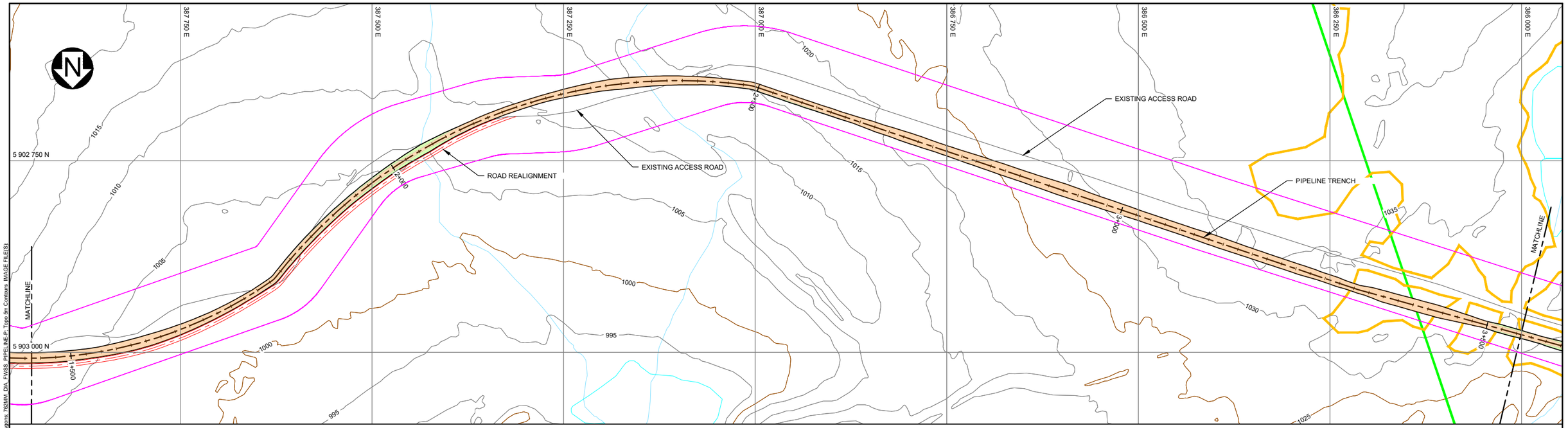
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

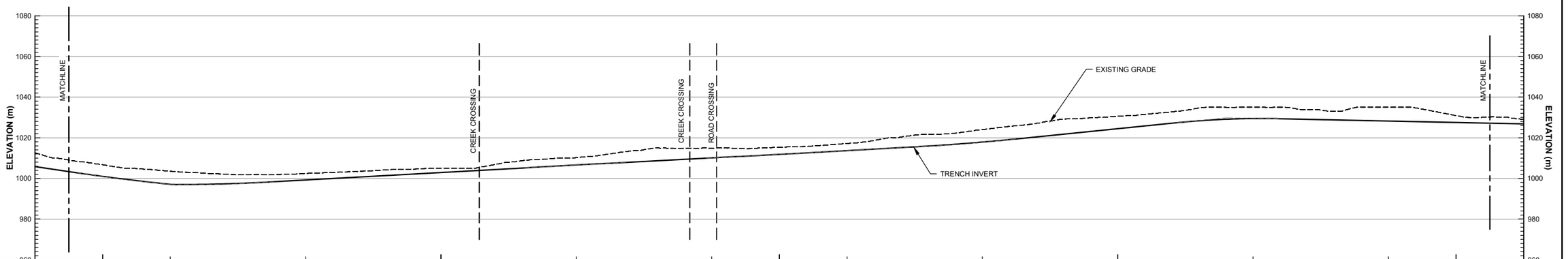
REV	DATE	DESCRIPTION	DESIGNED
0	04NOV'21	ISSUED FOR PERMITTING	BXF

REVISIONS

SAVED: M:\1\101\00457\33\Acad\DWGS\C5411\C5411_11/5/2021 8:22:03 AM_MFLYNN PRINTED: 11/5/2021 9:28:54 AM_C5411_SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Hydro Topo 5m Contours; Site C Embankment - YEAR 23; YR23 Mine Objects; Mine Access Road; Fresh Water Reservoir; Intake Structure ; Option B; Property/Boundary; Existing Roads & Trails_2020; Site D Embankment and PAG in Stages; CPD Polygons; 792MM_DIA_FWSS_PIPELINE-P IMAGE FILE(S):



PLAN
SCALE A



EXISTING GRADE (masl)	1012.62	1006.70		1005.02		1015.28		1030.55		1030.91	1029.07			
TRENCH INVERT (masl)	1005.83	1001.00		1002.92		1011.87		1024.45		1027.51	1026.80			
STATION (m)	1+400	1+500	2+000		2+500		3+000		3+500	3+600				
PIPE SPECIFICATION	ND 750 mm DR17 HDPE (SEE NOTE 2)													

PROFILE
HORIZONTAL: SCALE B
VERTICAL: SCALE C

LEGEND:

- FILL AREAS
- CUT AREAS
- EXISTING ACCESS TRAILS
- PROPERTY BOUNDARY
- CERTIFIED PROJECT DESCRIPTION BOUNDARY
- FOREST TENURES
- SUNFIELD ENERGY INVESTIGATIVE LICENSE
- FWSS PIPELINE ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. REFER TO DRAWING M5050 FOR PIPELINE DETAILS

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE C 20 10 0 20 40 60 80 100 m
SCALE B 60 30 0 100 200 300 m
SCALE A 50 25 0 50 100 150

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PROFESSIONAL ENGINEER
PROVINCE OF
B. S. FICHOT

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Knight Piésold CONSULTING

BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE
PLAN AND PROFILE (SHEET 2 OF 8)

DRAWING NO.	REVISION
C5412	0

REFERENCE DRAWINGS	
G0006	CIVIL GENERAL NOTES
C5410	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - GENERAL ARRANGEMENT
M5050	FRESH WATER SUPPLY SYSTEM - PIPELINE - PLAN AND PROFILE

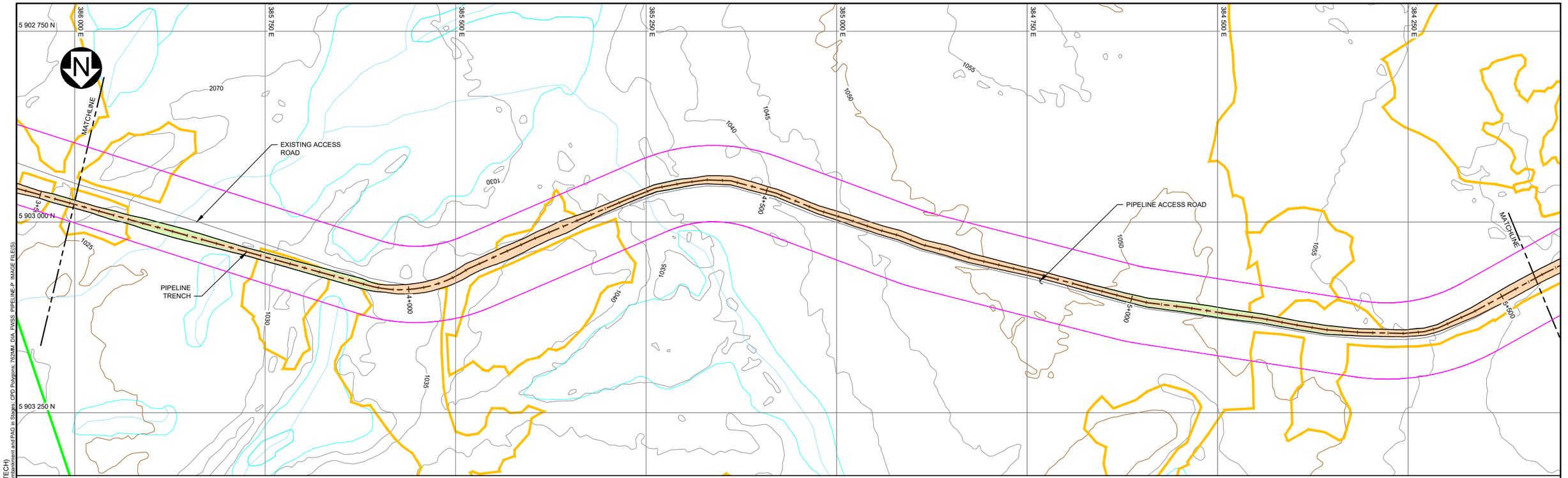
DRG. NO.	DESCRIPTION

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	04NOV'21	ISSUED FOR PERMITTING	BXF	B		

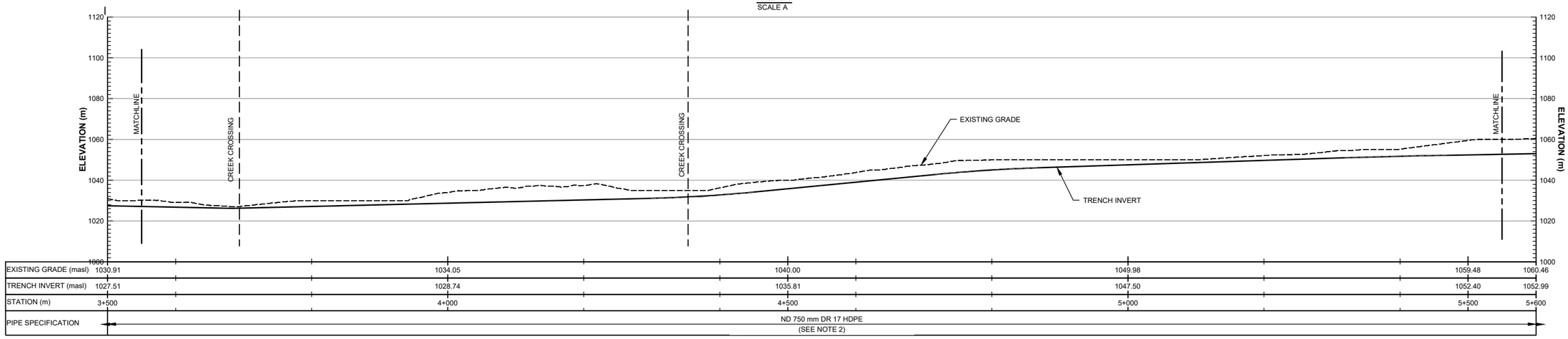
REVISIONS				
REV	DATE	DESCRIPTION	DESIGNED	DR

SAVED: M:\101\10045733\A\Acad\DWGS\C5412C5412_11\5\2021 12:11:21 PM, SCAMMAYO, PRINTED: 11\5\2021 12:14:54 PM, C5412_SCAMMAYO.ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Hydro: Site C Embankment - YEAR 2 to YR23 Mine Objects; Mine Access Road; Fresh Water Reservoir; Intake Structure Option B; PropertyBoundary; Existing Roads & Trails, 2020; Site D Embankment and PAG in Stages; CPD Polygons, 760MM_DIA_FWSS_PIPELINE-P; Topo 5m Contours IMAGE FILE(S):

SAVED: M:\1101\00457\33\A\acad\DWGS\C5413\C5413_11-5-2021 8:24:15 AM, MFLYNN, PRINTED: 11/5/2021 9:30:16 AM, C5413_SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Hydro: Topo 5m Contours; Site C Embankment - YEAR 23: YR23 Mine Objects Mine Access Road; Fresh Water Reservoir; Intake Structure_Option B; Property/Boundary; Existing Roads & Trails_2020; Site D Embankment and PAG in Stages; CPD Polygons; 792MM_DIA_FWSS_PIPELINE-P_IMAGE FILE(S):



PLAN
SCALE A



EXISTING GRADE (masl)	1030.91	1034.05	1040.00	1049.98	1059.48	1060.46
TRENCH INVERT (masl)	1027.51	1028.74	1035.81	1047.50	1052.40	1052.99
STATION (m)	3+500	4+000	4+500	5+000	5+500	5+600
PIPE SPECIFICATION	ND 750 mm DR 17 HDPE (SEE NOTE 2)					

LEGEND:

- FILL AREAS
- CUT AREAS
- EXISTING ACCESS TRAILS
- PROPERTY BOUNDARY
- CERTIFIED PROJECT DESCRIPTION BOUNDARY
- FOREST TENURES
- SUNFIELD ENERGY INVESTIGATIVE LICENSE
- FWSS PIPELINE ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. REFER TO DRAWING M5050 FOR PIPELINE DETAILS.

PROFILE
HORIZONTAL: SCALE B
VERTICAL: SCALE C

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE C: 20 10 0 20 40 60 80 100 m
SCALE B: 60 30 0 100 200 300 m
SCALE A: 50 25 0 50 100 150

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
C5410	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - GENERAL ARRANGEMENT
M5050	FRESH WATER SUPPLY SYSTEM - PIPELINE - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	04NOV'21	ISSUED FOR PERMITTING	BXF	BRS

REVISIONS

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PROFESSIONAL ENGINEER
PROVINCE OF
B. S. EICHOT

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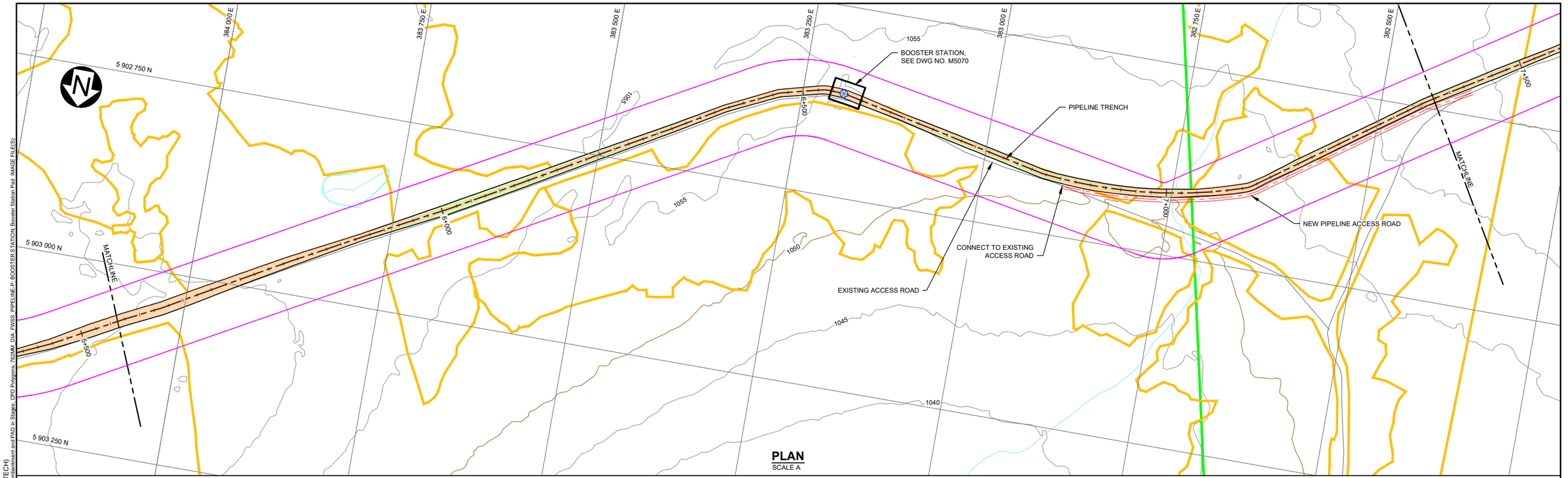
Knight Piésold CONSULTING

BW GOLD LTD.

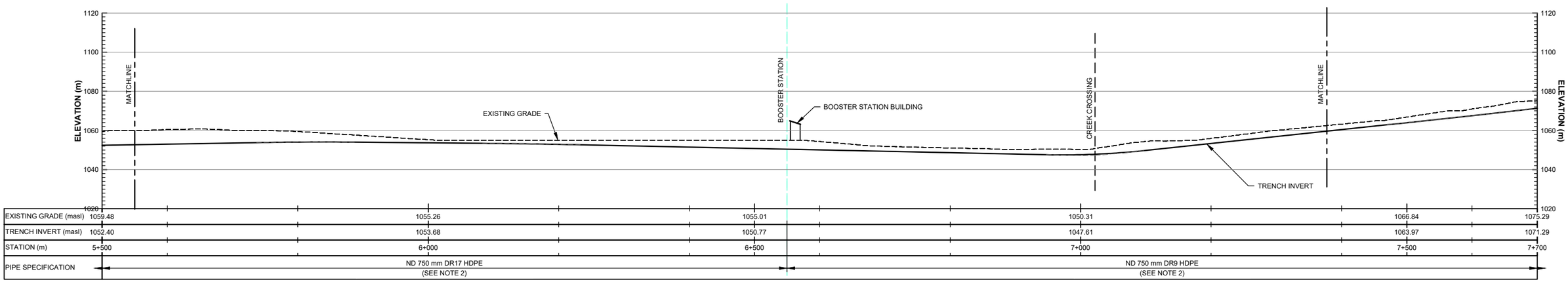
BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE
PLAN AND PROFILE (SHEET 3 OF 8)

VA NO.	DRAWING NO.	REVISION
-05 VA101-457/33	C5413	0



PLAN
SCALE A



EXISTING GRADE (masl)	1059.48		1055.26		1055.01		1050.31		1066.84		1075.29		
TRENCH INVERT (masl)	1052.40		1053.68		1050.77		1047.61		1063.97		1071.29		
STATION (m)	5+500		6+000		6+500		7+000		7+500		7+700		
PIPE SPECIFICATION	ND 750 mm DR17 HDPE (SEE NOTE 2)						ND 750 mm DR9 HDPE (SEE NOTE 2)						

PROFILE
HORIZONTAL: SCALE B
VERTICAL: SCALE C

LEGEND:

- FILL AREAS
- CUT AREAS
- EXISTING ACCESS TRAILS
- PROPERTY BOUNDARY
- CERTIFIED PROJECT DESCRIPTION BOUNDARY
- FOREST TENURES
- SUNFIELD ENERGY INVESTIGATIVE LICENSE
- FWSS PIPELINE ACCESS ROAD
- PUMP STATION

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. REFER TO DRAWING M5050 FOR PIPELINE DETAILS.

FOR INFORMATION ONLY
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SCALE C 20 10 0 20 40 60 80 100 m
SCALE B 60 30 0 100 200 300 m
SCALE A 50 25 0 50 100

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE
PLAN AND PROFILE (SHEET 4 OF 8)

PTA NO.	DRAWING NO.	REVISION
-05 **VA101-457/33**	**C5414**	**0**

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
C5410	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - GENERAL ARRANGEMENT
M5050	FRESH WATER SUPPLY SYSTEM - PIPELINE - PLAN AND PROFILE
M5070	FRESH WATER SUPPLY SYSTEM - BOOSTER STATION - PLAN

REFERENCE DRAWINGS

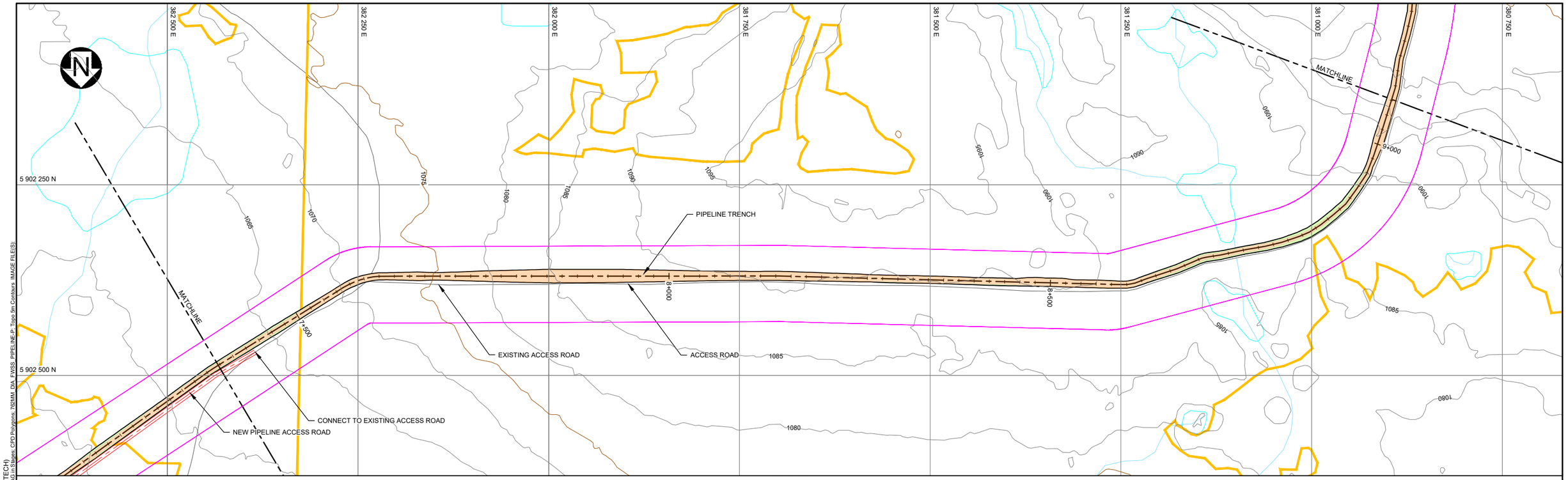
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

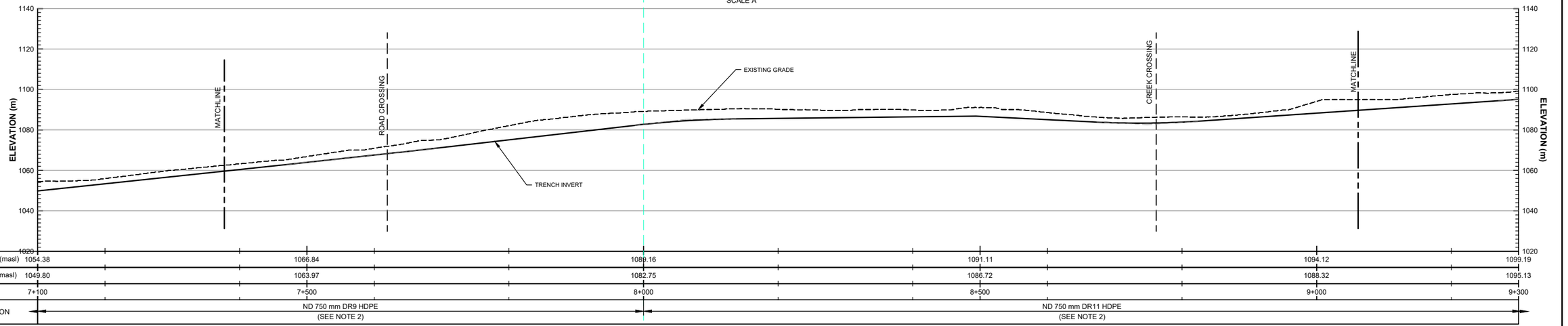
REV	DATE	DESCRIPTION	DESIGN
0	04NOV'21	ISSUED FOR PERMITTING	BXF

REVISIONS

SAVED: M:\101\00\457\33\Acad\DWG\SC5414\C5414_11\5\2021 8:24:54 AM_MFLYNN PRINTED: 11\5\2021 9:36:02 AM_C5414_SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Hydro_Topo 5m Contours_Site C Embankment - YEAR 23_YR23 Mine Objects_Mine Access Road_Fresh Water Reservoir_Intake Structure - Option B_PropertyBoundary_Existing Roads & Trails_2020_Site D Embankment and PAG in Stages_CPD Polygons_792MM_DIA_FWSS_PIPELINE-P_BOOSTER STATION_Booster Station Pad IMAGE FILE(S):



PLAN
SCALE A



EXISTING GRADE (masl)	1054.38	1066.84	1089.16	1091.11	1094.12	1099.19
TRENCH INVERT (masl)	1049.80	1063.97	1082.75	1086.72	1088.32	1095.13
STATION (m)	7+100	7+500	8+000	8+500	9+000	9+300
PIPE SPECIFICATION	ND 750 mm DR9 HDPE (SEE NOTE 2)			ND 750 mm DR11 HDPE (SEE NOTE 2)		

LEGEND:

- FILL AREAS
- CUT AREAS
- EXISTING ACCESS TRAILS
- PROPERTY BOUNDARY
- CERTIFIED PROJECT DESCRIPTION BOUNDARY
- FOREST TENURES
- SUNFIELD ENERGY INVESTIGATIVE LICENSE
- FWSS PIPELINE ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. REFER TO DRAWING M5050 FOR PIPELINE DETAILS.

PROFILE
HORIZONTAL: SCALE B
VERTICAL: SCALE C

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE C 20 10 0 20 40 60 80 100 m
SCALE B 60 30 0 100
SCALE A 50 25 0 50 100 1

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PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

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Knight Piésold CONSULTING

BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE
PLAN AND PROFILE (SHEET 5 OF 8)

2021-11-05	VA101-457/33	C5415	0

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
C5410	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - GENERAL ARRANGEMENT
M5050	FRESH WATER SUPPLY SYSTEM - PIPELINE - PLAN AND PROFILE

REFERENCE DRAWINGS

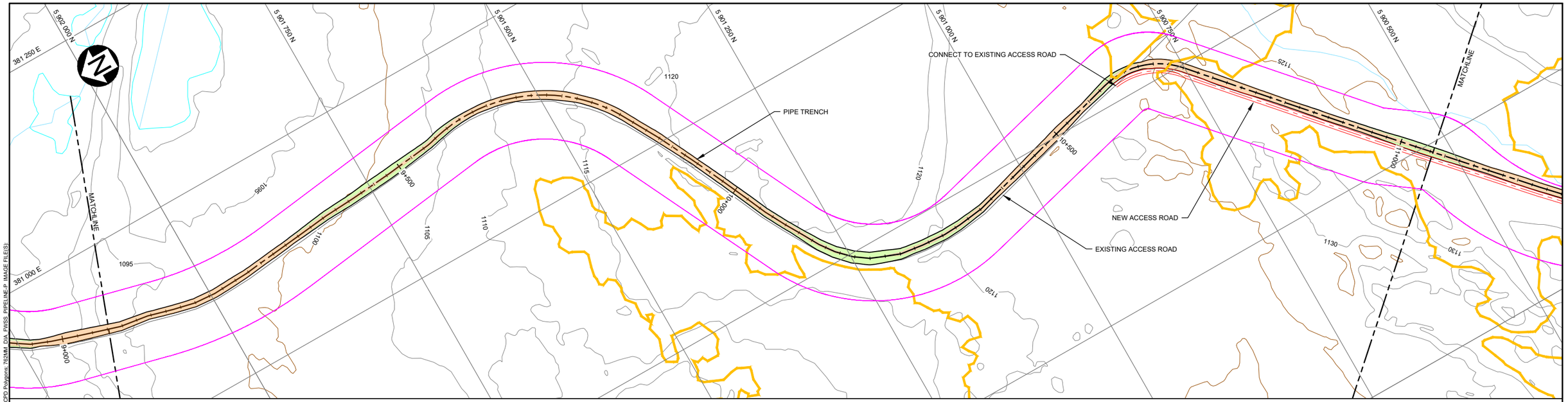
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

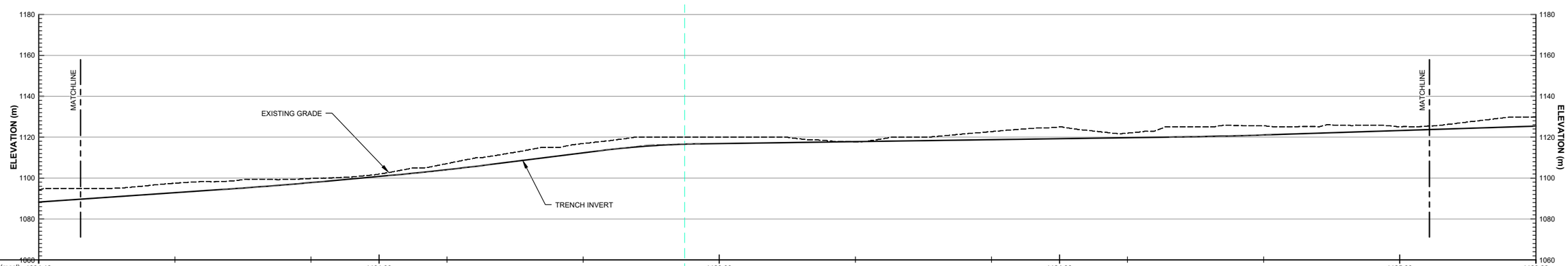
REV	DATE	DESCRIPTION	DESIGNED
0	04NOV'21	ISSUED FOR PERMITTING	BXF

REVISIONS

SAVED: M:\1\01\00457\33\Acad\DWG\C5415\C5415_11/5/2021 8:25:24 AM_MFLYNN PRINTED: 11/5/2021 9:37:18 AM_C5415_SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Hydro; Site C Embankment - YEAR 23; YR23 Mine Objects; Mine Access Road; Fresh Water Reservoir; Intake Structure_Option B; PropertyBoundary; Existing Roads & Trails_2020; Site D Embankment and PAG in Stages; CPD Polygons_760MM_DIA_FWSS_PIPELINE-P; Topo 5m Contours IMAGE FILE(S):



PLAN
SCALE A



EXISTING GRADE (masl)	1094.12		1101.93		1120.00		1124.98		1125.09		1129.88			
TRENCH INVERT (masl)	1088.32		1100.80		1116.89		1119.27		1123.24		1125.41			
STATION (m)	9+000		9+500		10+000		10+500		11+000		11+200			
PIPE SPECIFICATION	ND 750 mm DR11 HDPE (SEE NOTE 2)				ND 750 mm DR17 HDPE (SEE NOTE 2)									

PROFILE
HORIZONTAL: SCALE B
VERTICAL: SCALE C

LEGEND:

- FILL AREAS
- CUT AREAS
- EXISTING ACCESS TRAILS
- PROPERTY BOUNDARY
- CERTIFIED PROJECT DESCRIPTION BOUNDARY
- FOREST TENURES
- SUNFIELD ENERGY INVESTIGATIVE LICENSE
- FWSS PIPELINE ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. REFER TO DRAWING M5050 FOR PIPELINE DETAILS.

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE C: 20 10 0 20 40 60 80 100 m
SCALE B: 60 30 0 100 200 300 m
SCALE A: 50 25 0 50 100 1

<original signed by>

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
G5410	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - GENERAL ARRANGEMENT
M5050	FRESH WATER SUPPLY SYSTEM - PIPELINE - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
0	04NOV'21	ISSUED FOR PERMITTING	BXF

REVISIONS

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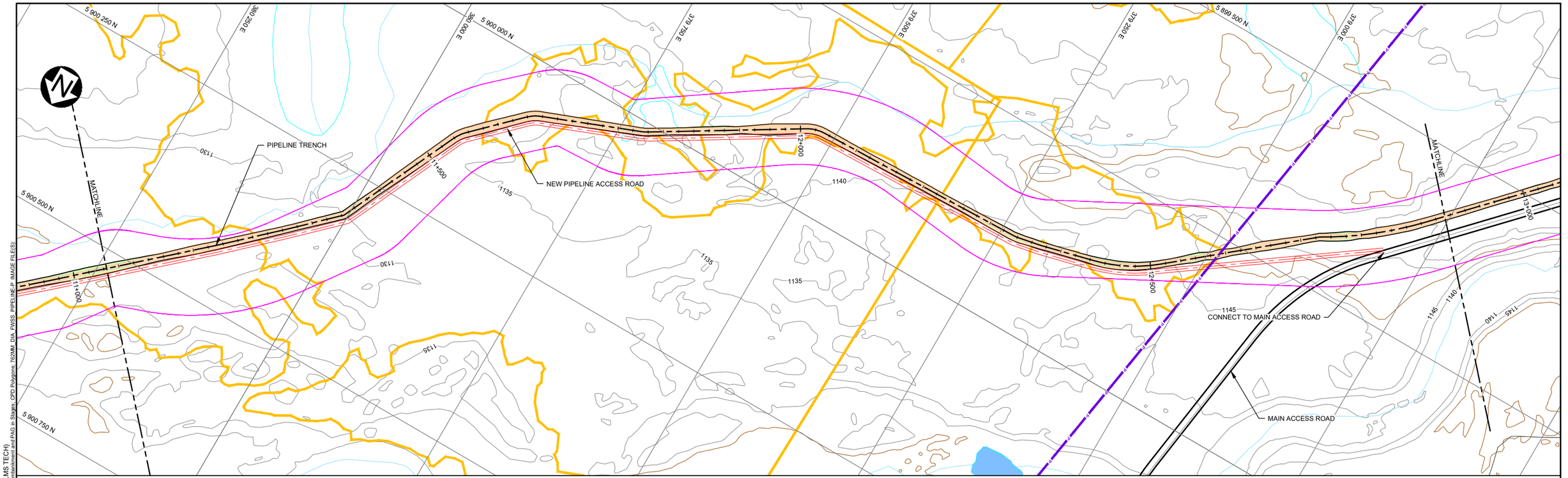
BW GOLD LTD.

BLACKWATER GOLD PROJECT

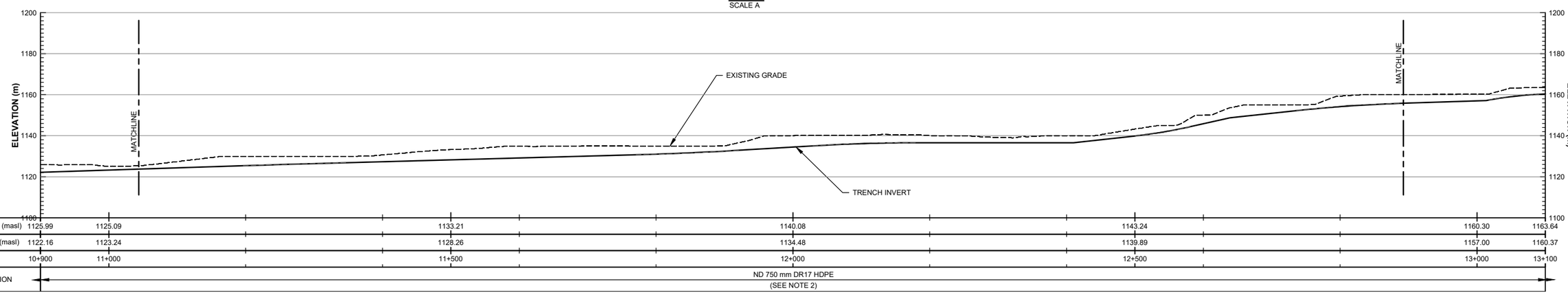
FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE
PLAN AND PROFILE (SHEET 6 OF 8)

NO.	DRAWING NO.	REVISION
05 VA101-457/33	C5416	0

SAVED: M:\101\10457\33\A\acad\DWG\SC5416\C5416_11-5-2021 11-27-10 AM_SCAMMAYO_PRINTED: 11/5/2021 11:29:38 AM, C5416_SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Hydro: Topo 5m Contours; Site C Embankment - YEAR 23; YR23 Mine Objects; Mine Access Road; Fresh Water Reservoir; Intake Structure; Option B; Property/Boundary; Existing Roads & Trails - 2020; Site D Embankment and PAG in Stages; CPD Polygons; 792MM_DIA_FWSS_PIPELINE-P_IMAGE FILE(S):



PLAN
SCALE A



EXISTING GRADE (masl)	1125.99	1125.09	1133.21	1140.08	1143.24	1160.30	1163.64
TRENCH INVERT (masl)	1122.16	1123.24	1128.26	1134.48	1139.89	1157.00	1160.37
STATION (m)	10+900	11+000	11+500	12+000	12+500	13+000	13+100
PIPE SPECIFICATION	ND 750 mm DR17 HDPE (SEE NOTE 2)						

PROFILE
HORIZONTAL: SCALE B
VERTICAL: SCALE C

LEGEND:

- FILL AREAS
- CUT AREAS
- EXISTING ACCESS TRAILS
- PROPERTY BOUNDARY
- CERTIFIED PROJECT DESCRIPTION BOUNDARY
- FOREST TENURES
- SUNFIELD ENERGY INVESTIGATIVE LICENSE
- FWSS PIPELINE ACCESS ROAD
- TRANSMISSION LINE

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. REFER TO DRAWING M5050 FOR PIPELINE PROFILE.

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE C 20 10 0 20 40 60 80 100 m
SCALE B 60 30 0 100 200 300 m
SCALE A 50 25 0 50 100 150

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
C5410	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - GENERAL ARRANGEMENT
M5050	FRESH WATER SUPPLY SYSTEM - PIPELINE - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	04NOV'21	ISSUED FOR PERMITTING	BXF	BRS

REVISIONS

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PROFESSIONAL ENGINEER PROVINCE OF B. S. FICHOT

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Knight Piésold CONSULTING

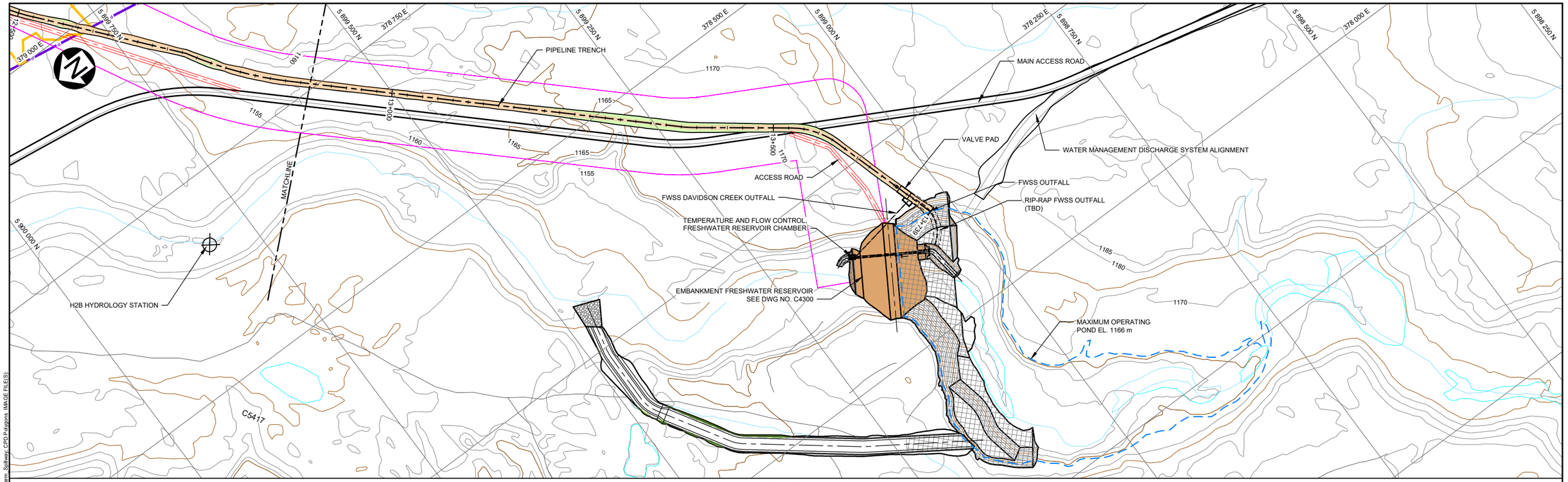
BW GOLD LTD.

BLACKWATER GOLD PROJECT

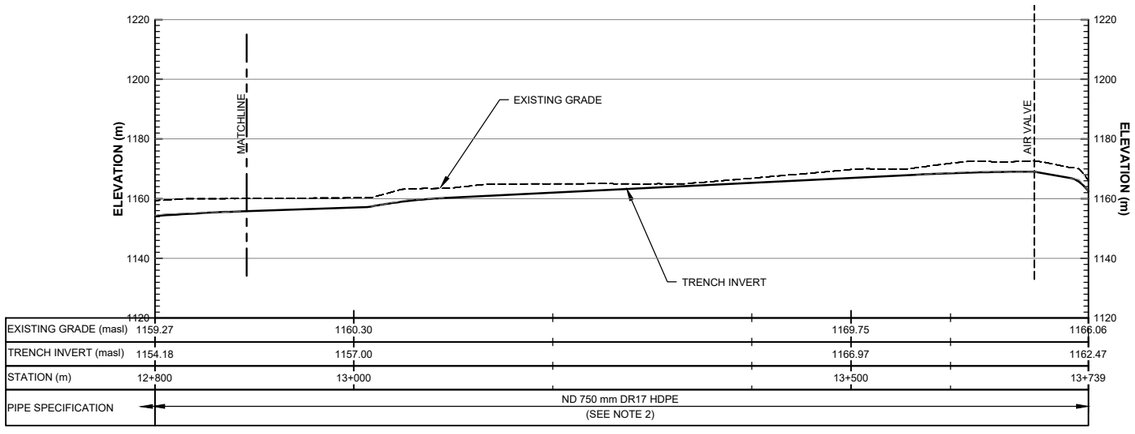
FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE
PLAN AND PROFILE (SHEET 7 OF 8)

P/A NO.	DRAWING NO.	REVISION
11-05 VA101-457/33	C5417	0

SAVED: M:\101\10045733\AAcad\DWGS\C5417\C5417_11(5)2021 9:58:43 AM_SCAMMAYO, PRINTED: 11/5/2021 10:20:11 AM, C5417_SCAMMAYO.ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Hydro - Topo 5m Contours; Site C Embankment - YEAR 23; YR23 Mine Objects Mine Access Road Fresh Water Reservoir; Intake Structure_Option B; Property Boundary; Existing Roads & Trails_2020; Site D Embankment and PAG in Stages; CPD Polygons; 792MM_DIA_FWSS_PIPELINE-P_IMAGE FILE(S):



PLAN
SCALE A



PROFILE
HORIZONTAL: SCALE B
VERTICAL: SCALE C

LEGEND:

- FILL AREAS
- CUT AREAS
- HDPE LINER
- EXISTING ACCESS TRAILS
- PROPERTY BOUNDARY
- CERTIFIED PROJECT DESCRIPTION BOUNDARY
- FOREST TENURES
- SUNFIELD ENERGY INVESTIGATIVE LICENSE
- FWSS PIPELINE ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. REFER TO DRAWING M5050 FOR PIPELINE PROFILE

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE C: 20 10 0 20 40 60 80 100 m
SCALE B: 60 30 0 100 200 300 m
SCALE A: 50 25 0 50 100 150 200 250 m

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PROFESSIONAL ENGINEER
PROVINCE OF
B. S. FICHOT
30575

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2021-11-05

Knight Piésold CONSULTING

BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE
PLAN AND PROFILE (SHEET 8 OF 8)

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
C5410	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - GENERAL ARRANGEMENT
C4300	FRESH WATER RESERVOIR - EMBANKMENT - PLAN
M5050	FRESH WATER RESERVOIR - PIPELINE - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
0	04NOV'21	ISSUED FOR PERMITTING	BXF

REVISIONS

PROJECT NO.	DRAWING NO.	REVISION
VA101-457/33	C5418	0

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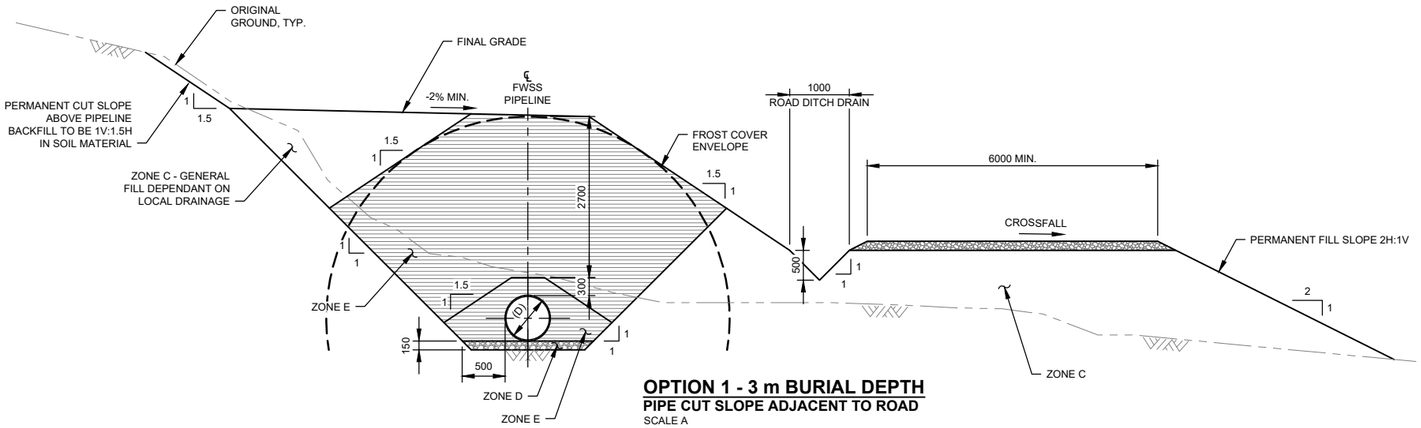
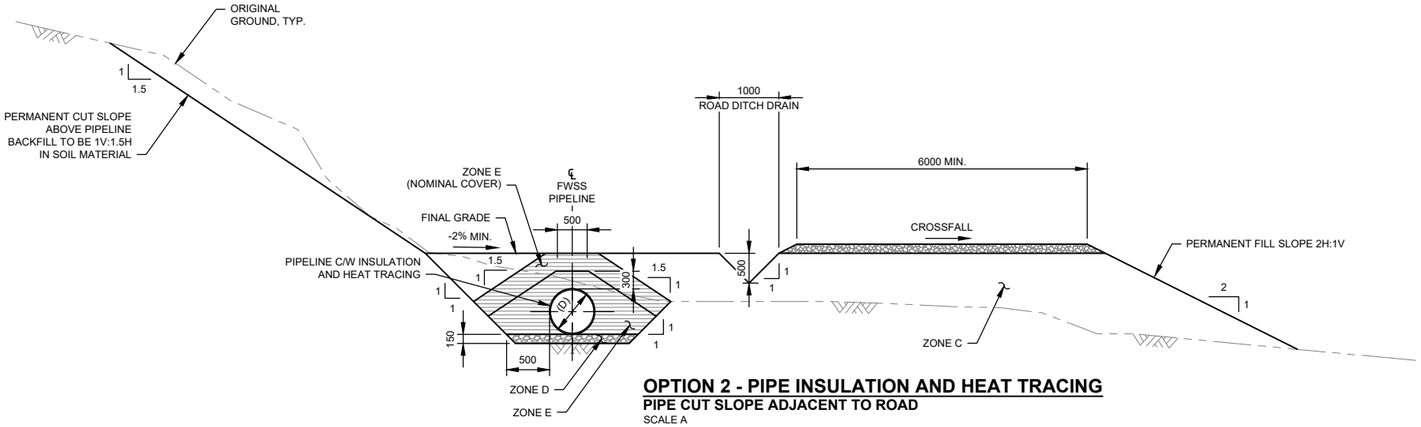
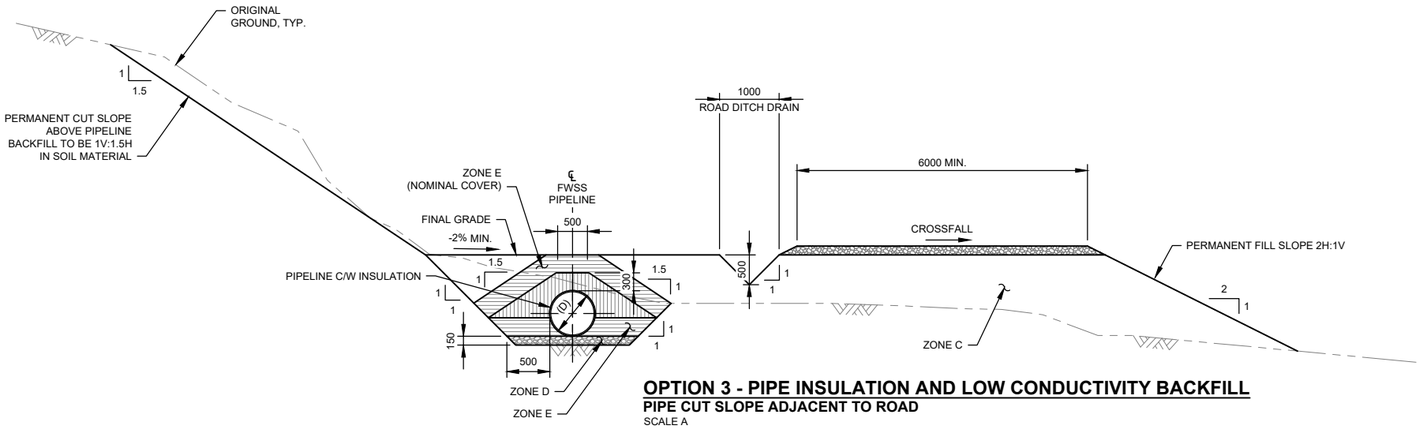
XREF FILE(S): Hydro; Topo 5m Contours; Mine Access Road; Fresh Water Reservoir Intake Structure_Option B; Property Boundary; Existing Roads & Trails_2020; 762MM_DIA_FWSS_PIPELINE-P; Fresh Water Reservoir_Berm_Spillway; CPD Polygons IMAGE FILE(S):



OPTION 1 - 3 m BURIAL DEPTH
PIPE CUT SLOPE ADJACENT TO ROAD
SCALE A



OPTION 2 - PIPE INSULATION AND HEAT TRACING
PIPE CUT SLOPE ADJACENT TO ROAD
SCALE A



OPTION 3 - PIPE INSULATION AND LOW CONDUCTIVITY BACKFILL
PIPE CUT SLOPE ADJACENT TO ROAD
SCALE A

LEGEND:

- ZONE C
- ZONE D
- ZONE E
- LOW CONDUCTIVITY / INSULATING MATERIAL
- WEARING COURSE

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006..
2. FOR FILL MATERIAL SPECIFICATIONS SEE DRAWING G0040.
3. WHERE THE DOWNSLOPE SIDE OF THE PIPE IS NOT IN TRENCH, THE PROFILE SHALL BE MADE UP OF ENGINEERED FILL.
4. EROSION PROTECTION OF ALL FILL SLOPES WILL BE REQUIRED TO THE SATISFACTION OF THE ENGINEER.
5. TRANSVERSE DRAINAGE, CONSISTING OF ND100 NON-PERFORATED CORRUGATED HIGH DENSITY POLYETHYLENE (HDPE) PIPE AT 2% GRADE, TO BE PROVIDED AT LOCATIONS.
6. OPTION 4 - ALIGNMENT OPTIMIZATION WITH OPTION 2 BACKFILL AND OPERATIONAL CONTROLS TO ALLOW AUTOMATED DRAINING OF THE PIPELINE.

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE A 1 0.5 0 1 2 3 4 5 m

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PROFESSIONAL ENGINEER
PROVINCE OF
B. S. FICHOT
30575
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Knight Piésold CONSULTING

BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE PIPELINE
ALTERNATIVE SECTIONS FOR FROST PROTECTION
1 OF 3

P/A NO.	DRAWING NO.	REVISION
21-11-05 VA101-457/33	C5420	0

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
G0040	CONSTRUCTION MATERIAL GRADATIONS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	04NOV'21	ISSUED FOR PERMITTING	BXF	SKC

REVISIONS

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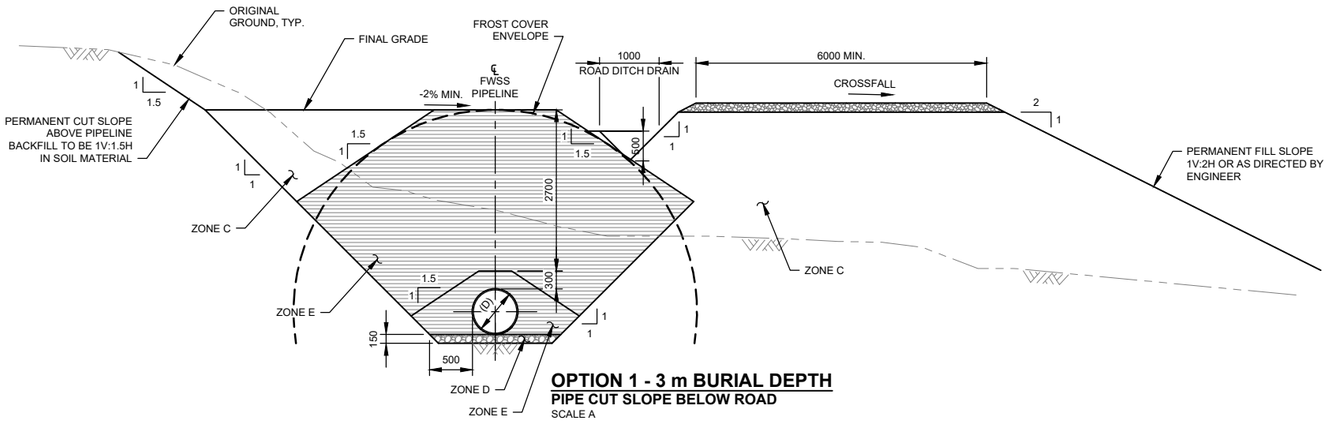
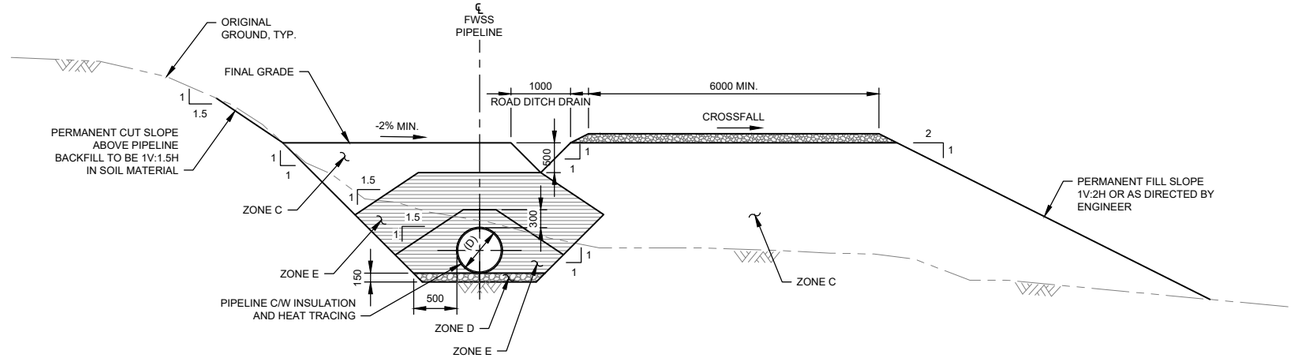
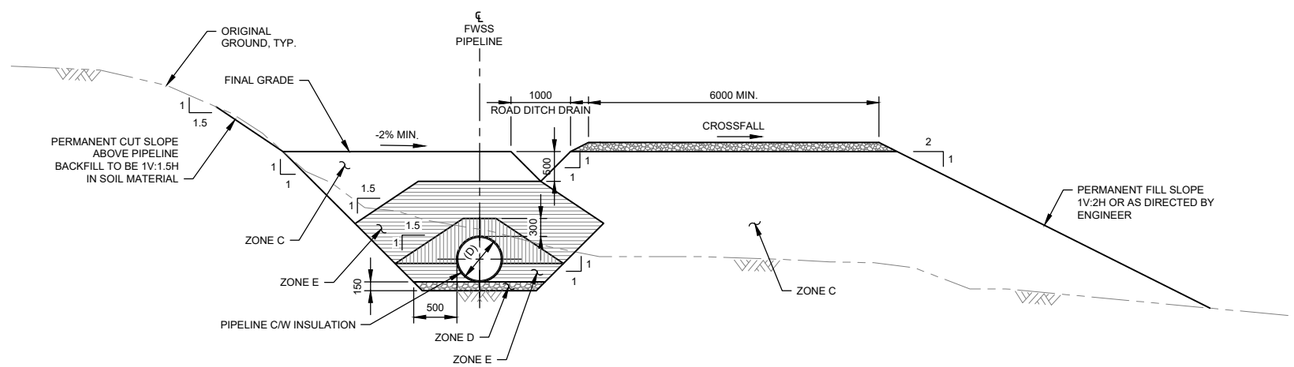


OPTION 1 - 3 m BURIAL DEPTH
PIPE CUT SLOPE BELOW ROAD
SCALE A



OPTION 2 - PIPE INSULATION AND HEAT TRACING
PIPE CUT SLOPE BELOW ROAD
SCALE A



OPTION 3 - PIPE INSULATION AND LOW CONDUCTIVITY BACKFILL
PIPE CUT SLOPE BELOW ROAD
SCALE A

LEGEND:

- ZONE C
- ZONE D
- ZONE E
- LOW CONDUCTIVITY / INSULATING MATERIAL
- WEARING COURSE

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006..
2. FOR FILL MATERIAL SPECIFICATIONS SEE DRAWING G0040.
3. WHERE THE DOWNSLOPE SIDE OF THE PIPE IS NOT IN TRENCH, THE PROFILE SHALL BE MADE UP OF ENGINEERED FILL.
4. EROSION PROTECTION OF ALL FILL SLOPES WILL BE REQUIRED TO THE SATISFACTION OF THE ENGINEER.
5. TRANSVERSE DRAINAGE, CONSISTING OF ND100 NON-PERFORATED CORRUGATED HIGH DENSITY POLYETHYLENE (HDPE) PIPE AT 2% GRADE, TO BE PROVIDED AT LOCATIONS.
6. OPTION 4 - ALIGNMENT OPTIMIZATION WITH OPTION 2 BACKFILL AND OPERATIONAL CONTROLS TO ALLOW AUTOMATED DRAINING OF THE PIPELINE.

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE A 1 0.5 0 1 2 3 4 5 m

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Knight Piésold CONSULTING

BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE PIPELINE
ALTERNATIVE SECTIONS FOR FROST PROTECTION
2 OF 3

PTA NO.	DRAWING NO.	REVISION
1-05 VA101-457/33	C5421	0

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
G0040	CONSTRUCTION MATERIAL GRADATIONS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED
0	04NOV'21	ISSUED FOR PERMITTING	BXF

REVISIONS

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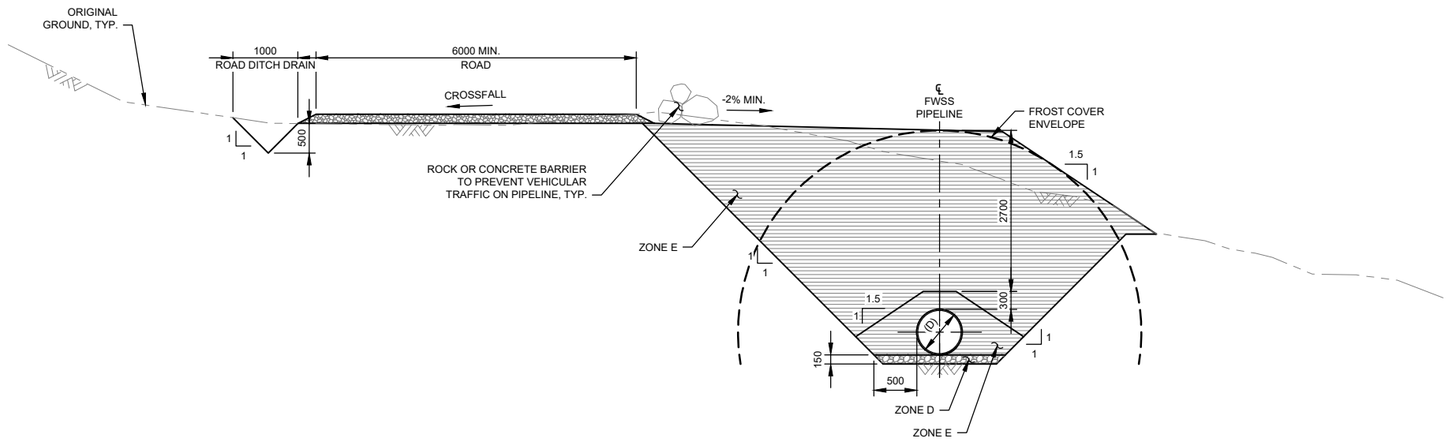
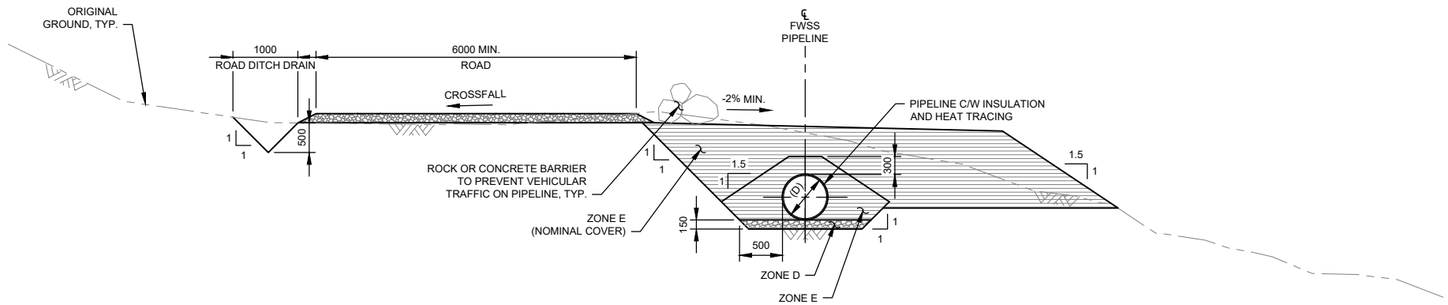
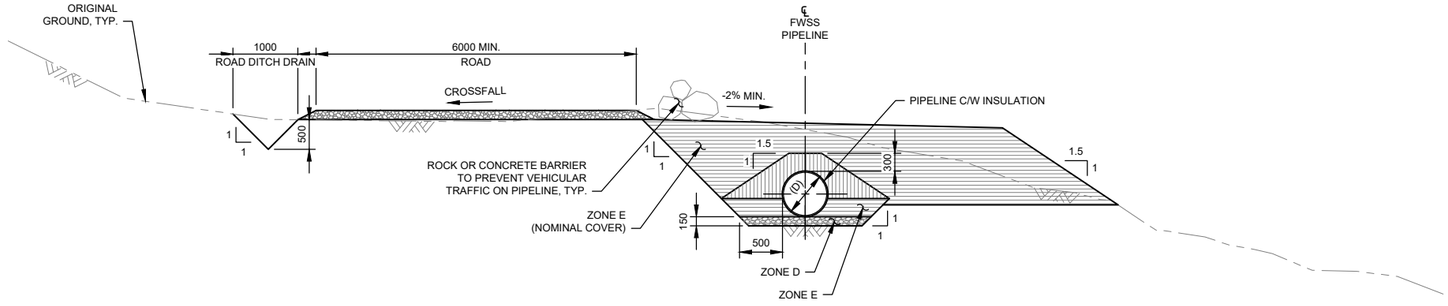


OPTION 1 - 3 m BURIAL DEPTH
ROAD ON UPSLOPE SIDE OF PIPELINE
SCALE A



OPTION 2 - PIPELINE INSULATION AND HEAT TRACING
ROAD ON UPSLOPE SIDE OF PIPELINE
SCALE A



OPTION 3 - PIPE INSULATION AND LOW CONDUCTIVITY BACKFILL
ROAD ON UPSLOPE SIDE OF PIPELINE
SCALE A

LEGEND:

- ZONE C
- ZONE D
- ZONE E
- LOW CONDUCTIVITY / INSULATING MATERIAL
- WEARING COURSE

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006..
2. FOR FILL MATERIAL SPECIFICATIONS SEE DRAWING G0040.
3. WHERE THE DOWNSLOPE SIDE OF THE PIPE IS NOT IN TRENCH, THE PROFILE SHALL BE MADE UP OF ENGINEERED FILL.
4. EROSION PROTECTION OF ALL FILL SLOPES WILL BE REQUIRED TO THE SATISFACTION OF THE ENGINEER.
5. TRANSVERSE DRAINAGE, CONSISTING OF ND100 NON-PERFORATED CORRUGATED HIGH DENSITY POLYETHYLENE (HDPE) PIPE AT 2% GRADE, TO BE PROVIDED AT LOCATIONS.
6. OPTION 4 - ALIGNMENT OPTIMIZATION WITH OPTION 2 BACKFILL AND OPERATIONAL CONTROLS TO ALLOW AUTOMATED DRAINING OF THE PIPELINE.

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE A 1 0.5 0 1 2 3 4 5 m

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PROFESSIONAL ENGINEER PROVINCE OF B. S. FICHOT # 30575

Knight Piésold CONSULTING

BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
WATER CONVEYANCE PIPELINE
ALTERNATIVE SECTIONS FOR FROST PROTECTION
3 OF 3

<original signed by>

REFERENCE DRAWINGS	
G0006	CIVIL GENERAL NOTES
G0040	CONSTRUCTION MATERIAL GRADATIONS
DRG. NO.	DESCRIPTION

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	04NOV'21	ISSUED FOR PERMITTING	BXF	S

REVISIONS			
REV	DATE	DESCRIPTION	DESIGNED	DR

	DRAWING NO.	REVISION
-05 **VA101-457/33**	**C5422**	**0**

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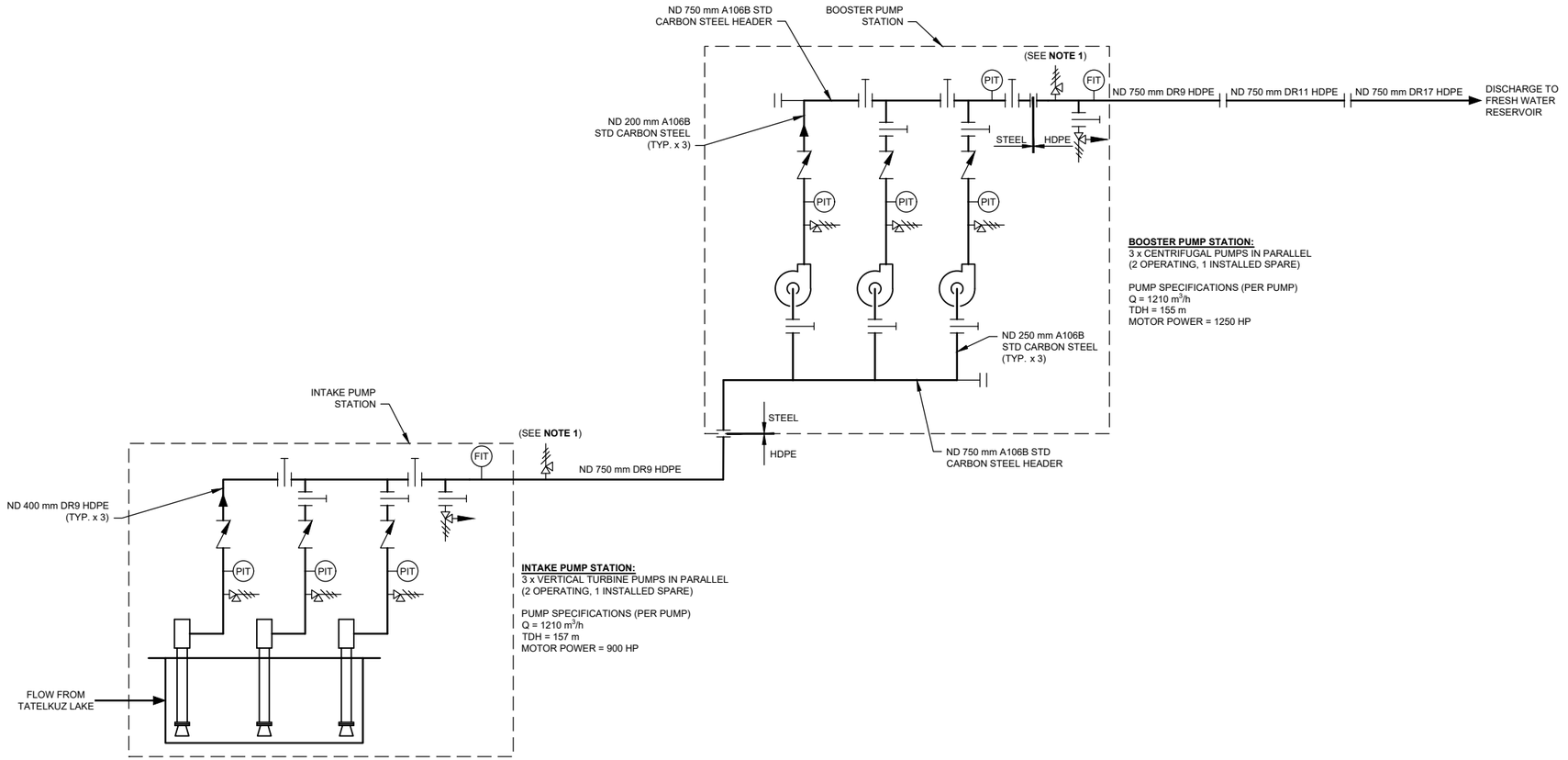


BOOSTER PUMP STATION:
3 x CENTRIFUGAL PUMPS IN PARALLEL
(2 OPERATING, 1 INSTALLED SPARE)

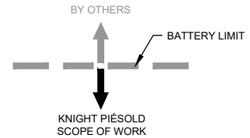
PUMP SPECIFICATIONS (PER PUMP)
Q = 1210 m^3/h
TDH = 155 m
MOTOR POWER = 1250 HP

INTAKE PUMP STATION:
3 x VERTICAL TURBINE PUMPS IN PARALLEL
(2 OPERATING, 1 INSTALLED SPARE)

PUMP SPECIFICATIONS (PER PUMP)
Q = 1210 m^3/h
TDH = 157 m
MOTOR POWER = 900 HP

LEGEND:

- PIPE FLOW
- FLOW DIRECTION
- FLANGED CONNECTION
- BLIND FLANGE
- GATE VALVE
- AIR VALVE / VACUUM RELIEF COMBINATION VALVE
- PRESSURE RELIEF VALVE
- CHECK GATE VALVE
- PRESSURE INDICATOR / TRANSMITTER
- FLOW INDICATOR / TRANSMITTER
- CENTRIFUGAL PUMP
- VERTICAL TURBINE PUMP



NOTES:

1. NOT ALL AIR/VACUUM RELIEF AND DRAIN VALVES ARE SHOWN ALONG PIPELINE INFRASTRUCTURE. REFER TO PIPELINE ALIGNMENT AND PROFILE DRAWING M5050 FOR ADDITIONAL PIPELINE ALIGNMENT DETAILS.
2. HEAT TRACING AND INSULATION OR OTHER SUITABLE WEATHER PROTECTION SUCH AS AN INSULATED AND HEATED ENCLOSURE IS REQUIRED ON ALL PUMP STATION EQUIPMENT, COMBINATION AIR/VACUUM RELEASE VALVES, AND DRAIN POINTS.

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

REFERENCE DRAWINGS	
M5070	FRESH WATER SUPPLY SYSTEM - BOOSTER STATION - PLAN
M5060	FRESH WATER SUPPLY SYSTEM - INTAKE PUMP STATION - PLAN AND SECTION
M5050	FRESH WATER SUPPLY SYSTEM - PIPELINE - PLAN AND PROFILE

REVISIONS							
DRG. NO.	DESCRIPTION	REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS			
REV	DATE	DESCRIPTION	DESIG
0	04NOV'21	ISSUED FOR PERMITTING	MR

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BW GOLD LTD.

BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
PIPING AND INSTRUMENTATION DIAGRAM

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — LYNN 12

<original signed by>

2021-11-15

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M5005	0

SAVED: M:\101\00457\33\A\Acad\DWGS\M5005\M5005, 11/4/2021 10:08:06 AM , MFLYNN PRINTED: 11/4/2021 10:32:52 AM, M5005, SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
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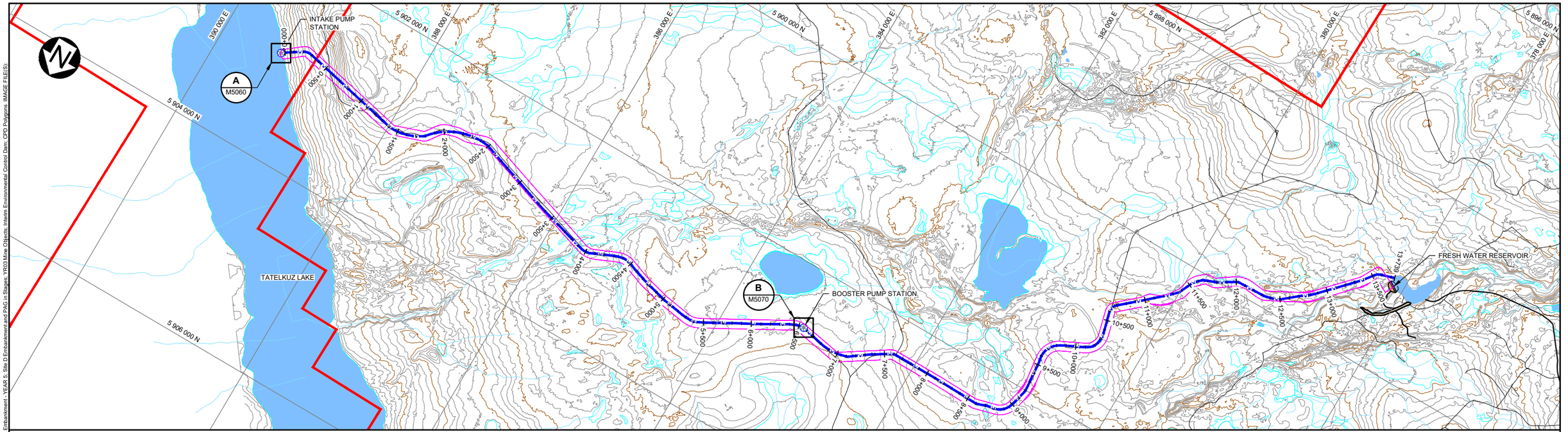
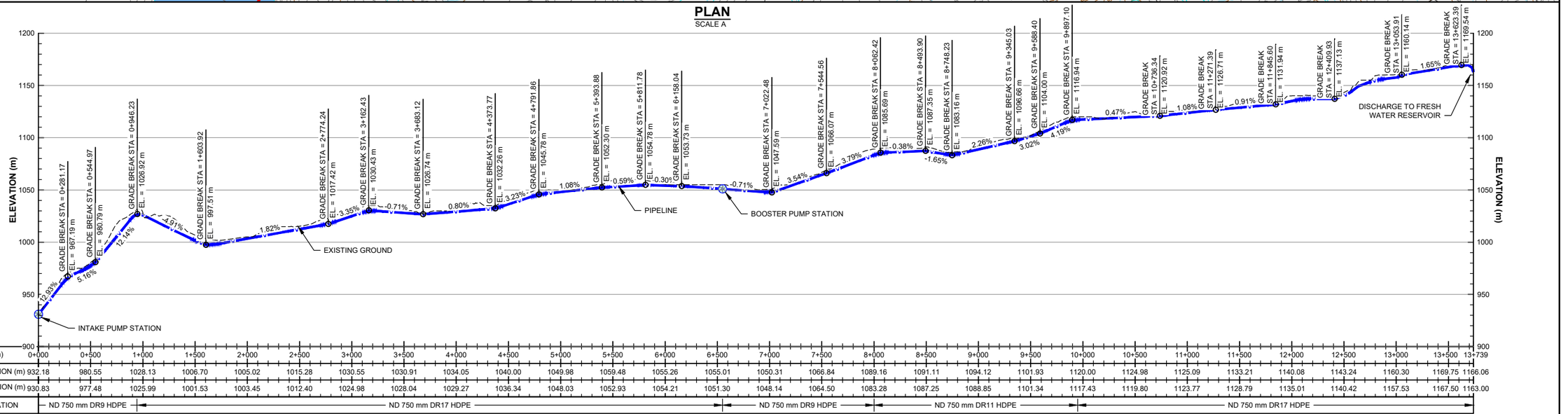


PLAN
SCALE A



STATION (m)	0+000	0+500	1+000	1+500	2+000	2+500	3+000	3+500	4+000	4+500	5+000	5+500	6+000	6+500	7+000	7+500	8+000	8+500	9+000	9+500	10+000	10+500	11+000	11+500	12+000	12+500	13+000	13+500	13+739
GROUND ELEVATION (m)	932.18	980.55	1028.13	1006.70	1005.02	1015.28	1030.55	1030.91	1034.05	1040.00	1049.98	1059.48	1055.26	1055.01	1050.31	1066.84	1089.16	1091.11	1094.12	1101.93	1120.00	1124.98	1125.09	1133.21	1140.08	1143.24	1160.30	1169.75	1166.06
PIPE INVERT ELEVATION (m)	930.83	977.48	1025.99	1001.53	1003.45	1012.40	1024.98	1028.04	1029.27	1036.34	1048.03	1052.93	1054.21	1051.30	1048.14	1064.50	1083.28	1087.25	1088.85	1101.34	1117.43	1119.80	1123.77	1128.79	1135.01	1140.42	1157.53	1167.50	1163.00
PIPE SPECIFICATION	ND 750 mm DR9 HDPE			ND 750 mm DR17 HDPE											ND 750 mm DR9 HDPE				ND 750 mm DR11 HDPE							ND 750 mm DR17 HDPE			

LEGEND:

- FRESH WATER
- EMBANKMENT FILL
- EXISTING ACCESS TRAILS
- ACCESS ROAD
- CONSTRUCTION ROAD
- PROPERTY BOUNDARY
- CERTIFIED PROJECT DESCRIPTION BOUNDARY
- WATER CONVEYANCE PIPELINE
- PUMP STATION

NOTES:

1. INSTRUMENTATION DEVICES ARE NOT SHOWN AT THIS STAGE OF DESIGN.
2. LOCATION OF ALL AIR / VACUUM RELIEF VALVES NOT SHOWN. AIR / VACUUM RELIEF VALVES TO BE LOCATED AT ALL HIGH / LOW POINTS OR AT A MAXIMUM SPACING OF 600 m.
3. FOR GENERAL NOTES SEE DRAWING G0006.
4. FOR THE FWSS PIPING AND INSTRUMENTATION DIAGRAM REFER TO DRAWING M5005.
5. PIPELINE ALIGNMENT RELATIVE TO ACCESS ROAD ALIGNMENT IS PRESENTED ON DRAWING C5410

PROFILE
FRESH WATER SUPPLY SYSTEM PIPELINE
HORIZONTAL: SCALE A
VERTICAL: SCALE B

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE B: 80 40 0 100 200 300 400 m
SCALE A: 400 200 0 400 800 1200 1600 2000 m

DRG. NO.	DESCRIPTION
C5410	FRESH WATER SUPPLY SYSTEM - WATER CONVEYANCE - GENERAL ARRANGEMENT
G0006	CIVIL GENERAL NOTES
M5005	FRESH WATER SUPPLY SYSTEM - PIPING AND INSTRUMENTAL DIAGRAM
M5060	FRESH WATER SUPPLY SYSTEM - WATER PUMP STATION - PLAN AND SECTION
M5070	FRESH WATER SUPPLY SYSTEM - BOOSTER STATION - PLAN

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DE
0	04NOV'21	ISSUED FOR PERMITTING	

REVISIONS

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2021-11-15

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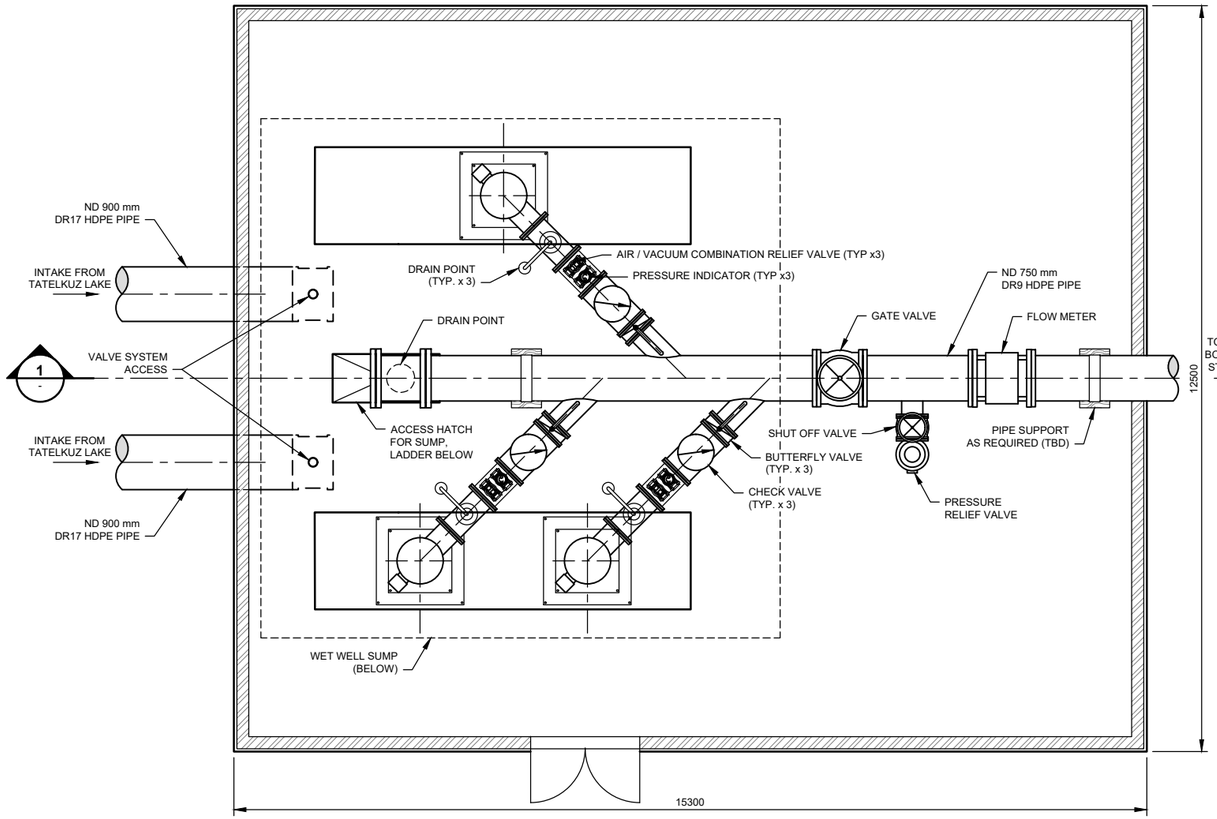
BLACKWATER GOLD PROJECT

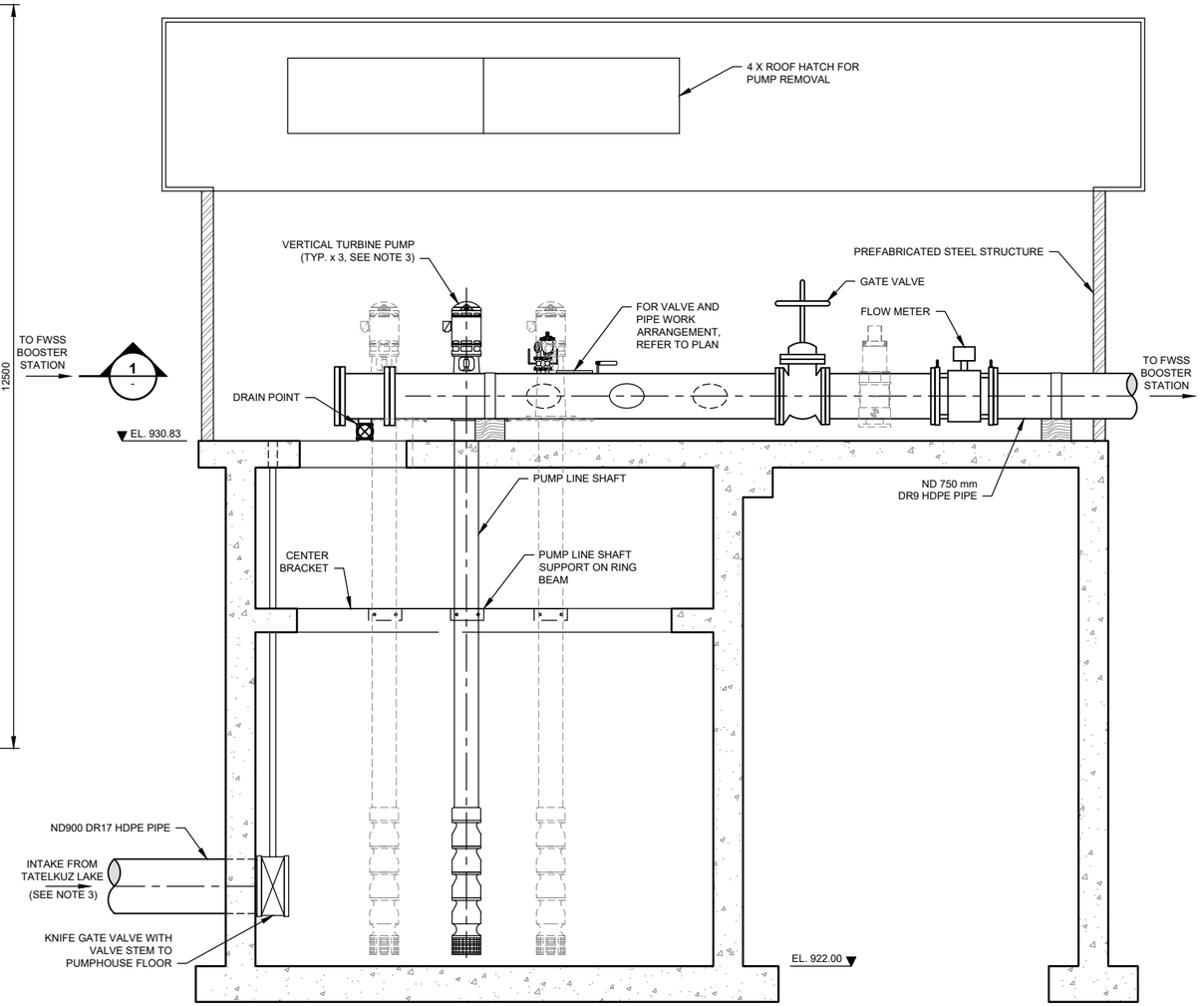
FRESH WATER SUPPLY SYSTEM PIPELINE PLAN AND PROFILE

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M5050	0

SAVED: M:\101\100\457\3\A\acad\DWG\M5050.M5050, 11/3/2021 6:15:14 PM, MFLYNN PRINTED: 11/4/2021 10:39:55 AM, M5050, SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): Topo 5m Contours; Fresh Water Reservoir; Hydro; PropertyBoundary; Intake Structure ; Option B; Access and Construction Roads - Central Diversion and Pipelines; Existing Roads & Trails; 2020; Environmental Control Dam; Site C Embankment - YEAR 5; Site D Embankment and PAG in Stages; YR03 Mine Objects; Interim Environmental Control Dam; CPD Polygons IMAGE FILE(S):



A M5050 **PLAN**
SCALE A



1 - **SECTION**
PUMP STATION
SCALE A

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006.
2. REFER TO DRAWING C5300 AND C5310 FOR WATER STRUCTURE CIVIL DESIGN DETAILS.
3. REFER TO DRAWING M5005 FOR PUMP PERFORMANCE SPECIFICATIONS.

SCALE A 1 0.5 0 1 2 3 4 5 m

DRG. NO.	DESCRIPTION
C5300	FRESH WATER SUPPLY SYSTEM - INTAKE STRUCTURE - OVERVIEW
C5310	FRESH WATER SUPPLY SYSTEM - INTAKE STRUCTURE - PLAN AND SECTION
G0006	CIVIL GENERAL NOTES
M5005	FRESH WATER SUPPLY SYSTEM - PIPING AND INSTRUMENTAL DIAGRAM
M5050	FRESH WATER SUPPLY SYSTEM - PIPELINE - PLAN AND SECTION
C5310	FRESH WATER SUPPLY SYSTEM - INTAKE STRUCTURE - PLAN AND SECTION

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNE
0	04NOV'21	ISSUED FOR PERMITTING	MRF

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BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
INTAKE PUMP STATION
PLAN AND SECTION

P/A NO.	DRAWING NO.	REVISION
VA101-457-33	M5060	0

SAVED: M:\101\00457\33\A\Acad\DWGS\M5060\M5060, 11/4/2021 3:33:43 PM , SCAMMAYO PRINTED: 11/4/2021 3:33:57 PM, M5060, SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
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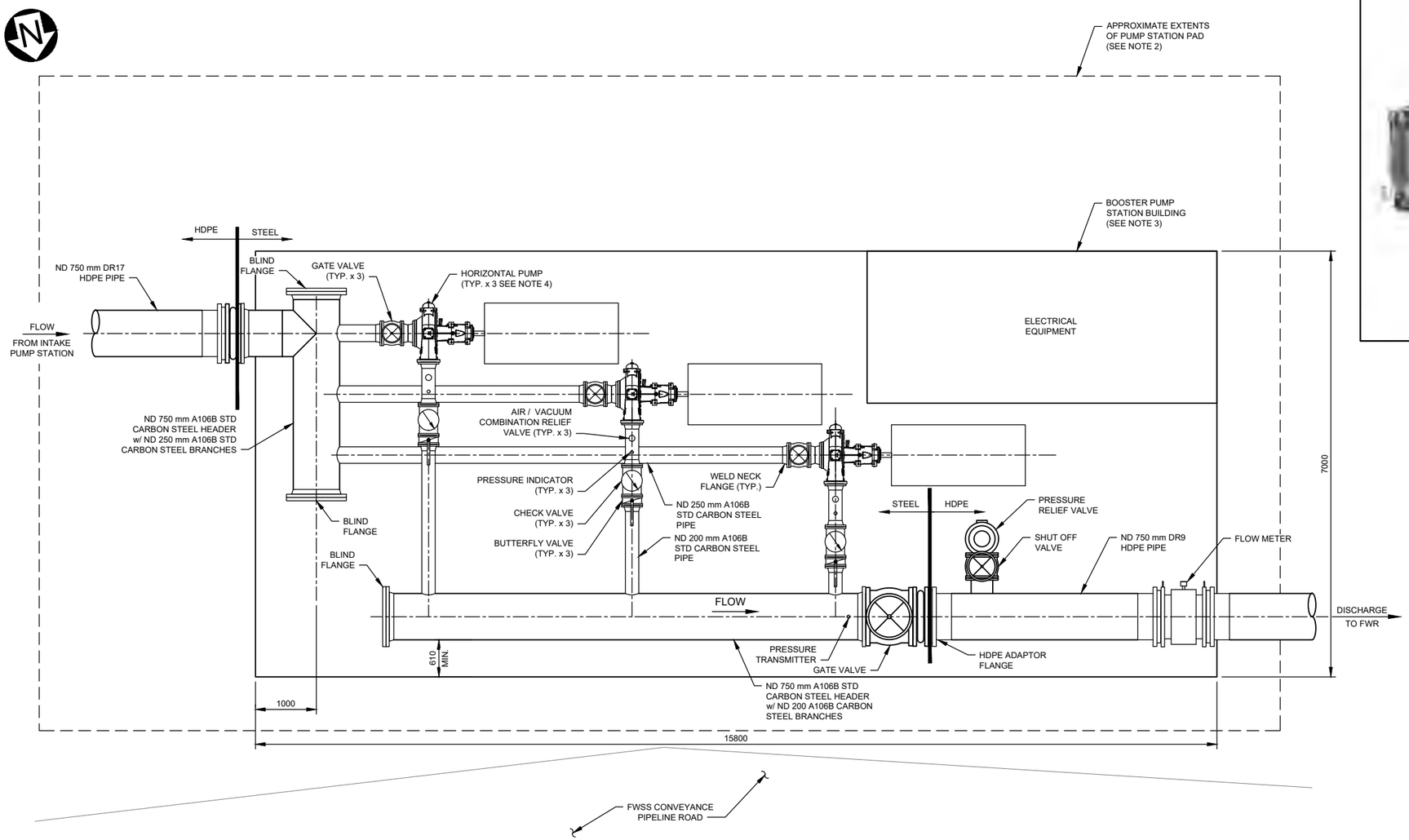

TYPICAL PUMP SKID BUILDING
FOR ILLUSTRATION PURPOSES ONLY
(SEE NOTE 3)

B M5050 **PLAN**
BOOSTER PUMP STATION
SCALE A

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. PUMP STATION PAD TO BE CLEARED / COMPACTED TO PROVIDE COMPETENT SURFACE FOR PUMP STATION SEACAN, AS REQUIRED. PAD DETAILS TO BE CONFIRMED DURING SUBSEQUENT DESIGN PHASES.
3. PUMP STATION CONFIGURATION AS PER PUMP SUPPLIER RECOMMENDATIONS, EXACT PUMP / EQUIPMENT LAYOUT AND BUILDING DETAILS TO BE CONFIRMED DURING SUBSEQUENT DESIGN PHASES, IN CONJUNCTION WITH THE EQUIPMENT SUPPLIER.
4. REFER TO DRAWING M5005 FOR PUMP PERFORMANCE SPECIFICATIONS.

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

SCALE A 0.8 0.4 0 1 2 3 4 mm

DRG. NO.	DESCRIPTION
G0006	CIVIL GENERAL NOTES
M5005	FRESH WATER SUPPLY SYSTEM - PIPING AND INSTRUMENTAL DIAGRAM
M5050	FRESH WATER SUPPLY SYSTEM - PLAN AND SECTION

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
0	04NOV'21	ISSUED FOR PERMITTING	MRF			

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2021-11-15

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BLACKWATER GOLD PROJECT

FRESH WATER SUPPLY SYSTEM
BOOSTER STATION
PLAN

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	M5070	0

SAVED: M:\101\10045733\A\cad\DWGS\M5070\M5070_11-4-2021 10-44-47 AM_SCAMMAYO PRINTED: 11/4/2021 4:30:25 PM, M5070_ SCAMMAYO ACAD VERSION: 23.1S (LMS TECH)
XREF FILE(S): CPD Polygons, Existing Roads & Trails_2020, Wood LiDAR_1m, Booster Station Pad IMAGE FILE(S)

APPENDIX C MINE ACCESS ROAD DESIGN

Appendix C-1: Allnorth Road Design Specifications Memo

Appendix C-2: Allnorth Plan and Profile Drawings

Appendix C-3: Allnorth Bridge Plan and Profile Drawings

Appendix C-4: Allnorth Culvert Report

Road Design Specifications

2011 PG Pulpmill Road, PO Box 968, Prince George, BC V2L 4V1 Phone: 250-614-7291			
Date:	January 29, 2021	Project Number:	2003569
Client:	Artemis Gold Inc.	Project Name:	Artemis Gold MAR Design
Client Contact Name:	Alastair Tiver	Design Engineer:	Jordan Smith P.Eng.
Designer:	Teena Major	Project Manager:	Caleb Allen R.P.F.

Mine Access Road

Length of Road:	~13.736km		Design / AutoTurn Vehicle:	L-100 (90,680 kg)
Running Surface Width:	5m minimum for 40km/hr 4m minimum for 20km/hr		Maximum Grade (40km/hr):	8% Sustained 10% Short Pitch (<100m)
Design Speed:	40 km/hr with 20km/hr reductions		Maximum Grade (20km/hr):	9% Sustained 12% Short Pitch (<100m)
Surface Cross Slope / Crown:	-2%		Turnout Size:	4m min. width beyond running surface width x 30m min. plus 7.5m lg. tapers at each end
Right of Way Width:	20m Maximum		Turnout Spacing:	Inter-visible, or 2 per km minimum
Minimum Cross Drain Culvert Size / Spacing:	600 mm	Varies (100m to 300m)	Stripping Depth:	0.3m
Ditch Type (V, Flat):	Flat bottom		Select Granular Subbase SGSB	Varies 0.2m to 0.9m (As per Geotech Report)
Ditch Depth / Width:	0.3 m Min. (below subgrade)	1 m Min.	Well Graded Base WGB	0.3m
Develop Borrow/Waste Pits (Y/N):	n/a		Surfacing Depth:	0.2m
Borrow/Waste Pit Interval:	n/a		Cut Slopes (h:v):	1.5H:1V granular material 2.5H:1V fine grained material
Data Source:	2017 LiDAR		Fill Slopes (h:v):	1.5H:1V granular material 2.5H:1V fine grained material
Geotech Report (Y/N):	Yes		Min. K Value (40km/hr):	9.6 Crest / 8.5 Sag
			Min. Hrz Curve Radius:	65m (40km/hr)
Geotech Engineer:	GeoNorth Engineering Ltd.		Min. K Value (20km/hr):	1.7 Crest / 2.1 Sag
			Min. Hrz Curve Radius:	15m (20km/hr)

Comments

The Mine Access Road will have a 40km/hr design speed, with 20km/hr speed reductions due to narrow width and steep grades.

Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PO\2020\2003569 Atremis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 13092\2003569-200-1920_210111 | Layout: 000 | Paper Size: 863.6mm x 558.8mm

BLACKWATER PROJECT
PROPOSED MINE
ACCESS ROAD
km 0+000 to km 13+736

DRAWING LIST			
DRAWING NO	**DRAWING TITLE**		**REVISION**
2003569-100-1920-100	SINGLE LANE MINE ACCESS ROAD TYPICAL SECTIONS		B
2003569-100-1920-101	PROPOSED CULVERT AND PULLOUT DETAILS		A
2003569-100-1920-102	PROPOSED HORIZONTAL ALIGNMENT TABLE		A
2003569-200-1920-200-213	PROPOSED PLAN AND PROFILE DRAWINGS		A
2003569-300-1920-300-315	PROPOSED CROSS SECTION DRAWINGS		A
2003569-400-1920-400-413	PROPOSED MASS HAUL DIAGRAMS		A

REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

PRELIMINARY
NOT FOR CONSTRUCTION

DESCRIPTION: ISSUED FOR REVIEW
ISSUE DATE: 21/01/29

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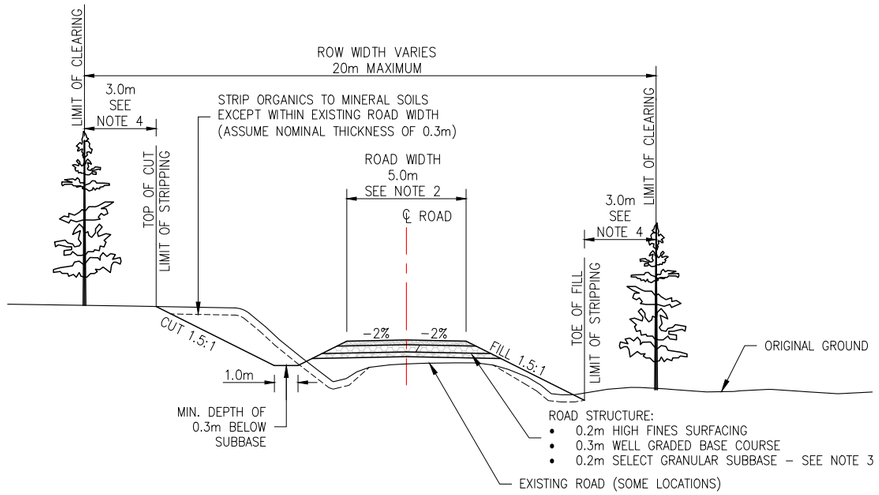
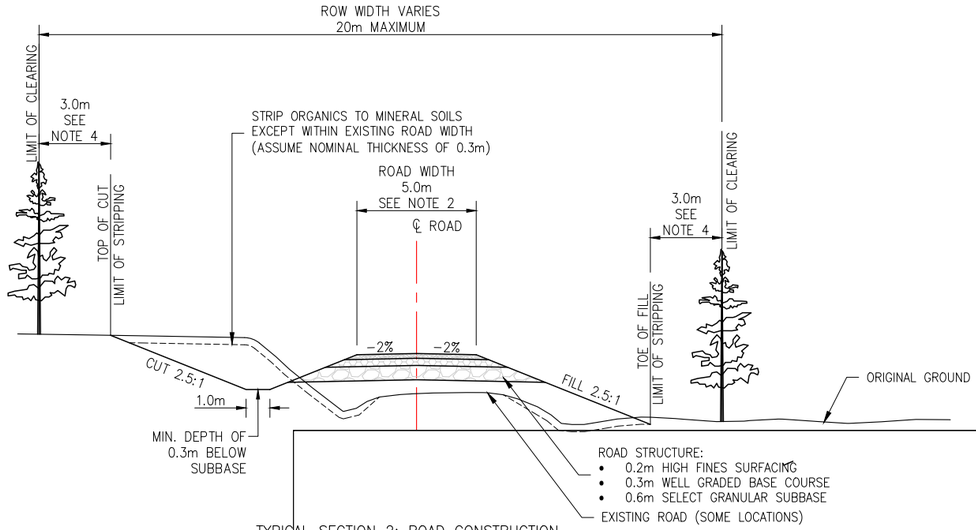
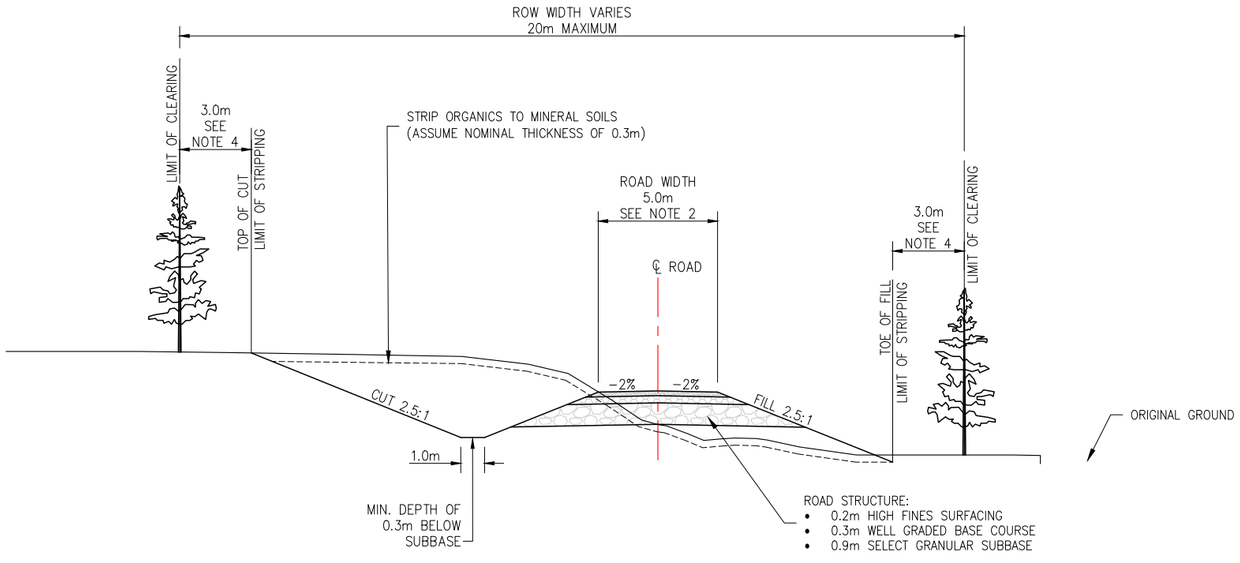
CLIENT NO:	-	DRWN:	CC	DATE:	13/09/13
PROJECT NO:	2003569	DSGN:	CC	DATE:	31/09/10
DRAWING SIZE:	11x17	CHKD:	JDS	DATE:	
SCALE:	AS NOTED	APVD:	JDS	DATE:	-
DWG NO:	**2003569-000-1920**			REV:	**A**



TYPICAL SECTION 1: ROAD CONSTRUCTION
SCALE: 1:250
(GEOLOGICAL LANDFORM: GLACIOFLUVIAL)



TYPICAL SECTION 2: ROAD CONSTRUCTION
SCALE: 1:250
(GEOLOGICAL LANDFORM: TILL)



TYPICAL SECTION 3: ROAD CONSTRUCTION
SCALE: 1:250
(GEOLOGICAL LANDFORM: GLACIOLACUSTRINE AND LACUSTRINE)

RECOMMENDED ROAD STRUCTURE (SEE NOTE 1)		
ROAD COMPONENT (ESTIMATED)	GEOLOGICAL LANDFORM	APPLICABLE TYPICAL SECTION
km 0 to 0.61 km 5.2 to 8.3 km 10.2 to 13	GLACIOFLUVIAL	1
km 0.61 to 4.89 km 4.99 to 5.2 km 8.3 to 10.2 km 13.0 to END	TILL	2
ISOLATED SPOTS km 4.89 to 4.99 km 13.47 to 13.5 km 13.59 to 13.62	GLACIOLACUSTRINE AND LACUSTRINE	3

REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
-	-	1

NOTES:
1. RECOMMENDED ROAD STRUCTURES AS PER GEONORTH ENGINEERING LTD. REPORT FILE NO. K-3663 DATED JULY 8th, 2013 AND AUGUST 9th 2013. LOCATIONS ARE APPROXIMATE, AND ARE TO BE CONFIRMED IN THE FIELD DURING CONSTRUCTION.
2. ROAD WIDTH NARROWS TO 4m IN SOME LOCATIONS TO ACCOMMODATE ROW WIDTH. SPEED REDUCED TO 20km/hr IN THESE AREAS.
3. OMIT SGSB LAYER WHERE SUBGRADE MEETS SPECIFICATIONS FOR SGSB.
4. 3.0m CLEARING WIDTH RECOMMENDED. THIS WIDTH MAY BE REDUCED TO ACCOMMODATE MAXIMUM ROW WIDTH.

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REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
B	21/01/29	ISSUED FOR REVIEW	TMM	JDS	JDS
A	20/11/16	ISSUED FOR REVIEW	SN	CA	SPF

CLIENT:

Allnorth

CLIENT NO:	-	DRWN:	SN	DATE:	20/11/16
PROJECT NO:	2003569	DSGN:	SN	DATE:	20/11/16
DRAWING SIZE:	ANSI "B"	CHKD:	CA	DATE:	20/11/16
SCALE:	AS NOTED	APVD:	SPF	DATE:	20/11/16

PROJECT:

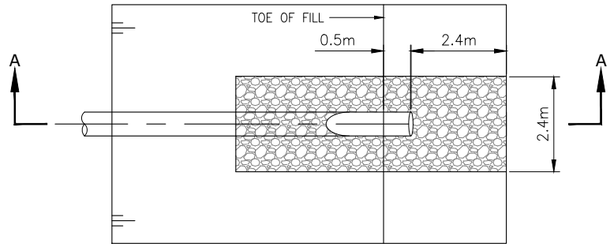
BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

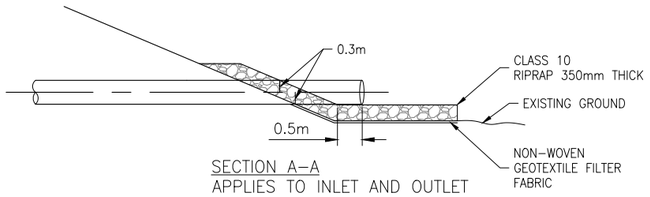
SINGLE LANE MINE ACCESS ROAD TYPICAL SECTIONS

DWG NO: **2003569-100-1920-100** REV: **B**

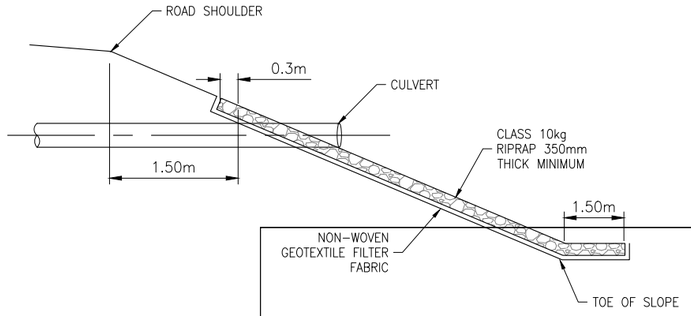
Date: 2021/01/29 10:16 AM | User: Terra Major | File: P:\GP\2020_PG\2020\2003569 Aiteris Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13FG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 130921\2003569-100-1920 | Layout: 100 | Paper Size: 558.8mm x 431.8mm



PLAN

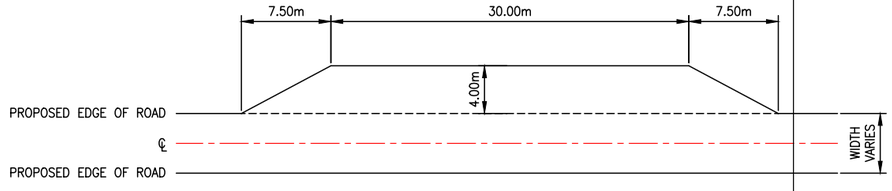


SECTION A–A
APPLIES TO INLET AND OUTLET



EXTENDED OUTFALL
DETAIL

RIPRAP TREATMENT FOR
CULVERT INVERTS
1:150



TYPICAL PULLOUT DETAIL
1:500

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REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
A	20/11/29	ISSUED FOR REVIEW	TMM	JDS	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN:	TMM	DATE:	21/01/11
PROJECT NO:	2003569	DSGN:	-	DATE:	-
DRAWING SIZE:	11x17	CHKD:	JDS	DATE:	-
SCALE:	AS NOTED	APVD:	JDS	DATE:	-

PROJECT:

BLACKWATER PROJECT
PROPOSED MINE
ACCESS ROAD

TITLE:

PROPOSED
CULVERT AND
PULLOUT DETAILS

DWG NO: **2003569-100-1920-101**

REV: **A**

Date: 2021/01/29 10:16 AM | User: Teina Major | File: P:\GP\2020_PG\2020\2003569 Aitemis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13RG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 130921\2003569-100-1920 | Layout: 101 | Paper Size: 558.8mm x 431.8mm

HORIZONTAL INFORMATION (MAINLINEALIGNMENT)							
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PI–1	0+061.7	5906165.67	378579.60		109.7m	62°52'18"	100.0m
T–2	0+110.3 0+219.7	5906121.94 5906043.66	378622.31 378698.77	135°40'25"	109.4m		
PI–2	0+226.5	5906038.79	378703.53		13.6m	3°53'40"	200.0m
T–3	0+233.3 0+263.5	5906034.26 5906014.17	378708.60 378731.09	131°46'45"	30.2m		
PI–3	0+267.2	5906011.67	378733.89		7.5m	2°09'21"	200.0m
T–4	0+271.0 0+441.6	5906009.05 5905890.69	378736.60 378859.45	133°56'05"	170.6m		
PI–4	0+531.7	5905828.19	378924.32		141.5m	90°03'14"	90.0m
T–5	0+583.1 0+604.5	5905763.37 5905747.91	378861.76 378846.83	223°59'19"	21.5m		
PI–5	0+617	5905738.95	378838.18		24.8m	9°29'29"	150.0m
T–6	0+629.4 0+687.4	5905731.54 5905697.05	378828.17 378781.59	233°28'48"	58.0m		
PI–6	0+708.7	5905684.33	378764.42		37.1m	70°55'23"	30.0m
T–7	0+724.5 0+871.8	5905663.94 5905523.37	378770.82 378814.99	162°33'25"	147.3m		
T–8	0+871.8 1+755.7	5905523.37 5904687.90	378814.99 379103.55	160°56'45"	883.9m		
PI–7	1+780	5904664.97	379111.47		48.5m	5°33'21"	500.0m
T–9	1+804.2 2+289.3	5904641.38 5904169.72	379117.13 379230.35	166°30'06"	485.1m		
PI–8	2+346.8	5904113.80	379243.78		113.6m	21°42'13"	300.0m
T–10	2+402.9 3+255.7	5904056.88 5903212.85	379235.57 379113.86	188°12'19"	852.8m		
PI–9	3+300	5903169.02	379107.54		88.6m	2°32'13"	2000.0m
T–11	3+344.2 4+700.8	5903125.51 5901792.75	379099.29 378846.44	190°44'32"	1356.5m		
PI–10	4+863	5901633.31	378816.19		276.3m	75°23'30"	210.0m
T–12	4+977.1 5+113.0	5901563.83 5901505.63	378962.85 379085.70	115°21'02"	135.9m		
PI–11	5+389.6	5901387.22	379335.62		403.4m	100°30'07"	230.0m
T–13	5+516.5 5+644.7	5901163.06 5901059.12	379173.65 379098.53	215°51'09"	128.2m		
PI–12	5+686.2	5901025.47	379074.22		82.3m	18°51'33"	250.0m
T–14	5+727.0 5+934.0	5900985.76 5900787.80	379062.08 379001.58	196°59'36"	207.0m		
PI–13	5+971.9	5900751.54	378990.50		75.3m	17°14'52"	250.0m
T–15	6+009.3 6+047.5	5900720.19 5900688.58	378969.17 378947.65	214°14'28"	38.2m		
PI–14	6+130.2	5900620.19	378901.10		159.8m	36°37'15"	250.0m
T–16	6+207.3 6+650.6	5900537.54 5900094.56	378904.54 378922.95	177°37'13"	443.4m		

HORIZONTAL INFORMATION (MAINLINEALIGNMENT)							
ITEM	STATION	NORTHING	EASTING	DIRECTION	LENGTH	DELTA	RADIUS
PI–15	6+673.2	5900071.97	378923.89		45.1m	10°19'57"	250.0m
T–17	6+695.7 6+908.0	5900049.59 5899839.39	378920.76 378891.39	187°57'10"	212.2m		
PI–16	7+003.6	5899744.71	378878.17		185.1m	35°20'55"	300.0m
T–18	7+093.1 7+653.6	5899675.14 5899267.22	378812.60 378428.17	223°18'06"	560.5m		
PI–17	7+692.8	5899238.69	378401.29		77.9m	14°53'08"	300.0m
T–19	7+731.5 8+132.2	5899204.23 5898851.87	378382.64 378192.00	208°24'57"	400.6m		
PI–18	8+172.8	5898816.14	378172.66		80.8m	15°25'28"	300.0m
T–20	8+212.9 8+567.6	5898776.55 5898430.91	378163.53 378083.79	192°59'30"	354.7m		
PI–19	8+664.6	5898336.39	378061.98		187.6m	35°50'12"	300.0m
T–21	8+755.3 9+323.9	5898246.99 5897723.00	378099.64 378320.40	157°09'17"	568.6m		
PI–20	9+361.4	5897688.38	378334.98		74.7m	14°16'18"	300.0m
T–22	9+398.6 10+068.5	5897658.44 5897124.28	378357.64 378761.87	142°52'59"	669.9m		
PI–21	10+130.7	5897074.66	378799.42		120.3m	36°16'02"	190.0m
T–23	10+188.7 10+230.3	5897012.44 5896970.88	378800.34 378800.95	179°09'01"	41.6m		
PI–22	10+280.6	5896920.57	378801.70		98.4m	29°39'57"	190.0m
T–24	10+328.7 10+403.2	5896876.48 5896811.15	378777.45 378741.50	208°48'59"	74.6m		
PI–23	10+431.2	5896786.66	378728.03		55.7m	12°45'27"	250.0m
T–25	10+458.9 10+562.4	5896765.75 5896688.36	378709.49 378640.84	221°34'26"	103.5m		
PI–24	10+620.7	5896644.75	378602.15		115.2m	21°59'35"	300.0m
T–26	10+677.5 11+551.8	5896589.82 5895766.06	378582.62 378289.60	199°34'50"	874.3m		
PI–25	11+719.9	5895607.72	378233.28		306.4m	58°31'01"	300.0m
T–27	11+858.2 12+618.1	5895573.05 5895416.35	378068.82 377325.35	258°05'51"	759.8m		
PI–26	12+705.5	5895398.31	377239.78		170.2m	32°30'03"	300.0m
T–28	12+788.2 13+023.8	5895429.08 5895511.96	377157.93 376937.40	290°35'54"	235.6m		
PI–27	13+157.1	5895558.86	376812.62		262.4m	25°03'10"	600.0m
T–29	13+286.2 13+736.9	5895548.51 5895513.50	376679.71 376230.30	265°32'44"	450.8m		

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REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
A	20/11/29	ISSUED FOR REVIEW	TMM	JDS	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN: TMM	DATE: 21/01/11
PROJECT NO:	2003569	DSGN: -	DATE: -
DRAWING SIZE:	ANSI "B"	CHKD: JDS	DATE: -
SCALE:	AS NOTED	APVD: JDS	DATE: -

PROJECT:

BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

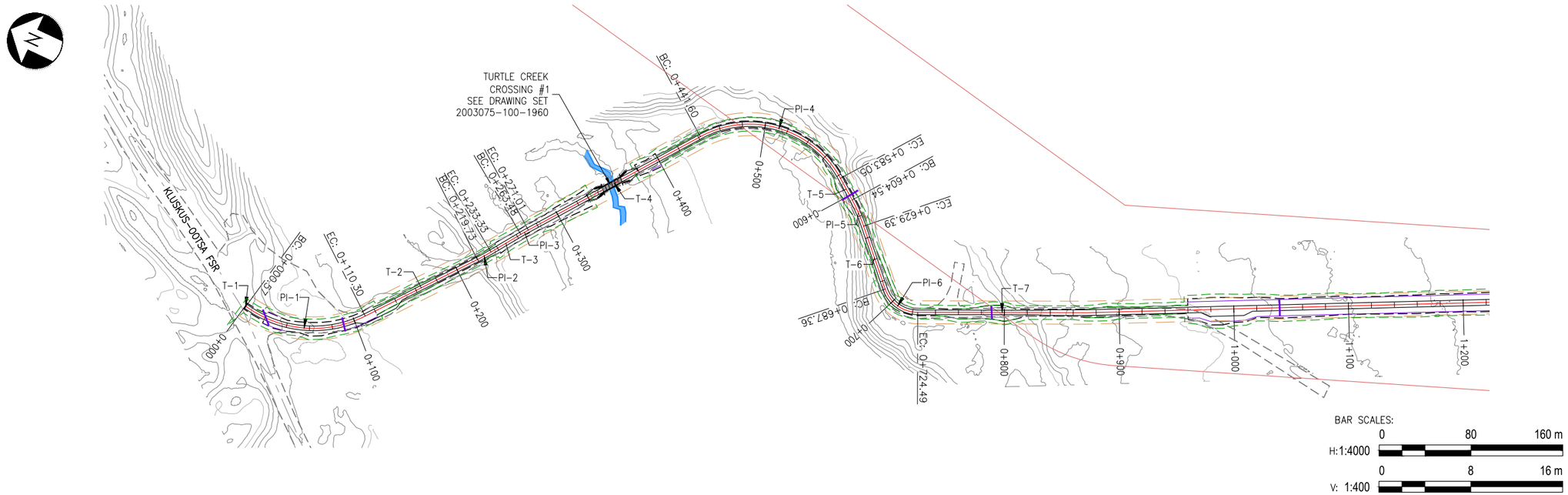
TITLE:

PROPOSED HORIZONTAL ALIGNMENT TABLE

DWG NO: **2003569-100-1920-102**

REV: **A**

Date: 2021/01/29 10:16 AM | User: Teena Major | File: P:\GP\2020_PG\2020\2003569 Atremis Gold MAR Design\1000 Dwgs\1011–Civil\Data from 13FG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 130921\2003569-100-1920 | Layout: 102 | Paper Size: 558.8mm x 431.8mm



BAR SCALES:

H: 1:4000 — 0 — 80 — 160 m

V: 1:400 — 0 — 8 — 16 m

LEGEND:

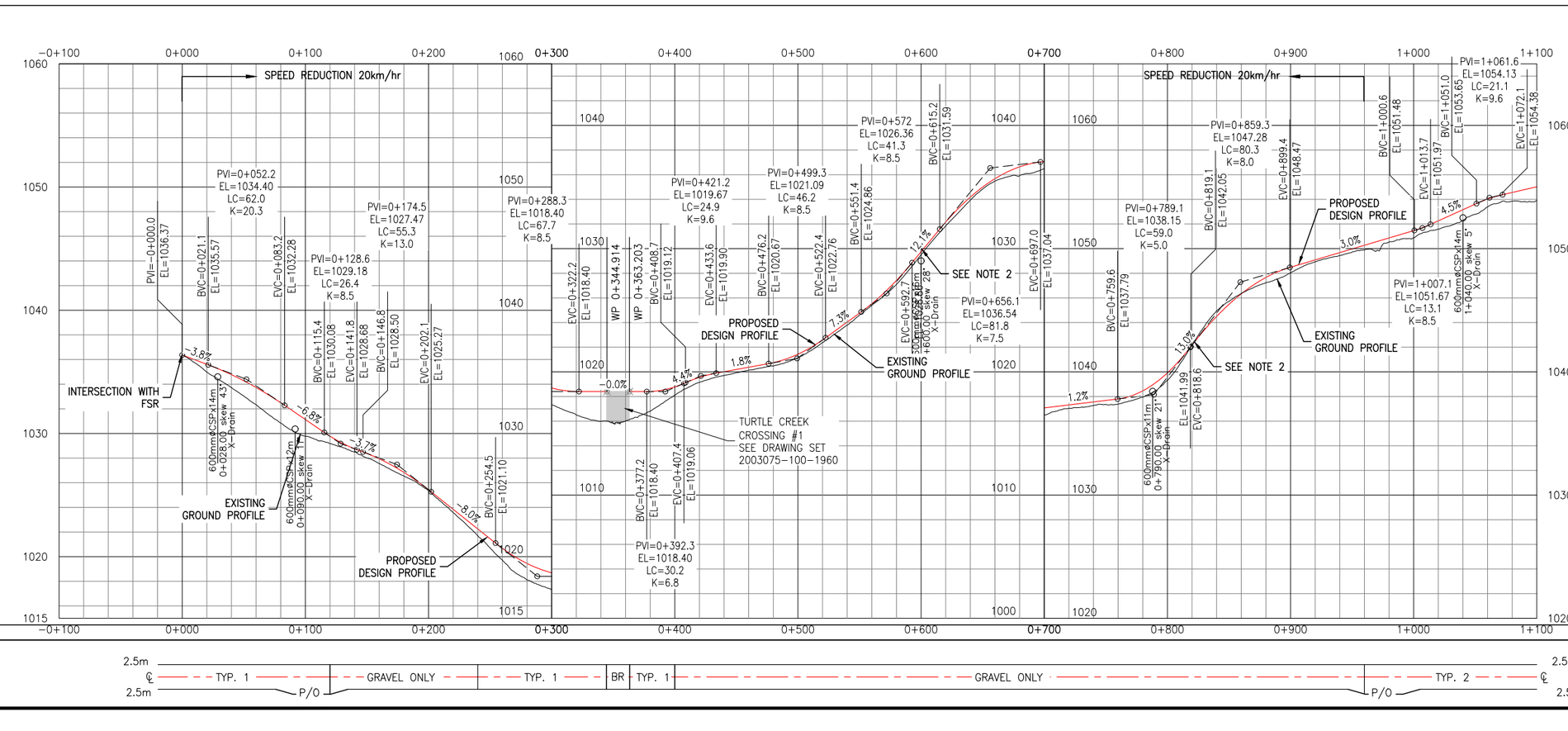
EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (8+000)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

NOTES:

1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.
2. STEEP ROAD GRADES RECOMMENDED MAXIMUM GRADES. ENSURE GRADES HAVE PROPER WARNING SIGNAGE.
3. EXISTING CULVERT LOCATIONS UNKNOWN, DRAINAGE FROM km 0+000 to km 1+000 TO BE ASSESSED BY OTHERS.

PRELIMINARY
NOT FOR CONSTRUCTION



ROAD TYPICAL:

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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

CLIENT NO:	-	DRWN:	TMM	DATE: 21/01/11
PROJECT NO:	2003569	DSGN:	CC	DATE: 13/09/13
DRAWING SIZE:	11x17	CHKD:	JDS	DATE: -
SCALE:	1:4000	APVD:	JDS	DATE: -

PROJECT:

BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

PROPOSED PLAN AND PROFILE km 0+000 to km 1+000

DWG NO: **2003569-200-1920-200** REV: **A**

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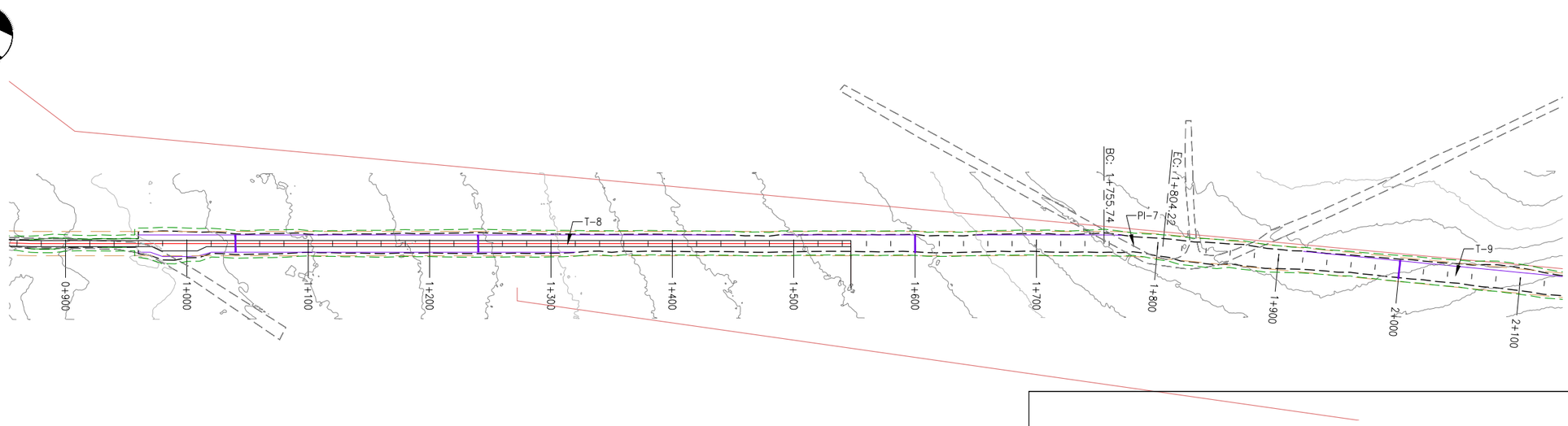


LEGEND:

EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (0+000 … 1+800 … 2+100)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

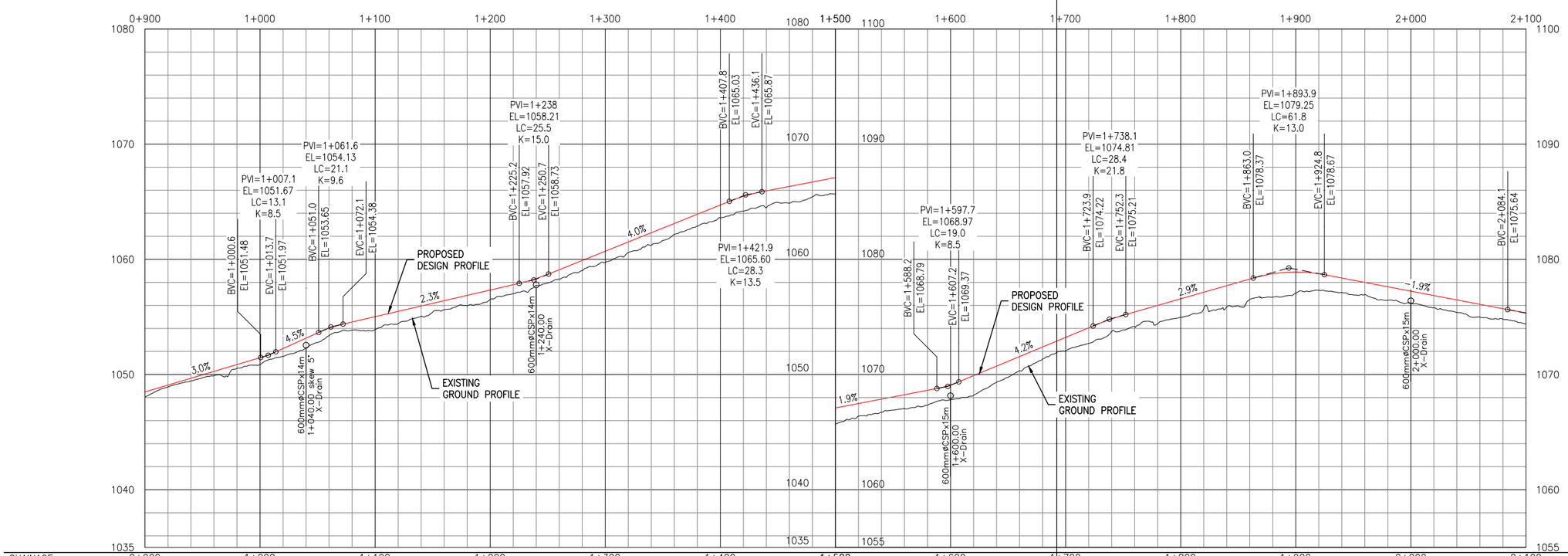
NOTES:

1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

BAR SCALES:

H:1:4000 — 0 — 80 — 160 m

V: 1:400 — 0 — 8 — 16 m



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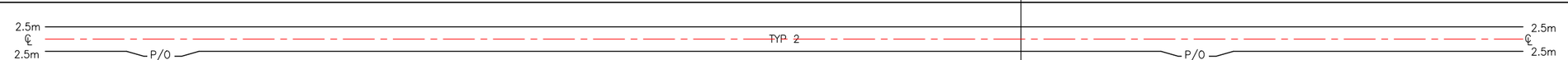

PRELIMINARY
NOT FOR CONSTRUCTION

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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN:	TMM	DATE: 21/01/11
PROJECT NO:	2003569	DSGN:	CC	DATE: 13/09/13
DRAWING SIZE:	11x17	CHKD:	JDS	DATE: -
SCALE:	1:4000	APVD:	JDS	DATE: -

PROJECT:

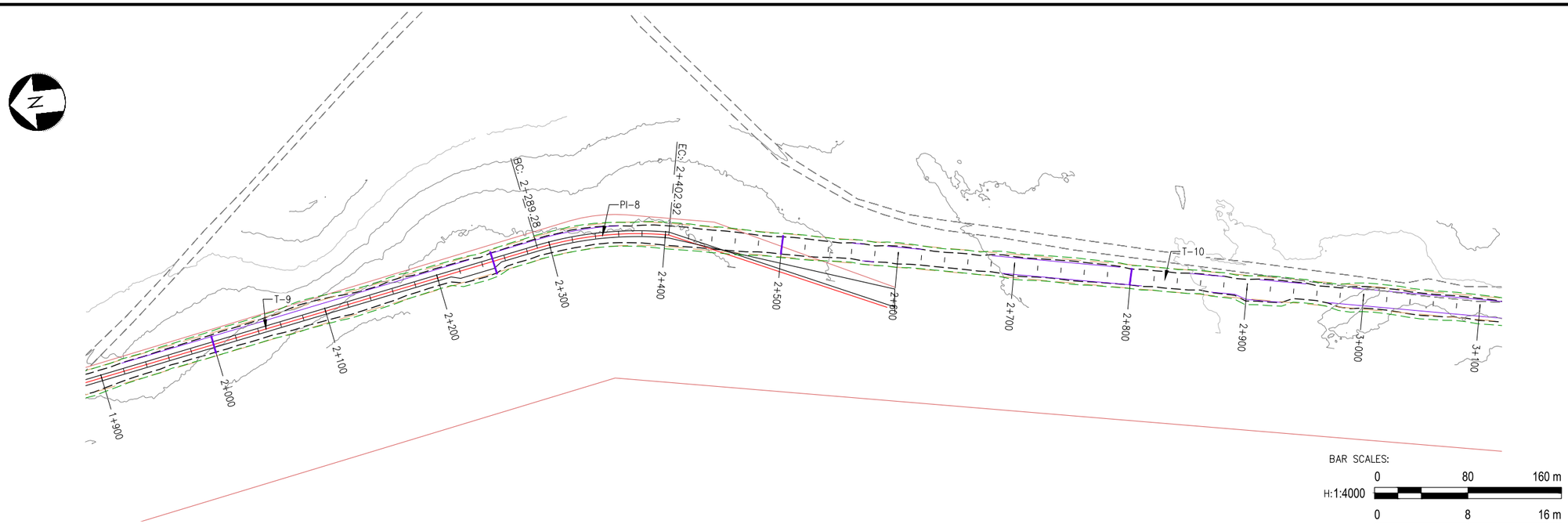
BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

PROPOSED PLAN AND PROFILE km 1+000 to km 2+000

DWG NO: **2003569-200-1920-201** REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PO\2020\2003569 Artemis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PD0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 13092\2003569-200-1920_210111 | Layout: 201 | Paper Size: 558.8mm x 431.8mm



BAR SCALES:

H:1:4000 — 0 — 80 — 160 m

V: 1:400 — 0 — 8 — 16 m

LEGEND:

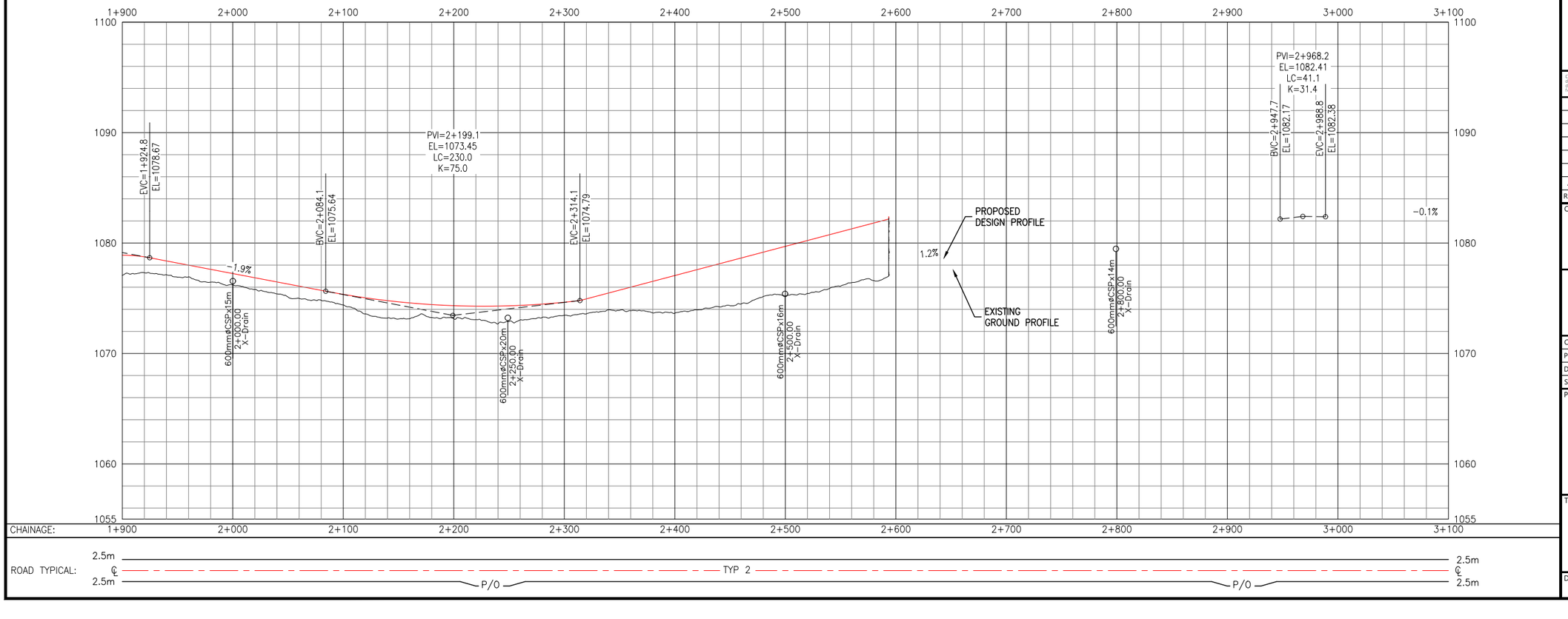
EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (8+000)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

NOTES:

1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

PRELIMINARY
NOT FOR CONSTRUCTION



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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

CLIENT NO:	-	DRWN:	TMM	DATE: 21/01/11
PROJECT NO:	2003569	DSGN:	CC	DATE: 13/09/13
DRAWING SIZE:	11x17	CHKD:	JDS	DATE: -
SCALE:	1:4000	APVD:	JDS	DATE: -

PROJECT:

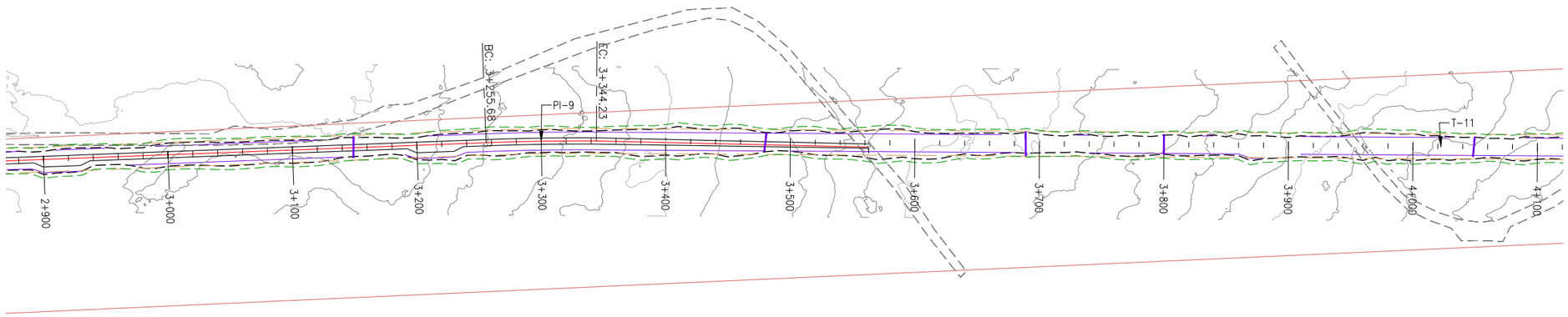
BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

PROPOSED PLAN AND PROFILE km 2+000 to km 3+000

DWG NO: **2003569-200-1920-202** REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PG\2020\2003569 Atremis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 13092



LEGEND:

EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (8+000)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

NOTES:

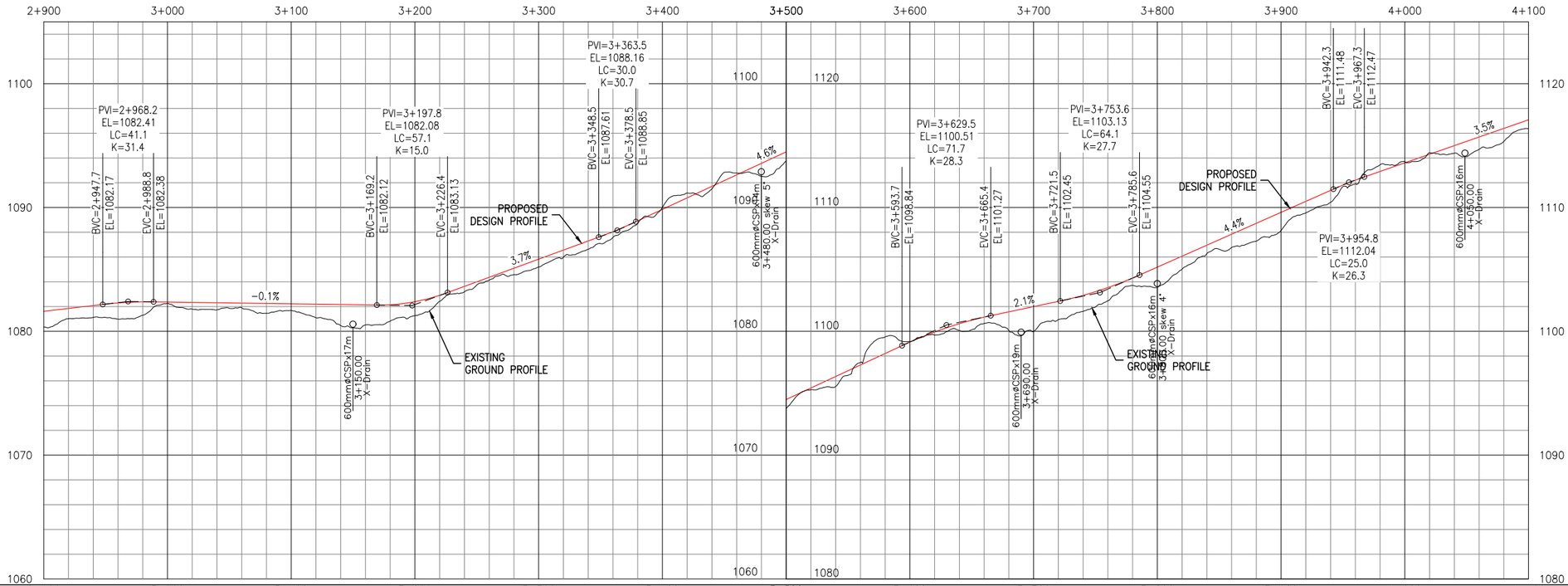
1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

BAR SCALES:

H:1:4000 — 0 — 80 — 160 m

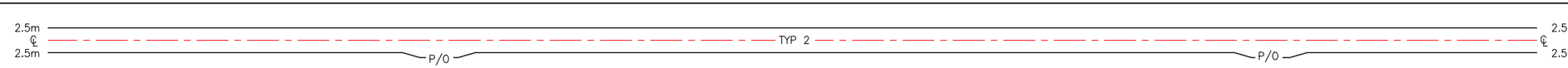
V: 1:400 — 0 — 8 — 16 m

PRELIMINARY
NOT FOR CONSTRUCTION



CHAINAGE: 2+900 3+000 3+100 3+200 3+300 3+400 3+500 3+600 3+700 3+800 3+900 4+000 4+100

ROAD TYPICAL:



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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN:	TMM	DATE: 21/01/11
PROJECT NO:	2003569	DSGN:	CC	DATE: 13/09/13
DRAWING SIZE:	11x17	CHKD:	JDS	DATE: -
SCALE:	1:4000	APVD:	JDS	DATE: -

PROJECT:

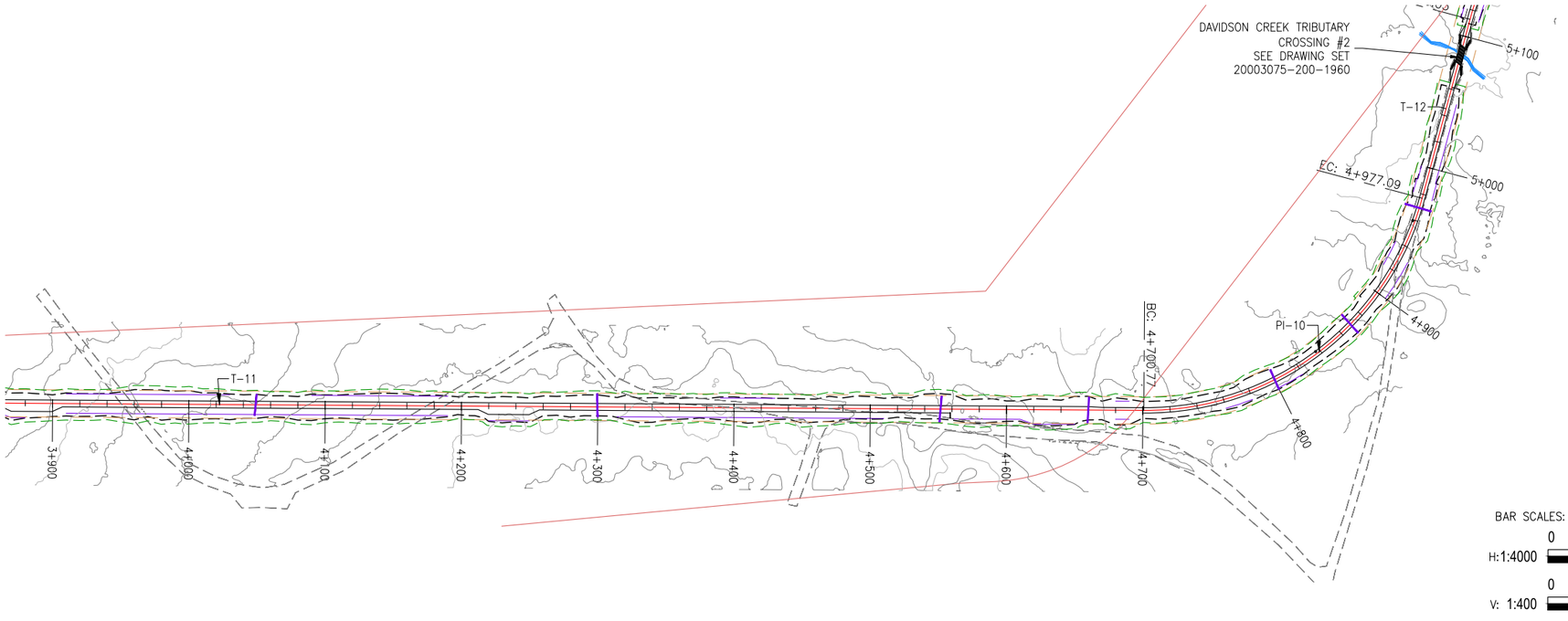
BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

PROPOSED PLAN AND PROFILE km 3+000 to km 4+000

DWG NO: **2003569-200-1920-203** REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PG\2020\2003569 Artemis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 130921\2003569-200-1920_210111 | Layout: 203 | Paper Size: 558.8mm x 431.8mm



LEGEND:

EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (8+000)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

NOTES:

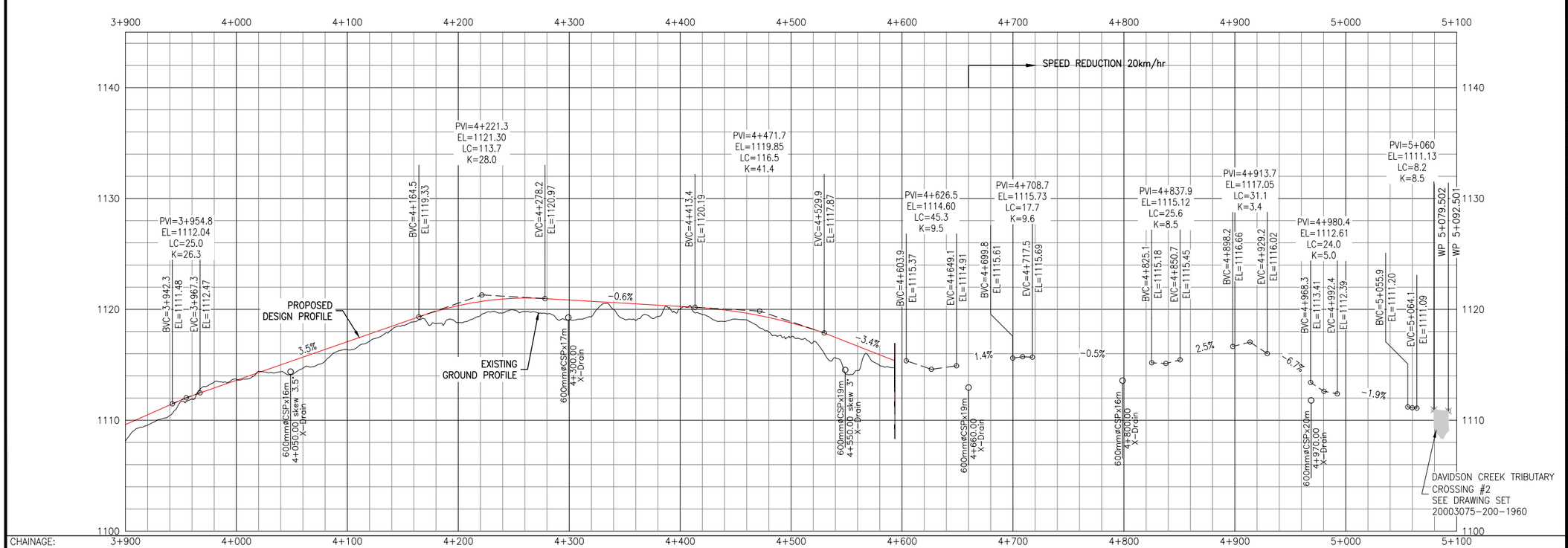
1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

BAR SCALES:

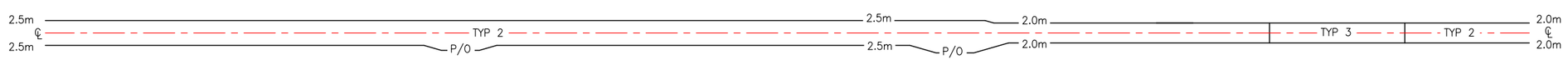
H:1:4000 — 0 — 80 — 160 m

V: 1:400 — 0 — 8 — 16 m

PRELIMINARY
NOT FOR CONSTRUCTION



ROAD TYPICAL:



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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN: TMM	DATE: 21/01/11
PROJECT NO:	2003569	DSGN: CC	DATE: 13/09/13
DRAWING SIZE:	11x17	CHKD: JDS	DATE: -
SCALE:	1:4000	APVD: JDS	DATE: -

PROJECT:

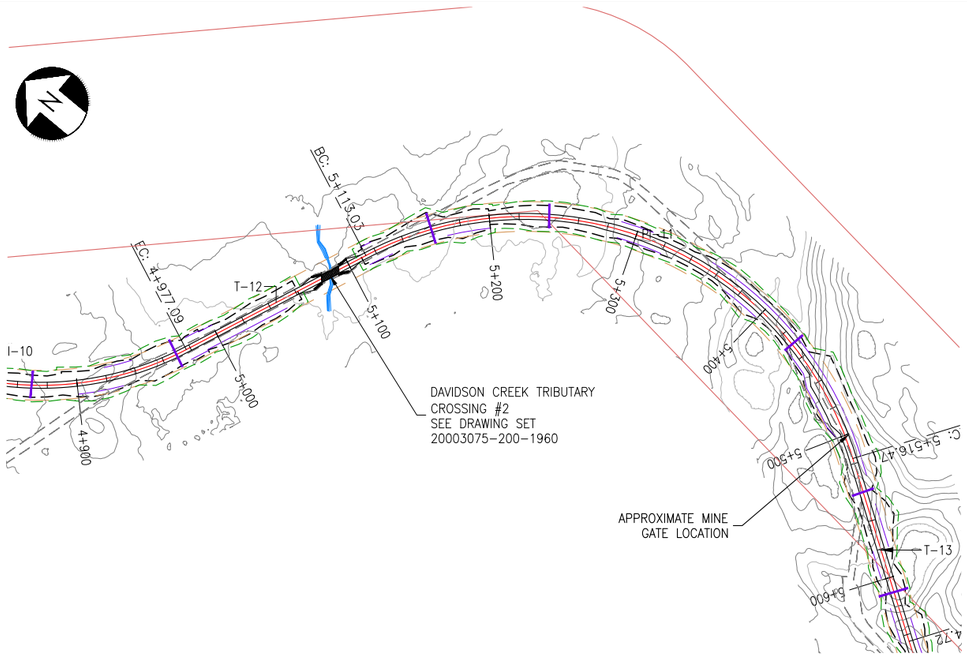
BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

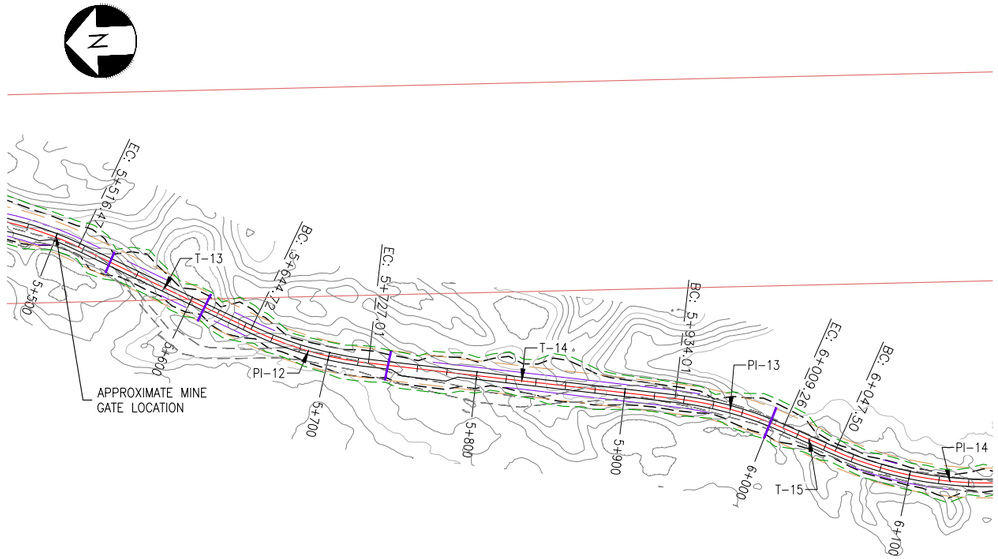
TITLE:

PROPOSED PLAN AND PROFILE km 4+000 to km 5+000

DWG NO: **2003569-200-1920-204** REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PG\2020\2003569 Atremis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 13092\2003569-200-1920_210111 | Layout: 204 | Paper Size: 558.8mm x 431.8mm





BAR SCALES:

H:1:4000 — 0 — 80 — 160 m

V: 1:400 — 0 — 8 — 16 m

LEGEND:

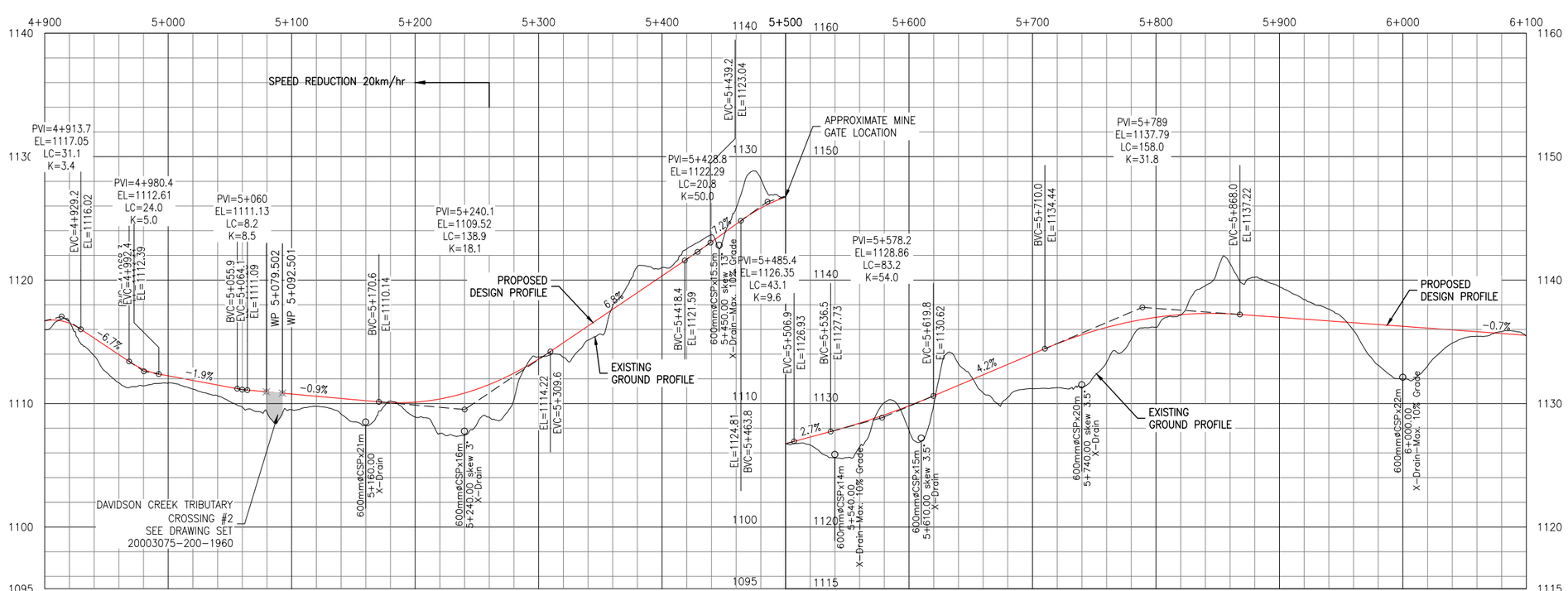
EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (8+000)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

NOTES:

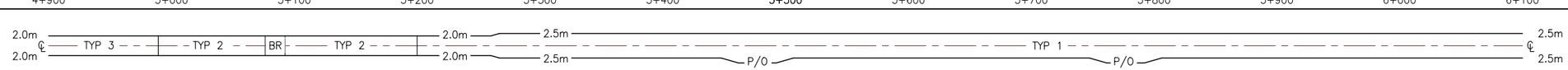
1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

PRELIMINARY
NOT FOR CONSTRUCTION



CHAINAGE: 4+900 5+000 5+100 5+200 5+300 5+400 5+500 5+600 5+700 5+800 5+900 6+000 6+100

ROAD TYPICAL:



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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

CLIENT NO:	-	DRWN:	TMM	DATE: 21/01/11
PROJECT NO:	2003569	DSGN:	CC	DATE: 13/09/13
DRAWING SIZE:	11x17	CHKD:	JDS	DATE: -
SCALE:	1:4000	APVD:	JDS	DATE: -

PROJECT:

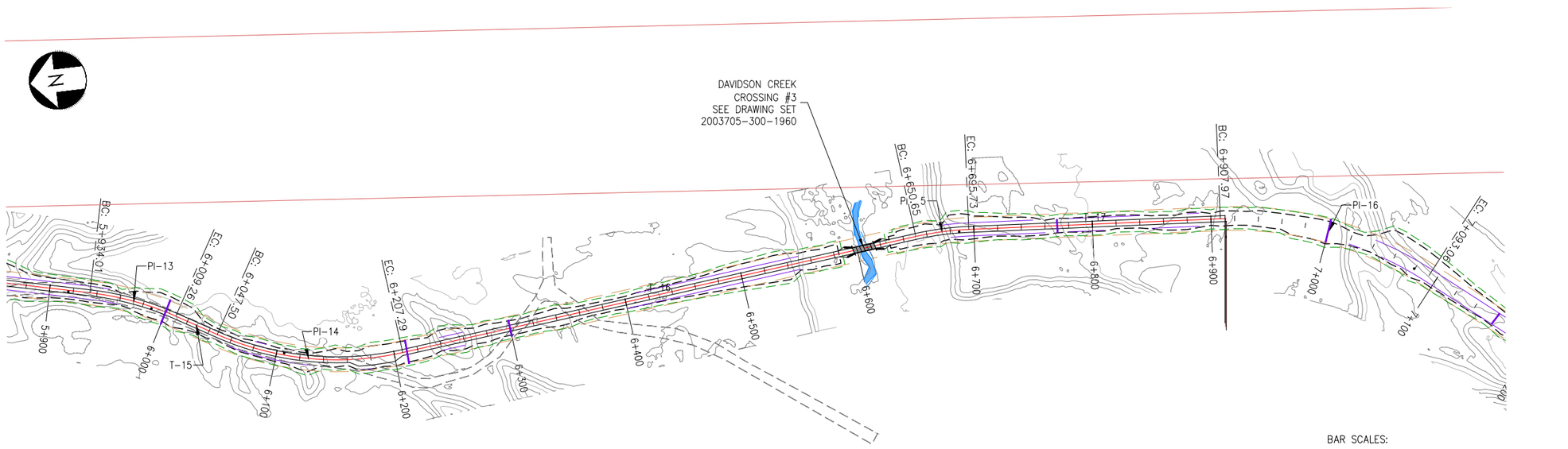
BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

PROPOSED PLAN AND PROFILE km 5+000 to km 6+000

DWG NO: **2003569-200-1920-205** REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GIP\2020_PO\2020\2003569 Artemis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 13092\2003569-200-1920_210111 | Layout: 205 | Paper Size: 558.8mm x 431.8mm



BAR SCALES:

H:1:4000 — 0 — 80 — 160 m

V: 1:400 — 0 — 8 — 16 m

LEGEND:

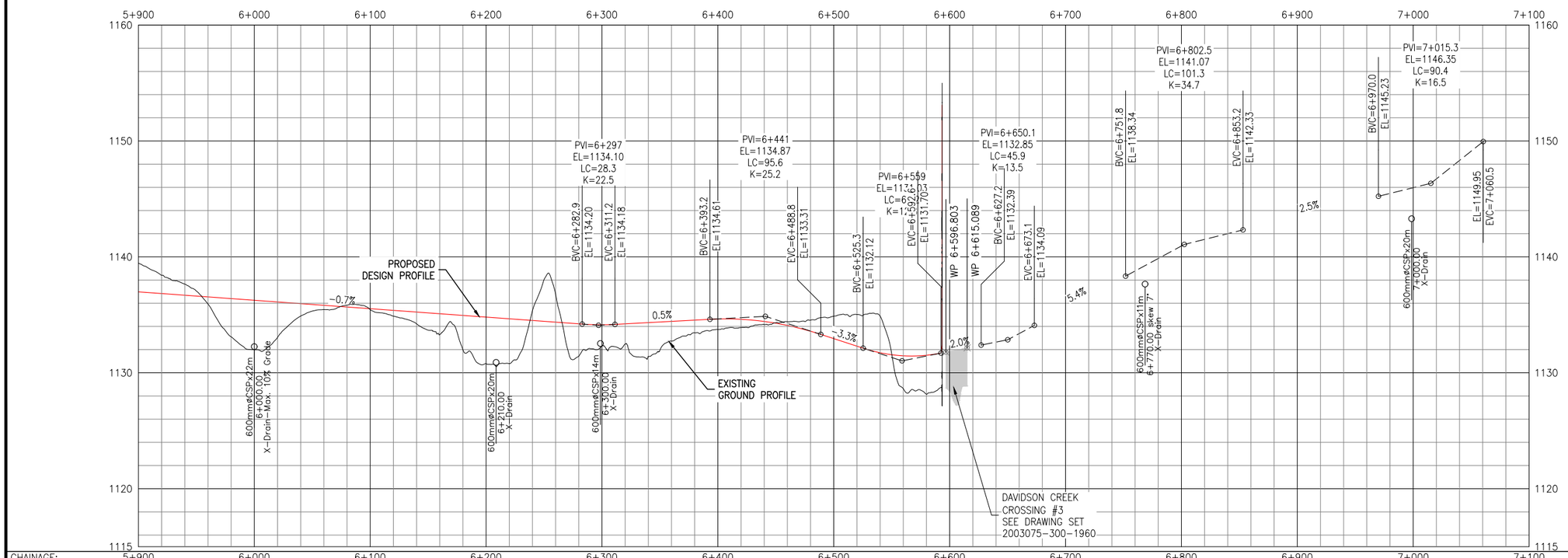
EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (8+000)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

NOTES:

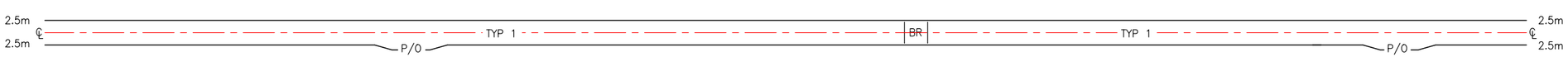
1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

PRELIMINARY
NOT FOR CONSTRUCTION



CHAINAGE: 5+900 6+000 6+100 6+200 6+300 6+400 6+500 6+600 6+700 6+800 6+900 7+000 7+100

ROAD TYPICAL:



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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN:	TMM	DATE:	21/01/11
PROJECT NO:	2003569	DSGN:	CC	DATE:	13/09/13
DRAWING SIZE:	11x17	CHKD:	JDS	DATE:	-
SCALE:	1:4000	APVD:	JDS	DATE:	-

PROJECT:

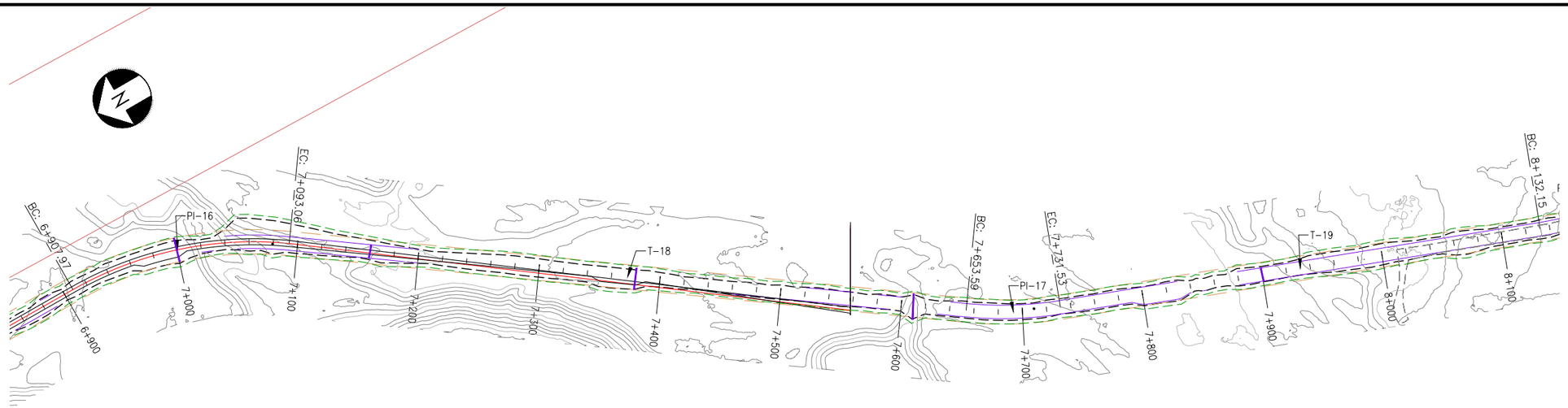
BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

PROPOSED PLAN AND PROFILE km 6+000 to km 7+000

DWG NO: **2003569-200-1920-206** REV: **A**

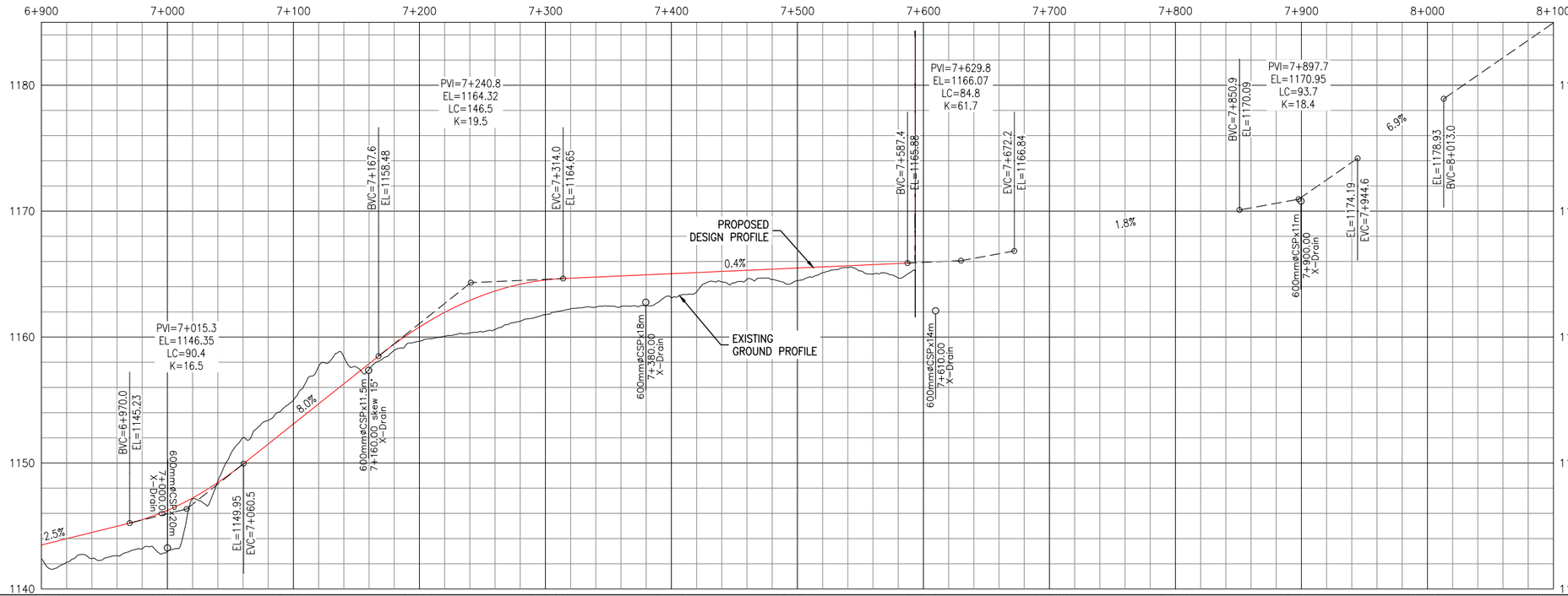
Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PG\2020\2003569 Atremis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 13092\2003569-200-1920_210111 | Layout: 206 | Paper Size: 558.8mm x 431.8mm



BAR SCALES:

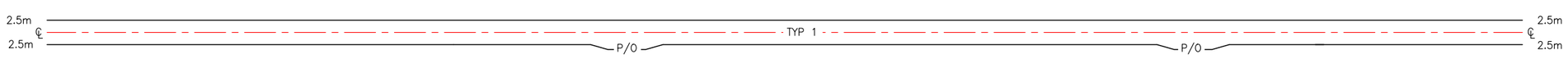
H: 1:4000 — 0 — 80 — 160 m

V: 1:400 — 0 — 8 — 16 m



CHAINAGE: 6+900 7+000 7+100 7+200 7+300 7+400 7+500 7+600 7+700 7+800 7+900 8+000 8+100

ROAD TYPICAL:



LEGEND:

EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (8+000)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

NOTES:

1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

PRELIMINARY
NOT FOR CONSTRUCTION

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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN:	TMM	DATE:	21/01/11
PROJECT NO:	2003569	DSGN:	CC	DATE:	13/09/13
DRAWING SIZE:	11x17	CHKD:	JDS	DATE:	-
SCALE:	1:4000	APVD:	JDS	DATE:	-

PROJECT:

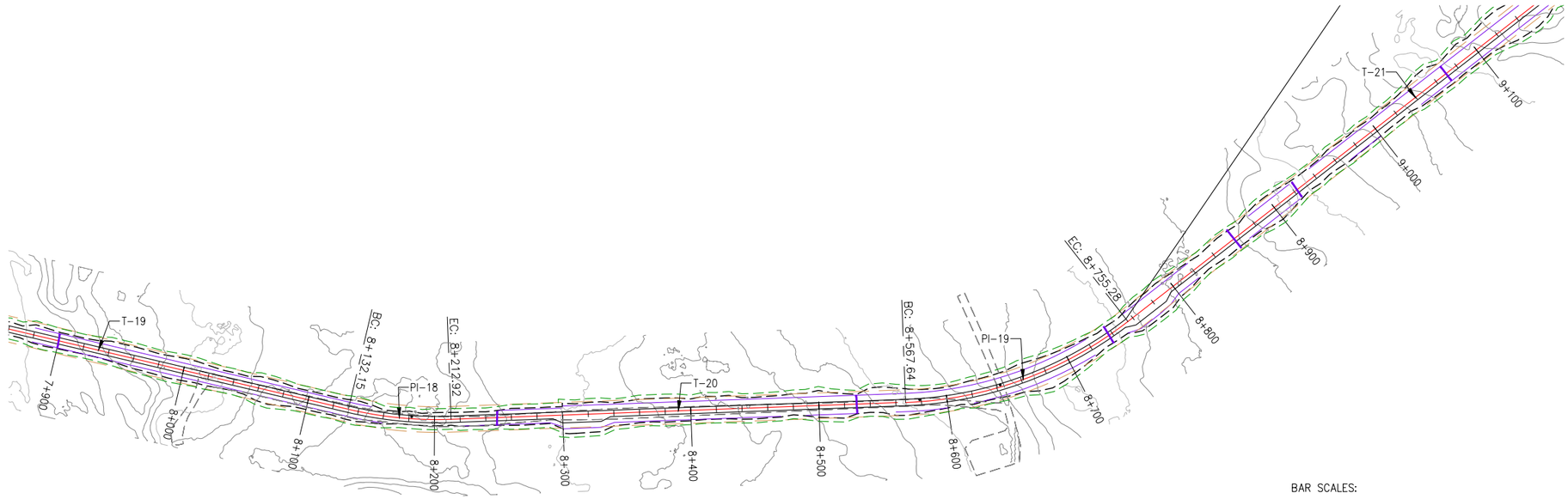
BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

PROPOSED PLAN AND PROFILE km 7+000 to km 8+000

DWG NO: **2003569-200-1920-207** REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PG\2020\2003569 Artemis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 13092\2003569-200-1920_210111 | Layout: 207 | Paper Size: 558.8mm x 431.8mm



LEGEND:

EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (8+000)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

NOTES:

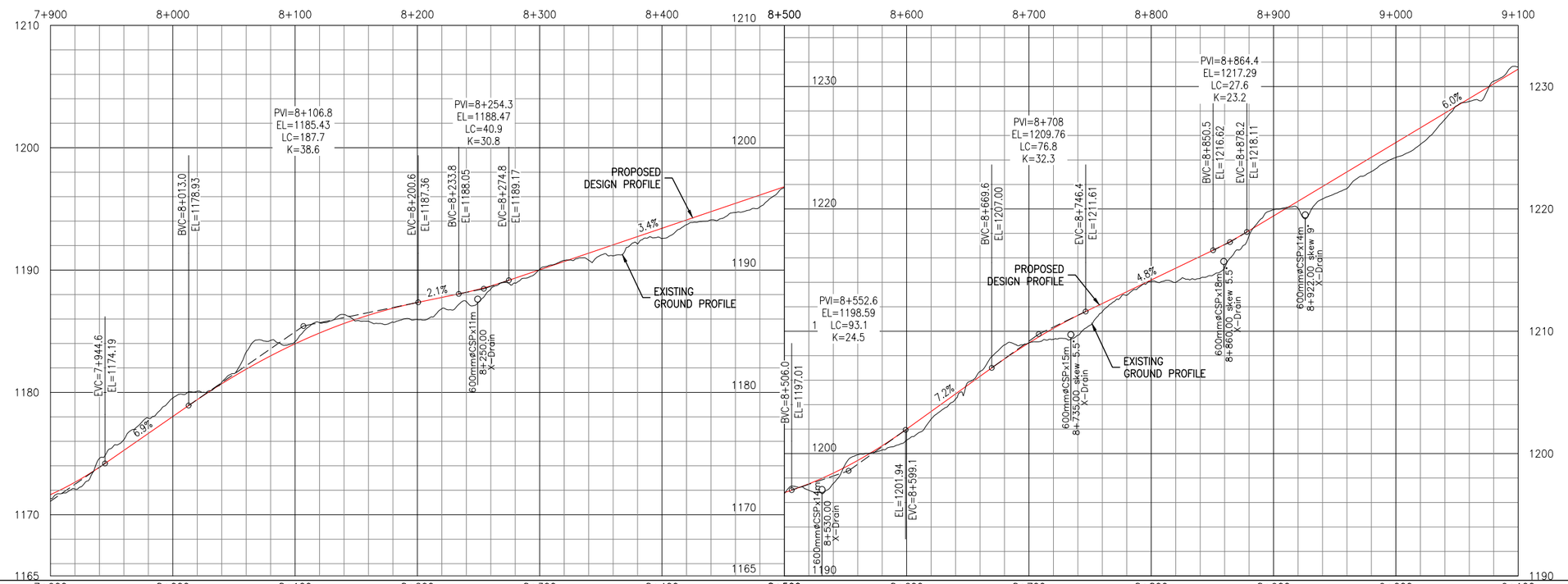
1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

BAR SCALES:

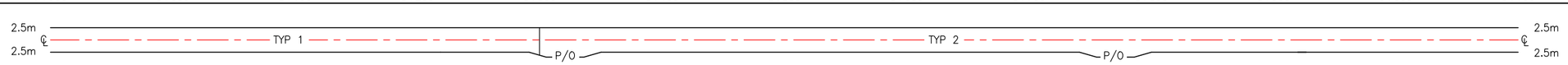
H:1:4000 — 0 — 80 — 160 m

V: 1:400 — 0 — 8 — 16 m

PRELIMINARY
NOT FOR CONSTRUCTION



ROAD TYPICAL:



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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN:	TMM	DATE:	21/01/11
PROJECT NO:	2003569	DSGN:	CC	DATE:	13/09/13
DRAWING SIZE:	11x17	CHKD:	JDS	DATE:	-
SCALE:	1:4000	APVD:	JDS	DATE:	-

PROJECT:

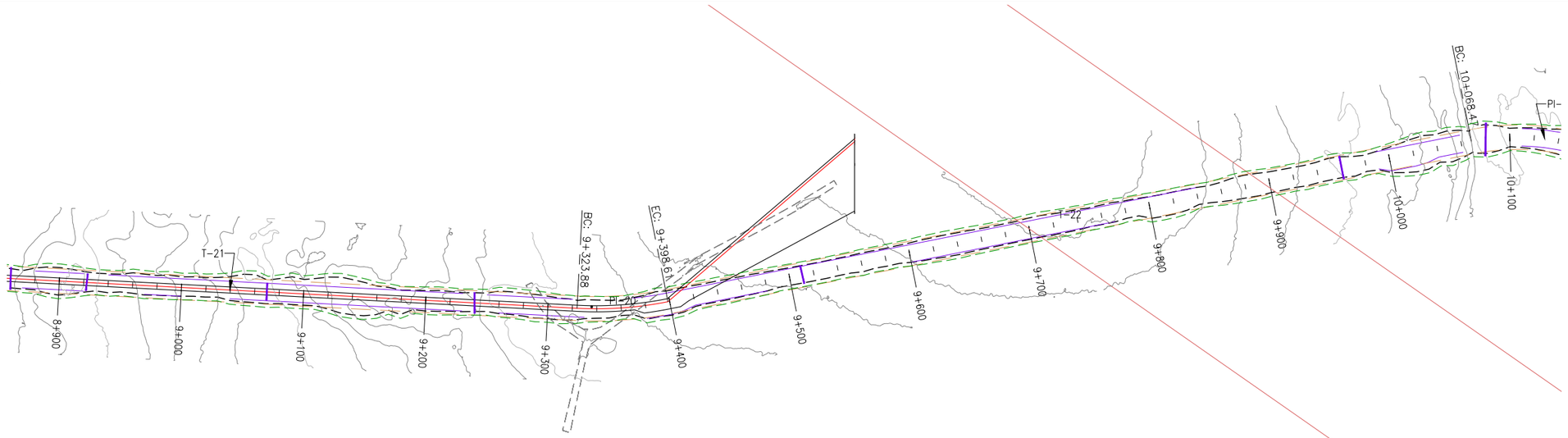
BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

PROPOSED PLAN AND PROFILE km 8+000 to km 9+000

DWG NO: **2003569-200-1920-208** REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PO\2020\2003569 Artemis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PO0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 13092\2003569-200-1920_210111 | Layout: 208 | Paper Size: 558.8mm x 431.8mm



LEGEND:

EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (8+000)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

NOTES:

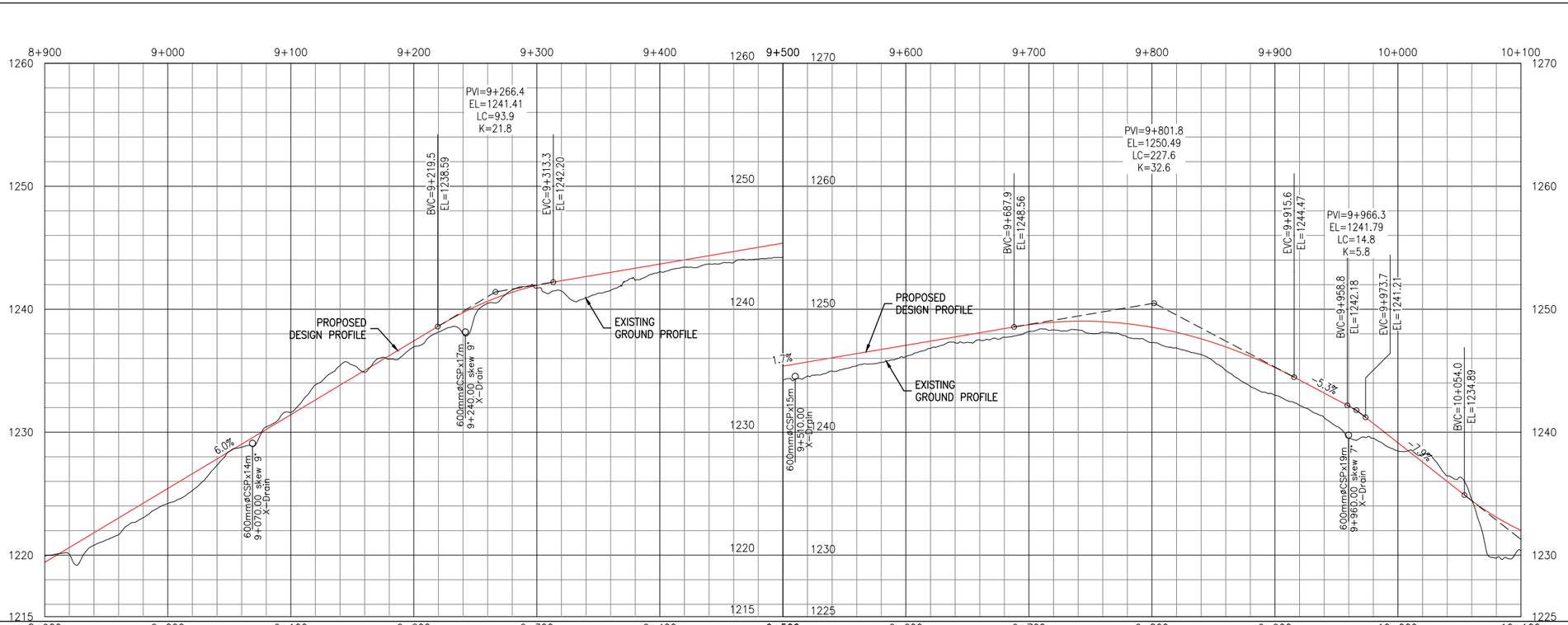
1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

BAR SCALES:

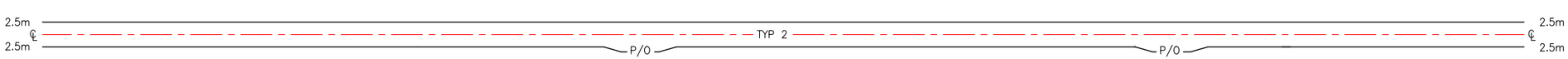
H: 1:4000 — 0 — 80 — 160 m

V: 1:400 — 0 — 8 — 16 m

PRELIMINARY
NOT FOR CONSTRUCTION



ROAD TYPICAL:



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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN: TMM	DATE:	21/01/11
PROJECT NO:	2003569	DSGN: CC	DATE:	13/09/13
DRAWING SIZE:	11x17	CHKD: JDS	DATE:	-
SCALE:	1:4000	APVD: JDS	DATE:	-

PROJECT:

BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

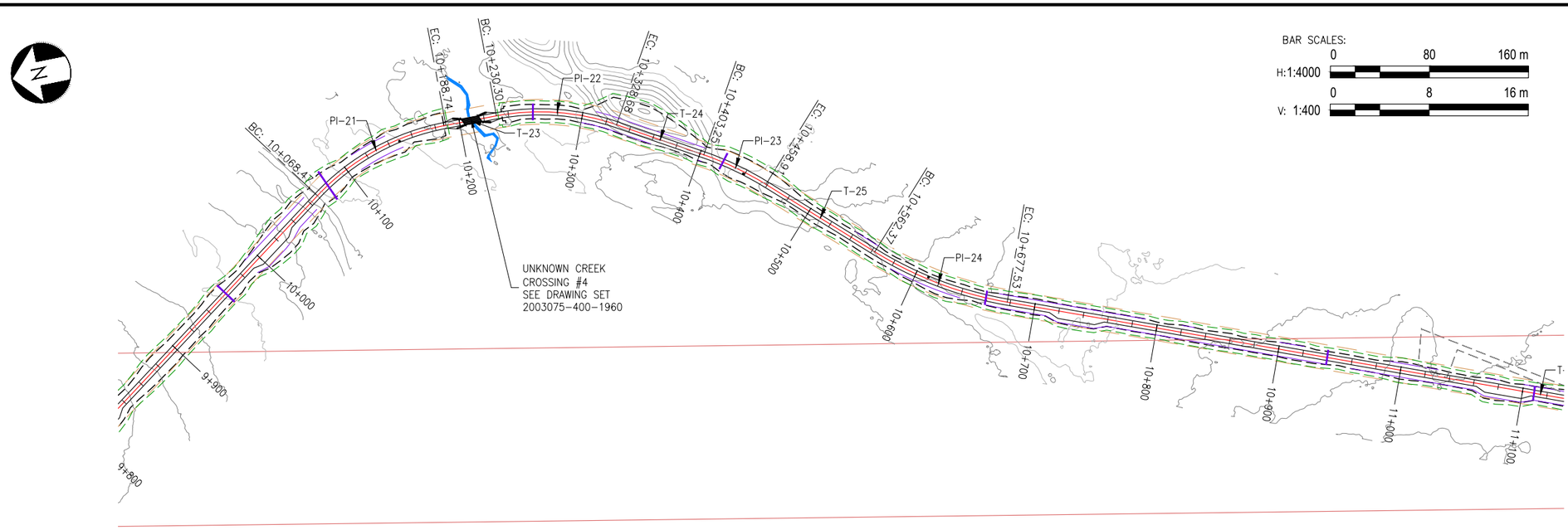
TITLE:

PROPOSED PLAN AND PROFILE km 9+000 to km 10+000

DWG NO: **2003569-200-1920-209**

REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GIP\2020_PO\2020\2003569 Artemis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PO0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 130921\2003569-200-1920_210111 | Layout: 209 | Paper Size: 558.8mm x 431.8mm



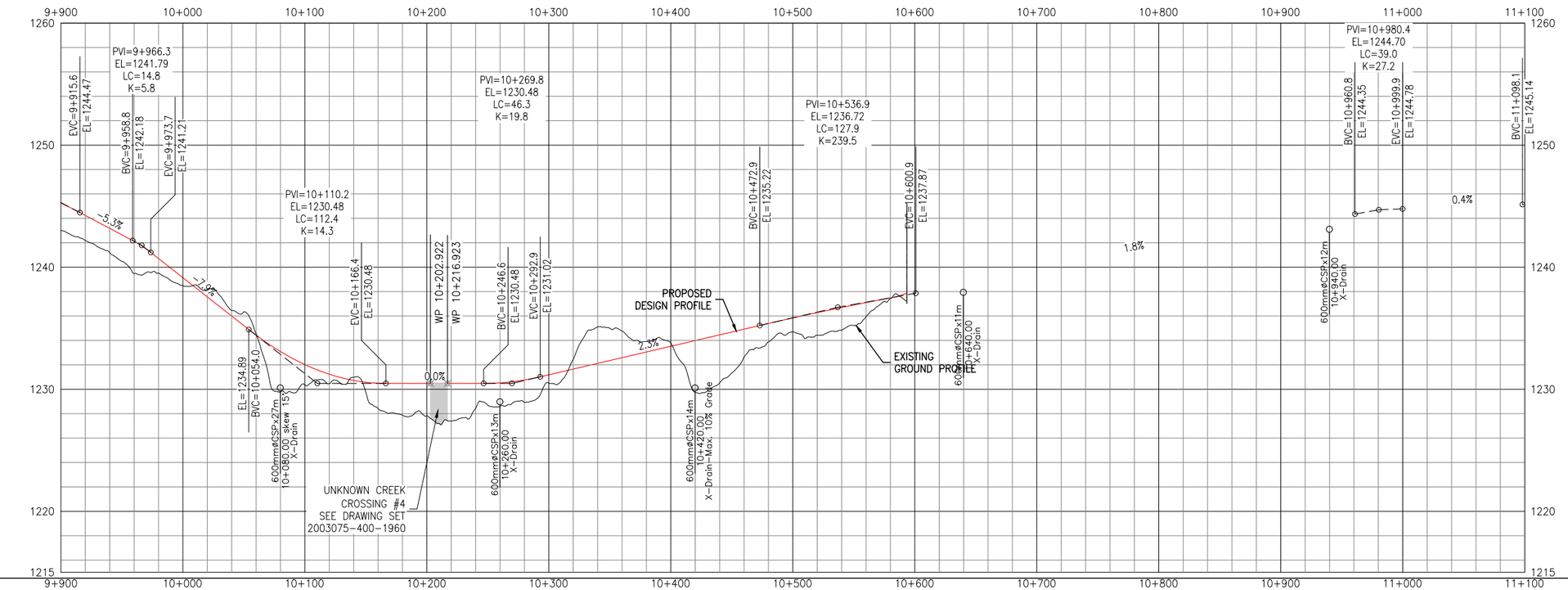
LEGEND:

EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (8+000)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

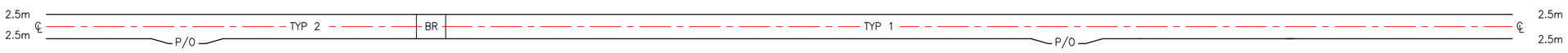
NOTES:

1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.



CHAINAGE: 9+900 10+000 10+100 10+200 10+300 10+400 10+500 10+600 10+700 10+800 10+900 11+000 11+100

ROAD TYPICAL:



PRELIMINARY
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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN:	TMM	DATE:	21/01/11
PROJECT NO:	2003569	DSGN:	CC	DATE:	13/09/13
DRAWING SIZE:	11x17	CHKD:	JDS	DATE:	-
SCALE:	1:4000	APVD:	JDS	DATE:	-

PROJECT:

BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

PROPOSED PLAN AND PROFILE km 10+000 to km 11+000

DWG NO: **2003569-200-1920-210** REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PG\2020\2003569 Atremis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 13092\2003569-200-1920_210111 | Layout: 210 | Paper Size: 558.8mm x 431.8mm

LEGEND:

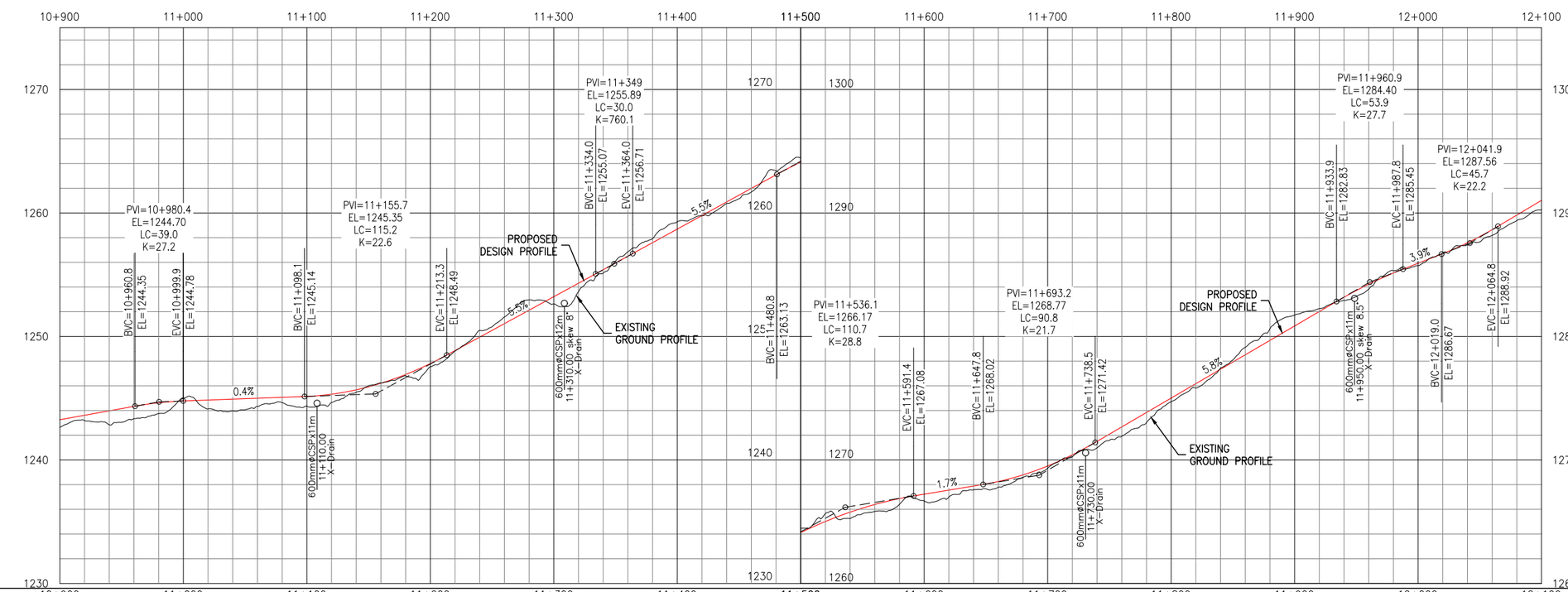
EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

NOTES:

1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

PRELIMINARY
NOT FOR CONSTRUCTION



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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN:	TMM	DATE:	21/01/11
PROJECT NO:	2003569	DSGN:	CC	DATE:	13/09/13
DRAWING SIZE:	11x17	CHKD:	JDS	DATE:	-
SCALE:	1:4000	APVD:	JDS	DATE:	-

PROJECT:

BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

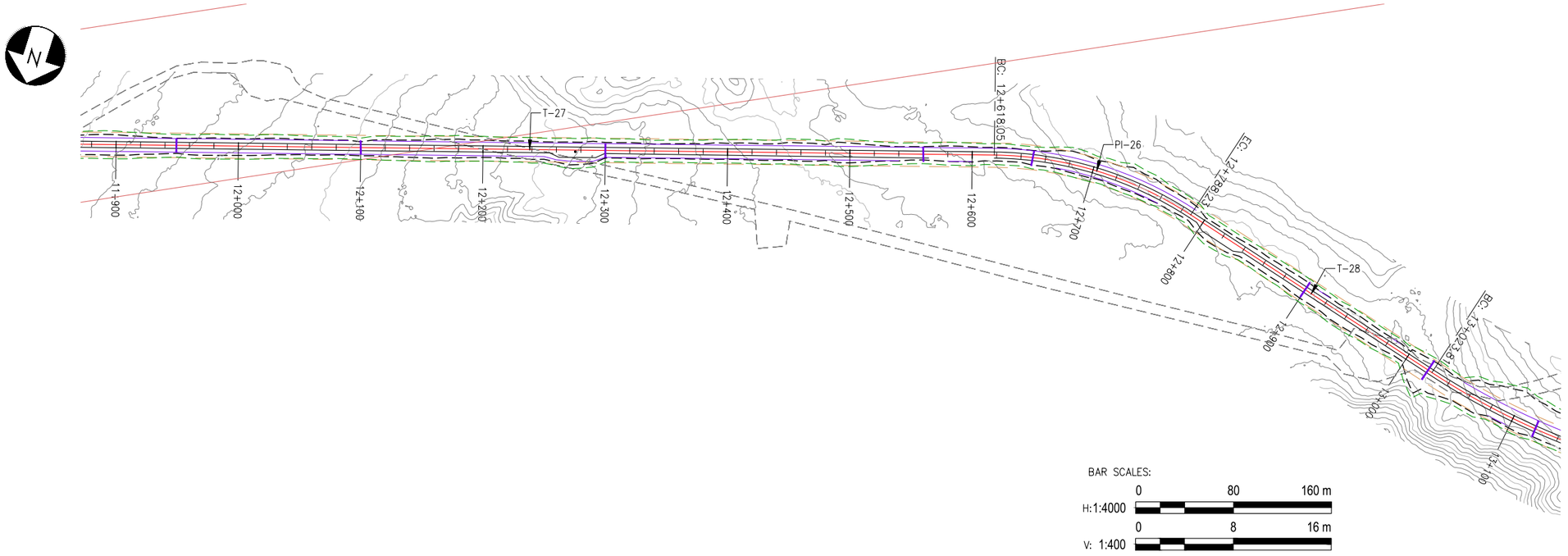
TITLE:

PROPOSED PLAN AND PROFILE km 11+000 to km 12+000

DWG NO: **2003569-200-1920-211**

REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PG\2020\2003569 Artemis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13P.G0040 New Gold\Mine Access Road\Red Deer Design\Design Drawings\Revised 13092\2003569-200-1920_210111 | Layout: 211 | Paper Size: 558.8mm x 431.8mm



BAR SCALES:

H:1:4000 0 80 160 m

V: 1:400 0 8 16 m

LEGEND:

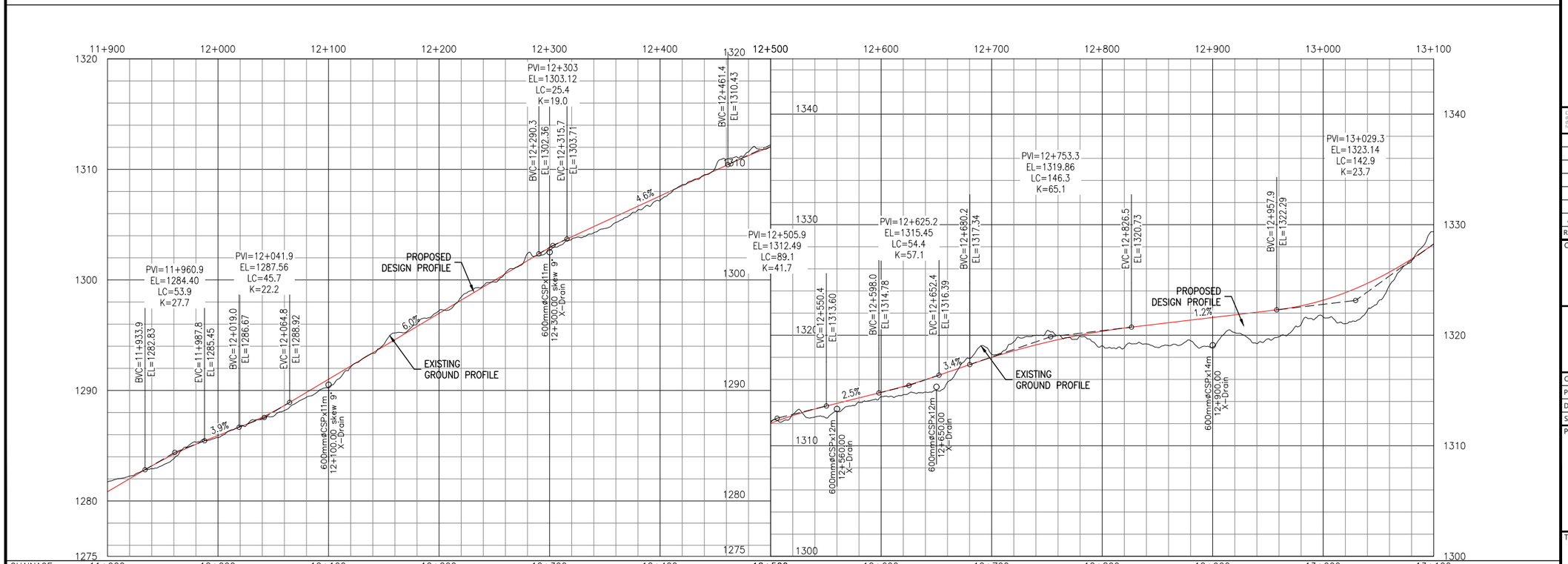
EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED
- DESIGN CENTERLINE (8+000)
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

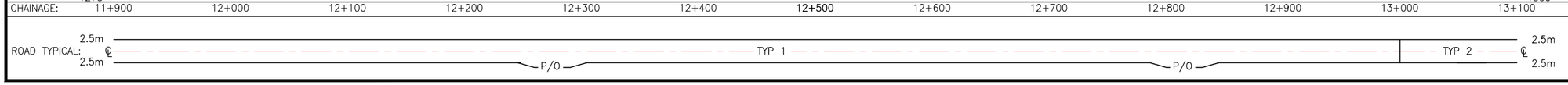
NOTES:

1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

PRELIMINARY
NOT FOR CONSTRUCTION



CHAINAGE: 11+900 12+000 12+100 12+200 12+300 12+400 12+500 12+600 12+700 12+800 12+900 13+000 13+100



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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

Allnorth

CLIENT NO:	-	DRWN:	TMM	DATE: 21/01/11
PROJECT NO:	2003569	DSGN:	CC	DATE: 13/09/13
DRAWING SIZE:	11x17	CHKD:	JDS	DATE: -
SCALE:	1:4000	APVD:	JDS	DATE: -

PROJECT:

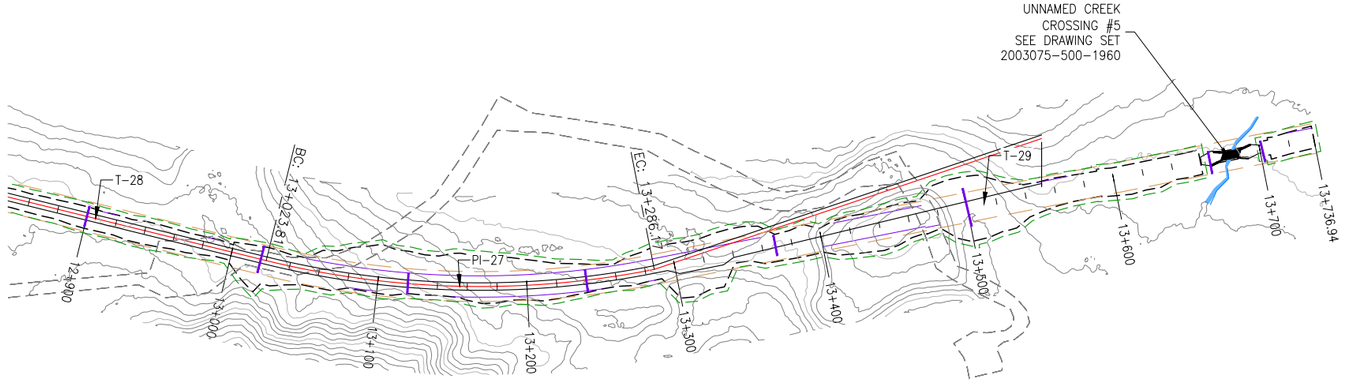
BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

PROPOSED PLAN AND PROFILE km 12+000 to km 13+000

DWG NO: **2003569-200-1920-212** REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PO\2020\2003569 Artemis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 13092\2003569-200-1920_210111 | Layout: 212 | Paper Size: 558.8mm x 431.8mm



MATERIAL AND VOLUME SUMMARY m3

TOTAL 0+000.00 TO 13+736.94	HIGH FINES SURFACING	15499
	WELL GRADED BASE COURSE	26675
	SELECT GRANULAR SUBBASE	48591
	COMMON EXCAVATION	106153
	EMBANKMENT FILL (factored 1.13)	87284
	STRIPPING	64354
	BORROW	14694
	WASTE	34993

NOTE: UNLESS OTHERWISE SPECIFIED, QUANTITIES ARE REPORTED AS NEAT (COMPACTED) VOLUME

LEGEND:

EXISTING
- CENTERLINE
- ROAD EDGE
- POWERLINE BDY
- WATER EDGE
- MAJOR CREEKS

PROPOSED (8+000)
- DESIGN CENTERLINE
- ROAD SHOULDERS
- DITCHLINE
- DAYLIGHT LINES
- CLEARING LIMITS
- 20m ROW
- CULVERT

NOTES:

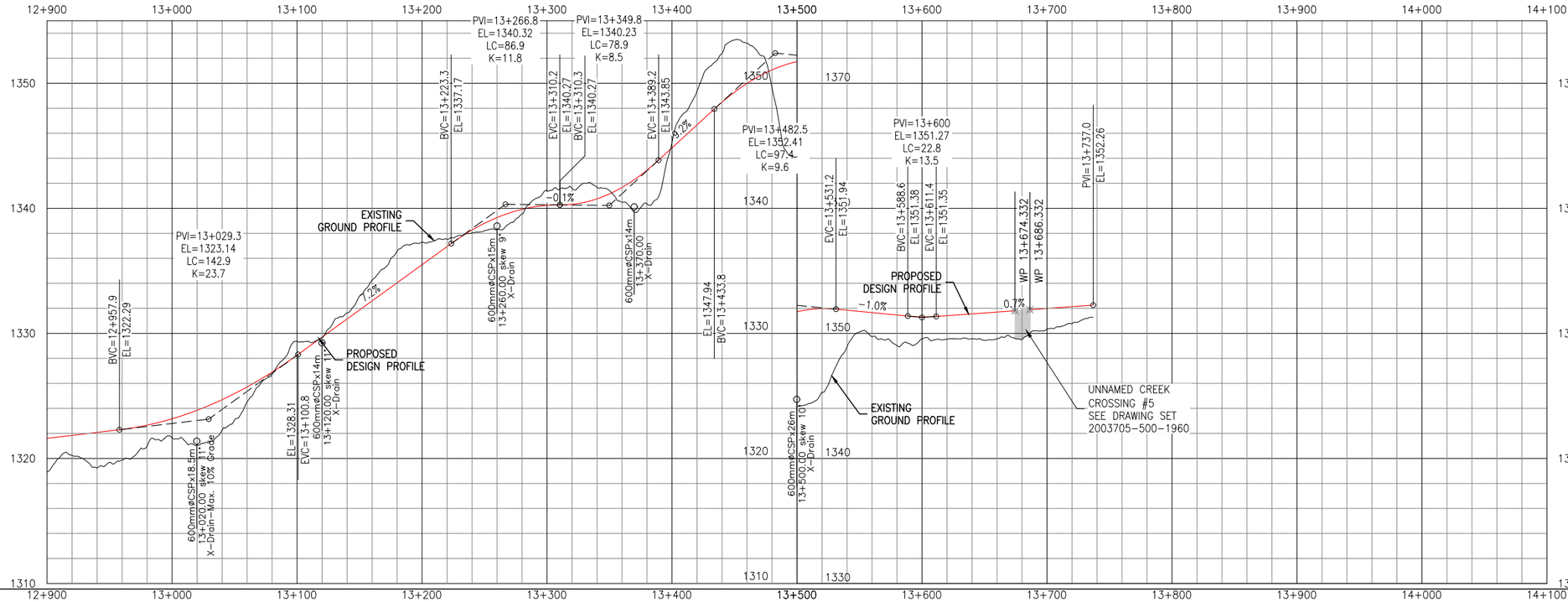
1. DESIGN SPEED IS 40km/hr WITH 20km/hr SPEED REDUCTIONS.

BAR SCALES:

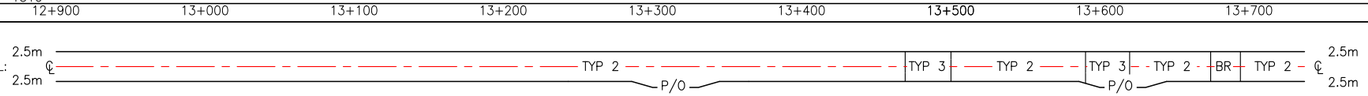
H:1:4000 — 0 — 80 — 160 m

V: 1:400 — 0 — 8 — 16 m

PRELIMINARY
NOT FOR CONSTRUCTION



ROAD TYPICAL:



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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
A	21/01/29	ISSUED FOR REVIEW	TMM	JDS

CLIENT:

CLIENT NO:	-	DRWN: TMM	DATE: 21/01/11
PROJECT NO:	2003569	DSGN: CC	DATE: 13/09/13
DRAWING SIZE:	11x17	CHKD: JDS	DATE: -
SCALE:	1:4000	APVD: JDS	DATE: -

PROJECT:

BLACKWATER PROJECT
PROPOSED MINE ACCESS ROAD

TITLE:

PROPOSED PLAN AND PROFILE km 13+000 to km 13+736.94

DWG NO: **2003569-200-1920-213**

REV: **A**

Date: 2021/01/29 | User: Teena Major | File: P:\GP\2020_PG\2020\2003569 Artemis Gold MAR Design\1000-Dwgs\1011-Civil\Data from 13PG0040 New Gold\Mine Access Road\Red Deer Design\Design Drawing\Revised 13092\2003569-200-1920_210111 | Layout: 213 | Paper Size: 558.8mm x 431.8mm

ARTEMIS
GOLD INC

BLACKWATER PROJECT
MINE ACCESS ROAD
DAVIDSON CREEK
CROSSING #3

DRAWING LIST		
DRAWING NO	**DRAWING TITLE**	**REVISION**
2003075-300-1960-001	SITE PLAN, PROFILES, SECTIONS AND NOTES	0
2003075-300-1960-002	GENERAL ARRANGEMENT AND BRIDGE PROFILE	0
2003075-300-1960-003	ABUTMENT ELEVATION AND NOTES	0

<original signed by>

REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

Allnorth

DESCRIPTION: ISSUED FOR CONSTRUCTION
ISSUE DATE: 20/11/17

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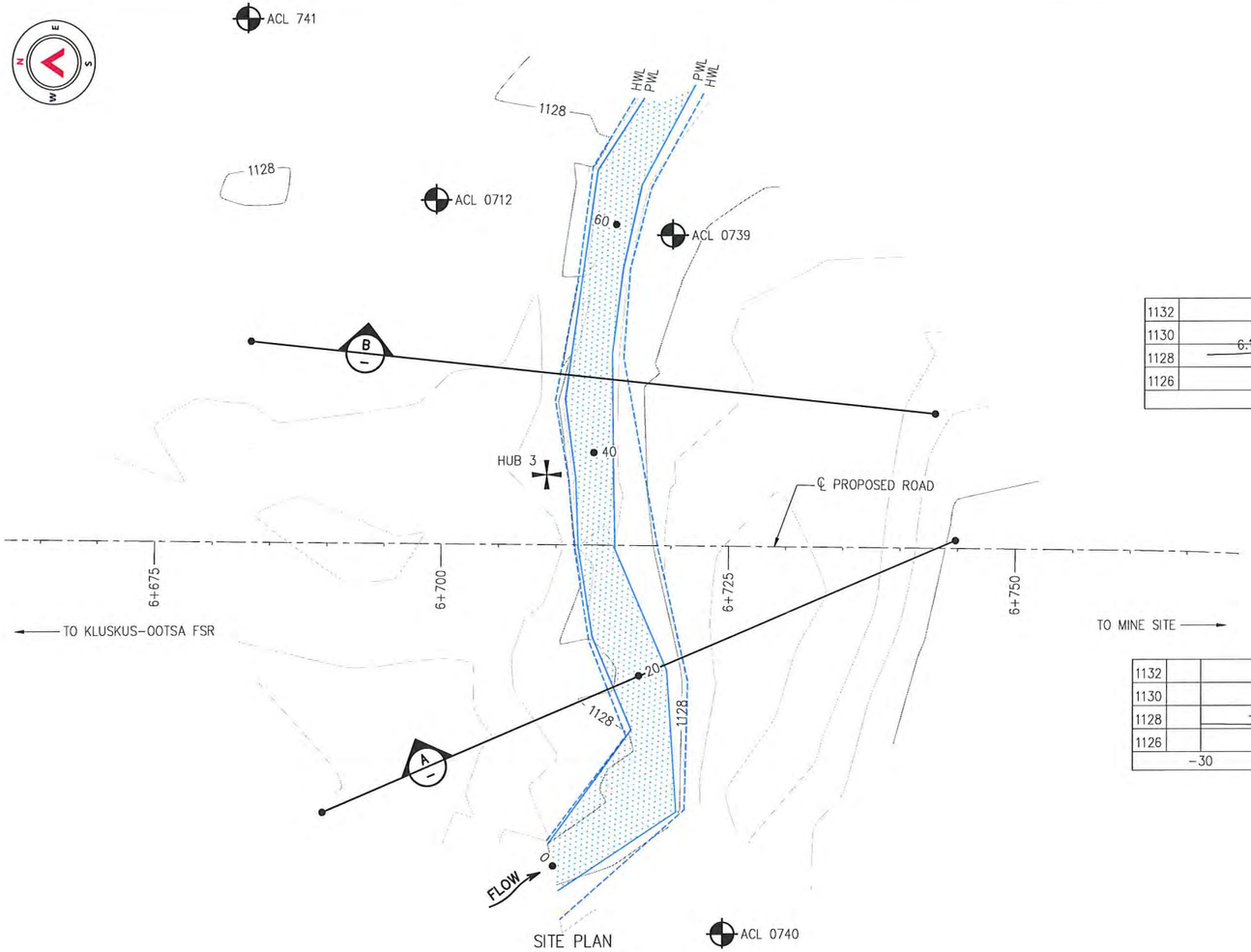
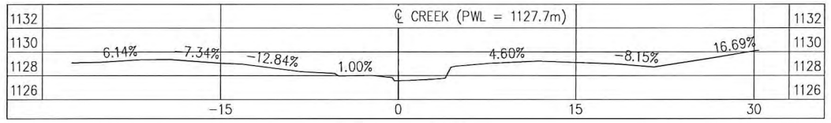
CLIENT NO:	-	DRWN:	SN	DATE:	20/11/09
PROJECT NO:	2003075	DSGN:	SN	DATE:	20/11/09
DRAWING SIZE:	ANSI "B"	CHKD:	AZH	DATE:	20/11/10
SCALE:	AS NOTED	APVD:	SPF	DATE:	20/11/17
DWG NO: 2003075-300-1960-00T				REV:	0

Date: 2020/11/17 | User: Stefanie Neack | File: P:\PO\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #3\2003075-300-1960.SP | Layout: 00T | Paper Size: 863.6mm x 558.8mm

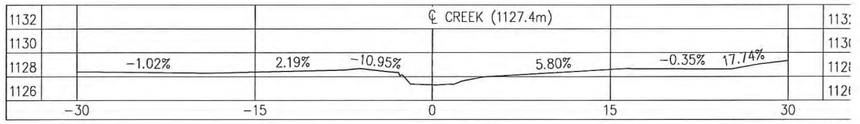


SITE PLAN
SCALE: 1:500

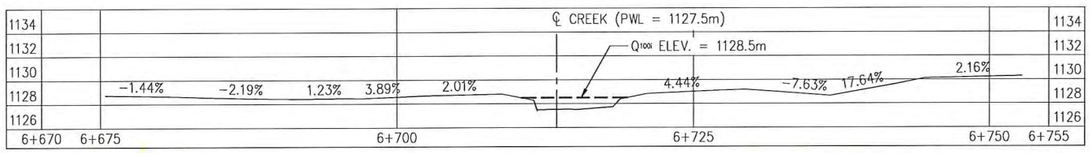
SURVEY INFORMATION			
DESCRIPTION	NORTHING	EASTING	ELEVATION
ACL 741	5900174.074	378965.136	1128.175
ACL 0712	5900156.810	378950.250	1128.069
ACL 0739	5900136.105	378948.217	1128.106
ACL 0740	5900128.584	378887.878	1129.607
HUB 3	5900145.947	378926.883	1128.827



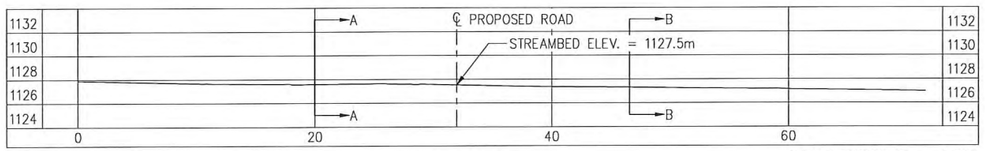
SECTION A
SCALE: 1:500



SECTION B
SCALE: 1:500



PROPOSED ROAD PROFILE
SCALE: 1:500



AVERAGE GRADIENT = -1.28%

CREEK PROFILE
SCALE: 1:500

SITE/SURVEY NOTES:

1. SITEPLAN WAS COMPLETED ON: 2012/10/18
2. SURVEY DATA WAS ESTABLISHED USING NO DECLINATION.
3. SITE SURVEYOR: S. JACOBS
   SITE RODMAN: K. MOE
4. STREAM RIPARIAN CLASSIFICATION: S3
5. DOMINANT RIPARIAN DESCRIPTION: SPRUCE-PINE
6. UTM COORDINATES: N5900140 E378921
7. HYDROLOGY:
   - DRAINAGE AREA: 48.5Km^2
   - ESTIMATED Q100 FLOW: 13.8m^3/s
   - ESTIMATED VELOCITY: 1.8m/s
8. SUGGESTED BRIDGE STRUCTURE:
   - SPAN: 18.286m
   - MINIMUM U/S GIRDER: 1130.543m
9. NO GEOTECHNICAL REPORT HAS BEEN COMPLETED TO DATE.

REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
		1
		2
		3
		4
		5
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<original signed by>

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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

CLIENT: ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN:	SN	DATE:	20/1109
PROJECT NO:	2003075	DSGN:	SN	DATE:	20/11/09
DRAWING SIZE:	ANSI "B"	CHKD:	AZH	DATE:	20/11/10
SCALE:	AS NOTED	APVD:	SPF	DATE:	20/11/17

PROJECT:

BLACKWATER PROJECT
MINE ACCESS ROAD
DAVIDSON CREEK
CROSSING #3

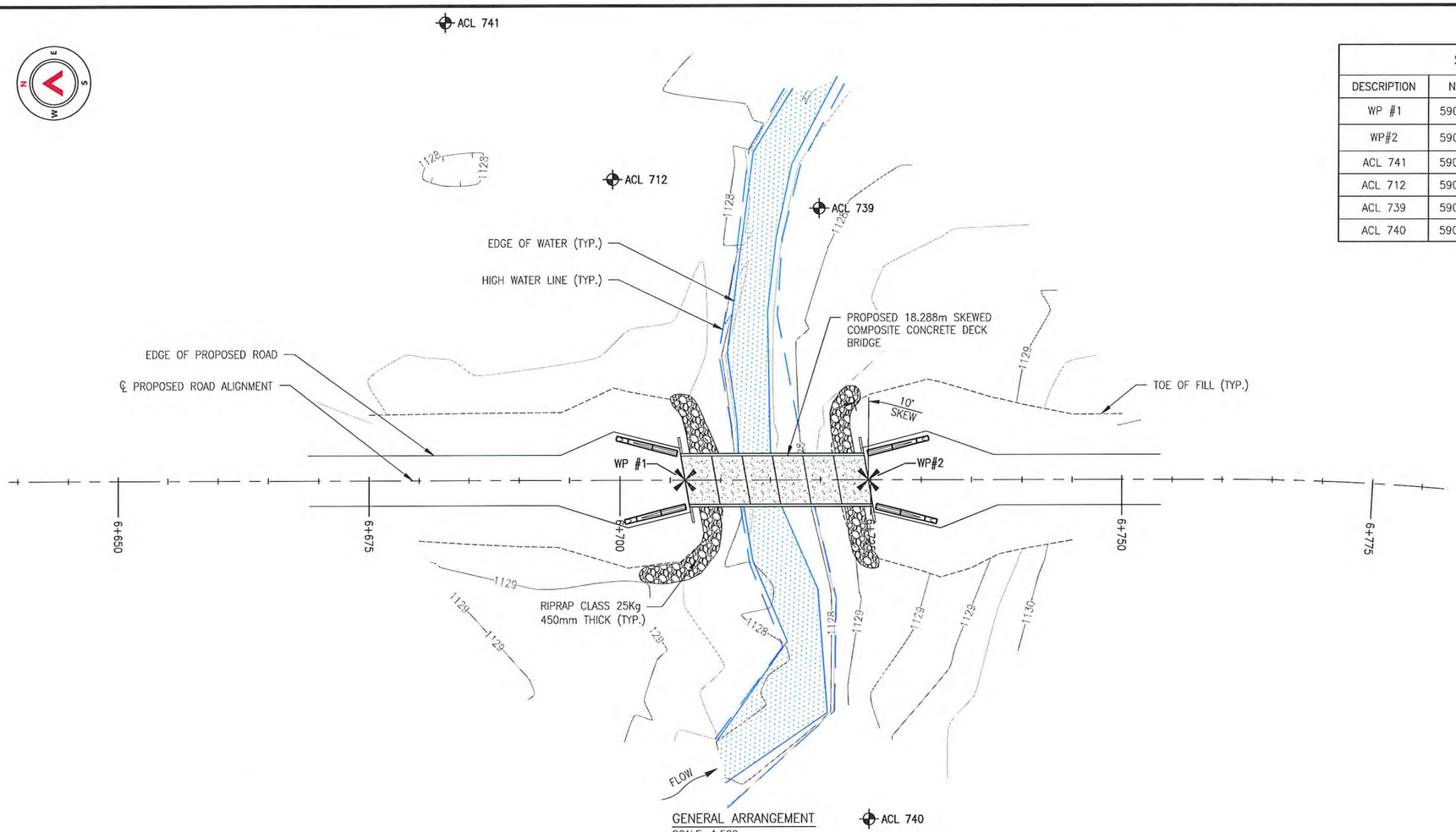
TITLE:

SITE PLAN, PROFILES, SECTIONS AND NOTES

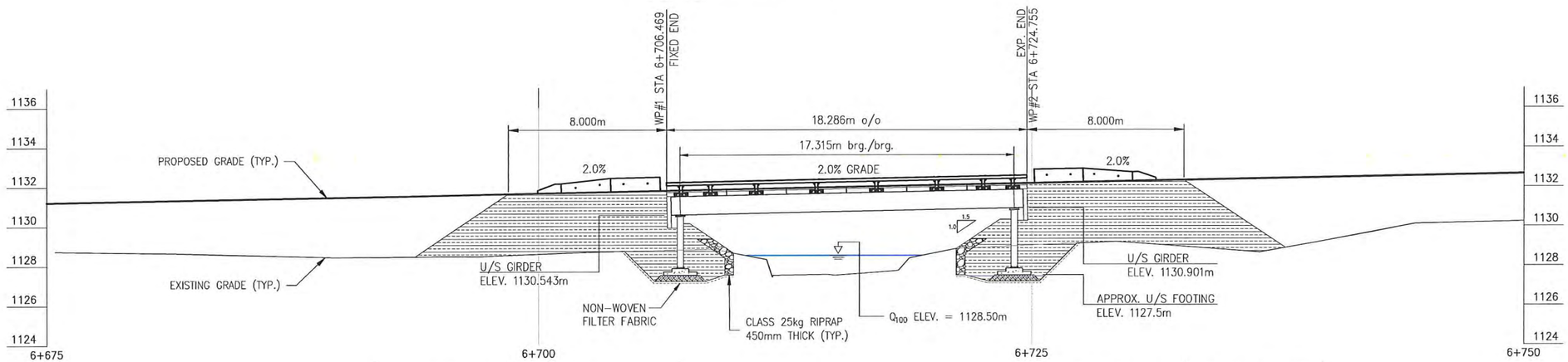
DWG NO: **2003075-300-1960-001**

REV: **0**

Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #3\2003075-300-1960 SP | Layout: 001 | Paper Size: 558.8mm x 431.8mm



GENERAL ARRANGEMENT
SCALE: 1:500



BRIDGE PROFILE
SCALE: 1:250

SURVEY CONTROL

DESCRIPTION	NORTHING	EASTING	ELEVATION
WP #1	5900148.355	378920.711	1131.787
WP#2	5900130.085	378921.471	1132.152
ACL 741	5900174.074	378965.136	1128.175
ACL 712	5900156.810	378950.250	1128.069
ACL 739	5900136.105	378948.217	1128.106
ACL 740	5900128.584	378887.878	1129.607

REFERENCE DRAWINGS

DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
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		2
		3
		4
		5
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REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	AZH	SPF

CLIENT: ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN: SN	DATE: 20/11/09
PROJECT NO:	2003075	DSGN: SN	DATE: 20/11/09
DRAWING SIZE:	ANSI "B"	CHKD: AZH	DATE: 20/11/10
SCALE:	AS NOTED	APVD: SPF	DATE: 20/11/17

PROJECT:

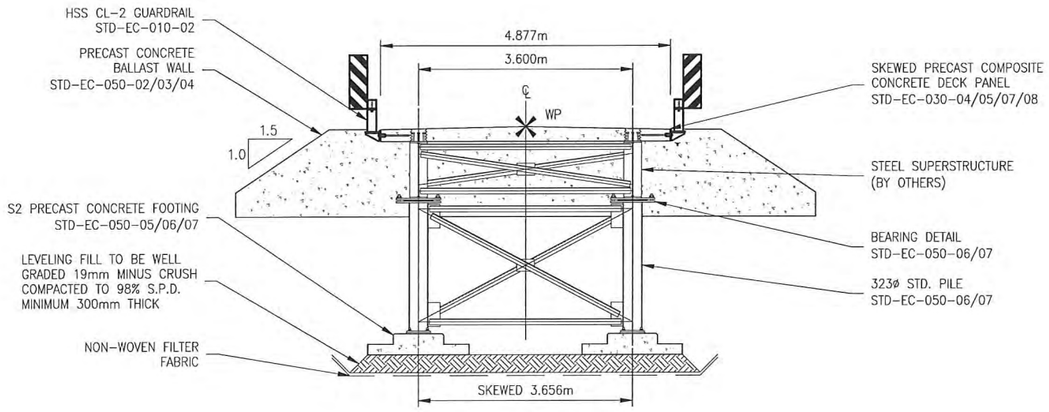
BLACKWATER PROJECT
MINE ACCESS ROAD
DAVIDSON CREEK
CROSSING #3

TITLE:

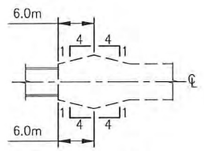
GENERAL ARRANGMENT AND BRIDGE PROFILE

DWG NO: **2003075-300-1960-002** REV: **0**

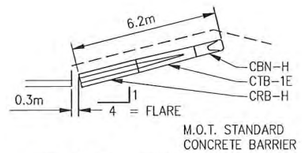
Date: 2020/11/17 1:10 PM | User: Stefanie Naack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #3\2003075-300-1960 GA | Layout: 002 | Paper Size: 558.8mm x 431.8mm



ABUTMENT ELEVATION
SCALE: 1:100



FLARE DETAIL
SCALE: 1:1000



PRECAST CONCRETE BARRIER DETAIL
SCALE: 1:250

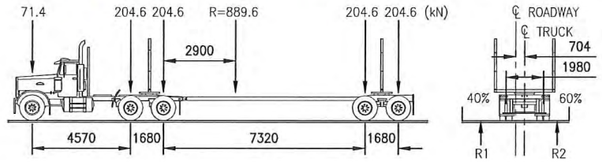
NOTES:

1. BACK FILL OF APPROACHES SHALL GENERALLY CONFORM TO THE LINES SHOWN ON THE DRAWINGS AND SHALL BE PLACED IN LIFTS NOT EXCEEDING 305mm THICK, COMPACTED TO 95% STANDARD PROCTOR DENSITY USING A MINIMUM 1000lbs VIBRATORY PLATE COMPACTOR. MATERIAL SHALL BE CLEAN, FREE DRAINING, WELL GRADED GRANULAR FILL OF 75mm MAXIMUM SIZE. LIFTS SHALL ALTERNATE BOTH WAYS AT EACH END OF THE BRIDGE TO ENSURE MINIMAL MOVEMENT.
2. NON-WOVEN FILTER FABRIC TO BE PLACED OVER EXCAVATION TO HAVE A MINIMUM CBR PUNCTURE STRENGTH OF 2300KN. FILTER FABRIC TO BE USED UNDER FOUNDATIONS.
3. ALL EXPOSED MINERAL SOILS TO BE SEEDED USING AN APPROVED RECLAMATION GRASS SEED MIXTURE AND COVERED WITH AN APPROVED EROSION CONTROL BLANKET.
4. THE CONTRACTOR IS TO CONTACT THE ENGINEER PRIOR TO PLACING FOUNDATIONS. FOUNDATIONS PLACEMENT SHALL BE SUPERVISED BY THE ENGINEER TO CONFIRM BEARING REQUIREMENTS.
5. ALL PERMITS AND REGULATORY APPROVALS TO BE IN PLACE PRIOR TO COMMENCING WORK.
6. ENVIRONMENTAL MANAGEMENT PLAN TO BE PREPARED FOR PROJECT BY OTHERS. COMPLETION OF WORKS TO COMPLY WITH MITIGATION RECOMMENDATIONS OUTLINED IN ENVIRONMENTAL MANAGEMENT PLAN.
7. NO SITE SPECIFIC GEOTECHNICAL INVESTIGATION HAS BEEN COMPLETED AS PART OF ALLNORTH CONSULTANTS LIMITED SCOPE OF WORK. THEREFORE, THIS DESIGN HAS BEEN PREPARED WITHOUT THE BENEFIT OF A SITE SPECIFIC GEOTECHNICAL FIELD INVESTIGATION OR GEOTECHNICAL ADVICE. GROUND CONDITIONS MAY VARY AND THE FOUNDATION REQUIREMENTS AND BRIDGE CONCEPT MAY NEED TO BE MODIFIED TO ACCOMMODATE ACTUAL SITE CONDITIONS ENCOUNTERED DURING CONSTRUCTION. ALLNORTH CONSULTANTS LIMITED ACCEPTS NO RESPONSIBILITY FOR ADDITIONAL COSTS OR DELAYS THAT MAY RESULT IF THE GROUND CONDITIONS VARY FROM THOSE ASSUMED IN THE DESIGN. THE DESIGN ENGINEER SHALL BE CONTACTED IF FIELD CONDITIONS VARY FROM THE DESIGN ASSUMPTIONS SHOWN ON THE DRAWINGS OR IN THE CONSTRUCTION SPECIFICATIONS. INSTALLATIONS OF FOUNDATIONS SHALL BE SUPERVISED BY THE DESIGN ENGINEER OR THEIR REPRESENTATIVE.
8. WHERE EXCAVATION SPECIFICATIONS ON THESE DRAWINGS CONFLICT WITH WORKSAFE BC (WSBC) REGULATIONS, WSBC REGULATIONS ARE TO GOVERN.
9. GENERAL ARRANGEMENT DRAWING. SOME STRUCTURE DETAIL NOT SHOWN. REFER TO FABRICATION DRAWINGS FOR FURTHER DETAIL PRIOR TO EXCAVATION AND INSTALLATION.
10. RIPRAP SPECIFICATIONS:

CLASS OF RIPRAP (kg.)	NOMINAL THICKNESS OF RIPRAP (mm)	ROCK GRADATION PERCENTAGE SMALLER THAN GIVEN ROCK MASS (kg)			APPROXIMATE AVERAGE DIMENSION (mm)		
		15%	50%	85%	15%	50%	85%
10	350	1	10	30	90	195	280
25	450	2.5	25	75	120	260	380
50	550	5	50	150	155	330	475
100	700	10	100	300	195	415	600
250	1000	25	250	750	260	565	815
500	1200	50	500	1500	330	715	1030

11. DESIGN LIFE: BRIDGE DESIGN LIFE: 45 YEARS

LOADING DIAGRAM L-100 OFF HIGHWAY G.V.W. = 90 680kg:
DESIGN IN ACCORDANCE WITH CAN/CSA-S6-14 WITH MODIFIED LOADING AS FOLLOWS:



REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
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REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	AZH	SPF

CLIENT:
ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN:	SN	DATE:	20/11/09
PROJECT NO:	2003075	DSGN:	SN	DATE:	20/11/09
DRAWING SIZE:	ANSI "B"	CHKD:	AZH	DATE:	20/11/10
SCALE:	AS NOTED	APVD:	SPF	DATE:	20/11/17

PROJECT:
BLACKWATER PROJECT
MINE ACCESS ROAD
DAVIDSON CREEK
CROSSING #3

TITLE:
ABUTMENT ELEVATION AND NOTES

DWG NO: **2003075-300-1960-003**
REV: **0**

Date: 2020/11/17 10:59 AM | User: Stefanie Noack | File: P:\PO\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #3\2003075-300-1960 GA | Layout: 003 | Paper Size: 558.8mm x 431.8mm

ARTEMIS GOLD INC

BLACKWATER PROJECT
MINE ACCESS ROAD
UNKNOWN CREEK
CROSSING #4

DRAWING LIST		
DRAWING NO	**DRAWING TITLE**	**REVISION**
2003075-400-1960-001	SITE PLAN, PROFILES, SECTIONS AND NOTES	0
2003075-400-1960-002	GENERAL ARRANGEMENT	0
2003075-400-1960-003	GENERAL NOTES AND SPECIFICATIONS	0

<original signed by>

REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

Allnorth

DESCRIPTION: ISSUED FOR CONSTRUCTION
ISSUE DATE: 20/11/17

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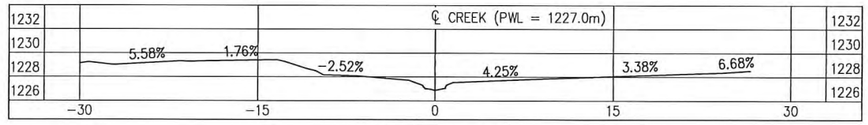
CLIENT NO:	-	DRWN:	JS	DATE:	20/11/12
PROJECT NO:	2003075	DSGN:	AZH	DATE:	20/11/12
DRAWING SIZE:	ANSI "B"	CHKD:	SPF	DATE:	20/11/12
SCALE:	AS NOTED	APVD:	SPF	DATE:	20/11/17

DWG NO: **2003075-400-1960-00T** REV: **0**

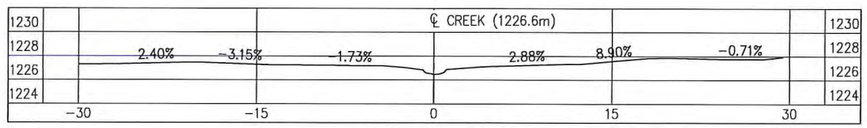
Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #4\2003075-400-1960 SP | Layout: 00T | Paper Size: 863.6mm x 558.8mm

SITE PLAN
SCALE: 1:500

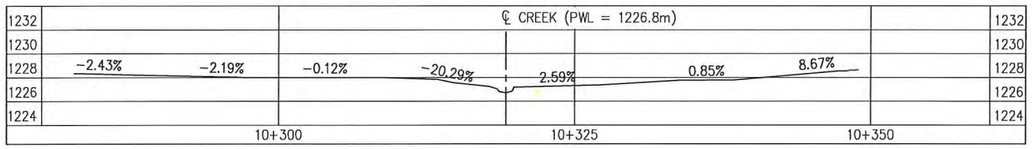
SURVEY INFORMATION			
DESCRIPTION	NORTHING	EASTING	ELEVATION
BM 051	5897014.973	378844.661	1226.303
BM 052	5896979.200	378841.103	1228.157
BM 053	5897014.381	378795.625	1228.118
BM 777	5897062.389	378870.320	1228.236
BM 888	5897089.715	378888.156	1227.018
BM 999	5897065.270	378906.115	1225.941



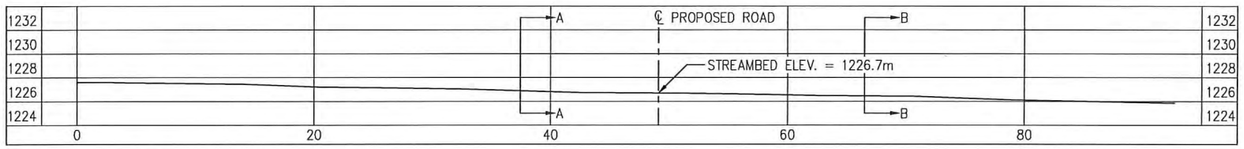
SECTION A
SCALE: 1:500



SECTION B
SCALE: 1:500



PROPOSED ROAD PROFILE
SCALE: 1:500



AVERAGE GRADIENT = -1.89%

CREEK PROFILE
SCALE: 1:500

SITE/SURVEY NOTES:

1. SITEPLAN WAS COMPLETED ON: 2013/07/16
2. SURVEY DATA WAS ESTABLISHED USING NO DECLINATION.
3. SITE SURVEYOR: S. JACOBS
   SITE RODMAN: D. MAIN
4. STREAM RIPARIAN CLASSIFICATION: S4
5. DOMINANT RIPARIAN DESCRIPTION: SPRUCE
   UTM COORDINATES: N5896992 E378815
6. HYDROLOGY:
   - DRAINAGE AREA: 4.9km²
   - ESTIMATED Q100 FLOW: 3.4m³/s
   - ESTIMATED VELOCITY: 1.7m/s
7. SUGGESTED BRIDGE STRUCTURE:
   - SPAN: 14.000m
   - MINIMUM U/S GIRDER: 1228.3m
8. NO GEOTECHNICAL REPORT HAS BEEN COMPLETED TO DATE.

REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
		1
		2
		3
		4
		5
		6
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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

CLIENT:

Allnorth

CLIENT NO:	-	DRWN: JS	DATE: 20/11/12
PROJECT NO:	2003075	DSGN: AZH	DATE: 20/11/12
DRAWING SIZE:	ANSI "B"	CHKD: SPF	DATE: 20/11/12
SCALE:	AS NOTED	APVD: SPF	DATE: 20/11/17

PROJECT:

BLACKWATER PROJECT
MINE ACCESS ROAD
UNKNOWN CREEK
CROSSING #4

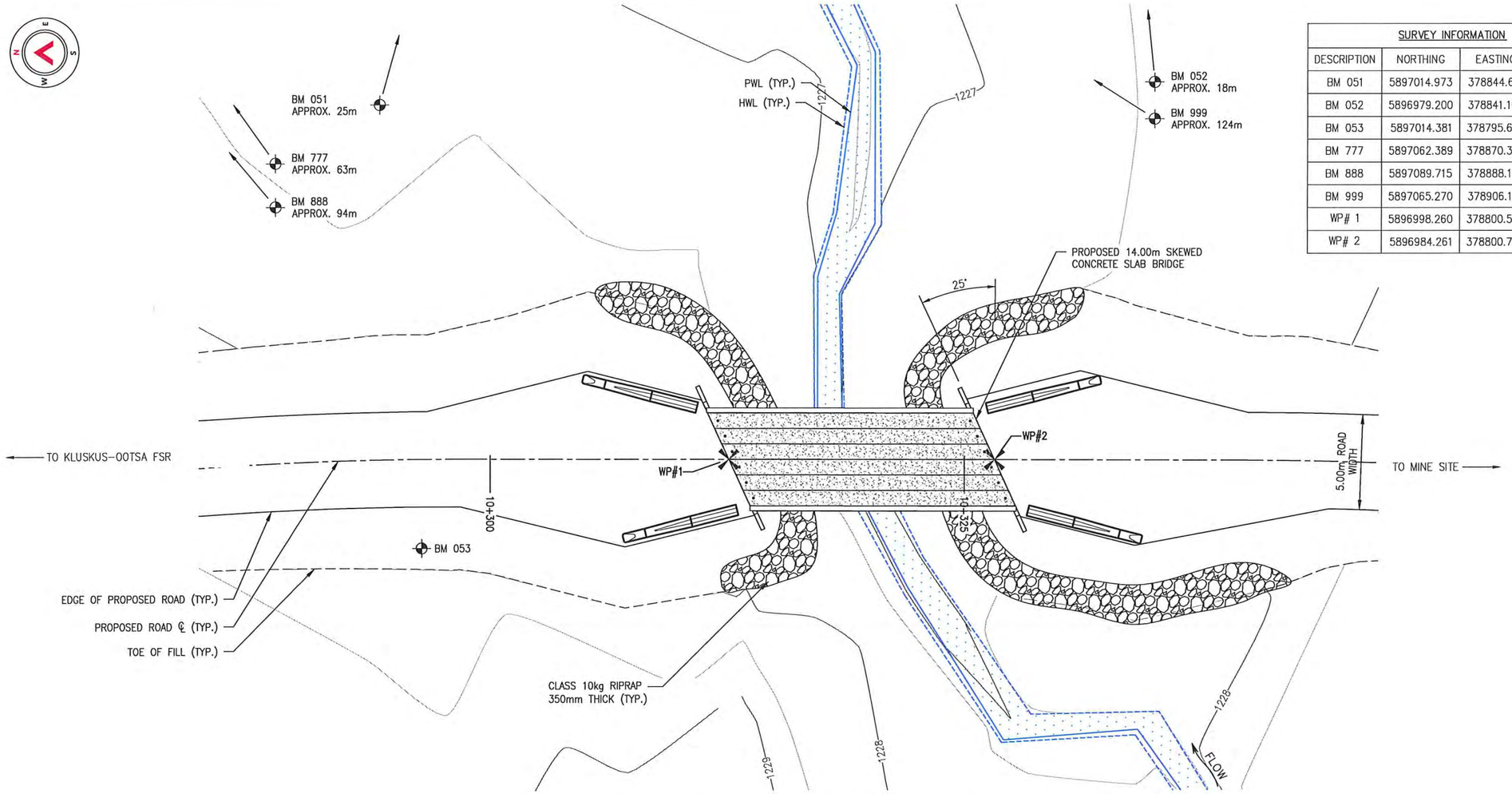
TITLE:

SITE PLAN, PROFILES, SECTIONS AND NOTES

DWG NO: **2003075-400-1960-001**

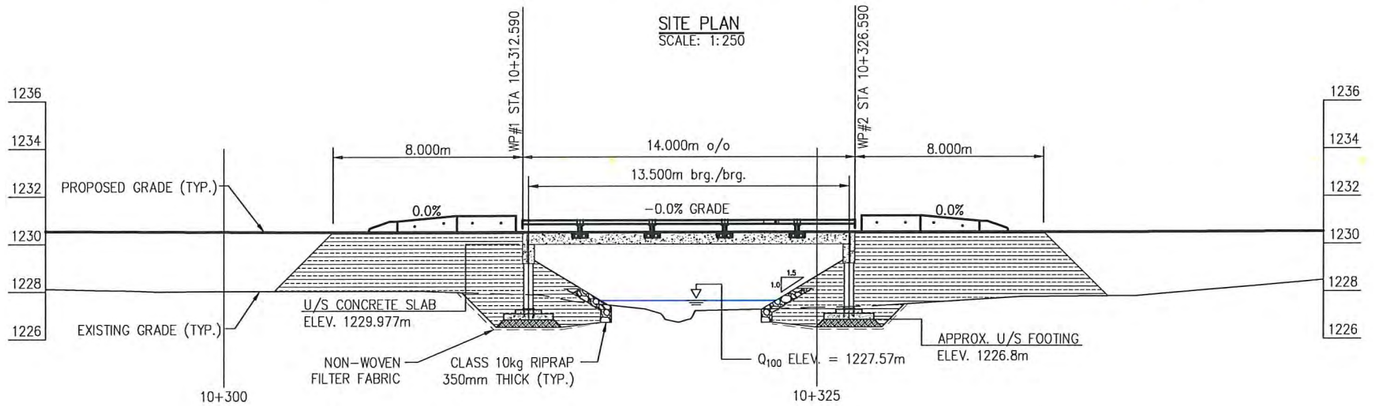
REV: **0**

Date: 2020/11/17 | User: Stefanie Nouck | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #4\2003075-400-1960.SP | Layout: 001 | Paper Size: 558.8mm x 431.8mm



SURVEY INFORMATION			
DESCRIPTION	NORTHING	EASTING	ELEVATION
BM 051	5897014.973	378844.661	1226.303
BM 052	5896979.200	378841.103	1228.157
BM 053	5897014.381	378795.625	1228.118
BM 777	5897062.389	378870.320	1228.236
BM 888	5897089.715	378888.156	1227.018
BM 999	5897065.270	378906.115	1225.941
WP# 1	5896998.260	378800.550	1230.478
WP# 2	5896984.261	378800.758	1230.478

SITE PLAN
SCALE: 1:250



BRIDGE PROFILE
SCALE: 1:250

7m APPROACH FILL	8m END FILL		8m END FILL	7m APPROACH FILL
CUT = 0 Bm³	CUT = 16 Bm³		CUT = 8 Bm³	CUT = 0 Bm³
FILL = 101 Bm³	FILL = 106 Bm³		FILL = 101 Bm³	FILL = 107 Bm³

REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

CLIENT: ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN: JS	DATE: 20/11/12
PROJECT NO:	2003075	DSGN: AZH	DATE: 20/11/12
DRAWING SIZE:	ANSI "B"	CHKD: SPF	DATE: 20/11/12
SCALE:	AS NOTED	APVD: SPF	DATE: 20/11/17

PROJECT:

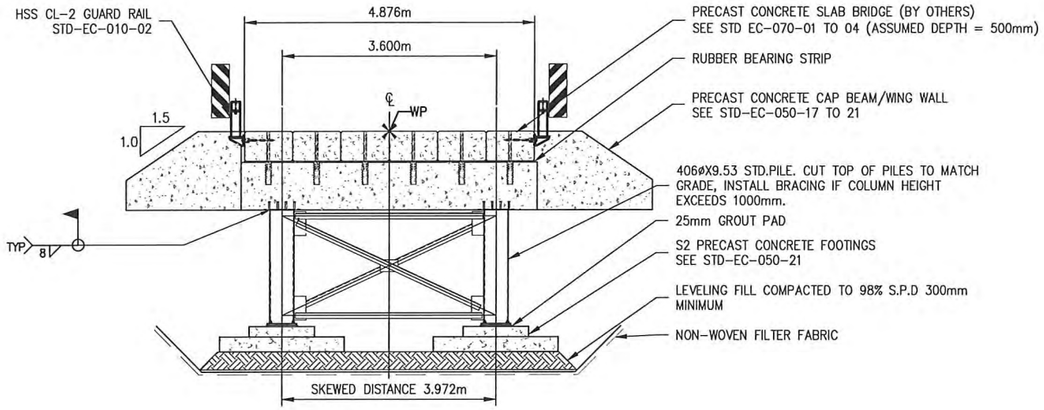
BLACKWATER PROJECT
MINE ACCESS ROAD
UNKNOWN CREEK
CROSSING #4

TITLE:

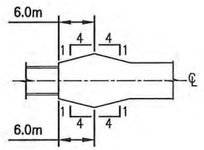
GENERAL ARRANGEMENT

DWG NO: **2003075-400-1960-002** REV: **0**

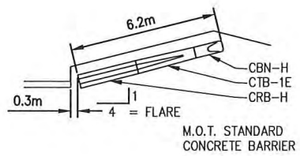
Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site 4x\2003075-400-1960 GA | Layout: 002 | Paper Size: 558.8mm x 431.8mm



ABUTMENT ELEVATION
SCALE: 1:100



FLARE DETAIL
SCALE: 1:1000



PRECAST CONCRETE BARRIER DETAIL
SCALE: 1:250

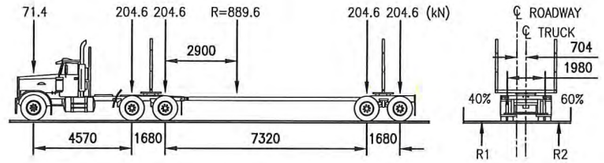
NOTES:

1. BACK FILL OF APPROACHES SHALL GENERALLY CONFORM TO THE LINES SHOWN ON THE DRAWINGS AND SHALL BE PLACED IN LIFTS NOT EXCEEDING 305mm THICK, COMPACTED TO 95% STANDARD PROCTOR DENSITY USING A MINIMUM 1000lbs VIBRATORY PLATE COMPACTOR. MATERIAL SHALL BE CLEAN, FREE DRAINING, WELL GRADED GRANULAR FILL OF 75mm MAXIMUM SIZE. LIFTS SHALL ALTERNATE BOTH WAYS AT EACH END OF THE BRIDGE TO ENSURE MINIMAL MOVEMENT.
2. NON-WOVEN FILTER FABRIC TO BE PLACED OVER EXCAVATION TO HAVE A MINIMUM CBR PUNCTURE STRENGTH OF 2300KN. FILTER FABRIC TO BE USED UNDER FOUNDATIONS.
3. ALL EXPOSED MINERAL SOILS TO BE SEEDED USING AN APPROVED RECLAMATION GRASS SEED MIXTURE AND COVERED WITH AN APPROVED EROSION CONTROL BLANKET.
4. THE CONTRACTOR IS TO CONTACT THE ENGINEER PRIOR TO PLACING FOUNDATIONS. FOUNDATIONS PLACEMENT SHALL BE SUPERVISED BY THE ENGINEER TO CONFIRM BEARING REQUIREMENTS.
5. ALL PERMITS AND REGULATORY APPROVALS TO BE IN PLACE PRIOR TO COMMENCING WORK.
6. ENVIRONMENTAL MANAGEMENT PLAN TO BE PREPARED FOR PROJECT BY OTHERS. COMPLETION OF WORKS TO COMPLY WITH MITIGATION RECOMMENDATIONS OUTLINED IN ENVIRONMENTAL MANAGEMENT PLAN.
7. NO SITE SPECIFIC GEOTECHNICAL INVESTIGATION HAS BEEN COMPLETED AS PART OF ALLNORTH CONSULTANTS LIMITED SCOPE OF WORK. THEREFORE, THIS DESIGN HAS BEEN PREPARED WITHOUT THE BENEFIT OF A SITE SPECIFIC GEOTECHNICAL FIELD INVESTIGATION OR GEOTECHNICAL ADVICE. GROUND CONDITIONS MAY VARY AND THE FOUNDATION REQUIREMENTS AND BRIDGE CONCEPT MAY NEED TO BE MODIFIED TO ACCOMMODATE ACTUAL SITE CONDITIONS ENCOUNTERED DURING CONSTRUCTION. ALLNORTH CONSULTANTS LIMITED ACCEPTS NO RESPONSIBILITY FOR ADDITIONAL COSTS OR DELAYS THAT MAY RESULT IF THE GROUND CONDITIONS VARY FROM THOSE ASSUMED IN THE DESIGN. THE DESIGN ENGINEER SHALL BE CONTACTED IF FIELD CONDITIONS VARY FROM THE DESIGN ASSUMPTIONS SHOWN ON THE DRAWINGS OR IN THE CONSTRUCTION SPECIFICATIONS. INSTALLATIONS OF FOUNDATIONS SHALL BE SUPERVISED BY THE DESIGN ENGINEER OR THEIR REPRESENTATIVE.
8. WHERE EXCAVATION SPECIFICATIONS ON THESE DRAWINGS CONFLICT WITH WORKSAFE BC (WSBC) REGULATIONS, WSBC REGULATIONS ARE TO GOVERN.
9. GENERAL ARRANGEMENT DRAWING. SOME STRUCTURE DETAIL NOT SHOWN. REFER TO FABRICATION DRAWINGS FOR FURTHER DETAIL PRIOR TO EXCAVATION AND INSTALLATION.
10. RIPRAP SPECIFICATIONS:

CLASS OF RIPRAP (kg.)	NOMINAL THICKNESS OF RIPRAP (mm)	ROCK GRADATION PERCENTAGE SMALLER THAN GIVEN ROCK MASS (kg)			APPROXIMATE AVERAGE DIMENSION (mm)		
		15%	50%	85%	15%	50%	85%
10	350	1	10	30	90	195	280
25	450	2.5	25	75	120	260	380
50	550	5	50	150	155	330	475
100	700	10	100	300	195	415	600
250	1000	25	250	750	260	565	815
500	1200	50	500	1500	330	715	1030

11. DESIGN LIFE: BRIDGE DESIGN LIFE: 45 YEARS

LOADING DIAGRAM L-100 OFF HIGHWAY G.V.W. = 90 680kg:
DESIGN IN ACCORDANCE WITH CAN/CSA-S6-14 WITH MODIFIED LOADING AS FOLLOWS:



REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

CLIENT: ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN:	JS	DATE:	20/11/12
PROJECT NO:	2003075	DSGN:	AZH	DATE:	20/11/12
DRAWING SIZE:	ANSI "B"	CHKD:	SPF	DATE:	20/11/12
SCALE:	AS NOTED	APVD:	SPF	DATE:	20/11/17

PROJECT:

BLACKWATER PROJECT
MINE ACCESS ROAD
UNKNOWN CREEK
CROSSING #4

TITLE:

GENERAL NOTES AND SPECIFICATIONS

DWG NO: **2003075-400-1960-003** REV: **0**

Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #4\2003075-400-1960 GA | Layout: 003 | Paper Size: 558.8mm x 431.8mm

ARTEMIS
GOLD INC

BLACKWATER PROJECT
MINE ACCESS ROAD
UNNAMED CREEK
CROSSING #5

DRAWING LIST		
DRAWING NO	**DRAWING TITLE**	**REVISION**
2003075-500-1960-001	SITE PLAN, PROFILES, SECTIONS AND NOTES	0
2003075-500-1960-002	GENERAL ARRANGEMENT AND BRIDGE PROFILE	0
2003075-500-1960-003	ABUTMENT ELEVATION AND NOTES	0

<original signed by>

REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

Allnorth

DESCRIPTION: ISSUED FOR CONSTRUCTION
ISSUE DATE: 20/11/17

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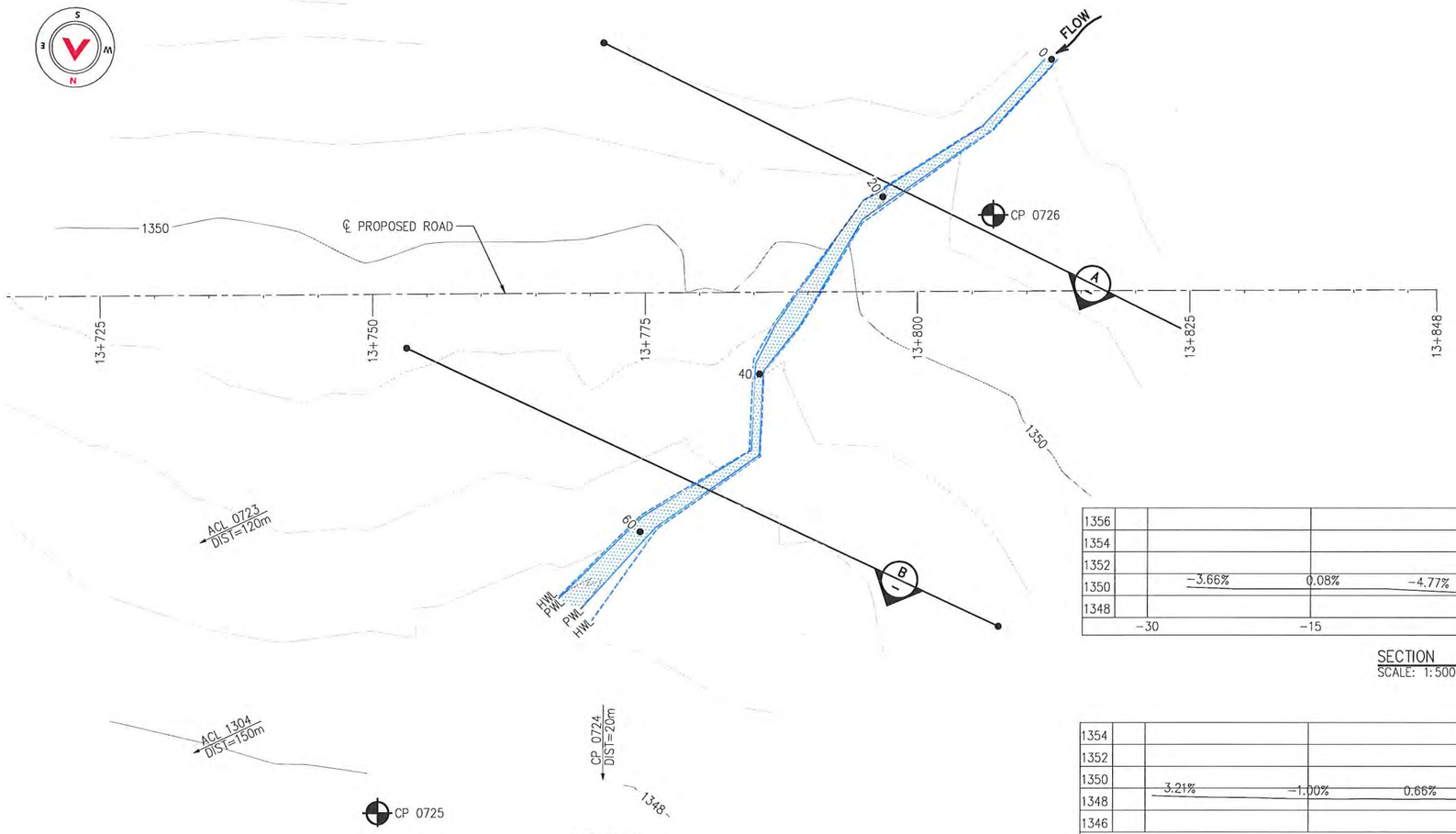
CLIENT NO:	-	DRWN:	SN	DATE:	20/11/09
PROJECT NO:	2003075	DSGN:	SN	DATE:	20/11/09
DRAWING SIZE:	ANSI "B"	CHKD:	AZH	DATE:	20/11/12
SCALE:	AS NOTED	APVD:	SPF	DATE:	20/11/17

DWG NO: **2003075-500-1960-00T** REV: **0**

Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #1\2003075-500-1960.SP | Layout: 00T | Paper Size: 863.6mm x 558.8mm



SITE PLAN
SCALE: 1:500

SURVEY INFORMATION			
DESCRIPTION	NORTHING	EASTING	ELEVATION
ACL 0723	5895600.379	376439.321	1344.428
ACL 1304	5895634.289	376464.614	1338.572
CP 0724	5895576.870	376301.275	1347.606
CP 0725	5895568.236	376322.626	1347.886
CP 0726	5895509.627	376270.411	1350.733

REFERENCE DRAWINGS		
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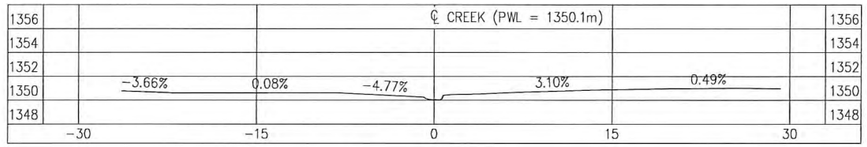
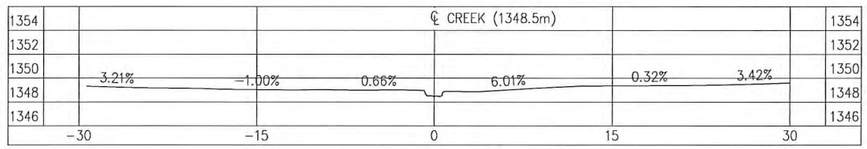


SECTION A
SCALE: 1:500



SECTION B
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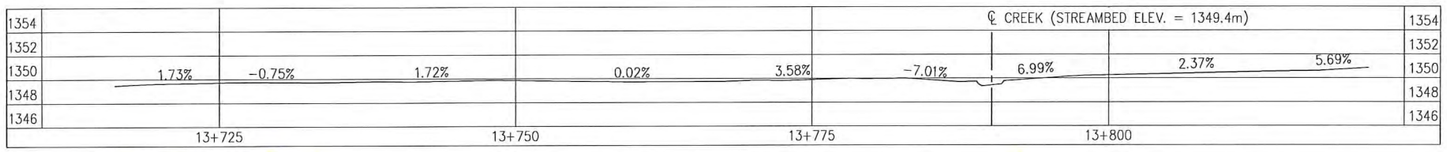
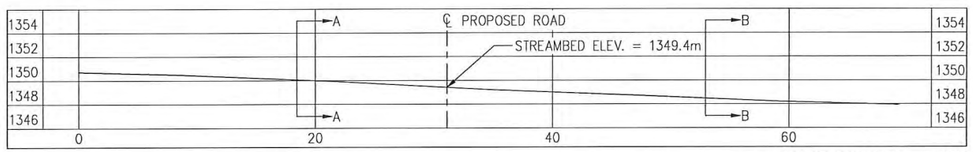


PROPOSED ROAD PROFILE
SCALE: 1:500



AVERAGE GRADIENT = −4.02%

CREEK PROFILE
SCALE: 1:500

SITE/SURVEY NOTES:

1. SITE PLAN WAS COMPLETED ON: 2013/07/16
2. SURVEY DATA WAS ESTABLISHED USING NO DECLINATION.
3. SITE SURVEYOR: S. JACOBS
   SITE RODMAN: D. MAIN
4. STREAM RIPARIAN CLASSIFICATION: S4
5. DOMINANT RIPARIAN DESCRIPTION: SPRUCE/FIR
6. UTM COORDINATES: N5895521 E376288
7. HYDROLOGY:
   - DRAINAGE AREA: 1.3km²
   - ESTIMATED Q100 FLOW: 1.5m³/s
   - ESTIMATED VELOCITY: 1.8m/s
8. SUGGESTED BRIDGE STRUCTURE:
   - SPAN: 12.000m
   - MINIMUM U/S GIRDER: 1350.3m
9. NO GEOTECHNICAL REPORT HAS BEEN COMPLETED TO DATE.

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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

CLIENT: ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN:	SN	DATE: 20/11/09
PROJECT NO:	2003075	DSGN:	SN	DATE: 20/11/09
DRAWING SIZE:	ANSI "B"	CHKD:	AZH	DATE: 20/11/12
SCALE:	AS NOTED	APVD:	SPF	DATE: 20/11/17

PROJECT:

BLACKWATER PROJECT
MINE ACCESS ROAD
UNNAMED CREEK
CROSSING #5

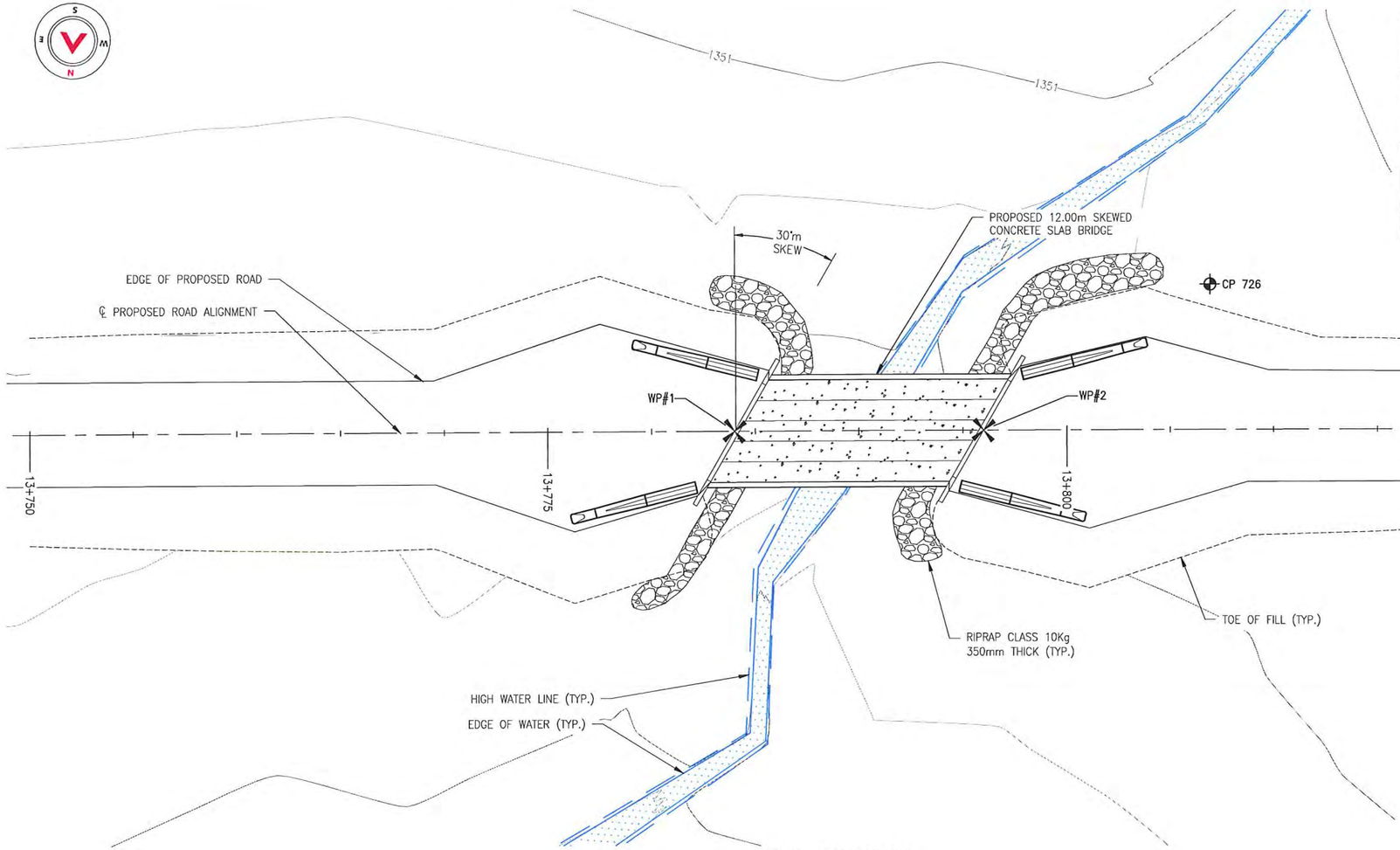
TITLE:

SITE PLAN, PROFILES, SECTIONS AND NOTES

DWG NO: **2003075-500-1960-001**

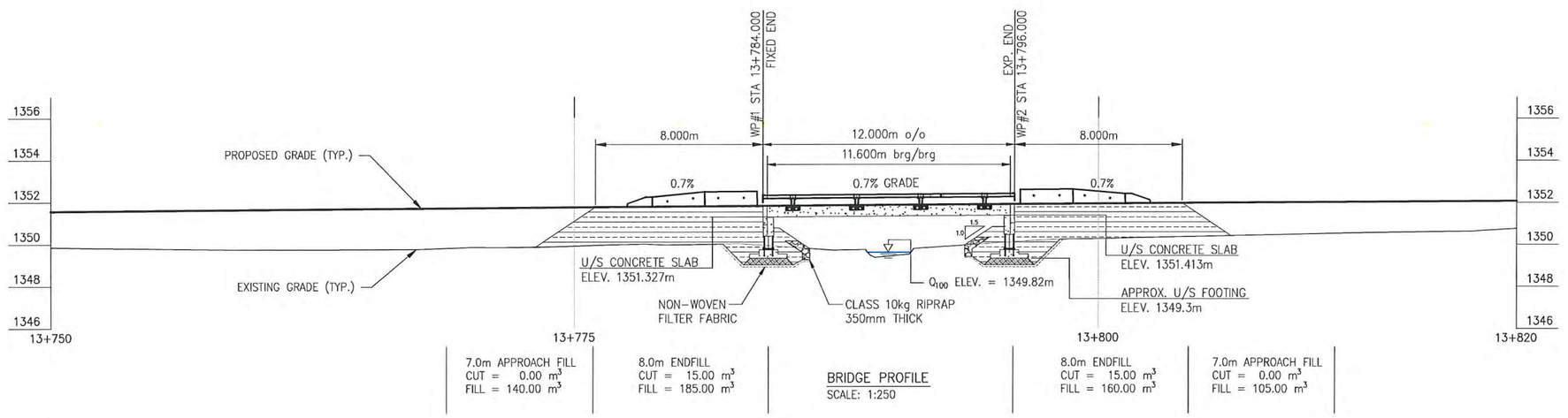
REV: **0**

Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #5\2003075-500-1960.SP | Layout: 001 | Paper Size: 558.8mm x 431.8mm



GENERAL ARRANGEMENT
SCALE: 1:250

SURVEY CONTROL			
DESCRIPTION	NORTHING	EASTING	ELEVATION
ACL 723	5895600.379	376439.321	1344.428
ACL 1304	5895634.289	376464.614	1338.572
CP 725	5895568.236	376322.626	1347.886
CP 724	5895576.870	376301.275	1347.606
CP 726	5895509.627	376270.411	1350.733
WP#1	5895518.359	376292.720	1351.807
WP#2	5895517.427	376280.757	1351.893



7.0m APPROACH FILL	8.0m ENDFILL		8.0m ENDFILL	7.0m APPROACH FILL
CUT = 0.00 m^3	CUT = 15.00 m^3	BRIDGE PROFILE	CUT = 15.00 m^3	CUT = 0.00 m^3
FILL = 140.00 m^3	FILL = 185.00 m^3	SCALE: 1:250	FILL = 160.00 m^3	FILL = 105.00 m^3

REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
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		2
		3
		4
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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

CLIENT: ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN:	SN	DATE: 20/11/09
PROJECT NO:	2003075	DSGN:	SN	DATE: 20/11/09
DRAWING SIZE:	ANSI "B"	CHKD:	AZH	DATE: 20/11/12
SCALE:	AS NOTED	APVD:	SPF	DATE: 20/11/17

PROJECT:

BLACKWATER PROJECT
MINE ACCESS ROAD
UNNAMED CREEK
CROSSING #5

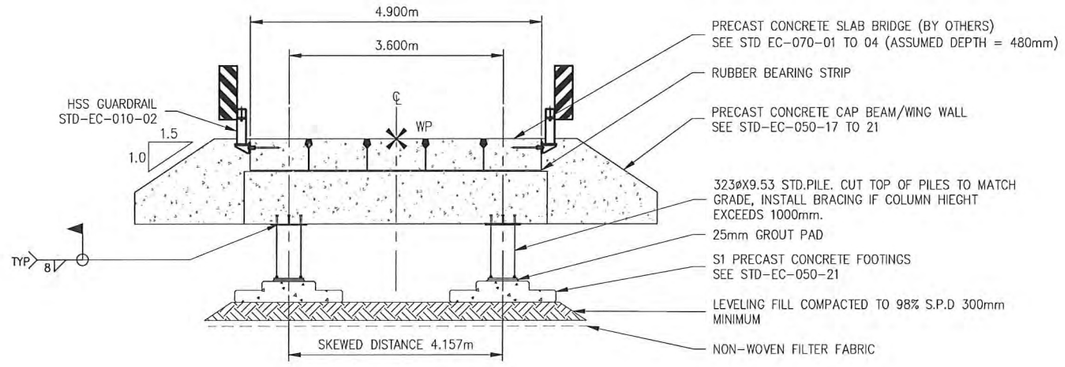
TITLE:

GENERAL ARRANGEMENT AND BRIDGE PROFILE

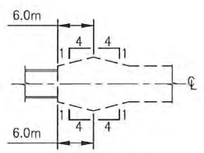
DWG NO: **2003075-500-1960-002**

REV: **0**

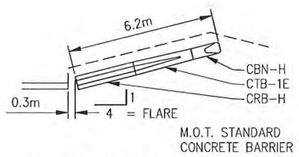
Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #5\2003075-500-1960 GA | Layout: 002 | Paper Size: 558.8mm x 431.8mm



ABUTMENT ELEVATION
SCALE: 1:100



FLARE DETAIL
SCALE: 1:1000



PRECAST CONCRETE BARRIER DETAIL
SCALE: 1:250

NOTES:

1. BACK FILL OF APPROACHES SHALL GENERALLY CONFORM TO THE LINES SHOWN ON THE DRAWINGS AND SHALL BE PLACED IN LIFTS NOT EXCEEDING 305mm THICK, COMPACTED TO 95% STANDARD PROCTOR DENSITY USING A MINIMUM 1000lbs VIBRATORY PLATE COMPACTOR. MATERIAL SHALL BE CLEAN, FREE DRAINING, WELL GRADED GRANULAR FILL OF 75mm MAXIMUM SIZE. LIFTS SHALL ALTERNATE BOTH WAYS AT EACH END OF THE BRIDGE TO ENSURE MINIMAL MOVEMENT.
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CLASS OF RIPRAP (kg.)	NOMINAL THICKNESS OF RIPRAP (mm)	ROCK GRADATION PERCENTAGE SMALLER THAN GIVEN ROCK MASS (kg)			APPROXIMATE AVERAGE DIMENSION (mm)		
		15%	50%	85%	15%	50%	85%
10	350	1	10	30	90	195	280
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50	550	5	50	150	155	330	475
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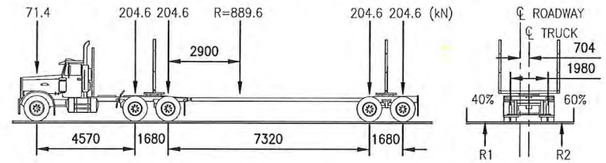
500	1200	50	500	1500	330	715	1030

11. DESIGN LIFE: BRIDGE DESIGN LIFE: 45 YEARS

LOADING DIAGRAM L-100 OFF HIGHWAY G.V.W. = 90 680kg:
DESIGN IN ACCORDANCE WITH CAN/CSA-S6-14 WITH MODIFIED LOADING AS FOLLOWS:



REFERENCE DRAWINGS		
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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

CLIENT: ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN:	SN	DATE: 20/11/09
PROJECT NO:	2003075	DSGN:	SN	DATE: 20/11/09
DRAWING SIZE:	ANSI "B"	CHKD:	AZH	DATE: 20/11/12
SCALE:	AS NOTED	APVD:	SPF	DATE: 20/11/17

PROJECT:

BLACKWATER PROJECT
MINE ACCESS ROAD
UNNAMED CREEK
CROSSING #5

TITLE:

ABUTMENT ELEVATION AND NOTES

DWG NO: **2003075-500-1960-003**

REV: **0**

Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #5\2003075-500-1960 GA | Layout: 003 | Paper Size: 558.8mm x 431.8mm

DESIGN CHAINAGE (m)	DIAMETER (mm)	LENGTH (m)	SKEW (deg.)	COMMENT
0+028	600	14	43	X-Drain
0+090	600	12	11	X-Drain
1+040	600	14	5	X-Drain
0+600	600	16	28	X-Drain
0+790	600	11	21	X-Drain
1+240	600	14		X-Drain
1+600	600	15		X-Drain
2+000	600	15		X-Drain
2+250	600	20		X-Drain
2+500	600	16		X-Drain
2+800	600	14		X-Drain
3+150	600	17		X-Drain
3+480	600	14	5	X-Drain
3+690	600	19		X-Drain
3+800	600	16	4	X-Drain
4+050	600	16	3.5	X-Drain
4+300	600	17		X-Drain
4+550	600	19	3	X-Drain
4+660	600	19		X-Drain
4+800	600	16		X-Drain
4+970	600	20		X-Drain
5+160	600	21		X-Drain
5+240	600	16	3	X-Drain
5+450	600	15.5	13	X-Drain-Max. 10% Grade
5+540	600	14		X-Drain-Max. 10% Grade
5+610	600	15	3.5	X-Drain
5+740	600	20	3.5	X-Drain
6+000	600	22		X-Drain-Max. 10% Grade
6+210	600	20		X-Drain
6+300	600	14		X-Drain
6+770	600	11	7	X-Drain
7+000	600	20		X-Drain
7+160	600	11.5	15	X-Drain
7+380	600	18		X-Drain
7+610	600	14		X-Drain
7+900	600	11		X-Drain
8+250	600	11		X-Drain
8+530	600	14		X-Drain
8+735	600	15	5.5	X-Drain
8+860	600	18	5.5	X-Drain
8+922	600	14	9	X-Drain
9+070	600	14	9	X-Drain
9+240	600	17	9	X-Drain
9+510	600	15		X-Drain

DESIGN CHAINAGE (m)	DIAMETER (mm)	LENGTH (m)	SKEW (deg.)	COMMENT
9+960	600	19	7	X-Drain
10+080	600	27	15	X-Drain
10+260	600	13		X-Drain
10+420	600	14		X-Drain-Max. 10% Grade
10+640	600	11		X-Drain
10+940	600	12		X-Drain
11+110	600	11	8	X-Drain
11+310	600	11		X-Drain
11+730	600	11		X-Drain
11+950	600	11	8.5	X-Drain
12+100	600	11	9	X-Drain
12+300	600	11	9	X-Drain
12+560	600	12		X-Drain
12+650	600	12		X-Drain
12+900	600	14		X-Drain
13+020	600	18.5	11	X-Drain-Max. 10% Grade
13+120	600	14	11	X-Drain
13+260	600	15	9	X-Drain
13+370	600	14		X-Drain
13+500	600	26	10	X-Drain

ARTEMIS
GOLD INC

BLACKWATER PROJECT
MINE ACCESS ROAD
TURTLE CREEK
CROSSING #1

DRAWING LIST		
DRAWING NO	**DRAWING TITLE**	**REVISION**
2003075-100-1960-001	SITE PLAN, PROFILES, SECTIONS AND NOTES	0
2003075-100-1960-002	GENERAL ARRANGEMENT	0
2003075-100-1960-003	GENERAL NOTES AND SPECIFICATIONS	0

<original signed by>

REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

Allnorth

DESCRIPTION: ISSUED FOR CONSTRUCTION
ISSUE DATE: 20/11/17

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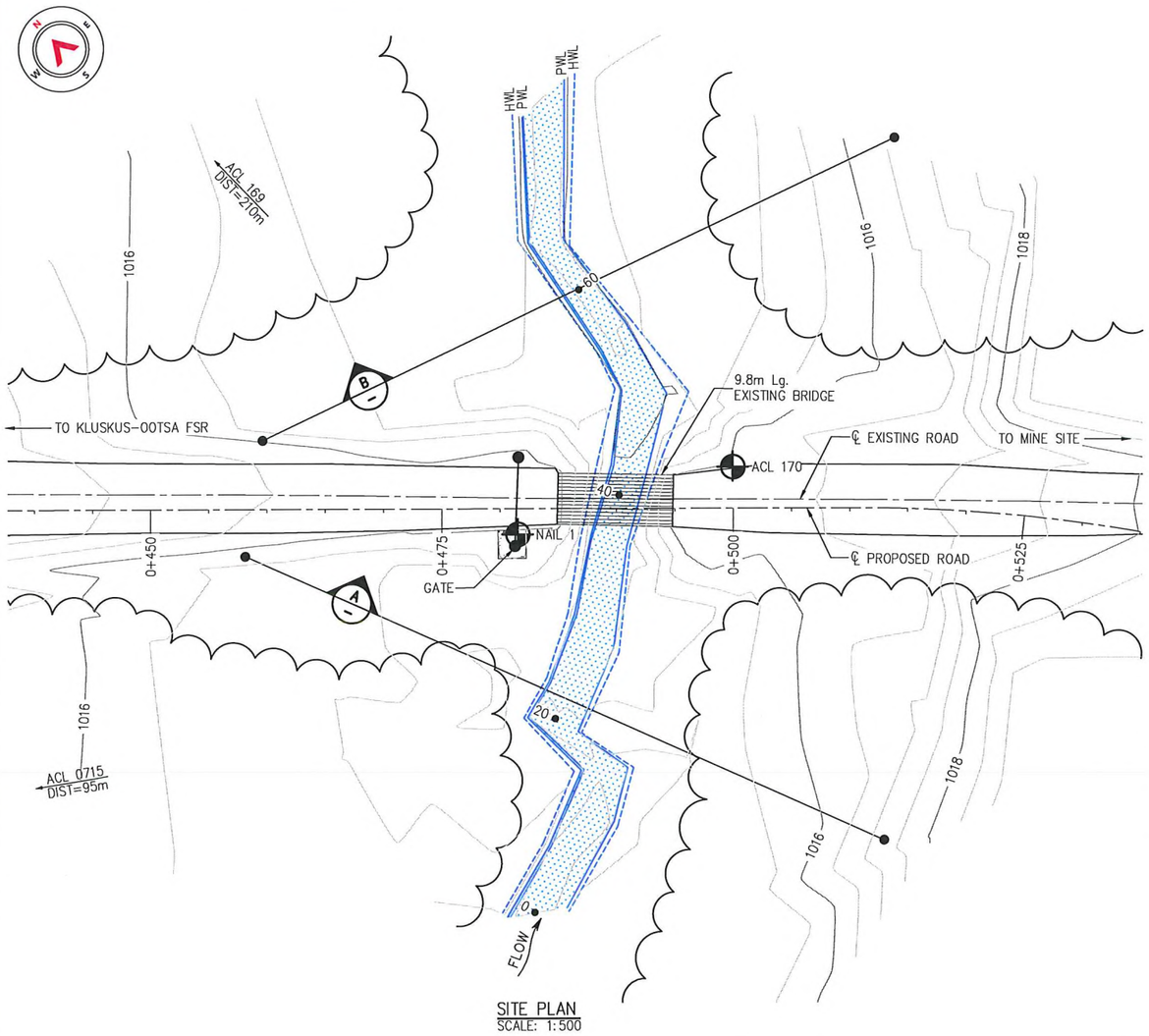
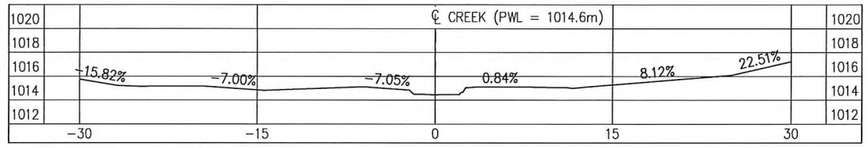
CLIENT NO:	-	DRWN:	JS	DATE: 20/11/10
PROJECT NO:	2002075	DSGN:	AZH	DATE: 20/11/10
DRAWING SIZE:	ANSI "B"	CHKD:	SPF	DATE: 20/11/10
SCALE:	AS NOTED	APVD:	SPF	DATE: 20/11/17
DWG NO: 2003075-100-1960-00T				REV: 0

Date: 2020/11/17 | User: Stefanie Noack | File: P:\PO\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #1\2003075-100-1960.SP | Layout: 00T | Paper Size: 863.6mm x 558.8mm

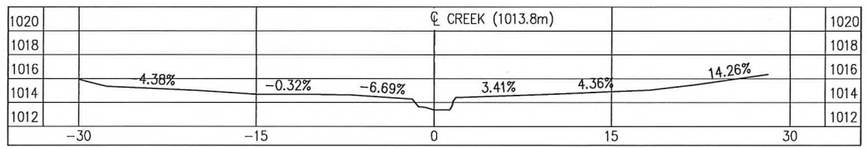


SITE PLAN
SCALE: 1:500

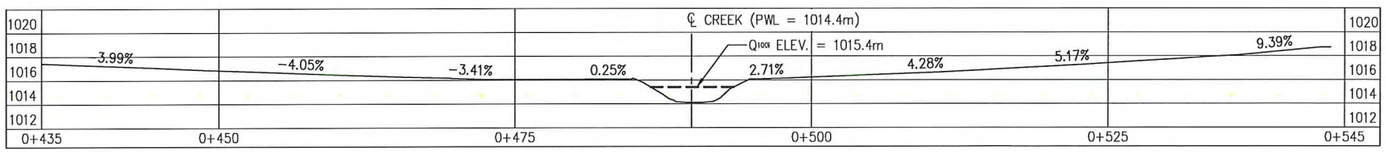
SURVEY INFORMATION			
DESCRIPTION	NORTHING	EASTING	ELEVATION
ACL 169	5906200.827	378791.668	1028.368
ACL 170	5905947.665	378805.416	1016.153
ACL 0715	5906020.036	378670.387	1029.759
NAIL 1	5905956.301	378788.183	1016.059



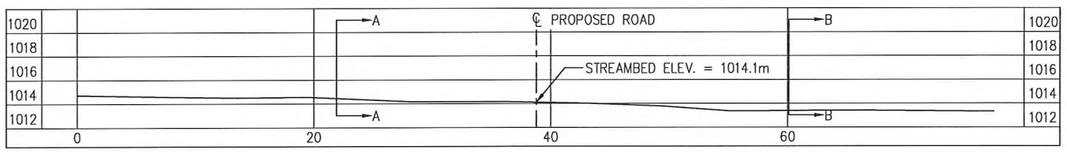
SECTION A
SCALE: 1:500



SECTION B
SCALE: 1:500



EXISTING GROUND PROFILE ALONG PROPOSED ROAD CENTERLINE
SCALE: 1:500



AVERAGE GRADIENT = -1.85%

CREEK PROFILE
SCALE: 1:500

SITE/SURVEY NOTES:

1. SITEPLAN WAS COMPLETED ON: 2012/10/17
2. SURVEY DATA WAS ESTABLISHED USING NO DECLINATION.
3. SITE SURVEYOR: S. JACOBS
   SITE RODMAN: K. MOE, B. KOOPS
4. STREAM RIPARIAN CLASSIFICATION: S3
5. DOMINANT RIPARIAN DESCRIPTION: SPRUCE/PINE
6. UTM COORDINATES: N5905952 E378796
7. HYDROLOGY:
   - DRAINAGE AREA: 54.2km²
   - ESTIMATED Q100 FLOW: 14.3m³/s
   - ESTIMATED VELOCITY: 2.4m/s
8. SUGGESTED BRIDGE STRUCTURE:
   - SPAN: 18.288m
   - MINIMUM U/S GIRDER: 1016.1m
9. NO GEOTECHNICAL REPORT HAS BEEN COMPLETED TO DATE.

REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
		1
		2
		3
		4
		5
		6
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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

CLIENT: ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN: JS	DATE: 20/11/10
PROJECT NO:	2003075	DSGN: AZH	DATE: 20/11/10
DRAWING SIZE:	ANSI "B"	CHKD: SPF	DATE: 20/11/10
SCALE:	AS NOTED	APVD: SPF	DATE: 20/11/17

PROJECT:

BLACKWATER PROJECT
MINE ACCESS ROAD
TURTLE CREEK
CROSSING #1

TITLE:

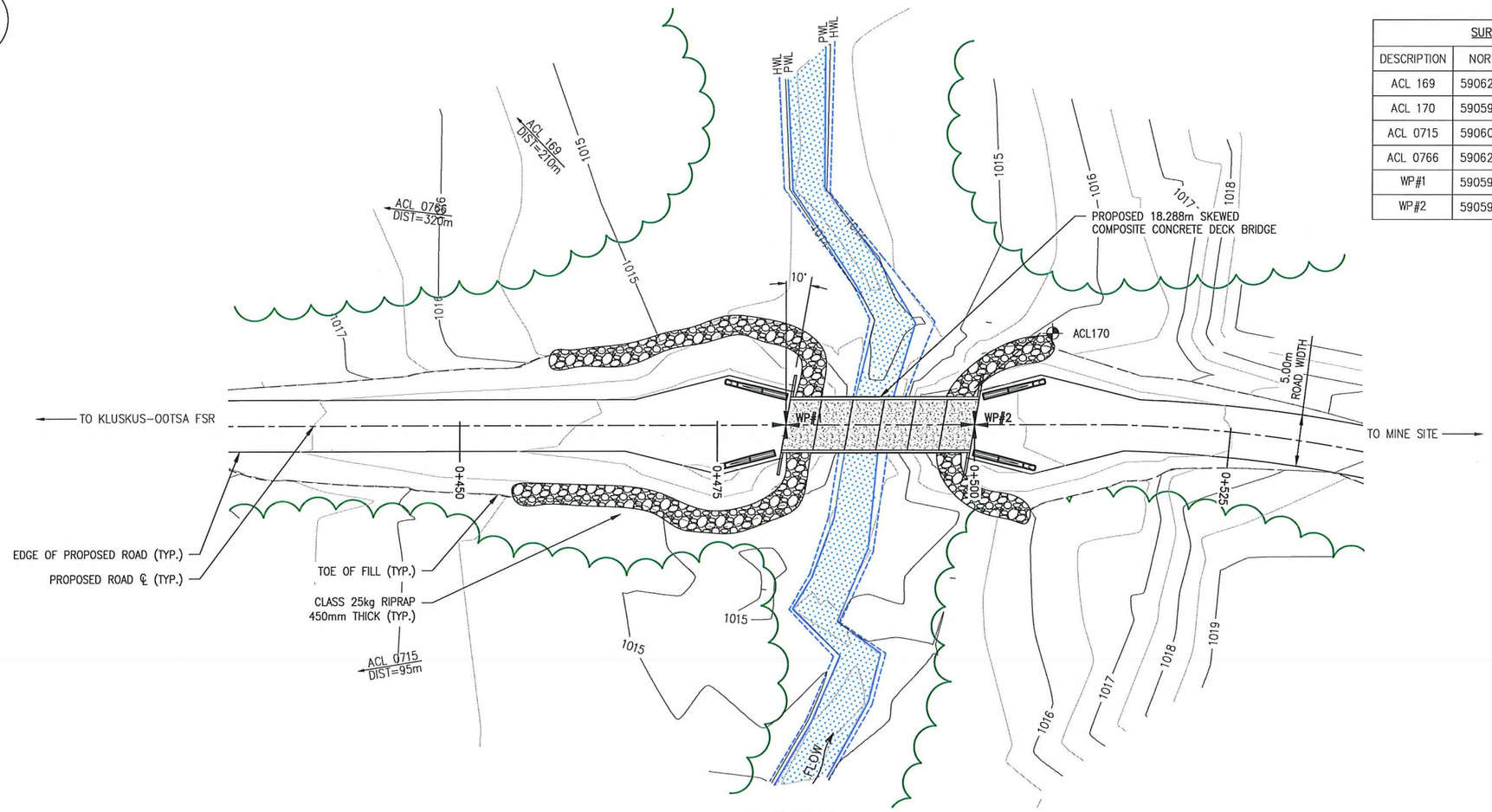
SITE PLAN, PROFILES, SECTIONS AND NOTES

DWG NO: **2003075-100-1960-001**

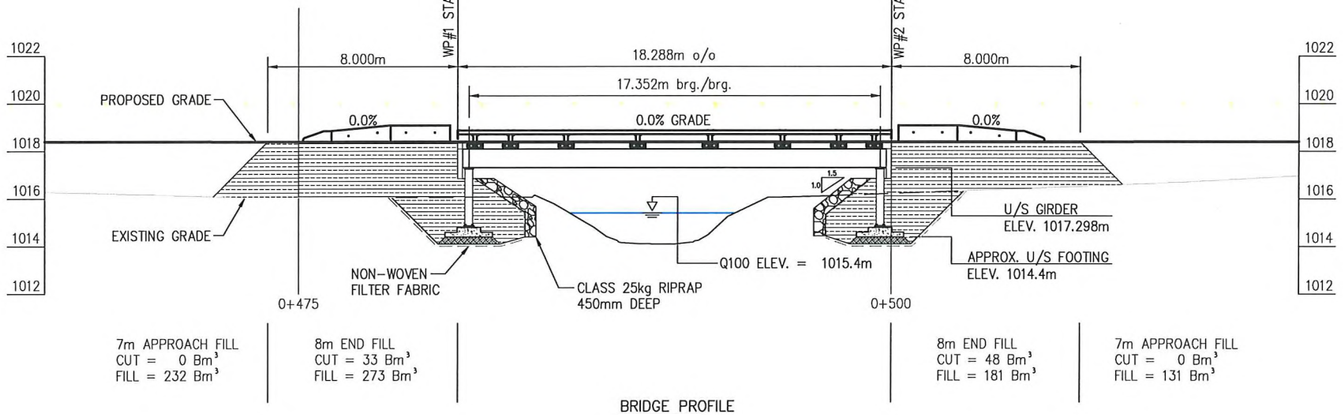
REV: **0**

Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #1\2003075-100-1960 SP | Layout: 001 | Paper Size: 558.8mm x 431.8mm

SURVEY INFORMATION			
DESCRIPTION	NORTHING	EASTING	ELEVATION
ACL 169	5906200.827	378791.668	1028.368
ACL 170	5905947.665	378805.416	1016.153
ACL 0715	5906020.036	378670.387	1029.759
ACL 0766	5906243.950	378579.474	1038.247
WP#1	5905957.775	378789.823	1018.393
WP#2	5905945.086	378802.993	1018.393



SITE PLAN
SCALE: 1:500



BRIDGE PROFILE
SCALE: 1:250

REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
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		2
		3
		4
		5
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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

CLIENT:
ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN: JS	DATE: 20/11/10
PROJECT NO:	2003075	DSGN: AZH	DATE: 20/11/10
DRAWING SIZE:	ANSI "B"	CHKD: SPF	DATE: 20/11/10
SCALE:	AS NOTED	APVD: SPF	DATE: 20/11/17

PROJECT:

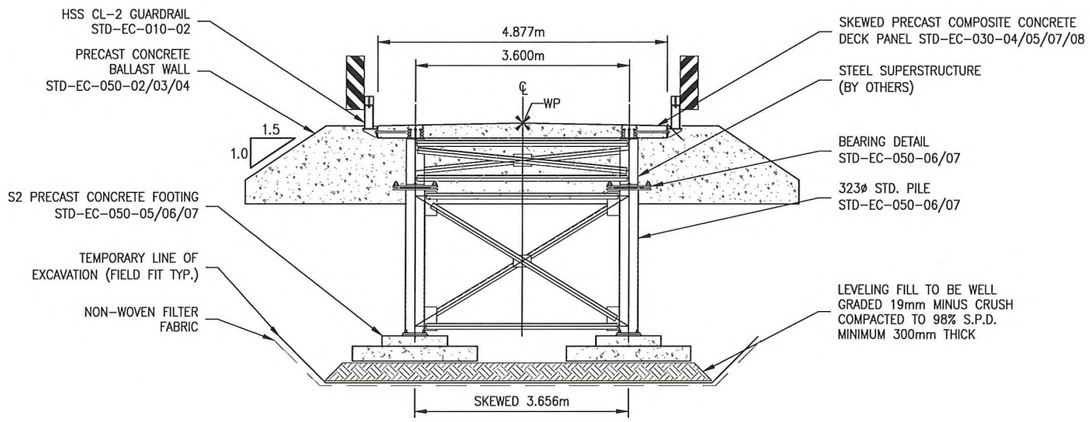
BLACKWATER PROJECT
MINE ACCESS ROAD
TURTLE CREEK
CROSSING #1

TITLE:

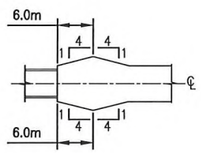
GENERAL ARRANGEMENT

DWG NO: **2003075-100-1970-002**
REV: **0**

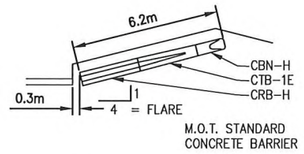
Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #1\2003075-100-1960 GA | Layout: 002 | Paper Size: 558.8mm x 431.8mm



ABUTMENT ELEVATION
SCALE: 1:100



FLARE DETAIL
SCALE: 1:1000



PRECAST CONCRETE BARRIER DETAIL
SCALE: 1:250

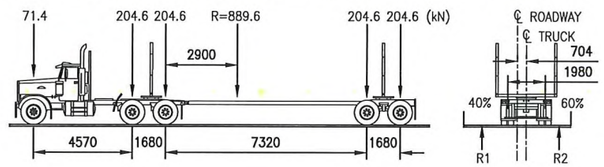
NOTES:

1. BACK FILL OF APPROACHES SHALL GENERALLY CONFORM TO THE LINES SHOWN ON THE DRAWINGS AND SHALL BE PLACED IN LIFTS NOT EXCEEDING 305mm THICK, COMPACTED TO 95% STANDARD PROCTOR DENSITY USING A MINIMUM 1000lbs VIBRATORY PLATE COMPACTOR. MATERIAL SHALL BE CLEAN, FREE DRAINING, WELL GRADED GRANULAR FILL OF 75mm MAXIMUM SIZE. LIFTS SHALL ALTERNATE BOTH WAYS AT EACH END OF THE BRIDGE TO ENSURE MINIMAL MOVEMENT.
2. NON-WOVEN FILTER FABRIC TO BE PLACED OVER EXCAVATION TO HAVE A MINIMUM CBR PUNCTURE STRENGTH OF 2300KN. FILTER FABRIC TO BE USED UNDER FOUNDATIONS.
3. ALL EXPOSED MINERAL SOILS TO BE SEEDED USING AN APPROVED RECLAMATION GRASS SEED MIXTURE AND COVERED WITH AN APPROVED EROSION CONTROL BLANKET.
4. THE CONTRACTOR IS TO CONTACT THE ENGINEER PRIOR TO PLACING FOUNDATIONS. FOUNDATIONS PLACEMENT SHALL BE SUPERVISED BY THE ENGINEER TO CONFIRM BEARING REQUIREMENTS.
5. ALL PERMITS AND REGULATORY APPROVALS TO BE IN PLACE PRIOR TO COMMENCING WORK.
6. ENVIRONMENTAL MANAGEMENT PLAN TO BE PREPARED FOR PROJECT BY OTHERS. COMPLETION OF WORKS TO COMPLY WITH MITIGATION RECOMMENDATIONS OUTLINED IN ENVIRONMENTAL MANAGEMENT PLAN.
7. NO SITE SPECIFIC GEOTECHNICAL INVESTIGATION HAS BEEN COMPLETED AS PART OF ALLNORTH CONSULTANTS LIMITED SCOPE OF WORK. THEREFORE, THIS DESIGN HAS BEEN PREPARED WITHOUT THE BENEFIT OF A SITE SPECIFIC GEOTECHNICAL FIELD INVESTIGATION OR GEOTECHNICAL ADVICE. GROUND CONDITIONS MAY VARY AND THE FOUNDATION REQUIREMENTS AND BRIDGE CONCEPT MAY NEED TO BE MODIFIED TO ACCOMMODATE ACTUAL SITE CONDITIONS ENCOUNTERED DURING CONSTRUCTION. ALLNORTH CONSULTANTS LIMITED ACCEPTS NO RESPONSIBILITY FOR ADDITIONAL COSTS OR DELAYS THAT MAY RESULT IF THE GROUND CONDITIONS VARY FROM THOSE ASSUMED IN THE DESIGN. THE DESIGN ENGINEER SHALL BE CONTACTED IF FIELD CONDITIONS VARY FROM THE DESIGN ASSUMPTIONS SHOWN ON THE DRAWINGS OR IN THE CONSTRUCTION SPECIFICATIONS. INSTALLATIONS OF FOUNDATIONS SHALL BE SUPERVISED BY THE DESIGN ENGINEER OR THEIR REPRESENTATIVE.
8. WHERE EXCAVATION SPECIFICATIONS ON THESE DRAWINGS CONFLICT WITH WORKSAFE BC (WSBC) REGULATIONS, WSBC REGULATIONS ARE TO GOVERN.
9. GENERAL ARRANGEMENT DRAWING. SOME STRUCTURE DETAIL NOT SHOWN. REFER TO FABRICATION DRAWINGS FOR FURTHER DETAIL PRIOR TO EXCAVATION AND INSTALLATION.
10. RIPRAP SPECIFICATIONS:

CLASS OF RIPRAP (kg.)	NOMINAL THICKNESS OF RIPRAP (mm)	ROCK GRADATION PERCENTAGE SMALLER THAN GIVEN ROCK MASS (kg)			APPROXIMATE AVERAGE DIMENSION (mm)		
		15%	50%	85%	15%	50%	85%
10	350	1	10	30	90	195	280
25	450	2.5	25	75	120	260	380
50	550	5	50	150	155	330	475
100	700	10	100	300	195	415	600
250	1000	25	250	750	260	565	815
500	1200	50	500	1500	330	715	1030

11. DESIGN LIFE: BRIDGE DESIGN LIFE: 45 YEARS

LOADING DIAGRAM L-100 OFF HIGHWAY G.V.W. = 90 680kg:
DESIGN IN ACCORDANCE WITH CAN/CSA-S6-14 WITH MODIFIED LOADING AS FOLLOWS:



REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

CLIENT: ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN:	JS	DATE: 20/11/10
PROJECT NO:	2003075	DSGN:	AZH	DATE: 20/11/10
DRAWING SIZE:	ANSI "B"	CHKD:	SPF	DATE: 20/11/10
SCALE:	AS NOTED	APVD:	SPF	DATE: 20/11/17

PROJECT:

BLACKWATER PROJECT
MINE ACCESS ROAD
TURTLE CREEK
CROSSING #1

TITLE:

ABUTMENT ELEVATION AND SPECIFICATIONS

DWG NO: **2003075-100-1970-003**
REV: **0**

Date: 2020/11/17 | User: Stefanie Noack | File: P:\PO\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-ProductionSite #1\2003075-100-1960.GA | Layout: 003 | Paper Size: 558.8mm x 431.8mm

ARTEMIS
GOLD INC

BLACKWATER PROJECT
MINE ACCESS ROAD
DAVIDSON CREEK TRIBUTARY
CROSSING #2

DRAWING LIST		
DRAWING NO	**DRAWING TITLE**	**REVISION**
2003075-200-1960-001	SITE PLAN, PROFILES, SECTIONS AND NOTES	0
2003075-200-1960-002	GENERAL ARRANGEMENT AND BRIDGE PROFILE	0
2003075-200-1960-003	ABUTMENT ELEVATION AND NOTES	0

<original signed by>

REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

Allnorth

DESCRIPTION: ISSUED FOR CONSTRUCTION
ISSUE DATE: 20/11/17

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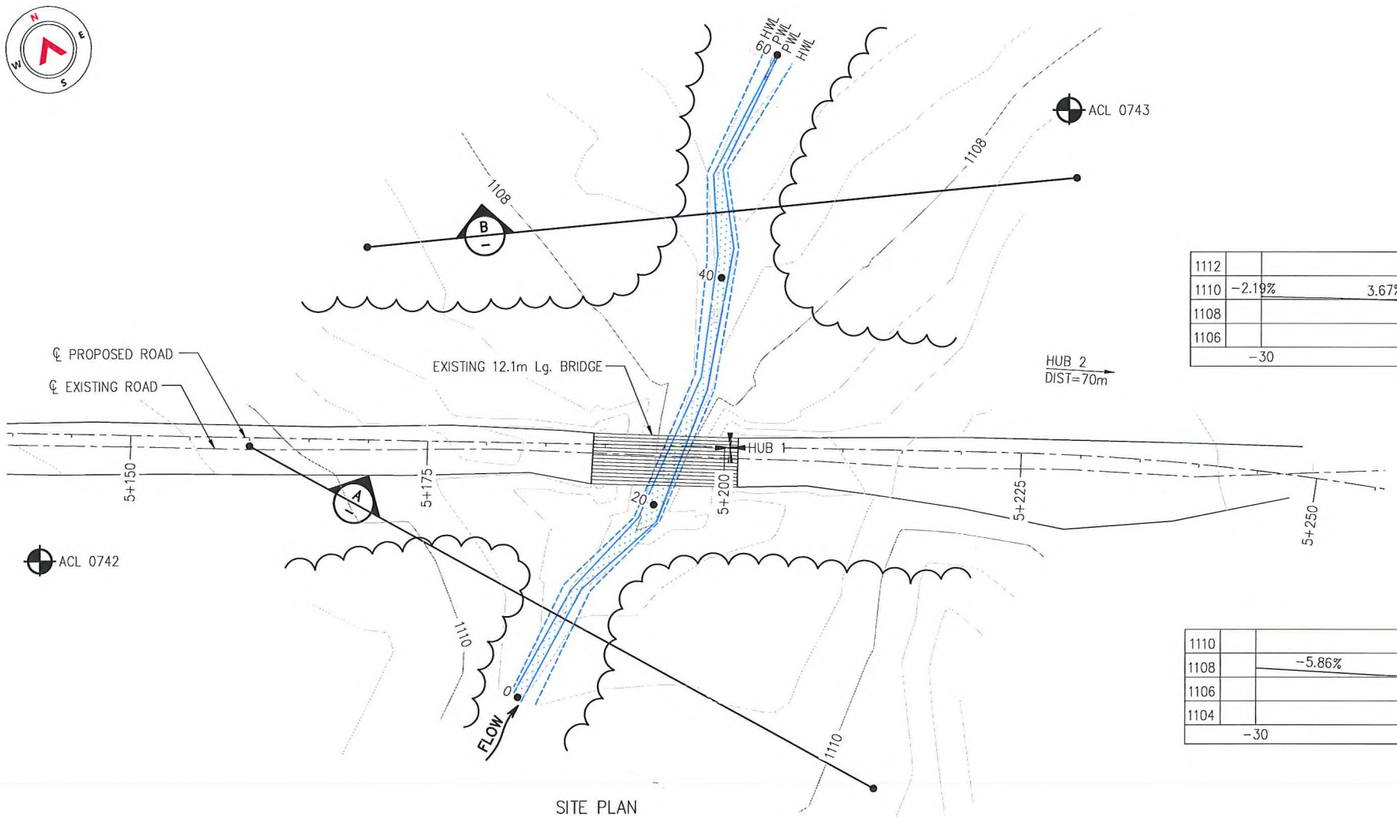
CLIENT NO:	-	DRWN:	SN	DATE:	20/11/09
PROJECT NO:	2003075	DSGN:	SN	DATE:	20/11/09
DRAWING SIZE:	ANSI "B"	CHKD:	AZH	DATE:	20/11/10
SCALE:	AS NOTED	APVD:	SPF	DATE:	20/11/17
DWG NO: 2003075-200-1960-00T				REV:	0

Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #2\2003075-200-1960 SP | Layout: 00T | Paper Size: 863.6mm x 558.8mm



SITE PLAN
SCALE: 1:500

SURVEY INFORMATION			
DESCRIPTION	NORTHING	EASTING	ELEVATION
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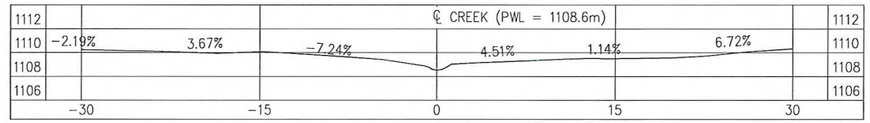
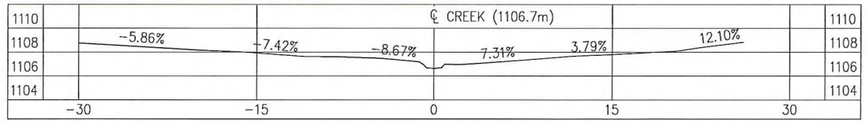
ACL 0743	5901529.442	379103.131	1109.023
ACL 0744	5901572.569	379033.645	1109.019
HUB 1	5901515.101	379065.608	1109.842
HUB 2	5901478.305	379154.876	1108.902



SECTION A
SCALE: 1:500



SECTION B
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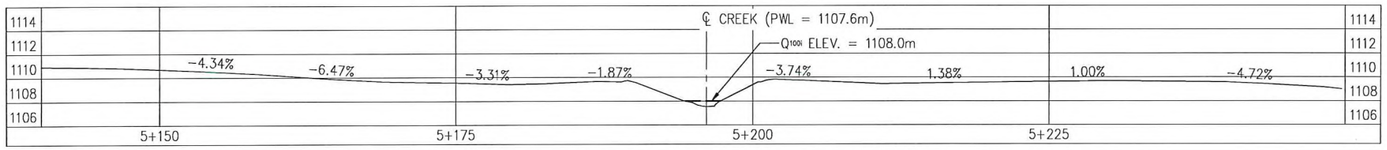
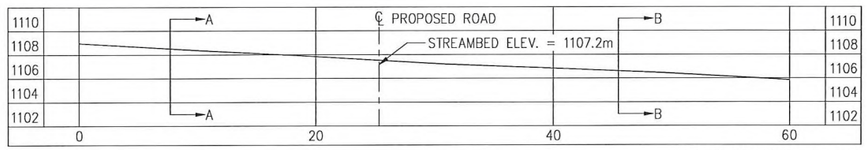


EXISTING GROUND PROFILE ALONG PROPOSED CENTERLINE
SCALE: 1:500



AVERAGE GRADIENT = -5.17%

CREEK PROFILE
SCALE: 1:500

SITE/SURVEY NOTES:

1. SITEPLAN WAS COMPLETED ON: 2012/10/18
2. SURVEY DATA WAS ESTABLISHED USING NO DECLINATION.
3. SITE SURVEYOR: S. JACOBS
   SITE RODMAN: K. MOE
4. STREAM RIPARIAN CLASSIFICATION: S4
5. DOMINANT RIPARIAN DESCRIPTION: SPRUCE/PINE
6. UTM COORDINATES: N5901517 E379063
7. HYDROLOGY:
   - DRAINAGE AREA: 5.9Km²
   - ESTIMATED Q100 FLOW: 3.9m³/s
   - ESTIMATED VELOCITY: 2.6m/s
8. SUGGESTED BRIDGE STRUCTURE:
   - SPAN: 13.000m
   - MINIMUM U/S GIRDER: 1108.7m
9. NO GEOTECHNICAL REPORT HAS BEEN COMPLETED TO DATE.

REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
		1
		2
		3
		4
		5
		6
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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
0	20/11/17	ISSUED FOR CONSTRUCTION	SN	SPF

CLIENT: ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN:	SN	DATE: 20/11/09
PROJECT NO:	2003075	DSGN:	SN	DATE: 20/11/09
DRAWING SIZE:	ANSI "B"	CHKD:	AZH	DATE: 20/11/10
SCALE:	AS NOTED	APVD:	SPF	DATE: 20/11/17

PROJECT:

BLACKWATER PROJECT
MINE ACCESS ROAD
DAVIDSON CREEK TRIBUTARY
CROSSING #2

TITLE:

SITE PLAN, PROFILES, SECTIONS AND NOTES

DWG NO: **2003075-200-1960-001**

REV: **0**

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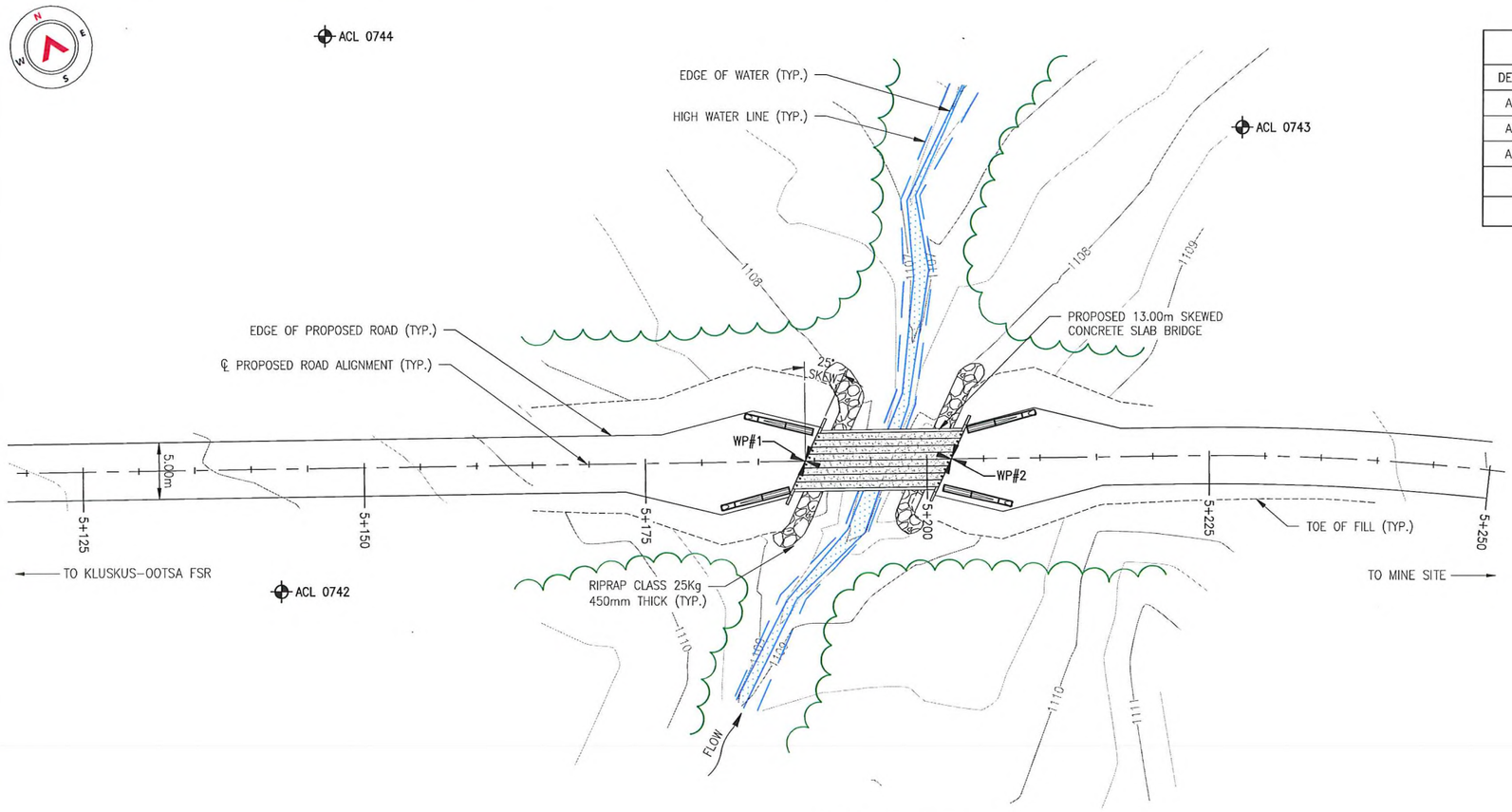
Date: 2020/11/17 | User: Stefanie Nowck | File: P:\PO\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #2\2003075-200-1960.SP | Layout: 001 | Paper Size: 558.8mm x 431.8mm



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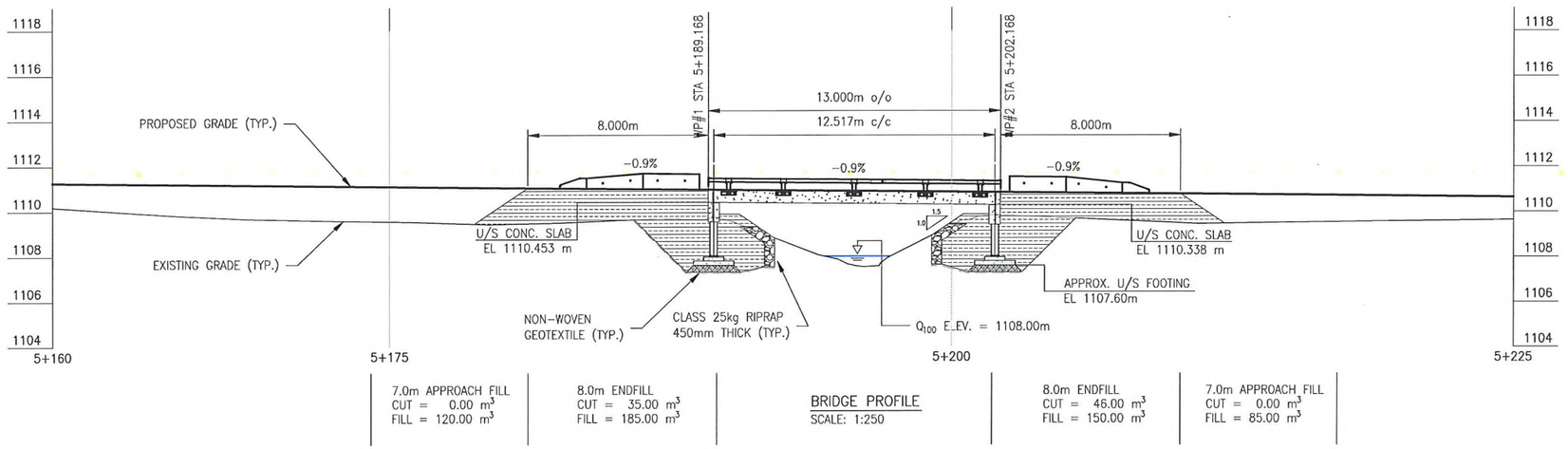

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FILL = 120.00 m^3	FILL = 185.00 m^3		FILL = 150.00 m^3	FILL = 85.00 m^3

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Allnorth

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SCALE:	AS NOTED	APVD: SPF	DATE: 20/11/17

PROJECT:
BLACKWATER PROJECT
MINE ACCESS ROAD
DAVIDSON CREEK TRIBUTARY
CROSSING #2

TITLE:
GENERAL ARRANGEMENT AND BRIDGE PROFILE

DWG NO: **2003075-200-1960-002**
REV: **0**

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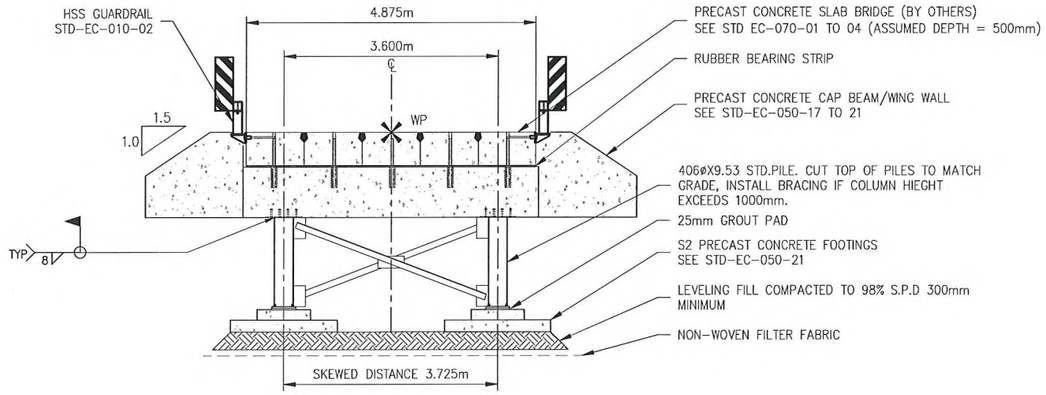

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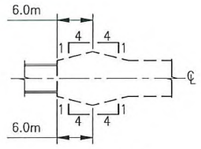

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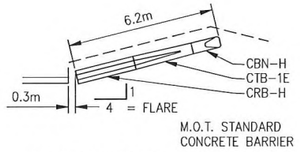


PRECAST CONCRETE BARRIER DETAIL
SCALE: 1:250

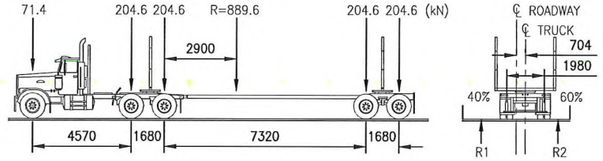
NOTES:

1. BACK FILL OF APPROACHES SHALL GENERALLY CONFORM TO THE LINES SHOWN ON THE DRAWINGS AND SHALL BE PLACED IN LIFTS NOT EXCEEDING 305mm THICK, COMPACTED TO 95% STANDARD PROCTOR DENSITY USING A MINIMUM 1000lbs VIBRATORY PLATE COMPACTOR. MATERIAL SHALL BE CLEAN, FREE DRAINING, WELL GRADED GRANULAR FILL OF 75mm MAXIMUM SIZE. LIFTS SHALL ALTERNATE BOTH WAYS AT EACH END OF THE BRIDGE TO ENSURE MINIMAL MOVEMENT.
2. NON-WOVEN FILTER FABRIC TO BE PLACED OVER EXCAVATION TO HAVE A MINIMUM CBR PUNCTURE STRENGTH OF 2300KN. FILTER FABRIC TO BE USED UNDER FOUNDATIONS.
3. ALL EXPOSED MINERAL SOILS TO BE SEEDED USING AN APPROVED RECLAMATION GRASS SEED MIXTURE AND COVERED WITH AN APPROVED EROSION CONTROL BLANKET.
4. THE CONTRACTOR IS TO CONTACT THE ENGINEER PRIOR TO PLACING FOUNDATIONS. FOUNDATIONS PLACEMENT SHALL BE SUPERVISED BY THE ENGINEER TO CONFIRM BEARING REQUIREMENTS.
5. ALL PERMITS AND REGULATORY APPROVALS TO BE IN PLACE PRIOR TO COMMENCING WORK.
6. ENVIRONMENTAL MANAGEMENT PLAN TO BE PREPARED FOR PROJECT BY OTHERS. COMPLETION OF WORKS TO COMPLY WITH MITIGATION RECOMMENDATIONS OUTLINED IN ENVIRONMENTAL MANAGEMENT PLAN.
7. NO SITE SPECIFIC GEOTECHNICAL INVESTIGATION HAS BEEN COMPLETED AS PART OF ALLNORTH CONSULTANTS LIMITED SCOPE OF WORK. THEREFORE, THIS DESIGN HAS BEEN PREPARED WITHOUT THE BENEFIT OF A SITE SPECIFIC GEOTECHNICAL FIELD INVESTIGATION OR GEOTECHNICAL ADVICE. GROUND CONDITIONS MAY VARY AND THE FOUNDATION REQUIREMENTS AND BRIDGE CONCEPT MAY NEED TO BE MODIFIED TO ACCOMMODATE ACTUAL SITE CONDITIONS ENCOUNTERED DURING CONSTRUCTION. ALLNORTH CONSULTANTS LIMITED ACCEPTS NO RESPONSIBILITY FOR ADDITIONAL COSTS OR DELAYS THAT MAY RESULT IF THE GROUND CONDITIONS VARY FROM THOSE ASSUMED IN THE DESIGN. THE DESIGN ENGINEER SHALL BE CONTACTED IF FIELD CONDITIONS VARY FROM THE DESIGN ASSUMPTIONS SHOWN ON THE DRAWINGS OR IN THE CONSTRUCTION SPECIFICATIONS. INSTALLATIONS OF FOUNDATIONS SHALL BE SUPERVISED BY THE DESIGN ENGINEER OR THEIR REPRESENTATIVE.
8. WHERE EXCAVATION SPECIFICATIONS ON THESE DRAWINGS CONFLICT WITH WORKSAFE BC (WSBC) REGULATIONS, WSBC REGULATIONS ARE TO GOVERN.
9. GENERAL ARRANGEMENT DRAWING. SOME STRUCTURE DETAIL NOT SHOWN. REFER TO FABRICATION DRAWINGS FOR FURTHER DETAIL PRIOR TO EXCAVATION AND INSTALLATION.
10. RIPRAP SPECIFICATIONS:

CLASS OF RIPRAP (kg.)	NOMINAL THICKNESS OF RIPRAP (mm)	ROCK GRADATION PERCENTAGE SMALLER THAN GIVEN ROCK MASS (kg)			APPROXIMATE AVERAGE DIMENSION (mm)		
		15%	50%	85%	15%	50%	85%
10	350	1	10	30	90	195	280
25	450	2.5	25	75	120	260	380
50	550	5	50	150	155	330	475
100	700	10	100	300	195	415	600
250	1000	25	250	750	260	565	815
500	1200	50	500	1500	330	715	1030

11. DESIGN LIFE: BRIDGE DESIGN LIFE: 45 YEARS

LOADING DIAGRAM L-100 OFF HIGHWAY G.V.W. = 90 680kg:
DESIGN IN ACCORDANCE WITH CAN/CSA-S6-14 WITH MODIFIED LOADING AS FOLLOWS:



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CLIENT: ARTEMIS GOLD INC

Allnorth

CLIENT NO:	-	DRWN:	SN	DATE:	20/11/09
PROJECT NO:	2003075	DSGN:	SN	DATE:	20/11/09
DRAWING SIZE:	ANSI "B"	CHKD:	AZH	DATE:	20/11/10
SCALE:	AS NOTED	APVD:	SPF	DATE:	20/11/17

PROJECT:

BLACKWATER PROJECT
MINE ACCESS ROAD
DAVIDSON CREEK TRIBUTARY
CROSSING #2

TITLE:

ABUTMENT ELEVATION AND NOTES

DWG NO: **2003075-200-1960-003** REV: **0**

Date: 2020/11/17 | User: Stefanie Noack | File: P:\PG\2020\2003075 Artemis SUP Application\1000-Dwgs\1011-Civil\01-Production\Site #2\2003075-200-1960 GA | Layout: 003 | Paper Size: 558.8mm x 431.8mm

Appendix C

Instream Flow Needs for Davidson Creek Memo

470 Granville Street, Suite 630, Vancouver, BC V6C 1V5
Tel: 604-629-9075 | www.pecg.ca

Memorandum

Date: December 3, 2021
Project #: 2006501

To: Ryan Todd and Travis Desormeaux, Blackwater Gold Ltd.
From: Stefan Gronsdahl, Thomas Gast, and Rick Palmer, Palmer
cc: Gregory Smyth, Knight Piésold Ltd.
Re: Blackwater Fisheries Offsetting Plan
Instream flow needs for Davidson Creek.

1. Introduction

BW Gold Ltd. (BW Gold), a wholly-owned subsidiary of Artemis Gold Inc., is proposing to develop the Blackwater Gold Project (the Project), located approximately 160 km southwest of Prince George, B.C. (Figure 1). The Project will consist of an open pit mine, a tailings storage facility (TSF), and other mine infrastructure. The Project is primarily located within the Davidson Creek watershed, which is 78 km^2 and supports both rainbow trout (*Oncorhynchus mykiss*) and Kokanee salmon (*Oncorhynchus nerka*). Palmer has been retained to prepare a Fisheries Offsetting Plan that will be submitted for a *Fisheries Act* Section 35(2) authorization in support of developing the Project.

Development of the TSF and other mine infrastructure is expected to reduce streamflow in Davidson Creek. Reductions will incrementally increase, as the Project expands, and water needs for ore processing increase. This reduction in flow has the potential to result in a loss of instream fish habitat in Davidson Creek.

A Fresh Water Reservoir (FWR) will be constructed to store water and provide flows to lower Davidson Creek to meet a defined instream flow needs (IFN) schedule. It is anticipated that, at some stage of mine development, the amount of available water from runoff to the FWR and flows conveyed to the FWR from the Davidson Creek watershed will be insufficient to meet the IFN in Davidson Creek. To offset the potential loss of fish habitat associated with flow reductions, BW Gold is proposing to construct a Fresh Water Supply System (FWSS) to provide additional freshwater, drawn from Tatelkuz Lake and released at the FWR, when required and as needed to supplement the water available for release to Davidson Creek to meet the IFN schedule. The FWSS will comprise of an intake structure and pumpstation at Tatelkuz Lake, a water supply pipeline, an outlet at the FWR, booster pumpstation(s), and connections to the FWR outlet works (KP, 2021b).

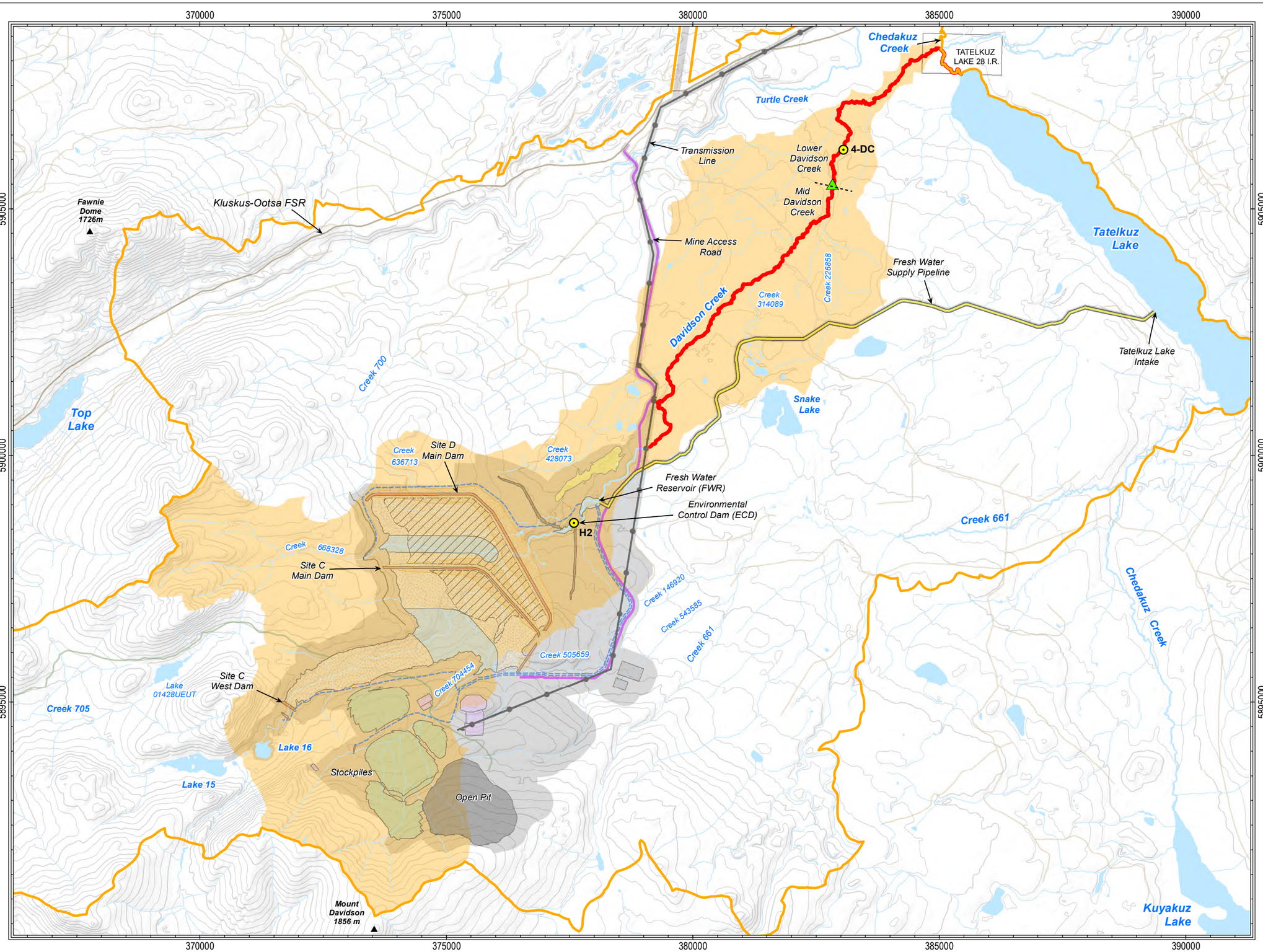
The IFN identifies the timing of the streamflow rate in Davidson Creek that would be required to provide adequate habitat to instream aquatic species throughout the year. The purpose of this memo is to review and update the IFN considering new information that is relevant to Davidson Creek.

The initial IFN was developed by AMEC (2015) as a part of the Environmental Assessment (EA) application. AMEC's approach for developing the IFN relied on field-intensive instream flow assessments for certain times of year and estimates of baseline hydrology when their instream flow assessments were not relevant (e.g., flushing flows and overwintering flows). Since the initial IFN was developed, the mine design has changed in such a way to mitigate some of the negative impacts to streamflow and the corresponding potential impacts to fish habitat. Flow regulation is not planned during construction as the facilities to supply and regulate flow releases are components of the construction work itself. The IFN schedule will guide minimum flow releases to Davidson Creek once the FWR, flow regulation facilities, and associated diversion systems, are constructed and commissioned. This is expected to occur late in the initial construction period prior to ore processing at the mine.

The work conducted by AMEC (2015) was conducted under the assumption that the IFN would be entirely met by water sourced from Tatelkuz Lake. Since then, a key change to the water management strategy was made to divert non-contact water that originated upstream of the mine footprint around the TSF so that it can rejoin Davidson Creek downstream of mine infrastructure and reduce the volume of water impounded by the TSF. This change will allow more water that originates from the upper portions of Davidson Creek to be available to meet the IFN, which will further reduce the amount of water that will need to be withdrawn from Tatelkuz Lake.

Since the IFN was initially developed, additional hydrometric data from Davidson Creek have been collected. These data have been used to update the baseline hydrological model. These updates have resulted in a different understanding of the baseline hydrology for Davidson Creek.

Note: this memorandum is intended to update the Instream Flow Study developed for the EA application (AMEC, 2015). Much of the analysis described herein relies on the work conducted during this Instream Flow Study. This memo should be read in conjunction with this previous Instream Flow Study, as it provides considerable information relevant to this analysis.



Legend

- Watershed Model Node
- Upstream extent of kokanee in Davidson Creek and Creek 661
- Spot Height
- Elevation Contour (25 m interval)
- Indian Reserve
- Mine Footprint
- Local Study Area Boundary

Impacted Fish Habitat

- Downstream Flow

Watersheds

- Davidson Creek

Scale 1:75000
UTM Zone 10N
NAD 1983 Datum

0 1 2 kilometres

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Prepared For:

CLIENT: Artemis Gold Inc.
PROJECT: Blackwater
DRAWN: B. Elder
CHECKED: S. Gronsdahl
PROJECT: 2006501
DATE: Mar 19, 2021

Prepared by: Palmer

Portion of Davidson Creek Subject to Instream Flow Needs

FIGURE 1

Document Path: G:\Shared drives\Projects 2020\20065 - Artemis Gold Inc\20065\01 - Blackwater Project 2020\Mapping\Figures\5 ArcGIS\Figure 1 - Portion of Davidson Creek Subject to Instream Flow Needs.mxd

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2. Instream Flow Needs Objectives

The volume and timing of streamflow is critical to support the rainbow trout and Kokanee populations that use Davidson Creek. Once the FWR is operational, flows in Davidson Creek will follow the IFN, which is designed to optimize the timing and magnitude of streamflow in Davidson Creek downstream of the mine footprint to provide the greatest benefit to fish inhabiting Davidson Creek. The FWR will allow for the storage of runoff and augmentation of flows at critical times to reduce the negative impacts to fish habitat. The IFN is not intended to fully recreate the baseline streamflow regime in Davidson Creek because it is undesirable to do so for two key reasons. Firstly, the volume of withdrawals that would be required from Tatelkuz Lake to supplement the water supply at the FWR to fully replicate the baseline streamflow regime in Davidson Creek would likely introduce negative effects to Chedakuz Creek. Secondly, the natural streamflow regime may not provide optimal habitat conditions (e.g., naturally occurring summertime low flows may limit fish productivity).

Therefore, it is desirable to withdraw the minimum amount of water from Tatelkuz Lake that will allow adequate habitat to be sustained in Davidson Creek. To address this, AMEC (2015) previously defined an IFN intended to maintain at least 90% of available habitat under average 30-day low flows. They defined the IFN separately for biologically relevant time periods for different species and life-stages of rainbow trout and Kokanee (also known as stanzas) in Davidson Creek. The updated IFN presented herein utilizes the same approach taken by AMEC, but with a few minor modifications. Specifically, our proposed IFN was developed based on the following principles:

1) To maintain a minimum of 90% of available habitat under average baseline conditions for each stanza.
2) To reduce the occurrence of naturally occurring low flows that may occur naturally and limit fish populations in Davidson Creek, (i.e. habitat bottleneck scenarios). Habitat bottlenecks are typically characterized by periods of high or low flow that limit the amount of critical habitat available for fish in a stream (Jowett and Hayes, 2004). Habitat bottlenecks may have cascading effects and limit overall production at later points in the year, even when streamflow increases and does not limit fish habitat.
3) To minimize the water withdrawn from Tatelkuz Lake and thereby limit the impacts to habitat in Tatelkuz Lake and Chedakuz Creek.

3. Methods

The 2015 instream flow study (AMEC, 2015) was conducted for two reaches of Davidson Creek downstream of the mine infrastructure footprint, as well as for a reach of Chedakuz Creek between the outlet of Tatelkuz Lake and its confluence with Davidson Creek. The study produced a series of relationships that estimate fish habitat as a function of streamflow. These relationships were used in conjunction with a baseline hydrological model to estimate how changes in flow affect fish habitat when the streamflow regime in Davidson Creek is controlled by the IFN.

3.1 Stanzas

AMEC (2015) developed the initial IFN for Davidson Creek based on biologically relevant time periods for different species and life-stages of rainbow trout and Kokanee (i.e., stanzas). These time periods were based on life history information that was verified during the baseline surveys conducted in Davidson Creek in 2011 and 2012 (Table 1, AMEC, 2015). These stanzas were used to define the IFN for distinct periods throughout the year. The stanzas that were originally proposed by AMEC have been applied to this update with minor adjustments, which are detailed in Section 3.6.

Table 1 – Species, life stages and periodicity for Davidson Creek as reported by AMEC (2015).

Species	Life Stage	Jan				Feb				Mar				Apr				May				Jun				Jul				Aug				Sep				Oct				Nov				Dec			
Rainbow Trout	Juvenile overwintering																																															
	Juvenile rearing and migration																																															
	Adult migration and spawning																																															
	Egg incubation																																															
Kokanee	Adult migration and spawning																																															
	Egg incubation																																															

3.2

3.3 Davidson Creek Baseline Hydrological Model

An updated long-term modelled hydrological timeseries for Davidson Creek was used to quantify habitat availability under different flow conditions. The timeseries was generated on a monthly time-step using the current baseline watershed model for Davidson Creek by KP (KP, 2021a). The model utilizes a semi-distributed representation of hydrological processes to develop monthly streamflow from 1980-2020 that are representative of baseline conditions.

3.4 Instream Flow Study

As a part of the EA application, AMEC conducted an instream flow study in streams where changes in flow were anticipated due to mine activities. The study involved extensive field campaigns during 2011, 2012, and 2013, as well as modelling and data analysis using the System for Environmental Flow Analyses (SEFA) software. Initially, AMEC developed site specific habitat suitability curves (HSCs) for their analysis that were adapted from curves developed using province-wide data by Ron Ptolemy, Instream Flow Specialist, BC Ministry of Environment (AMEC Foster Wheeler, 2016). However, upon subsequent review of this work in 2017, Palmer identified potential biases in these project-specific curves because they were only generated using fish presence observations at low flows. Therefore, the SEFA models were updated using the provincial HSCs (Figure 2, Table 2). No further updates were made to the SEFA models developed by AMEC.

Table 2 - Habitat suitability curves for substrate used in the instream flow studies. Developed by Ron Ptolemy, Instream Flow Specialist, BC Ministry of Environment

Species/Life-stage	Vegetation	Fines	Small Gravel	Large Gravel	Small Cobble	Large Cobble	Boulder	Bedrock
Rainbow fry	0.0	1.0	1.0	1.0	1.0	1.0	1.0	0.2
Rainbow juveniles	0.0	0.3	0.5	0.8	1.0	1.0	1.0	0.4
Rainbow adult	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0
Kokanee adult	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0

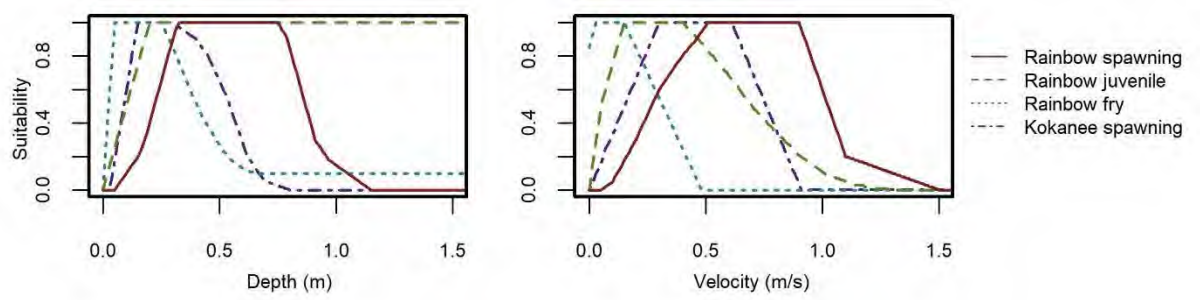

Figure 2- Habitat suitability curves for depths and velocities used in the instream flow studies. Developed by Ron Ptolemy, Instream Flow Specialist, BC Ministry of Environment

The SEFA models used the provincial HSCs in conjunction with the hydraulic models to produce fish habitat - streamflow relationships for each stanza in the affected streams (Figure 3). These relationships are used to quantify how changes in streamflow affect fish habitat using a metric called Area Weighted Suitability (AWS). The AWS of a stream is expressed in m^2/m and is the product of the cross-sectional area of a reach and its habitat suitability. Refer to AMEC (2015) for a detailed description of how AWS is calculated.

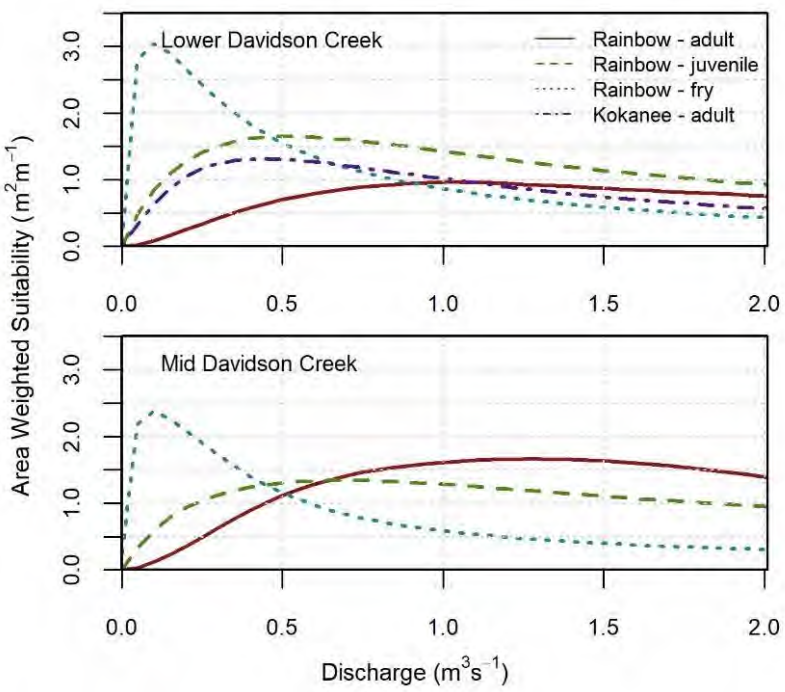

Figure 3 - Fish habitat - streamflow relationships for Davidson Creek.

3.5 Quantifying Changes in Habitat

As described above, the IFN is designed to maintain at least 90% of available habitat under average flow conditions for each stanza. The SEFA modelling platform was used to calculate the suitabily of the habitat for each of the life-stages during each of the stanzas for a 40-year timeseries. The IFN was then designed to replicate the average habitat conditions in each of the stanzas. Detailed information regarding the development of the SEFA models is contained in AMEC (2015).

3.5.1 Mid Davidson Creek

Mid Davidson Creek is located directly downstream of the proposed mine infrastructure and will have a flow regime that is controlled by IFN releases during operations. The habitat value for this reach was determined as the average habitat available over the 40-year baseline timeseries, and the IFN was developed to maintain an adequate proportion of habitat value in each of the stanzas. This approach coupled the timeseries of simulated baseline monthly flow data for Davidson Creek (KP, 2021a) in conjunction with the SEFA-derived streamflow-habitat relationships to generate a 40-year habitat timeseries for each stanza that is representative of historical baseline conditions. For this analysis, streamflow in mid Davidson Creek was represented using watershed model node H2, which is located at approximately the same location as the outlet of the FWR.

These baseline habitat timeseries were then compared against habitat timeseries developed by coupling the streamflow-habitat relationships to streamflow defined by the IFN. The difference between the AWS

available under baseline conditions and the AWS available under the IFN represent the expected habitat loss that would result in Davidson Creek. A separate timeseries analysis was conducted for each stanza.

Note, no SEFA models were developed to quantify overwintering habitat in Davidson Creek because SEFA is unable to quantify habitat under ice cover. However, because the IFN proposed herein will fully recreate median baseline flows during the overwintering period, median habitat conditions during overwintering will be replicated.

3.5.2 Lower Davidson Creek

The lower Davidson Creek reach is located further downstream from mid Davidson Creek and will exhibit a semi-natural flow regime that represents the combination of IFN releases and surface and groundwater inputs generated downstream of the mine infrastructure. Habitat value in lower Davidson Creek was quantified using the same timeseries analysis approach detailed for mid Davidson Creek. Streamflow at this location was defined using watershed model node 4-DC. The flows at 4-DC are expected to be more variable due to runoff contributions and groundwater inputs to Davidson Creek that are generated below the mine footprint, between station H2 and 4-DC. Therefore, the expected flows in lower Davidson Creek when the IFN is being met were estimated considering these streamflow inputs. This was done by subtracting the modelled baseline flows at H2 from 4-DC for each month in the 40-year baseline timeseries to determine the proportion of streamflow at 4-DC that was generated downstream of H2. These downstream flow contributions were then added to the IFN to develop an estimate of lower Davidson Creek streamflow during mine operation. Like in mid Davidson Creek, no losses to overwintering habitat were predicted during this period because the IFN was defined using median flow conditions.

3.5.3 Chedakuz Creek

The effects of withdrawals from Tatelkuz Lake on habitat in Chedakuz Creek between the outlet of Tatelkuz Lake and the confluence with Davidson Creek were quantified by AMEC using a hydrological routing model and a streamflow-fish habitat relationship developed as a part of their instream flow study. These data were previously analyzed using the same timeseries approach detailed in Section 3.5.1.

The streamflow routing model for Chedakuz Creek has not been updated since the work conducted by AMEC (2015). The annual volume of water to be withdrawn from Tatelkuz Lake to meet the IFN has not increased from the time of this study; however, since 2015 the baseline hydrology has been updated and the mine plan now proposes to divert more runoff that originates in the upper portion of the Davidson Creek catchment around the TSF. The surface water diversions result in more water originating from the upper portions of Davidson Creek to contribute downstream to meet the IFN, thus reducing the demand on the volume of water from Tatelkuz Lake. The increased freshwater diversions reduce the amount of water that will need to be withdrawn from Tatelkuz Lake to support IFN. Given this, the previously analyzed timeseries of habitat conditions from Chedakuz Creek represent a conservative over-estimate of the necessary withdrawals from Tatelkuz Lake, and subsequently, the actual habitat losses in Chedakuz Creek.

3.6 Updates to Instream Flow Needs

Considerations specific to updating the IFN for different periods are detailed in the below sections.

3.6.1 Overwintering and Incubating Kokanee Eggs

From the beginning of December until around April 15, Davidson Creek supports overwintering juvenile rainbow trout and incubating Kokanee eggs in the lower Davidson Creek reach. Due to challenges associated with collecting data to characterize winter habitat, AMEC did not conduct instream flow assessments to characterize these life-stages. Instead, AMEC assumed that average March flows (the lowest mean monthly flow during the winter period) would provide adequate habitat from December to April. Due to the limiting nature of overwintering habitat in the Davidson Creek watershed, we propose updating the IFN with a more conservative approach that uses the median baseline flow from December to March to define the IFN for this period. By defining the overwintering IFN using median overwintering flows that have been calculated using the most recent baseline hydrological model (KP, 2021a), this approach will recreate average baseline flow conditions and eliminate extreme wintertime low flows that could cause habitat bottlenecks and limit the amount of critical habitat available for fish.

Another consideration for overwintering flows is to define an IFN that protects incubating Kokanee eggs. According to AMEC (2015), Kokanee typically spawn in water that has a minimum depth of 4 cm. Considering this, AMEC defined a flow that is adequate to protect incubating eggs as one that results in a decrease in depths that is 4 cm or less from the time when spawning occurs. They evaluated this flow using the rating curve from a hydrometric station located within the reach. This method is based on the empirical rating curve and is only applicable to the hydraulic conditions at that cross section. To improve this estimate, we calculated the flow that would result in a maximum decrease in water level of 4 cm for a section of Davidson Creek located downstream of the TSF using the below-bankfull hydraulic modelling component of the Geomorphic Instream Flow Tool (GIFT) (Gronsdahl et al., 2021). This analysis was conducted for the affected reaches of Davidson Creek using channel gradient, cross-sectional depth and velocity measurements, and pebble count data collected by Palmer.

3.6.2 April Flows

Flows in April are more variable because of the timing of the spring freshet. As streams become ice-free, overwintering habitat transitions to juvenile rainbow trout rearing habitat and the instream habitat needs change. To capture the variability in baseline streamflow that occurs during April and to more accurately prescribe flows that address the species and life-stages in Davidson Creek at any given time, Palmer recommends defining an IFN for the first half of April that is separate from the second half. From April 1-15, we propose an IFN that is equivalent to the overwintering December-March IFN. From April 16 to May 10, we propose an IFN that is designed to provide habitat to the juvenile rainbow trout that are present in Davidson Creek during this time. In reality, as the snowpack melts in the lower portions of the Davidson Creek watershed, it will contribute runoff to lower sections of Davidson Creek and create a more variable hydrograph for this period.

3.6.3 Flushing Flows

Flushing flows are intended to entrain and remove fine sediments which have accumulated along the bed of streams during periods of low flows. Ideally, flushing flows are based off site-specific observations and sediment entrainment calculations that predict the flow required to provide enough force to remove fine

sediments from the stream bed. When site-specific data are unavailable, these flows are commonly set using the guidance of relevant literature, which recommends flows that range from 100-400% of mean annual discharge (MAD) (Ptolemy and Lewis, 2002; Tennant, 1976; Wald, 2009). In the EA, the flushing flow was set at 400% of MAD for average and wetter than average years, which was equivalent to 1.120 m^3/s based on the data available at that time.

Since the initial IFN was developed by AMEC, Palmer has collected observations and data (longitudinal profile, cross-sections, pebble counts) in the affected reaches of Davidson Creek to calculate a site-specific flushing flow. Sediment entrainment thresholds were established for coarse sand (0.83 mm) and very coarse sand (2 mm - the threshold between sand and gravel) within the surveyed reach using both critical shear stress (Shields [1936] as presented by Church (2006)) and critical velocity (Hjulstrom, 1935) protocols.

3.6.4 Fry, juvenile, and adult rainbow trout and adult Kokanee stanzas

From spring to fall Davidson Creek provides habitat to rainbow fry, juvenile and adult rainbow trout and adult Kokanee for rearing, migration, and spawning. Our IFN uses the flows previously proposed by AMEC, which provide a minimum of 90% of the habitat available under average streamflow conditions for each relevant stanza. When more than one stanza utilizes Davidson Creek at the same time, the IFN was defined using the stanza which requires the greatest flow to maintain adequate habitat, which is also consistent with the IFN initially proposed by AMEC. This approach strikes a reasonable balance between maintaining adequate habitat in Davidson Creek while minimizing the impacts to Tatelkuz Lake and Chedakuz Creek. In addition, like the strategy to address overwintering flows, this approach uses an average scenario to define the IFN and eliminates extreme low flows that could cause habitat bottlenecks and limit the amount of critical habitat available for fish.

3.7 Ramping Rates

Flow ramping refers to the gradual change in streamflow that occurs because of the operation of regulated reservoirs. The ramping rates refer to the appropriate change of stage (water level) per unit time. Ramping rates are defined to mitigate harm to fish that may occur if flows are ramped too quickly. Generally accepted guidance for streams where salmonid fry are present, such as Davidson Creek, specifies a maximum allowable ramping rate of 2.5 cm/hour (KP, 2005).

Ramping rates were determined for the FWR using the rating curve at the H2 hydrometric station, which is used to characterize the reach of Davidson Creek immediately downstream of the proposed mine infrastructure. KP (2021a) define the current rating curve for H2 as follows:

$$Q = 6.2 \cdot Stage^{2.4} \quad (1)$$

where Q represents streamflow (m^3/s) and $Stage$ represents the stage (m) above zero-flow conditions in the local gauge datum. The relationship between streamflow and stage, as defined by this rating curve, was used to evaluate the streamflow that corresponds to 2.5 cm change in stage for the range of flows defined by the IFN.

4. Results and Discussion

4.1 Updates to Instream Flow Needs

The following section describes the IFN for Davidson Creek downstream of the mine footprint. This IFN is reflective of the required in-channel flow immediately downstream of the FWR to maintain adequate fish habitat within Davidson Creek (Table 3, Figure 4). The timing of the stanzas varies slightly from those proposed by AMEC (2015) to more accurately represent the timing that different species and life stages utilize habitat in Davidson Creek. The ramping rates described in Table 3 are consistent with those detailed by AMEC (2015), who propose ramping rates below the maximum allowable rate of 2.5 cm/hour that is defined for hydroelectric facilities.

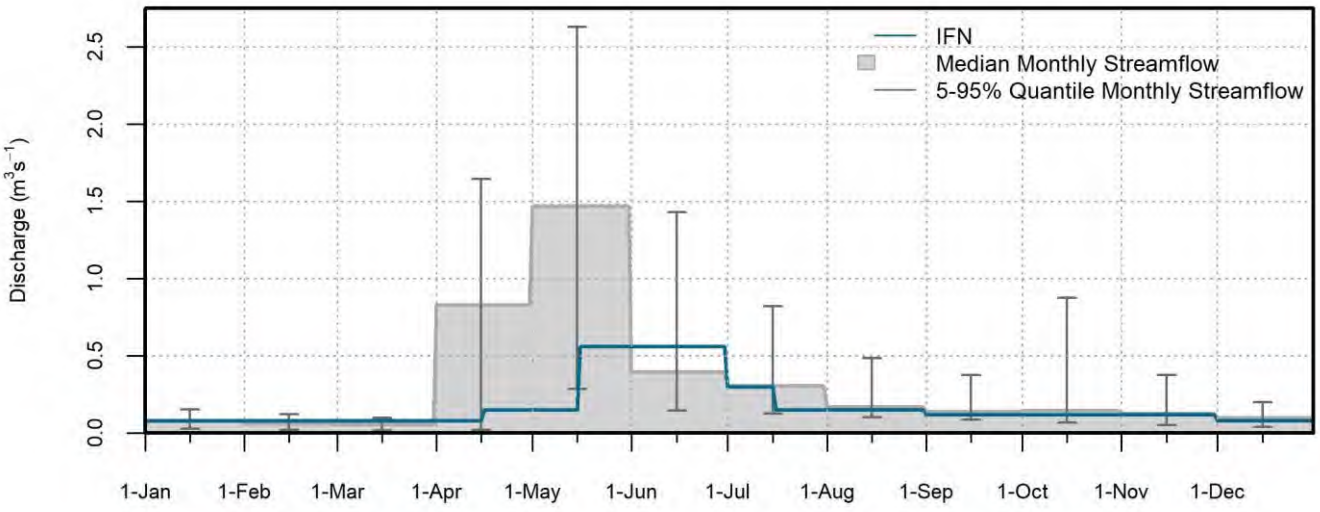

Figure 4 – Long-term modelled monthly streamflow at H2 and Instream Flow Needs for Davidson Creek downstream of the FWR.

4.1.1 Overwintering and Kokanee Egg Incubation

The mean streamflow from December to March is 0.08 m^3/s. The flow that corresponds to an estimated maximum 4 cm reduction in reach-averaged depth for Davidson Creek below the mine footprint is 0.06 m^3/s, as determined using GIFT. Furthermore, this estimate does not quantify groundwater inputs that will also supplement over-winter flows in Davidson Creek. Therefore, from December to March, the IFN is defined as 0.08 m^3/s, which is more conservative and should coincide with a reduction in reach-averaged depth of less than 4 cm. From April 1-15, we propose an IFN of 0.08 m^3/s, which is equivalent to the overwintering December-March IFN.

4.1.2 Flushing Flows

The critical velocity analyses indicated coarse sands are entrained at a discharge of approximately 0.26 m^3/s and very coarse sands are entrained at a discharge of approximately 0.49 m^3/s. These findings suggest that the flow of 0.56 m^3/s, which is prescribed to provide habitat for adult rainbow trout throughout May and June (Section 4.1.3) is also capable of entraining and transporting fine sediments. As the flow to provide adult rainbow trout habitat is greater, it is also a suitability conservative flushing flow. Therefore, a separate flushing flow is not required.

4.1.3 Juvenile and adult rainbow trout and kokanee

From April 16 to May 15, we propose an IFN of 0.15 m^3/s, which is designed to provide habitat to the juvenile rainbow trout that are present in Davidson Creek during this time. From May 16 – June 30, the IFN is 0.56 m^3/s and is designed to provide habitat to adult rainbow trout, in addition to providing flushing flows. From July 1 – 15 the IFN is 0.30 m^3/s and is designed to provide habitat to juvenile rainbow trout and Kokanee migration. From July 16 – August 31, the IFN is 0.15 m^3/s and is designed to provide habitat to juvenile rainbow trout and Kokanee and rainbow trout egg incubation and Kokanee migration and spawning. From September 1 – November 30, the IFN is 0.12 m^3/s and is designed to provide habitat to juvenile rainbow trout and Kokanee egg incubation. The ramping rates are below the maximum allowable rate of 2.5 cm/hour for hydroelectric facilities.

Table 3. Proposed instream flow needs for Davidson Creek. Values are representative of streamflow immediately downstream of the FWR and are not end-of-pipe requirements.

Period	Fish Species/Life Stages	IFN (m^3/s)	Previous IFN (m^3/s)[1]	Rationale
Dec 1 – Apr 15	Kokanee egg incubation, Juvenile rainbow trout overwintering	0.08	0.13	Updated baseline hydrology
Apr 16 – May 10	Juvenile rainbow trout	0.15	0.13	Updated based on fish periodicity and instream habitat modelling conducted by AMEC (2015)
May 11 – May 15	Flushing flows	0.56	1.12	Updated sediment entrainment calculations
May 16 – Jun 30	Juvenile and adult rainbow trout, rainbow trout egg incubation	0.56	0.56	Consistent with AMEC (2015) instream habitat modelling and sediment entrainment calculations
Jul 1 – Jul 15	Juvenile rainbow trout, Kokanee and rainbow trout egg incubation, Kokanee migration	0.30	0.30	Consistent with AMEC (2015) instream habitat modelling
Jul 16 – Aug 31	Juvenile rainbow trout, Kokanee and rainbow trout egg incubation, Kokanee migration and spawning	0.15	0.15	Consistent with AMEC (2015) instream habitat modelling
Sep 1 – Nov 30	Juvenile rainbow trout, Kokanee egg incubation	0.12	0.12	Consistent with AMEC (2015) instream habitat modelling and updated baseline hydrology

1. As defined by AMEC (2015).

4.2 Ramping Rates

Using Equation 1, the rating curve for H2, we calculated a rating table, discrete points along the streamflow – stage relationship downstream for H2, which is near the downstream extent of the proposed mine infrastructure (Table 4). The proposed ramping rates are appropriately conservative if actual ramping rates were to vary by approximately 10%. Based on this relationship, the following ramping rates are proposed:

- **0.030 m^3/s per hour:** when flows are less than 0.15 m^3/s.
- **0.040 m^3/s per hour:** when flows are greater than 0.15 m^3/s.

Table 4 – Streamflow that corresponds to 2.5 cm changes in water level at flows relevant to instream flow needs at the H2 hydrometric station, near the downstream extent of proposed mine infrastructure.

Stage (m above zero flow water level)	Streamflow (m^3/s)	Δ Streamflow (m^3/s)
0.160	0.076	0.032
0.185	0.108	0.038
0.210	0.146	0.045
0.235	0.192	0.053
0.260	0.245	0.060
0.285	0.305	0.068
0.310	0.373	0.076
0.335	0.449	0.085
0.360	0.534	0.093
0.385	0.627	0.102

The proposed ramping rates are specific to the compliance point downstream of the FWR. Any additional infrastructure that may convey streamflow to Davidson Creek in excess of the prescribed flushing flows, such as an overflow spillway from the FWR, should be operated to mimic the natural variability of the streamflow regime at Davidson Creek at that time. For example, if water is being discharged to Davidson Creek via a spillway, it should convey flows that are approximately equivalent to the inflows to the FWR at that time.

4.3 Alleviation of Habitat Bottlenecks and Critical Flows

Periods of low flow for streams in the Project area occur during the late summer, early fall, and winter. A key benefit of introducing an IFN to Davidson Creek is that it is designed to alleviate habitat bottlenecks and negate the occurrence of flows below critical thresholds that could do irreparable harm to fish communities in Davidson Creek during these low flow periods. The relevant exceedance flows for key low flow periods are displayed on Table 5 and on Figure 5. The IFN during these periods more closely resembles baseline habitat and removes these naturally occurring low flows that are potentially harmful to the fish communities in Davidson Creek. For example, monthly flow exceedance plots from August – November and the December – March overwintering period indicate that the prescribed IFN ranges from the 50% exceedance flow from December - March to the 65% exceedance flow in October. In other words, natural flows would exceed the IFN 65% of the time in October and 50% of the time from November to March. This strategy eliminates habitat bottlenecks that are associated with particularly low flows.

Table 5. The frequency that natural flows would exceed the IFN under natural conditions (exceedance flow percentages) during low flow periods in Davidson Creek.

	Aug	Sep	Oct	Nov	Dec - Mar
Exceedance Flow of IFN	63%	64%	65%	60%	50%

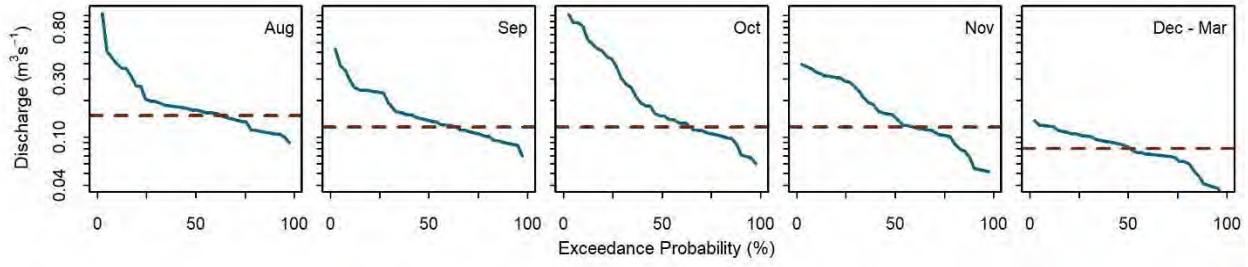

Figure 5 – Flow exceedance curves (solid blue line) and the corresponding IFN (dashed red line) during the low flow period for Davidson Creek. Note the logarithmic y-axis.

4.4 Habitat Availability

The estimated habitat availability for the affected reaches of Davidson and Chedakuz creeks under the IFN are detailed in Table 6. The relative changes in habitat are all at least 90% of what is available under baseline conditions. In many cases, these estimates suggest that the IFN will result in more habitat than was available under baseline conditions, particularly for rainbow trout spawning habitat and fry rearing habitat in Davidson Creek. This is possible because the IFN reduces variability in streamflow and removes natural low flow conditions that are habitat limiting.

Table 6. Relative habitat changes due to changes in Davidson and Chedakuz Creeks expressed as percent of habitat available under baseline conditions.

Affected Reach	Rainbow Trout Spawning	Juvenile rainbow rearing	Rainbow fry rearing	Kokanee spawning	Rainbow Trout Overwintering
Chedakuz Creek	100.4%	99.5%	101.7%	99.9%	100.0%
Lower Davidson Creek	119.0%	100.2%	115.7%	100.6%	100.0%
Middle Davidson Creek	116.4%	96.8%	120.3%	Not present	100.0%

4.5 Construction of the FWR

The FWR will be built during the construction phase. Flow regulation is not planned during construction as the facilities to supply and regulate flow releases are components of the construction work itself. Project-related activities will have a minor influence on streamflow in Davidson Creek prior to commencement of ore processing at the mine. The ability to divert, store, and manage water within the Davidson Creek watershed to meet IFN will only occur once the FWR and water diversion infrastructure has been built and is operational. The initial diversion of runoff generated within Davidson Creek watershed into water retention infrastructure (the freshwater infrastructure and a water management pond) is anticipated to occur towards the end of the construction phase. This initial diversion must occur to fill the water retention infrastructure to allow for the subsequent management of flows to meet the IFN and to support the operation of mine facilities. The rate and timing of the initial water diversion will be managed to maintain flows in Davidson Creek downstream of the mine that are within the natural range of flows and will follow general guidance provided by the BC Environmental Flow Needs Policy (BC MFLNRO and BC MoE, 2016).

4.6 Adaptive Management

The ability for the water management systems, including the mine area water management structures and systems, the FWR, and FWSS to provide adequate habitat and maintain fish health in Davidson Creek will be assessed through an effectiveness monitoring program. The results of this monitoring program may be used within an adaptive management framework, to make future modifications to the IFN for Davidson Creek.

5. Limitations and Assumptions

5.1 SEFA Model Assumptions

This analysis assumes that the SEFA models developed as a part of the EA application adequately represent current hydraulic conditions of the study streams. These models were developed using data collected from 2011-2013, and it is possible that site conditions have changed since then. These models have also been updated using provincial HSCs for rainbow trout and Kokanee developed by Ron Ptolemy, BC Ministry of Environment. Potential sample bias was identified with the project-specific HSCs that were initially developed for the site (AMEC Foster Wheeler, 2016) and they have been replaced with provincial HSCs for rainbow trout and Kokanee. This analysis is more conservative than the analysis using the site-specific HSC and assumes that the preferences of fish within the project site are accurately described by these provincial HSCs.

5.2 Hydrological Model Assumptions

This analysis relies on a long-term synthetic timeseries of monthly streamflow for Davidson Creek. These data were developed using a semi-distributed hydrological model of baseline flows. This model has been updated since the EA application, and each time the estimates of baseline watershed conditions have changed because of new data used. The information about the model presented by KP (2021a) is the most recent characterization of baseline conditions at the site; however, it should be noted that the understanding of the baseline hydrology of the site may change as new data become available in the future.

6. Conclusion

This memo provides updates to the IFN based on new data available to characterize Davidson Creek. The objectives of the IFN are to (1) maintain a minimum of 90% of habitat available under baseline conditions, (2) avoiding habitat bottlenecks that could limit fish productivity, and (3) minimize water withdrawn from Tatelkuz Lake to limit impacts to fish in Chedakuz Creek. These objectives are accomplished by maintaining a minimum of 90% of the habitat available specified using SEFA modelling, reducing the occurrence of natural low flows that could create habitat bottlenecks that could limit fish productivity in Davidson Creek, and by augmenting flows in Davidson Creek when they will have the greatest benefit to fish.

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Appendix D

Construction Phase Temporary Minimum Flow Threshold Memo

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Memorandum

Date: February 24, 2022
Project #: 2006501

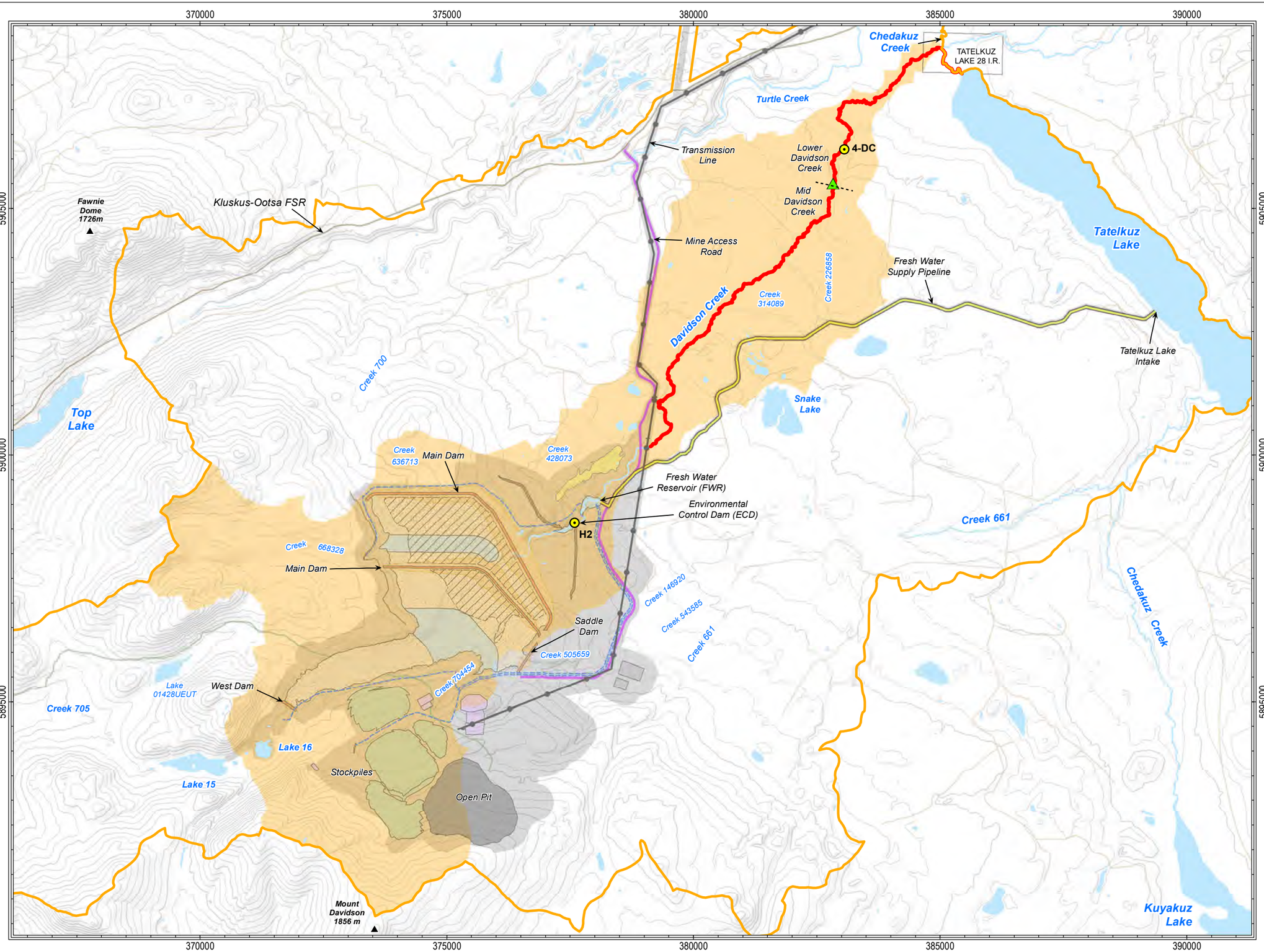
To: Ryan Todd and Travis Desormeaux, Blackwater Gold Ltd.
From: Stefan Gronsdahl, Ian MacLeod, Irene Tuite, and Rick Palmer, Palmer
cc: Gregory Smyth, Knight Piésold Ltd.
Re: **Blackwater Fisheries Offsetting Plan**
Construction Phase: Temporary Minimum Flow Threshold in Davidson Creek.

1. Introduction

1.1 Background

BW Gold Ltd. (BW Gold), a wholly-owned subsidiary of Artemis Gold Inc., is proposing to develop the Blackwater Gold Project (the Project), located approximately 160 km southwest of Prince George, B.C. (Figure 1). The Project will consist of an open pit mine, a tailings storage facility (TSF), and other mine infrastructure. The Project is primarily located within the Davidson Creek watershed, which is 78 km^2 and supports both Rainbow Trout (*Oncorhynchus mykiss*) and Kokanee (*Oncorhynchus nerka*) (Figure 1). Palmer has been retained to prepare a Fisheries Offsetting Plan in support of a *Fisheries Act* authorization for the Project.

Development of the TSF and other mine infrastructure is expected to reduce streamflow in Davidson Creek. These reductions will incrementally increase as the Project expands and water needs for ore processing increase. This reduction in flow has the potential to result in a loss of instream fish habitat in Davidson Creek. To address loss of flows that will result from the Project, BW Gold is proposing to construct a freshwater reservoir (FWR) and a water management pond (WMP) during the initial Construction Phase of the Project that will capture and store runoff from upstream portions of Davidson Creek and will be used manage flows in Davidson Creek downstream of the mine site to meet a defined instream flow needs (IFN) schedule. It is anticipated that, at some stage of mine development, the amount of available water from runoff to the FWR and WMP will be insufficient to meet the IFN in Davidson Creek. When that occurs, BW Gold is also proposing to construct a Fresh Water Supply System (FWSS) to provide additional freshwater, drawn from Tatelkuz Lake and released at the FWR, to supplement the water available for release to Davidson Creek to meet the IFN schedule. The FWSS will comprise of an intake structure and pumpstation at Tatelkuz Lake, a water supply pipeline, an outlet at the FWR, booster pumpstation(s), and connections to the FWR outlet works.



Legend

- Watershed Model Node
- Upstream extent of kokanee in Davidson Creek
- Spot Height
- Elevation Contour (25 m interval)
- Indian Reserve
- Mine Footprint
- Local Study Area Boundary

Impacted Fish Habitat

- Downstream Flow

Watersheds

- Davidson Creek

Scale 1:75000
UTM Zone 10N
NAD 1983 Datum

0 1 2
kilometres

N

Prepared For:

CLIENT: Artemis Gold Inc.
PROJECT: Blackwater
DRAWN: B. Elder
CHECKED: S. Gronsdahl
PROJECT: 2006501
DATE: Feb 24, 2022

Prepared by:

Palmer

Portion of Davidson Creek Subject to Instream Flow Needs

FIGURE 1

Document Path: G:\Shared drives\Projects 2020\20065 - Artemis Gold Inc\2006501 - Blackwater Project 2020-2022\Mapping\Figures\5_ArcGIS\Figure 1 - Portion of Davidson Creek Subject to Instream Flow Needs.mxd

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The IFN identifies the timing of the streamflow rate in Davidson Creek that would be required to maintain a minimum of 90% of available habitat under baseline conditions. The IFN is a long-term standard that is intended to maintain habitat for the Operations Phase of the Project. It was developed based on modelling conducted as a part of detailed instream flow assessment (AMEC, 2015), and considers the habitat available to different life-stages of both Rainbow Trout and Kokanee.

One outcome of the Environmental Assessment for the Project was a condition to meet the IFN in Davidson Creek, unless otherwise authorized by Fisheries and Oceans Canada (DFO). Specifically, Paragraph 3.8 of the *Canadian Environmental Assessment Act* Decision Statement for the Blackwater Project states:

> *The Proponent shall develop, prior to construction, measures to maintain instream flow needs in Davidson Creek. The Proponent shall maintain instream flow needs in Davidson Creek during all phases of the Designated Project at a minimum within flow rates recommended by the Proponent in Appendix 5.1.2.6D [AMEC, 2015] of the Environmental Impact Statement, unless otherwise authorized by Fisheries and Oceans Canada.*

1.2 Deviation from Environmental Assessment Condition

Based on the above-noted clause, DFO has the discretion to permit minimum flow rates within Davidson Creek that differ from the IFN. Such a deviation from the IFN is warranted during the 18-month Construction Phase of the Project and is proposed for the following reason.

Before the FWR and WMP are commissioned, the Project will have minimal impacts on Davidson Creek downstream of the mine site, which will continue to have an undisturbed streamflow regime subject to natural variability. Under these conditions, the natural variability of Davidson Creek is such that flows fall below the proposed IFN during drier than normal periods. If this were to happen during the Construction Phase, the Project would not yet be capable of managing streamflow in Davidson Creek to meet the IFN. The FWR and WMP must be constructed, commissioned, and filled with water before the Project has the capability to capture runoff and manage streamflow in Davidson Creek to meet the IFN. Therefore, a temporary deviation from the IFN for the Construction Phase would allow the Project adequate time to build, commission, and fill the FWR and WMP using runoff generated from the Davidson Creek watershed. This deviation from the IFN would be a temporary measure that would be in effect during the Construction Phase of the Project and would be managed to mitigate short-term effects of water withdrawals on fish. It would also support the efficient and effective filling of the FWR and WMP so that the Project can proceed with managing streamflow in Davidson Creek to meet the IFN during the Operations Phase.

1.3 Memorandum Objective

Once the FWR and WMP are commissioned, some of the streamflow in Davidson Creek would need to be diverted to fill these ponds and the Project would begin to affect the streamflow regime of Davidson Creek. This diversion has the potential to negatively affect fish habitat in Davidson Creek. The purpose of this memorandum is to detail a temporary minimum instream flow threshold (“the threshold”) that would mitigate the short-term effects of water withdrawals on fish habitat in Davidson Creek during this Construction Phase of the Project. The proposed threshold is intended to minimize the potential for harm to fish during short-

term periods of flow reduction. Expected potential effects of flow reduction on fish, informed by DFO's Pathways of Effects (DFO, 2010), include displacement or stranding of fish, change in migration patterns, or drying of embryos contained in channel substrates.

2. Methodology

Determination of the threshold was conducted in general accordance with the BC-Modified Tennant Method. Ptolemy and Lewis (2002) provide discussion that supports the scientific basis of the application of the BC-Modified Tennant Method, as well as how Tennant-style approaches are used to set conservation flows throughout North America. In addition, the BC-Modified Tenant Method is generally consistent with the BC Environmental Flow Needs Policy (BC FLNRORD and MECCS, 2016) and has been used to set conservation flows in other parts of B.C. (e.g., AE, 2016).

The BC-Modified Tennant Method considers the timing that different fish species and life-stages are present within a creek, as well as ecological processes that are necessary to maintain adequate channel conditions. Instream flows are minimum standards that are chosen to support the relevant species at different times of year and are set as a proportion of long-term mean annual discharge (MAD). The derivation of a long-term MAD value should be conducted using a long-term streamflow dataset that is representative of unaltered streamflow conditions. In scenarios where there may be existing water withdrawals, observed streamflow data may need to be corrected (i.e., naturalized) so that it represents unaltered conditions before calculating long-term MAD. Those BC-Modified Tennant Method flow standards for fish life-stages, and ecological processes that are relevant to Davidson Creek are summarized in Table 1. The standards are intended to be applicable to all species of fish, except where otherwise indicated.

Table 1 – Summary of BC-Modified Tennant Method minimum flow standards relevant to Davidson Creek.

Biological or Physical Requirement	Percentage of Mean Annual Discharge	Duration
Short-term biological maintenance	10%	days
Juvenile summer-fall rearing	20%	months
Overwintering	20%	months
Incubation	20%	months
Kokanee spawning	20%	weeks
Smolt emigration	20%	weeks
Adult spawning and migration	30-200%[1]	days to weeks
Sediment Flushing	>400%	days

1.Threshold is intended to vary based on stream size. See Ptolemy and Lewis (2002) additional detail.

2.1 Data Used

2.1.1 Fish Periodicity

As a part of the baseline program, AMEC (2015) identified biologically relevant periods when different species and life stages of Rainbow Trout and Kokanee use Davidson Creek. These periods were based on

life history information that was verified during baseline surveys conducted in Davidson Creek in 2011 and 2012 (Table 2, AMEC, 2015). These periods were used to identify relevant biological processes and appropriate instream flow thresholds.

Table 2 – Species, life stages and periodicity for Davidson Creek as reported by AMEC (2015).

Species	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainbow Trout	Juvenile overwintering	■	■	■	■								
	Juvenile rearing and migration				■	■	■	■	■	■	■	■	
	Adult migration and spawning					■	■						
	Egg incubation						■	■	■				
Kokanee	Adult migration and spawning							■	■				
	Egg incubation	■	■	■	■				■	■	■	■	■

2.1.2 Streamflow Data

Two sources of hydrological data were used to inform the development of a temporary instream flow threshold: a modelled 40-year hydrological timeseries for Davidson Creek and observed data from a hydrometric station located in Davidson Creek near the outlet of the FWR.

The 40-year hydrological timeseries for the 1981-2020 period for Davidson Creek was used to develop an estimate of long-term MAD and to characterize flows during winter months. The timeseries was generated on a monthly time-step using the current baseline watershed model for Davidson Creek by KP (KP, 2021). The model utilizes a semi-distributed representation of hydrological processes to develop monthly streamflow from 1981-2020 that are representative of baseline conditions.

A hydrometric station (Station ID: H2) has also been operated on Davidson Creek near the outlet of the FWR during open-water periods since 2011. Because Davidson Creek is small and completely freezes during winter months, the instrumentation is removed from this station during the winter period to minimize potential damage. Daily streamflow records observed at H2 were used to characterize the streamflow regime of Davidson Creek for relevant, open-water periods (KP, 2021).

Based on a search using the BC Water Resources Atlas, no past or present water licenses were identified for Davidson Creek (DataBC, 2022). Therefore, the observed and modelled streamflow data for Davidson Creek were deemed to be representative of baseline conditions, and no streamflow naturalization was warranted.

3. Proposed Minimum Instream Flow Threshold

3.1 BC-Modified Tennant Flows for Davidson Creek.

Analysis of the long-term modelled streamflow data for H2 indicates that MAD for this location is 0.35 m^3/s. Table 3 provides an overview of the recommended conservation flow for Davidson Creek for the different species and life-stages present. Note, the sediment flushing flow is presented in mid-May to late June, as this corresponds with the general timing of spring freshet, but this flow can occur at any time of year to support this process, and only needs to occur for a period of days.

Table 3 – BC-Modified Tennant recommended flows for species and life-stages in Davidson Creek.

Species	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainbow Trout	Juvenile overwintering	20% MAD											
	Juvenile rearing and migration					20% MAD							
	Adult migration and spawning					30-200% MAD							
	Egg incubation						20% MAD						
Kokanee	Adult migration and spawning							20% MAD					
	Egg incubation	20% MAD							20% MAD				
Sediment Flushing						160% MAD							

3.2 Modifications for Sediment Flushing

A site-specific modification was made to the required flows that support sediment flushing. To calculate an appropriate flow to support this requirement, hydraulic data specific to the downstream reaches of Davidson Creek (i.e., longitudinal profile, cross-sections, and pebble counts) were used to calculate sediment entrainment thresholds for coarse sand (0.83 mm) and very coarse sand (2 mm - the threshold between sand and gravel) using both critical shear stress (Shields [1936] as presented by Church (2006)) and critical velocity (Hjulstrom, 1935) protocols. Both calculations suggest that a streamflow of 0.56 m^3/s (160% MAD) is sufficient for entraining and transporting very coarse sands.

3.3 Proposed Operational Threshold

The proposed temporary flow threshold would provide a minimum instream flow rate to be maintained in Davidson Creek during times of active water diversion to fill the FWR and WMP. The threshold would be in effect during the Construction Phase of the Project. Water withdrawals from Davidson Creek would be permitted as follows:

- When the natural discharge in Davidson Creek exceeds the temporary threshold, water withdrawals from Davidson Creek would be allowed at a rate such that the actual instream flow in Davidson Creek immediately downstream of the FWR would meet the temporary threshold, at a minimum.
- When the natural discharge in Davidson Creek immediately downstream of the FWR is below the temporary threshold, no water withdrawals from Davidson Creek would be allowed.

Table 4 provides a summary of the proposed instream flow threshold applicable to Davidson Creek at the outlet of the FWR (Figure 1). Section 5 provides additional detail regarding proposed data collection and monitoring at the outlet of the FWR to evaluate compliance and confirm the effectiveness of the proposed threshold, as well as to support on-site operations and water management activities.

Table 4 – Proposed temporary instream flow threshold for Davidson Creek during the Construction Phase.

Period	Percentage of MAD	Proposed Threshold	Ecological and Physical Processes Supported
July 1 – May 14	20%	0.07 m^3/s	Rainbow trout: Juvenile rearing and migration, egg incubation, juvenile overwintering. Kokanee: Adult migration and spawning, egg incubation

Period	Percentage of MAD	Proposed Threshold	Ecological and Physical Processes Supported
May 15 – June 30	160%	0.56 m^3/s (21 days minimum)	Rainbow trout: Adult spawning and migration. Sediment flushing
May 15 – June 30	100%	0.35 m^3/s (remainder of period)*	Rainbow trout: Adult spawning and migration. Sediment flushing

Note, it is recommended that a minimum threshold of 0.56 m^3/s be maintained for a minimum of 21 continuous days during the May 15 – June 30 period to support adult Rainbow Trout migration and spawning, as well as sediment flushing. Due to the considerable variability in the timing of spring freshet, it is reasonable for the 21 days of 0.56 m^3/s to occur at any time during May 15-June 30 window. For the remainder of this period, both before and after the 21-day 0.56 m^3/s high-flow window, a minimum flow requirement of 0.35 m^3/s is recommended.

3.4 Ramping Rates:

During periods of active diversion, water withdrawals would need to be managed to maintain sufficient ramping rates in Davidson Creek. The ramping rates proposed as a part of the IFN will also be applicable during the Construction Phase. The derivation of ramping rates is described in detail by Palmer (2021) and is summarized below.

Ramping rates were determined for Davidson Creek using the rating curve at the H2 hydrometric station reported by KP (2021), which is:

$$Q = 6.2 \cdot Stage^{2.4} \quad (1)$$

where Q represents streamflow (m^3/s) and $Stage$ represents the stage (m) above zero-flow conditions in the local gauge datum. The relationship between streamflow and stage, as defined by this rating curve, was used to define a maximum allowable ramping rate of 2.5 cm/hour. Based on this, the following ramping rates are proposed:

- **0.030 m^3/s per hour:** when flows are less than 0.15 m^3/s.
- **0.040 m^3/s per hour:** when flows are greater than 0.15 m^3/s.

4. Justification for Proposed Threshold

This section provides an evaluation of the suitability of the proposed temporary threshold using photographs of channel conditions, a wetted-width analysis, and a review of historical hydrological data specific to Davidson Creek. The following analysis demonstrates that the proposed temporary flow reductions are expected to maintain water depths and allow for fish access, thereby avoiding stranding or alteration of migration patterns. Minimal reduction in wetted width is expected, which will limit potential drying of channel substrates. Furthermore, the proposed flows are within the range of natural variability observed in Davidson Creek during long-term monitoring.

4.1 Photographs of Channel Conditions

As a part of the fieldwork for the instream flow study (AMEC, 2015), channel conditions were photographed at a range of different streamflow conditions, with an emphasis on flows that most closely matched the proposed 0.07 m^3/s (20% MAD) threshold that would be relevant for most of the year. Relevant photographs from the survey reach immediately downstream of the outlet of the reservoir were compiled (Figure 2). These photographs indicate that flows near the proposed 20% MAD level maintain a large amount of wetted area at these representative sites. As calculated in Section 4.3, the broad, U-shaped channel profile at these sites minimizes wetted width reduction under these flow conditions. Coupled with the slow ramping rates described in Section 3.4, the proposed flow thresholds are expected to reduce potential drying of embryo-bearing substrates, while maintaining adequate depth and connectivity to allow rearing juvenile fish to freely migrate throughout the system. Verification of these predictions via site-specific monitoring is described further in Section 5.

Figure 2- Photographs taken during fieldwork to support the development of the instream flow study of channel conditions in Reach 7 of Davidson Creek when streamflow was 0.080 m^3/s (23% MAD). All photographs taken on September 25, 2012. (AMEC, 2015).

4.2 Evaluation of Historical Hydrological Variability

Historical flow duration statistics for critical low-flow periods were used to evaluate how commonly discharge in Davidson Creek falls below the proposed instream flow threshold. The months of August and March were selected for Rainbow Trout and Kokanee, respectively. Historical flow analysis is appropriate for these months because they are typically the months with the lowest mean discharge (and therefore are the months associated with the greatest risk of in-gravel embryo desiccation).

Based on the historical observed data, during August, the proposed temporary threshold was exceeded 77% of the time (Figure 3). In other words, 23% of the time, natural discharge was less than the proposed temporary threshold. During March, the proposed temporary threshold was only exceeded 35% of the time (Figure 3). The proposed temporary threshold is significantly more conservative during winter than it is during summer. This is warranted, as monitoring when there is an ice-cover during winter periods is more

challenging than during summer, when channel conditions are open. Section 5 provides further detail on the proposed monitoring strategy.

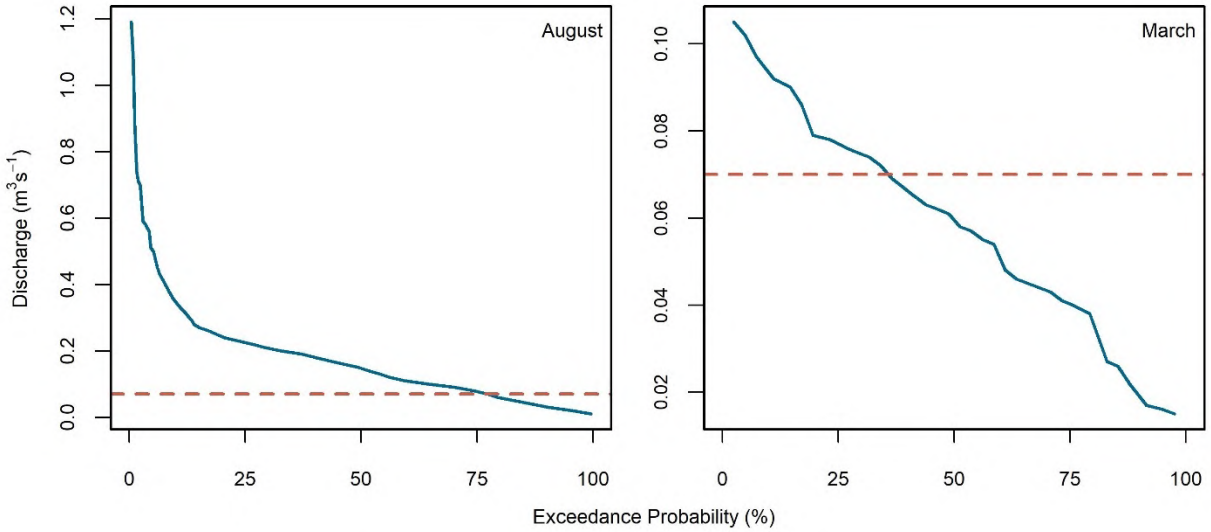

Figure 3- Flow-duration curves (solid blue line) for Davidson Creek during key low flow months. The August curve was developed using observed data (2011-2020) from the H2 hydrometric station and the March curve was developed using modelled monthly data (1981-2020) for H2. The dashed red line represents the proposed temporary instream flow threshold (20% MAD).

4.3 Wetted Width Analysis

An analysis was conducted for the reach of Davidson Creek immediately downstream of the FWR to understand how the wetted width of the channel changes at different discharges. The wetted-width analysis represents reach-averaged conditions for the section of Davidson Creek downstream of the proposed mine infrastructure and was conducted using site-specific hydraulic data. The analysis was conducted using the below-bankfull hydraulic modelling component of the Geomorphic Instream Flow Tool, which utilizes a simplified representation of the channel cross-section and a variable power-law flow resistance equation that has been shown to perform well in gravel streams (Gronsdahl et al., 2021). The results of this analysis (Table 5) indicate that although typical water depths will be lower and wetted widths will be narrower under temporary flow reduction scenarios, there should be sufficient depth to maintain fish passage and allow for migration, while maintaining water coverage of embryo-bearing substrates. These modelled results broadly indicate that alteration to fish habitat will be minimized in an idealized average reach; however, validation of the predictions must be supported by in-situ monitoring of flow conditions.

Table 5 – Modelled wetted width and average channel depth for the section of Davidson Creek downstream of proposed mine infrastructure at different discharges.

Discharge (m^3/s)	Discharge as a Proportion of MAD	Wetted Width (m)	Average Depth (cm)
0.07	20% MAD	3.08	8.9
0.35	100% MAD	3.86	16.4
0.56	160% MAD	3.99	20.2

5. Proposed Monitoring Strategy

This section details the proposed monitoring strategy that will be adopted during the period that this temporary threshold would apply. The objectives of the monitoring strategy would be to first validate the conclusion that naturally-occurring flows at the 20% MAD threshold maintain adequate fish habitat, then to confirm that the specified flows are maintained, and finally to regularly monitor fish habitat sites to ensure that there is adequate discharge to maintain habitat for fish.

5.1 Fish Habitat Surveys

Field-based evaluation of in-situ habitat conditions will be conducted in summer 2022. Surveys will be conducted to document natural in-channel conditions that reflect the proposed 20% MAD threshold to validate the assertions that this threshold will maintain adequate flow depth to allow for unencumbered passage of fish, minimize stranding potential, and maintain wetted depths necessary for the survival of embryos in spawning gravels. Surveys will coincide with typical low-flow periods in Davidson Creek. Discharge measurements will be conducted to confirm that flows are at or near the 20% MAD threshold. Stream segments with potential Rainbow Trout spawning habitat downstream of the FWR will be identified and four potential monitoring mesohabitat sites will be assessed. At each site, measurements of discharge, channel dimensions, substrate composition, wetted width and wetted depth will be recorded. Representative photographs will be taken, and locations will be recorded. Any evidence of Rainbow Trout spawning activity (e.g., redds) will be noted. These measurements will be compared with published Rainbow Trout habitat preference data to evaluate habitat suitability.

5.2 Real-time Discharge Monitoring

At or immediately below the outlet of the FWR, a hydraulic structure or a hydrometric station with real-time data transmission capabilities will be used to monitor the instream flow within Davidson Creek. Data from this location will be recorded and used to evaluate whether the temporary threshold is being met. This data will also be made available to field-based operators that are responsible for making operational decisions about water withdrawals and pumping rates from Davidson Creek.

5.3 Fish Habitat Monitoring

Two habitat monitoring sites, each consisting of a single mesohabitat unit (i.e., a riffle or glide) that provides Rainbow Trout spawning habitat, will be established downstream of the FWR. These two sites will be selected from the four assessment sites described in Section 5.1, at sites with good access and stability for

long-term monitoring. In each of these sites, a staff gauge will be installed to be used for manual water level measurements, and a pressure transducer that measures water level and temperature with real-time data transmission capabilities (e.g., telemetry) will also be fixed to the channel bed. Within each spawning reach, a trail camera will be securely mounted with a clear view of the monitoring reach and the staff gauge. The trail camera will be programmed to record hourly images that will be transmitted in real time to monitoring personnel to allow for high-resolution monitoring of instream conditions. Rebar stakes or other similar marking devices will be inserted into the channel substrate at regular intervals (e.g., 20 cm) to allow for evaluation of wetted width from photograph interpretation.

The monitoring will be primarily focused on assessing the suitability of the temporary threshold at maintaining adequate habitat during key summertime low flow months when Rainbow Trout eggs are incubating in gravels located on the channel bed. Given that the winter threshold is more conservative than median baseline conditions, no winter monitoring is proposed.

During critical low flow periods, or anytime that water is actively being withdrawn from Davidson Creek, a qualified professional will review remotely transmitted images, water level data, and water temperature data on a daily basis to visually evaluate whether adequate habitat is being maintained to submerge incubating eggs potentially located in the channel bed. Should this review indicate that water levels are too low, or that increased water temperatures may threaten fish, monitoring frequency will increase, field-based surveys of fish habitat and fish stranding will be conducted, and the minimum flow threshold may be increased until adequate habitat conditions are achieved.

5.4 Adaptive Framework

If, at any time, the monitoring indicates that discharge is dropping below the relevant threshold, water levels are too low or that increased water temperatures may threaten fish or fish habitat, remote monitoring frequency will be increased to a twice-daily level and daily field-based surveys of fish habitat and fish stranding will be conducted.

If excessive channel drying or fish stranding is identified by a qualified professional, then the minimum flow threshold will be increased. Flow thresholds will be increased in 5% MAD increments (i.e., 25% MAD, 30% MAD, etc.) until BW Gold's qualified professional and relevant regulatory authorities are satisfied that fish and fish habitat are not threatened.

6. Conclusion

This memo provides rationale and support for a temporary instream flow threshold in Davidson Creek during the Construction Phase of the Project. The threshold was determined following the BC-Modified Tennant Method, which uses long-term streamflow data and conservation flow specific to relevant fish species and life-stages.

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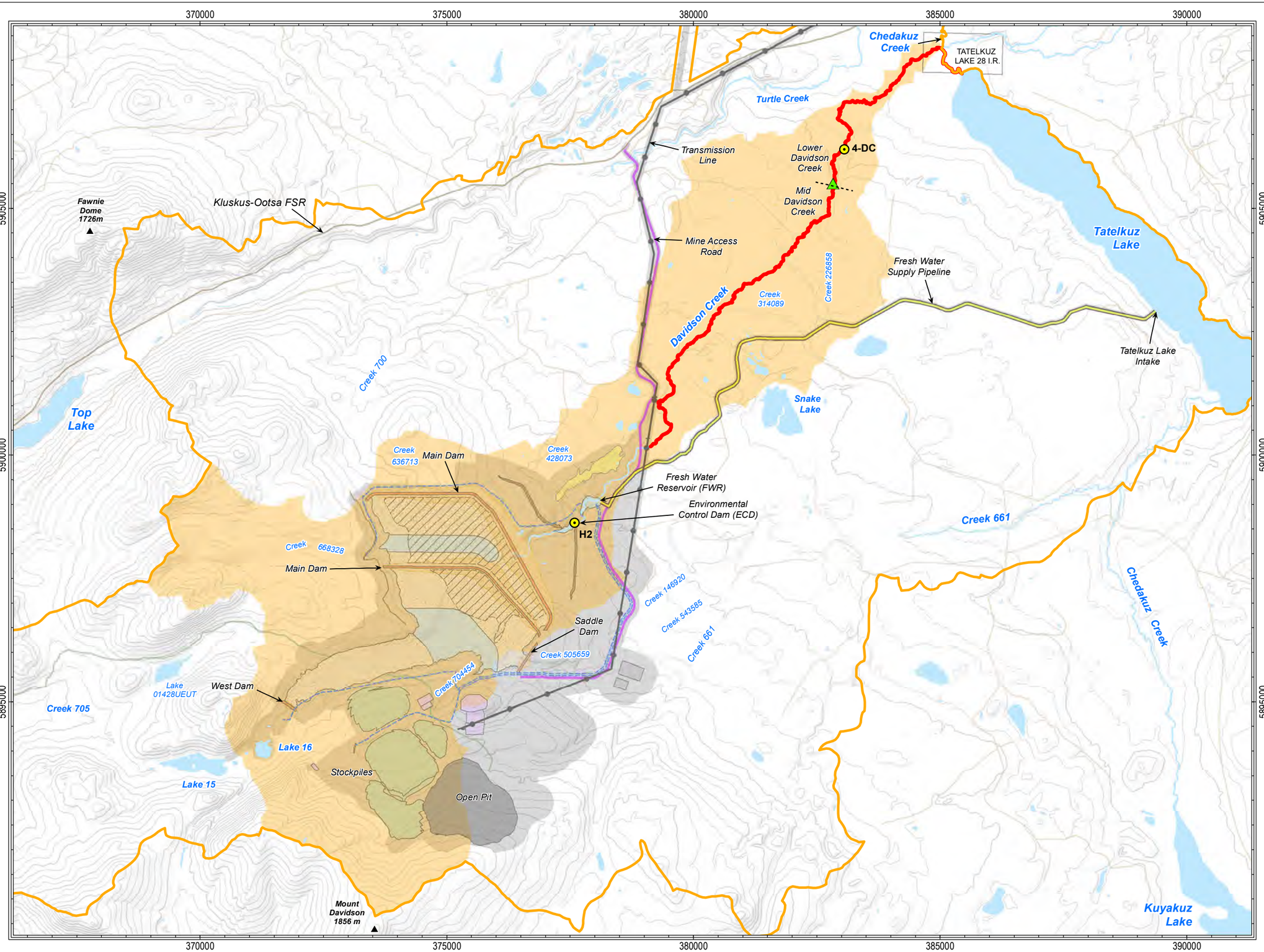

Legend

- Watershed Model Node
- Upstream extent of kokanee in Davidson Creek
- Spot Height
- Elevation Contour (25 m interval)
- Indian Reserve
- Mine Footprint
- Local Study Area Boundary

Impacted Fish Habitat

- Downstream Flow

Watersheds

- Davidson Creek

Scale 1:75000
UTM Zone 10N
NAD 1983 Datum

0 1 2
kilometres

N

Prepared For:

CLIENT: Artemis Gold Inc.
PROJECT: Blackwater
DRAWN: B. Elder
CHECKED: S. Gronsdahl
PROJECT: 2006501
DATE: Feb 24, 2022

Prepared by:

Palmer

Portion of Davidson Creek Subject to Instream Flow Needs

FIGURE 1

Document Path: G:\Shared drives\Projects 2020\20065 - Artemis Gold Inc\2006501 - Blackwater Project 2020-2022\Mapping\Figures\5_ArcGIS\Figure 1 - Portion of Davidson Creek Subject to Instream Flow Needs.mxd

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Appendix E

MDMER Schedule 2 Preparatory Works and Schedule Memo

Knight Piésold CONSULTING

Management System Certified by: bsi ISO 9001 ISO 14001 ISO 45001 CERTIFIED

MEMORANDUM

Date:	April 7, 2022	**File No.:**	VA101-00457/37-A.01
		Cont. No.:	VA22-00564
To:	Mr. Ryan Todd, Mr. Travis Desormeaux		
From:	Oscar Gustafson, Stephanie Eagen		
Re:	**Blackwater Gold Project – Schedule 2 Preparatory Works and Schedule**		

1.0 BACKGROUND AND PURPOSE

BW Gold Ltd. (BW Gold; the Proponent), a wholly owned subsidiary of Artemis Gold Inc. (Artemis), is proposing to develop the Blackwater Gold Project (the Project), a gold and silver open pit mine located in central BC. The Project is approximately 112 kilometres (km) southwest of Vanderhoof, 160 km southwest of Prince George, and 446 km northeast of Vancouver.

Before construction of certain works can commence, the Project requires both an amendment of Schedule 2 of the Metal and Diamond Mining Effluent Regulations (MDMER) and an Authorization under Paragraph 35(2)(*b*) of the *Fisheries Act*. The amendment to Schedule 2 of the MDMER specifically applies to the loss of fish habitat in tailings impoundment areas (TIAs) resulting from the placement of mine waste. The *Fisheries Act* Authorization application will address all other effects on fish and fish habitat resulting from Project activities. Most of the affected habitat is located in the upper reaches of Davidson Creek and its headwater tributaries. The remaining habitat is in the upper reaches of the Creek 661 watershed, namely Creek 505659 and a tributary stream.

BW Gold submitted a Fish Habitat Compensation Plan (Palmer, 2021a) dated February 5, 2021 to Environment and Climate Change Canada (ECCC) as part of the process to address the fish habitat compensation requirements related to placing mine waste on fish habitat. Palmer (2021a) developed the Compensation Plan to avoid, mitigate, and offset the loss of fish habitat resulting from the deposition of a deleterious substance into a TIA, in accordance with Section 27.1 of the MDMER.

An amendment to Schedule 2 of the MDMER will be required to designate portions of stream channels impacted by mine waste as affected water bodies. These stream channels include the portions of Davidson Creek within the tailings storage facility (TSF) and Environmental Control Dam (ECD) excluding partial footprints of the confining dams, the portions of tributaries to Davidson Creek and Creek 661 under the low-grade and high-grade ore stockpiles, and the overburden and non-acid generating (NAG) waste rock storage facilities. The locations of these stream channels within the Schedule 2 footprint of the TIA are shown on Figure 1.

DFO identified the need to provide additional details concerning construction details and timing of the preparatory works within the Schedule 2 footprint during a meeting on February 22, 2022. The purpose of this memorandum is to provide these details based on the current level of design and construction information contained in existing design reports (KP, 2021a; KP, 2021b; KP, 2021c).

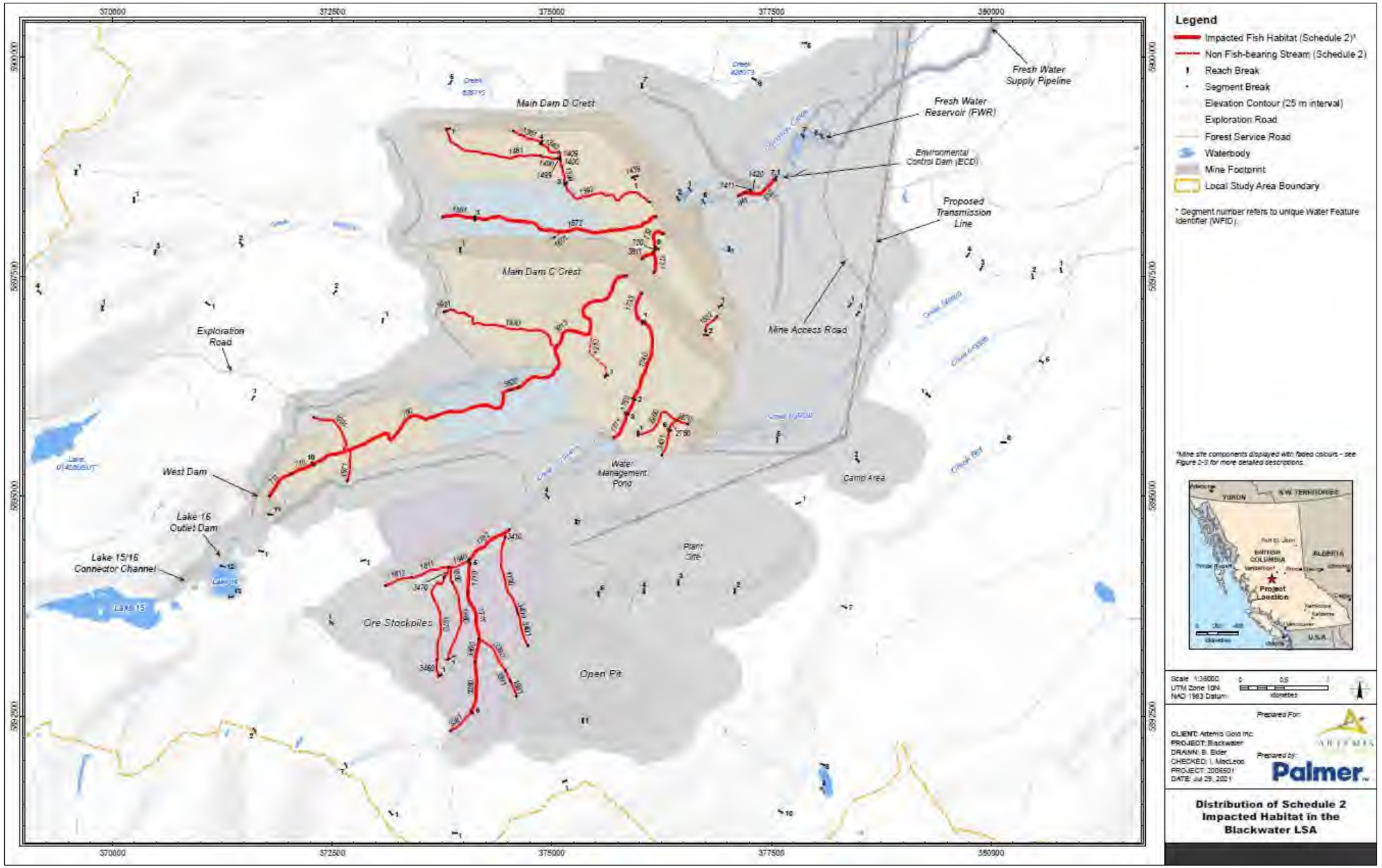


Figure 1 Schedule 2 Impacted Fish Habitat

2.0 CONSTRUCTION SCHEDULE

The construction activities planned in the Schedule 2 footprint during the construction phase (commencement targeted for Year -2 and Year -1) include the following:

- Vegetation clearing within the TSF including riparian vegetation (Year -2)
- Construction of the diversion works including the Davidson Creek Diversion System, Central Diversion System (CDS), and Mine Area Creek Diversion (Years -1 and -2)
- Construction of a Sediment Control Pond (SCP) and the associated inlet channels (Year -1)
- Main Dam C – Excavation of cut-off-trench and initial fill placement (Year -2) followed by Main Dam C Stage 1 construction to 1,273 masl (Year -1)
- TSF C Pond – Initiation of the starter pond upstream of the Diversion Berm (Year -2)
- Disposal of potentially acid generating (PAG) and metal leaching (ML) (PAG/NAG3) waste rock in designated disposal area located between the Diversion Berm and Main Dam C (Year -1)
- Tailings distribution pipeline constructed from processing facility to the west side TSF C (Year -1)
- Construction of the Interim ECD, pond and pumpback system (Year -1)
- Construction of the Water Management Pond (WMP) in Year -1
- Low-Grade Ore (LGO) Stockpile:
    - Vegetation clearing, grubbing, and surface preparation as required (Year -2)
    - Construction of water management systems, including non-contact water diversions, contact water collection channels, LGO Collection Pond, stockpile sub-grade preparation, and associated liner systems (Year -1)
    - Stockpiling of LGO Stockpile (lower grade ore) to 1,440 masl (Year -1)
    - Stockpiling of LGO Stockpile Pile A (higher grade ore) to 1,440 masl (Year -1)

The construction activities related to the Schedule 2 footprint during operations are primarily related to the tailing distribution systems and pipelines to convey tailings to the TSF. ECD construction will begin in approximately Year +5 and be fully constructed prior to PAG/NAG3 waste rock placement in TSF D. The West Dam will be constructed in stages to form the western limit of TSF C beginning in Year +6. An Upper Waste Stockpile is expected to be constructed in late stages of mine operations beginning in approximately Year +11.

3.0 TAILINGS STORAGE FACILITY

3.1 VEGETATION CLEARING AND TOPSOIL SALVAGE

The riparian vegetation within the Schedule 2 footprint will be removed following the first fish salvage. Timber will be felled and decked by logging/clearing crew(s) using a feller-buncher where suitable, or other means, and sold to local forest licensees where a market exists. Timber will be loaded and hauled from the mine site by the purchaser. Non-merchantable timber will be decked, and along with ground vegetation, a portion will be mulched and decked, with a suitable portion incorporated into the topsoil stockpiles as coarse woody debris (CWD). The site will be assessed after completion of logging and brushing activities to determine if the establishment of supplemental sediment and erosion control measures are required. Since there is a surplus of available mixed-mineral surface soils for salvage relative to reclamation demands, sufficient volumes can be obtained from the upper 0.3 m and there is no need to salvage the lower-quality deeper soils. Additional stripping of overburden (OVB) will, however, occur where required during pit stripping or as necessary for creating facility foundations in accordance with geotechnical specifications.

The organic (e.g., LFH) horizons of mineral soils will be salvaged with the underlying mineral horizons in one lift. Organic horizons of organic soils at the site are, on average, 1 m deep. Therefore, an average salvage depth of 1.3 m is proposed to capture the organic horizons plus an additional 0.3 m to include the underlying mineral soil, which is likely enriched in fine soil particles due to the landscape position and enriched in organic nutrients due to the overlying organic layers (ERM & IEG, 2021).

3.2 POST-VEGETATION CLEARING AND TOPSOIL SALVAGE EROSION AND SEDIMENT CONTROL MITIGATIONS

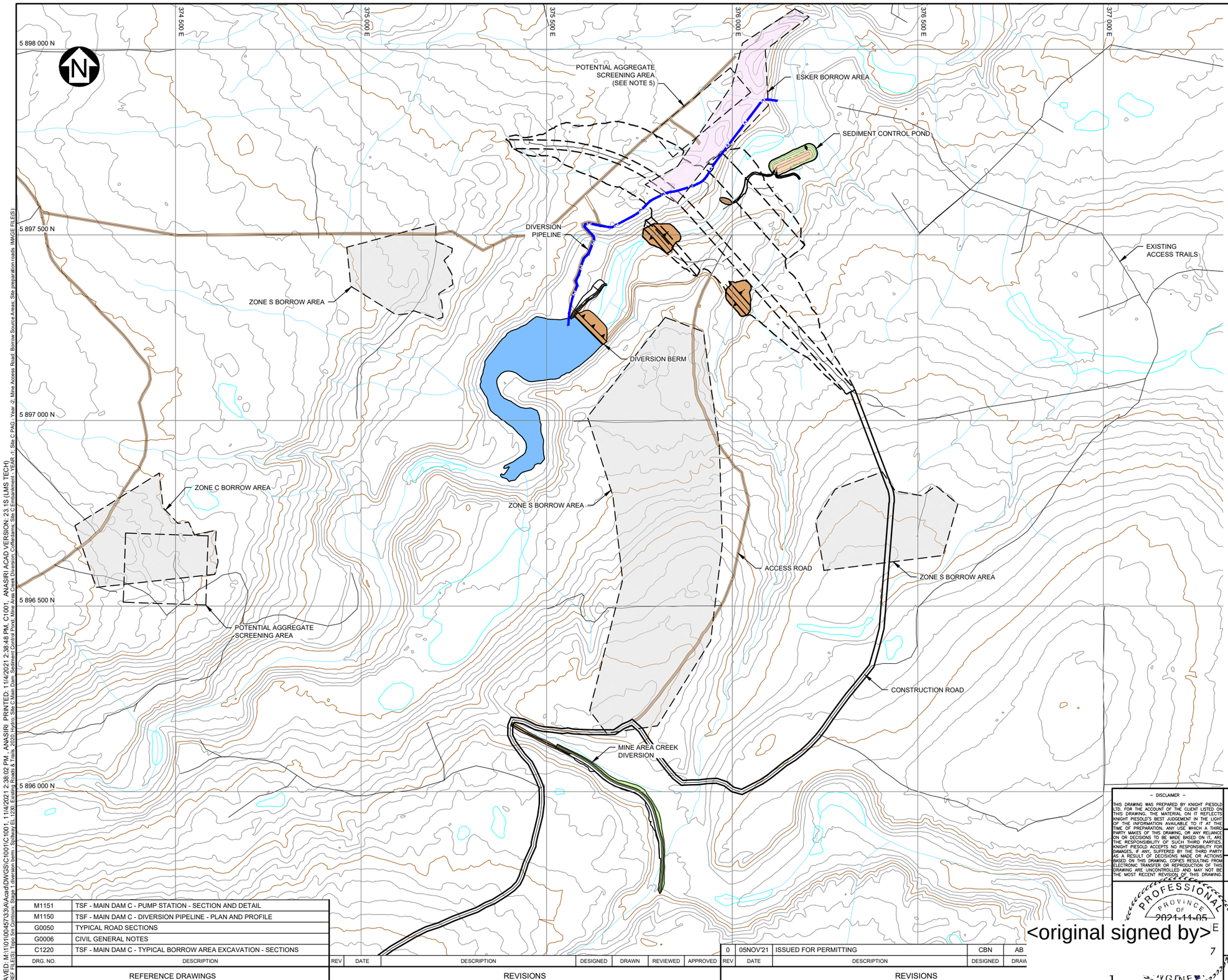
ERM (2021) developed a Construction Environmental Management Plan (CEMP) for the Early Works Phase to manage the environmental and heritage risks of Early Works construction activities The Plan considers potential environmental effects of Early Works components and activities, and describes management measures to avoid, minimize, or mitigate these potential effects. Early Works activities predominately involve tree clearing of select areas of mine site components, construction of the Mine Access Road (MAR) and mine site roads, and preparation of the Plant Site pad. BW Gold is in the process of developing a CEMP for Major Works to minimize and manage potential environmental risks during initial Project construction (Year -2 and Year -1).

KP (2021d) developed an Erosion and Sediment Control Plan (ESCP) to proactively manage water, erosion, and sedimentation throughout the early works phases of the project. Water management in the early stages of construction will focus on diverting non-contact water away from working areas, retention of the understory vegetation (brush and root networks) as much as possible during winter logging, and interception of contact water using Best Management Practices (BMPs). Disturbed areas will be seeded using quick establishing seed mixes (native and approved non-native) for initial soil stabilization followed by planting of native vegetation in accordance with Reclamation and Closure practices to facilitate progressive closure and reclamation of the project where final slopes are created. The Soil Management Plan (ERM & IEG, 2021) describes plans to provide soil for mine-site reclamation, including salvage, stockpiling, and placement of reclamation materials.

3.3 STAGE 1 WORKS – DAVIDSON CREEK DIVERSION SYSTEM

The Stage 1 diversion works are to be built prior to the completion of the Stage 1 Main Dam C. Site establishment for the Stage 1 diversion works are shown on C1001. A construction sequence schematic is shown on C1100 to illustrate the intent of the diversion, pumping, and collection schemes prior to and during the construction of the Stage 1 TSF.

A Diversion Berm will be constructed upstream of the Stage 1 Main Dam C to retain the inflows from Davidson Creek, as well as the inflows from the Mine Area Creek diversion works, with the aim of maintaining a dry working area for the initial embankment construction. The Diversion Berm is located approximately 500 m upstream of the Stage 1 Main Dam C centerline, retaining a direct upstream catchment of 6.9 km^2 in addition to inflows from the 11.6 km^2 Mine Area Creek catchment. Inflows are controlled via a primary and secondary outlet (emergency spillway). Together, the Diversion Berm and outlets are referred to as the Davidson Creek Diversion System.



LEGEND:

- FRESH WATER
- EMBANKMENT FILL
- ESKER BORROW
- BORROW AREA (ZONES S AND C)
- DIVERSION PIPELINE
- ACCESS ROAD
- EXISTING ACCESS TRAILS
- CONSTRUCTION ROAD

NOTES:

1. FOR GENERAL NOTES SEE DRAWING G0006.
2. TYPICAL ROAD SECTIONS SHOWN ON DRAWING G0050.
3. TYPICAL BORROW AREA EXCAVATION SECTIONS SHOWN ON DRAWING C1220.
4. DIVERSION PIPELINE SHOWN ON DRAWINGS M1150 AND M1151.
5. SEDIMENT AND EROSION CONTROL MEASURES FOR SCREENING AREAS AND BORROWS TO BE DETERMINED.

DETAILED DESIGN

NOT FOR CONSTRUCTION

SCALE A 100 50 0 100 200 300 400 500 m

DRG. NO.	DESCRIPTION
M1151	TSF - MAIN DAM C - PUMP STATION - SECTION AND DETAIL
M1150	TSF - MAIN DAM C - DIVERSION PIPELINE - PLAN AND PROFILE
G0050	TYPICAL ROAD SECTIONS
G0006	CIVIL GENERAL NOTES
C1220	TSF - MAIN DAM C - TYPICAL BORROW AREA EXCAVATION - SECTIONS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

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BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
MAIN DAM C
SITE ESTABLISHMENT
GENERAL ARRANGEMENT

REF. NO.	DRAWING NO.	REVISION
VA101-457/33	C1001	0

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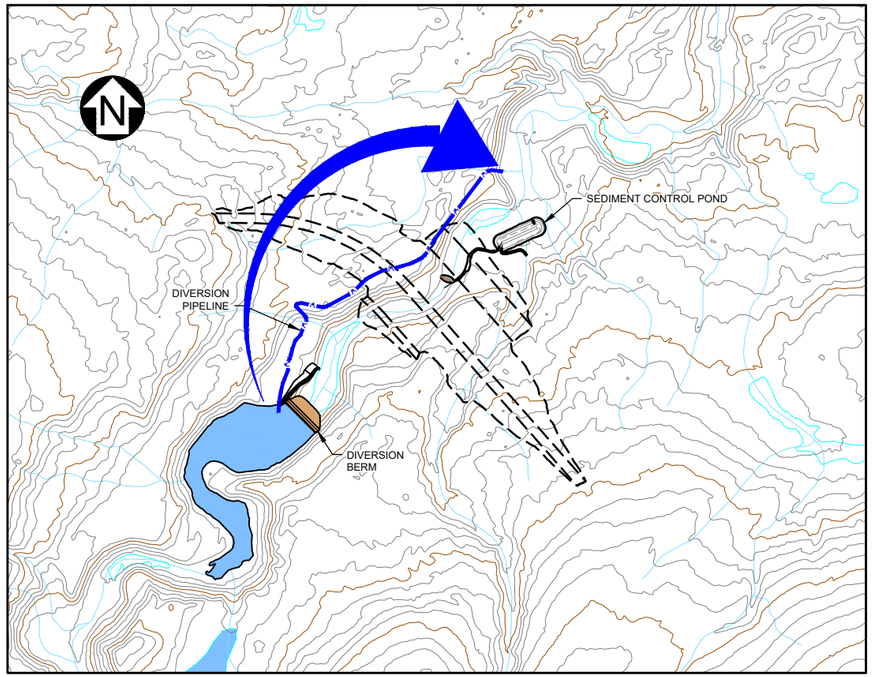
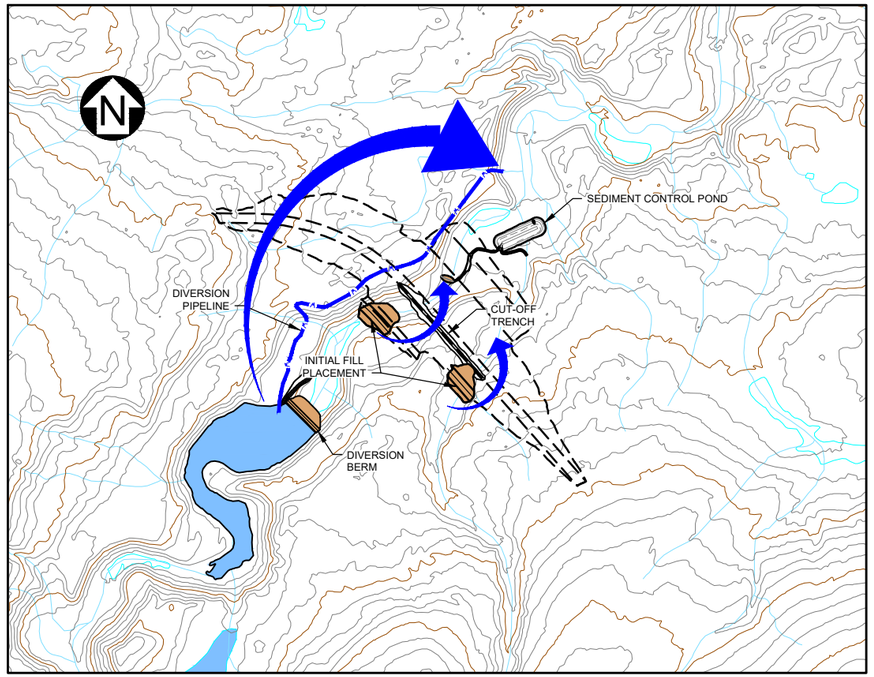
XREF FILE(S): Topo_5m Contours_Stage 1 diversion berm - spillway EL 1230_Existing Roads & Trails 2020_Hydro_Site C Main Dam_Sediment Control Pond_Mine Area Creek Diversion_Cofferdams_Site C Embankment - YEAR -1_Site C PAG - Year -2_Mine Access Road_Borrow Source Areas_Site preparation roads IMAGE FILE(S):



PLAN
PHASE 1 CONSTRUCTION
SCALE A



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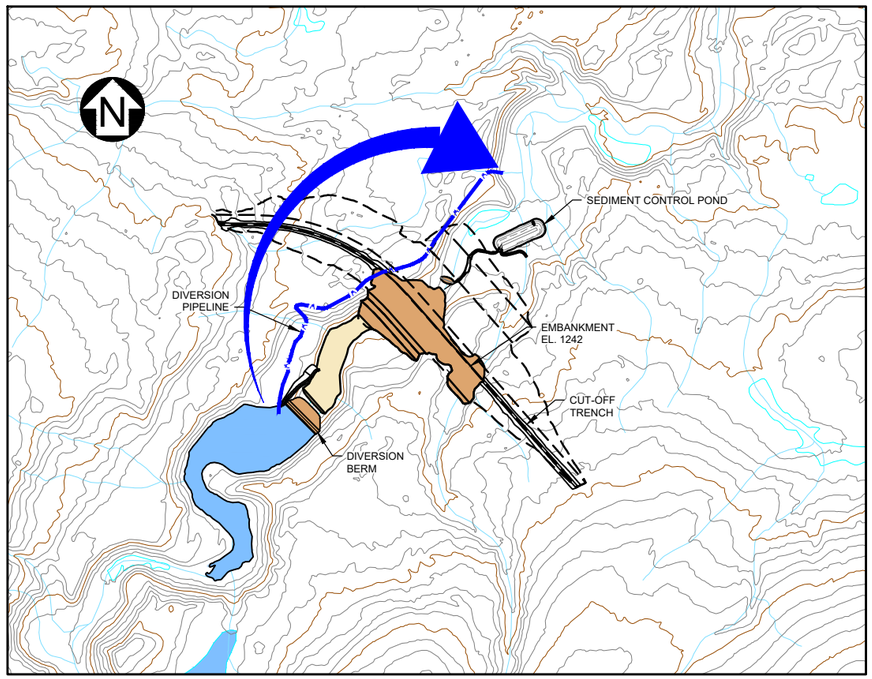

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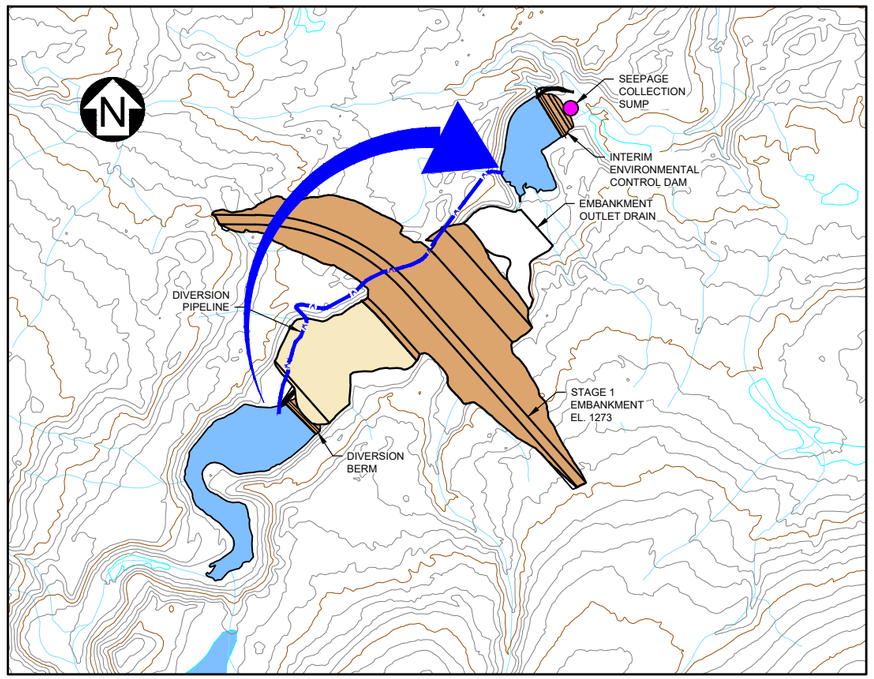
PHASE 3 CONSTRUCTION
SCALE A



PLAN
PHASE 4 CONSTRUCTION
SCALE A

CONSTRUCTION SEQUENCE NOTES:

PHASE 1:
1. CONSTRUCT SEDIMENT CONTROL POND.
2. CONSTRUCT DAVIDSON CREEK DIVERSION SYSTEM.
3. DIVERT FLOW AROUND STAGE 1 CONSTRUCTION AREA.

PHASE 2:
1. CONSTRUCT INITIAL FILL PLACEMENT AREAS IN DAVIDSON CREEK AND MINE AREA CREEK BASINS.
2. PUMP FLOW COLLECTED AT INITIAL FILL PLACEMENT AREAS.
3. EXCAVATE CUT-OFF TRENCH IN TOPOGRAPHICAL LOW POINTS.

PHASE 3:
1. BACKFILL CUT-OFF TRENCH EXCAVATION TO DAVIDSON CREEK DIVERSION SYSTEM ELEVATION.
2. CONSTRUCT UPSTREAM PORTION OF STAGE 1 DAM UP TO EL.1242 METERS.
3. EXCAVATE AND BACKFILL CUT-OFF TRENCH TO THE NORTH AND SOUTH OF DAVIDSON CREEK IN AREAS PREVIOUSLY UTILIZED FOR DIVERSION.

PHASE 4:
1. CONSTRUCT INTERIM ECD DOWNSTREAM OF SEDIMENT CONTROL POND.
2. DECONSTRUCT AND REMOVE SEDIMENT CONTROL POND.
3. COMPLETE CONSTRUCTION OF STAGE 1 EMBANKMENT TO EL. 1273 METERS.
4. CONSTRUCT STAGE 1 BUTTRESS AND EMBANKMENT OUTLET DRAIN.
5. DECOMMISION DIVERSION PIPELINE AND START IMPOUNDING WATER AT THE TSF.

LEGEND:

- FRESH WATER
- MINE WATER
- EMBANKMENT FILL
- PAG WASTE ROCK
- WATER DIVERSION PIPELINE
- FLOW

NOTES:
1. FOR GENERAL NOTES SEE DRAWING G0006.
2. CONTOUR INTERVAL IS 5 METRES.
3. SEE STAGE 1 EROSION AND SEDIMENT CONTROL PLAN FOR BEST MANAGEMENT PRACTICES AND DETAILS.

DETAILED DESIGN

NOT FOR CONSTRUCTION

150 75 0 250 500 750 m
SCALE A

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BLACKWATER GOLD PROJECT

TAILINGS STORAGE FACILITY
MAIN DAM C
STAGE 1 DIVERSION WORKS
BASED CONSTRUCTION SEQUENCE

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA
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2021-11-15

DRAWING NO.	REVISION
VA101-457/33	C1100	0

REFERENCE DRAWINGS		REVISIONS							REVISIONS							
DRG. NO.	DESCRIPTION	REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED	REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
G0006	CIVIL GENERAL NOTES								0	05NOV'21	ISSUED FOR PERMITTING	CBN	ABN	DDF	DDF

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XREF FILE(S): Topo 5m Contours; Hydro: Stage 1 diversion berm - Spillway EL 1230; Site C Main Dam - Sediment Control Pond; Site C Embankment - YEAR -1; Interim Environmental Control Dam; Cofferdams; Site C Embankment - Cut-Off Trench; Site C Embankment - Stage 1 Phase 3 IMAGE FILE(S):

The Davidson Creek Diversion System will dewater Davidson Creek downstream and around the working area of the Diversion Berm and starter dam C. This will largely eliminate the wetted portion of fish habitat from the point of diversion to where it is returned to Davidson Creek. Fish barriers (e.g., permanent fish fences, barrier nets) will be erected immediately downstream of all planned construction activities in Reach 6 of Davidson Creek, Creek 661 tributaries, and the outlet of Lake 16 (Palmer, 2021b). This will eliminate fish use of Davidson Creek and tributaries within the TSF footprint.

The Davidson Creek Diversion System will be operational until the start of tailings discharge and PAG/NAG3 waste rock placement into the TIA. The system has two outlets, a primary diversion pump system and pipeline which discharges downstream of the Stage 1 Main Dam C work area and a secondary emergency spillway which conveys storm flows around the Diversion Berm downstream toe.

The Diversion Berm was designed with a crest elevation of 1,231 masl and a maximum height of 14 m. The berm crest is 12 m wide and 110 m in length. The Diversion Berm will impound up to a total volume of 306,000 m^3 at its crest elevation. The berm will be constructed with locally sourced material. Safety berms and a minimum of 300 mm wearing course are specified for the berm crest. Coarse material is specified on the upstream and downstream slopes to protect the berm from scour and erosion. The Diversion Berm has a design life of up to approximately 2 years.

The peak flows at the Project site are expected to result from rain-on-snow events. The design peak flows were calculated using return period peak flow relationships developed for undisturbed areas following the methodology recommended in Section 3.3 of the 2020 Hydrometeorology Report (KP, 2021e). An instantaneous peak flow of 4.74 m^3/s was estimated for the Davidson Creek Diversion System during the 1 in 10-year, 24-hr return period storm event (KP, 2021b). The catchment area and peak flow estimate includes flows routed from the Mine Area Creek Diversion.

Pump and pipeline designs were developed for the Davidson Creek Diversion System primary outlet. An emergency spillway design was developed as a secondary outlet for controlled release of flows above the 1 in 10-year event. The storage capacity within the Diversion Berm impoundment, in combination with primary outlet pumping, is sufficient to contain and convey inflows up to the 1 in 10-year, 24-hour event.

Water collected upstream of the Diversion Berm will be pumped around the construction works. The pumping system comprises three operating end-suction centrifugal pumps and one installed spare unit, providing a total design flowrate of approximately 61,000 m^3/d or 2,540 m^3/hr. The system will be mounted on a floating barge and will be controlled via a level control float system, or equivalent. It is currently planned be installed in Year -2 and expected to operated until the end of Year -1. The pipeline will be approximately 940 m in length and will consist of a combination of nominal diameter (ND) 300 mm DR21 HDPE, ND 450 mm DR21 HDPE, and ND 600 mm DR21 HDPE pipe. The pipeline corridor will be graded to minimize high or low sections to the extent practicable and to allow for gravity flow to the discharge point after initial lifting from the pumping system.

The pumps will be operated upstream of the Diversion Berm. Each pump will be installed on a floating barge, anchored to the shore. This will allow the pumps to keep the water drawn down to a minimum level to provide the maximum amount of storage during storms events. The storage capacity within the Diversion Berm impoundment, in combination with pumping, is sufficient to contain and convey inflows up to the 1 in 10-year, 24-hour event provided that minimal volume of water is retained behind the berm prior to the storm event. The system will discharge into a stilling basin downstream of the construction works at elevation 1,208 masl.

3.4 COLLECTION WORKS

The Stage 1 collection works include a SCP and the Interim ECD and associated works for each. These structures are not part of the Schedule 2 footprint but are included here as part water management for early TSF construction. The SCP will be built prior to the start of Main Dam C construction to collect and settle sediment-laden runoff expected from the dam construction area. The Interim ECD and associated TSF pumpback system will be constructed, commissioned, and operational prior to the start of mining operations to recover seepage and runoff from Main Dam C.

Seepage collection at the Interim ECD will be achieved by constructing a collection dam approximately 500 m downstream at a topographic low point in Davidson Creek. The Interim ECD is positioned upstream of the confluence of a tributary, which drains a relatively large catchment area located to the northeast of TSF C (C1100). The Interim ECD will manage seepage and storm water inflows and will utilize a pumpback system to convey the recovered flows to the TSF. The dam will be maintained in a dewatered condition to the maximum extent practical. Seepage through the Interim ECD will be captured in a foundation drain system and sump and pumped back to the Interim ECD. The Interim ECD has a design life of 6 years and will be fully constructed in Year -1 prior to the start of operations. It was designed to manage seepage and runoff until the construction of Main Dam D and the ECD beginning in approximately Year +5.

3.5 MAIN DAM C STAGE 1

Construction of Main Dam C Stage 1 will commence following completion of the Diversion Berm, diversion pipeline, and SCP shown on C1001. The embankment foundations will be cleared and stripped in preparation for fill placement for each stage. Main Dam C Stage 1 was designed as a water retaining dam with a crest elevation of 1,273 masl. TSF C Stage 1 will provide sufficient capacity to impound tailings and PAG/NAG3 waste rock generated during the first year of operations and a supernatant pond up to 2 Mm^3, with additional capacity to manage seasonal water volume fluctuations and potential flood events.

Main Dam C was designed as a zoned earth-rockfill dam requiring placement of approximately 3.25 Mm^3 of fill material for Stage 1 that will be sourced from local external borrow sources or pre-stripping of the open pit during Year -1 of mine development.

3.6 CENTRAL DIVERSION SYSTEM

The CDS will be constructed to divert freshwater around the TSF to a tributary of Davidson Creek or to a water transfer pond where the flows can be pumped to the WMP. The WMP will provide make-up water to support ore processing. Water not needed to support mine operations will be discharged from the WMP to the Fresh Water Reservoir (FWR) and used to mitigate flow reductions in lower Davidson Creek. The CDS is planned to be constructed by the end of Year -1 prior to the start of ore processing. The primary components of the CDS and their design objectives are summarized in Table 1. The general arrangement for the CDS at Year -1 is shown on C3100.

The CDS will dewater Davidson Creek downstream from the Central Water Transfer Pond to the Stage 1 diversion berm. The TSF will receive localized runoff from the remaining catchment where it will be captured for use as mine process water.

Table 1 Central Diversion System – System Components and Design Objectives

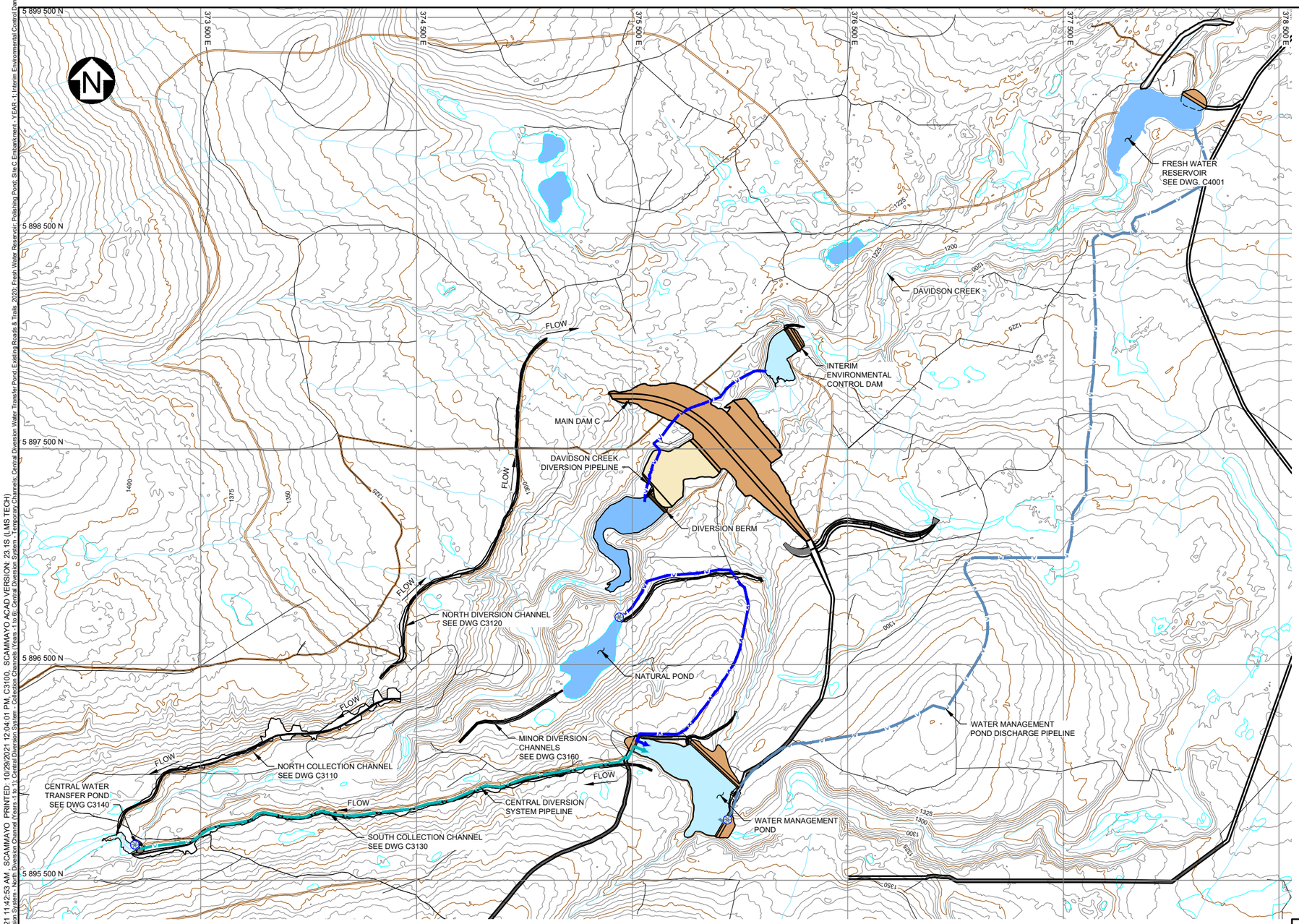
Diversion Component	Design Objective
North Diversion Channel	Divert water around the TSF and release to Creek 668328, which ultimately flows to Davidson Creek downstream of the TSF. The North Diversion Channel will be relocated in approximately Year +2.
North Collection Channel	Route water around the TSF to the Central Water Transfer Pond
South Collection Channel	
Minor Diversion Channels	Divert water towards a natural pond where flows will be pumped to the WMP until approximately Year +2
Central Water Transfer Pond	Temporarily store captured water to facilitate pump submergence and conveyance to the WMP
Central Diversion Pipeline	Route water from the Central Water Transfer Pond to the WMP using a pump and pipeline system

The design floods were estimated using the return period peak flow methodology presented in Section 3.3 of the 2020 Hydrometeorology Report (KP, 2021e). The channels were sized to convey the 1 in 10-year return, 24-hr flood with a minimum of 300 mm of freeboard and have sufficient capacity to pass the 1 in 200-year, 24-hr flood at bank full conditions. The estimated contributing catchment areas and associated design floods for the diversion and collection channels are shown in Table 2.

Table 2 Central Diversion System Channels – Phase 1 Design Flows

Channel Name	Catchment Area (ha)	1 in 10-year Return Period Flood (m^3/s)	1 in 200-year Return Period Flood (m^3/s)
North Diversion Channel (Year -1 to Year +1)	196	0.71	1.37
North Diversion Channel (Year +2 to Year +6)	213	0.76	1.46
North Collection Channel	83	0.36	0.71
South Collection Channel	170	0.64	1.23
Minor Diversion Channels	20	0.12	0.24

The North Diversion Channel is planned to be constructed in Year -1 and later, in approximately Year +1, is planned to be relocated further north to accommodate the growing TSF footprint. The relocated channel will be in place until approximately Year +6. Riprap lined, trapezoidal channels with 2H:1V side slopes with a minimum 0.5% grade were selected for the diversion channel design. In addition, the North Diversion Channel releases flow into Creek 668328, which ultimately flows to Davidson Creek downstream of the TSF. To minimize erosion of the natural bed material in Creek 668328, an erosion protection section was designed. The erosion protection section will consist of riprap material (D_{50} = 330 mm), which will line the confluence of the diversion channel and Creek 668328. The riprap armour will also extend a minimum of 4 m downstream of the confluence to provide sufficient erosion protection.



PLAN
SCALE A

LEGEND:

- TAILINGS BEACH
- MINE WATER
- FRESH WATER
- EMBANKMENT FILL
- PAG WASTE ROCK
- EXISTING ACCESS TRAILS
- CENTRAL WATER DIVERSION PIPELINE
- WATER MANAGEMENT POND DISCHARGE SYSTEM PIPELINE
- TEMPORARY DIVERSION SYSTEM PIPELINE
- CONSTRUCTION ROAD
- ACCESS ROAD

NOTES:

1. FOR GENERAL NOTES SEE DWG. G0006.
2. FOR DIVERSION PIPING SYSTEMS GENERAL ARRANGEMENT SEE DWG. M3050.
3. TSF C GENERAL ARRANGEMENT FOR YEAR -1 IS SHOWN. SEE C1000 DRAWING SERIES FOR DETAILS.

DETAILED DESIGN
NOT FOR CONSTRUCTION

SCALE A 200 100 0 200 400 600 800 1000 m

DRG. NO.	DESCRIPTION
M3050	WATER MANAGEMENT - DIVERSION PIPING SYSTEMS - GENERAL ARRANGEMENT YEAR -1
G0006	CIVIL GENERAL NOTES
C4001	FRESH WATER RESERVOIR - EMBANKMENT AND RESERVOIR - GENERAL ARRANGEMENT
C3160	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - MINOR DIVERSION DITCHES
C3140	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - WATER TRANSFER POND
C3130	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - SOUTH COLLECTION CHANNEL - PLAN AND PROFILE
C3120	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH DIVERSION CHANNEL - PLAN AND PROFILE
C3110	WATER MANAGEMENT - CENTRAL DIVERSION SYSTEM - NORTH COLLECTION CHANNEL - PLAN AND PROFILE

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN
0	29OCT'21	ISSUED FOR PERMITTING	MJB1	RMM

REVISIONS

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WATER MANAGEMENT DIVERSION SYSTEMS GENERAL ARRANGEMENT YEAR -1

P/A NO.	DRAWING NO.	REVISION
VA101-457/33	C3100	0

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XREF FILE(S): Hydro: Topo.3m Contours; Intake Structure Option B; Central Diversion System: North Diversion Channel (Years -1 to 1); Central Diversion System - Collection Channels (Years -1 to 6); Central Diversion System - Diversion System - Temporary Channels; Central Diversion Water Transfer Pond; Existing Roads & Trails, 2020; Fresh Water Reservoir; Polishing Pond; Site C Embankment - YEAR -1; Interim Environmental Control Dam; Stage 1

The North Collection Channel is planned to be constructed in Year -1 and operate until the end of Year +6. The collection channels will route water to the Central Diversion System Water Transfer Pond. A trapezoidal channel with 2H:1V side slopes and a minimum 0.5% grade was selected for the collection channel design. The channel terminates upstream of the Water Transfer Pond within a shallow gradient area. In order to minimize local erosion at the channel outlet, an apron is proposed to transition from the collection channel to the natural ground and dissipate the expected flow velocities during the design flood.

The South Collection Channel is planned to be constructed in Year -1 and operate until the end of Year +6. The collection channel will route water to the Central Diversion System Water Transfer Pond. Trapezoidal channels with 2H:1V side slopes with a minimum 0.5% grade were selected for the collection channel design. The channel terminates upstream of the Water Transfer Pond within a steep gradient area. In order to minimize local erosion at the channel outlet an erosion protection section is recommended. The erosion protection section will consist of riprap material (D_{50} = 565 mm), which will line the steep gradient area and transition to the natural grade. The erosion protection section will dissipate the expected flow velocities during the design flood.

Two minor diversions are planned to be constructed south of the TSF in Year -1 and are expected to be operated until the end of Year +1. These diversions will route water towards a natural pond, which will be repurposed for water collection such that the collected water can be pumped to the WMP. The channels are designed to pass the 1 in 10-year flood with a minimum of 300 mm of freeboard and are sufficiently sized to pass the 1 in 200-year flood at bank full.

The Central Water Transfer Pond is planned to be constructed upstream of the TSF within the Davidson Creek watershed and has a total contributing catchment area of approximately 8.6 km^2. The pond has a design life of approximately 7 years and will receive inflows from Davidson Creek and the North and South Collection Channels. Water will be impounded by a weir structure that will be constructed using a combination of fill and concrete lock blocks. The weir has a base elevation of 1,298 masl and rises 2 m to a crest elevation of 1,300 masl. The crest is approximately 750 mm wide and 38 m in length. The design flood was calculated using the return period peak flow methodology for undisturbed areas, as presented in Section 3.3 of the 2020 Hydrometeorology Report (KP, 2021e) and was estimated to be approximately 4.4 m^3/s.

Water from the Central Water Transfer Pond will be pumped to the WMP using a pumping system and pipeline, which has a design flow of 300 L/s. The design flow was selected to minimize spill into the TSF to the extent practicable and the selected flow rate corresponds to the 92nd percentile flow contributing to the Central Diversion System Water Transfer Pond. In other words, it is estimated that the capacity of the pump and pipeline system will be exceeded roughly 8% of the time, but it should be noted that the amount of water spilled will be much less than 8% of the annual runoff. When inflows exceed the capacity of the pumping system, excess water will flow over the weir onto a riprap apron, and then flow to the TSF. The riprap size (D_{50} = 330 mm) was selected to provide sufficient erosion protection during the 200-year 24-hour design flood.

3.7 MINE AREA CREEK DIVERSION

A temporary diversion channel and berm is planned to be constructed to divert flows from the Mine Area Creek to the northwest and into the Davidson Creek catchment, at a point upstream of the original confluence (C1001). Flows diverted from the Mine Area Creek Diversion will be ultimately managed by the Davidson Creek Diversion System. The Mine Area Creek Diversion was designed to convey water away

from the southern portion of Main Dam C cut-off trench excavation and initial fill placement area during initial construction.

The upstream portion of the diversion utilizes a berm, with a maximum fill height of 5 m, to maintain an elevated channel invert and minimize required excavation quantities at the western end of the channel. To pass the diverted flows beyond the northwest saddle and under a planned construction access road, the berm transitions to an excavated channel and flows to two parallel culverts, which will pass flows under the access road. The culvert outlets are on the northwest side of the access road where the resulting flows will follow existing drainage pathways through the forest before reaching Davidson Creek further to the north. The Mine Area Creek Diversion will be constructed after the Davidson Creek Diversion System is operational. The Mine Area Creek Diversion will remain operational until the WMP is constructed in the same location.

4.0 WATER MANAGEMENT POND

The WMP will be constructed downslope of the open pit and stockpiles area and within the ultimate footprint of TSF C to manage runoff from contributing areas and water pumped from collection points. The WMP will provide make-up water to support ore processing. Water not needed to support mine operations will be conveyed to the FWR and used to mitigate flow reductions in lower Davidson Creek. The WMP is planned to be constructed in Year -2 and will receive direct runoff from the Mine Area Creek catchment and water pumped from other collection points and water management systems. The location of the WMP in Year -1 is shown on C3100. Water generated from pit dewatering activities will be treated and directed the WMP.

5.0 STOCKPILES

The proposed LGO and waste stockpiles are located northwest of the Open Pit. Ore is planned to be placed in the LGO Stockpile commencing in Year -1. The LGO Stockpile will comprise two discrete stockpiles in early years, sorted into higher-grade ore and lower-grade ore. The higher-grade ore will be rehandled to the mill during the open pit operations and the vacated footprint will be filled up with additional lower-grade ore to form one larger stockpile that will reach its maximum footprint in the late stages of mine operations. The design capacity of the LGO stockpile is 111.1 Mt. The Upper Waste Stockpile is expected be constructed in later stages of mine operations (beginning in approximately Year +11) and will have a design capacity of 30.7 Mt (MMTS, 2021). Preliminary layouts of the proposed stockpiles are shown on Figure 2.

It is anticipated that the majority of low-grade ore will be potentially acid generating (PAG) with a very short lag time. The LGO Stockpile was designed with up to five 20 m high lifts using angle of repose lift slopes (of approximately 1.3H:1V) combined with benches to form an overall slope of approximately 3H:1V or flatter. The toe elevation of the proposed stockpile is at approximately 1,400 masl. The proposed ultimate stockpile crest is at elevation 1,500 masl, and the maximum height of the stockpile along the critical cross section is approximately 100 m.

It is anticipated that the Upper Waste Stockpile material will be comprised of glacial till (9.8 Mt) and NAG waste rock (20.9 Mt). The Upper Waste Stockpile was designed with typical 20 m high lifts and slopes combined with benches to form an overall slope of between 3H:1V to 4.5H:1V.

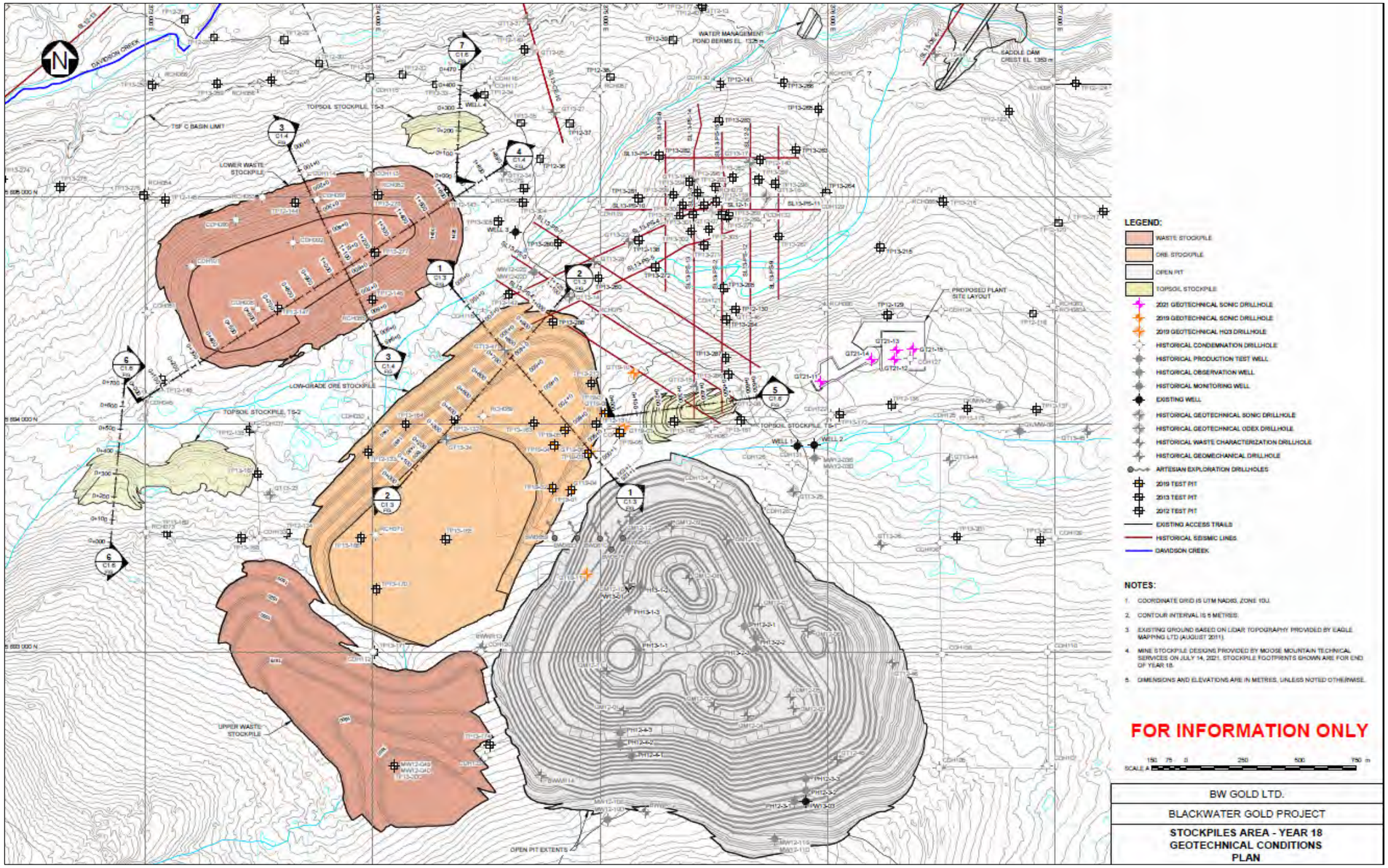

Figure 2 General Layout of the Stockpiles Area Near the Open Pit

6.0 CLOSURE

More detailed design and construction information can be found in existing engineering design reports (KP, 2021a; KP, 2021b; KP, 2021c). Please contact the undersigned of you have questions concerning the content of this letter.

Yours truly,
Knight Piésold Ltd.

<original signed by>

<original signed by>

Prepared:	Reviewed:
Oscar Gustafson, R.P.Bio. Specialist Environmental Scientist Associate	Stephanie Eagen, R.P.Bio. Specialist Environmental Scientist

<original signed by>

Approval that this document adheres to the Knight Piésold Quality Syste

References:

ERM and Integrated Ecology Group (IEG). (2021). BW Gold – Soil Management Plan, dated March 2022.

Knight Piésold Ltd. (KP, 2021a). TSF Life of Mine Design Report, KP Ref. No. VA101-457/33-5 Rev. 0, dated November 15, 2021.

Knight Piésold Ltd. (KP, 2021b). Blackwater Gold Project – TSF Stage 1 Detailed Design Report, KP Ref. No. VA101-457/33-6 Rev. 1, dated November 15, 2021.

Knight Piésold Ltd. (KP, 2021c). Blackwater Gold Project - Stockpiles Geotechnical and Water Management Design Report, KP Ref. No. VA101-457/33-22 Rev. 0, dated November 16, 2021.

Knight Piésold Ltd. (KP, 2021d). Blackwater Gold Project - Early Works Erosion and Sediment Control Plan, KP Ref. No. VA101-457/33-11 Rev. 0, dated February 4, 2021.

Knight Piésold Ltd. (KP, 2021e). Blackwater Gold Project – 2020 Hydrometeorology Report, KP Ref. No. VA101-457/33-8 Rev. 1, dated May 17, 2021.

Moose Mountain Technical Services (MMTS, 2021). Blackwater Gold Project – Open Pit and Stockpile Design Report, prepared for Artemis Gold Inc., dated September 13, 2021.

Palmer. 2021a. Blackwater Gold Project Fish Habitat Compensation Plan Pursuant to Section 27.1 of the Metal and Diamond Mining Effluent Regulations. Prepared for BW Gold Ltd. February 5, 2021.

Palmer. 2021b. Blackwater Project Fish Salvage and Relocation Plan. Prepared for BW Gold Ltd. October 22, 2021.

/wog

Appendix F

Baseline Validation
(DFO IR #6 Memo)

470 Granville Street, Suite 630, Vancouver, BC V6C 1V5
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Memorandum

Date: April 25, 2022
Project #: 2006501
DFO File # 21-HPAC-01447

To: Kevin DeBoer, Fisheries and Oceans Canada

From: Daniel King, B.Sc., Shreya Jain, M.Sc., B.I.T., Stefan Gronsdahl, M.Sc., P.Geo., Dave Huebert, Ph.D., R.P.Bio.; Palmer

cc: Ian MacLeod, Irene Tuite, Rick Palmer, Palmer
Ryan Todd, Travis Desormeaux, BW Gold Ltd.

Re: Blackwater Gold Project Application for a *Fisheries Act* Authorization
DFO Adequacy Review Letter – Information Request #6
DFO File: 21-HPAC-01447

On December 6, 2021, Palmer, on behalf of Blackwater Gold Ltd (BW Gold), submitted an application to Fisheries and Oceans Canada (DFO) for a *Fisheries Act* Authorization for the Blackwater Gold Project (the Project) near Vanderhoof, British Columbia. On January 21, 2022, BW Gold received a letter from DFO acknowledging receipt of the application and requesting addition information required by DFO for the application to be complete.

The purpose of this memorandum is to fulfill the following information request (IR) #6 from DFO's letter:

The baseline information used to characterize fish habitat loss is based on data collected between 2011 and 2013 and may not be representative of current conditions. Demonstrate that the presented baseline information on fish habitat represents current conditions.

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Acronyms

Abbreviations	Definition
Accumulated thermal units	ATU
the Project	Blackwater Gold Project
CABIN	Canadian Aquatic Biomonitoring Network
°C	Celsius
EIS	Environmental Impact Statement
DFO	Fisheries and Oceans Canada
IR	Information Request
Lake 16	Lake 01682LNRS
LWD	Large Woody Debris
LSA	Local Study Area
µS/cm	MicroSiemens Per Centimeter
SWD	Small Woody Debris
UAV	Unmanned Aerial Vehicle

1. Approach

To assess if baseline information presented in the application is representative of existing conditions, Palmer has conducted a detailed analysis of available datasets for the Project site. The analysis includes both long-term continuous or semi-continuous datasets, and direct comparison of measurements taken in 2017 and 2021 to baseline measurements for the Project by AMEC from 2011-2013 (AMEC 2013).

Long-term datasets that were analyzed include water temperature, water discharge, and water chemistry. These parameters have been measured continuously or nearly continuously at multiple sites throughout the Project's local study area (LSA) and are therefore useful indicators of long-term stability. For these datasets, trends analyses were completed, using Mann-Kendall trends testing or other appropriate methods. In addition to analysis of recorded temperature in Celsius (°C), accumulated thermal units (ATU) were calculated and evaluated for any significant change over time.

Direct comparison of 2011-2013 baseline data and data collected in 2017 and 2021 was also conducted. Aquatic assessments for the project conducted in 2017 included sampling of instream sediment, periphyton, benthic invertebrate community, and benthic invertebrate tissue residues. Sampling conducted in 2021 included fish capture, assessments of spawning migration abundances and timing, and assessments of a wide variety of habitat parameters in streams and lakes. While statistical evaluation and significance determination for these measurements was not possible, comparisons of datasets were conducted.

The weight of evidence provided by analyzing continuous long-term datasets, coupled with direct comparisons between baseline and 2017/2021 measurements was used to assess the applicability of 2011-2013 baseline dataset to current conditions. The methods and results of the analysis are detailed in the following sections of this memorandum. The site locations and codes used in this analysis are shown in Figure 2.1-1.

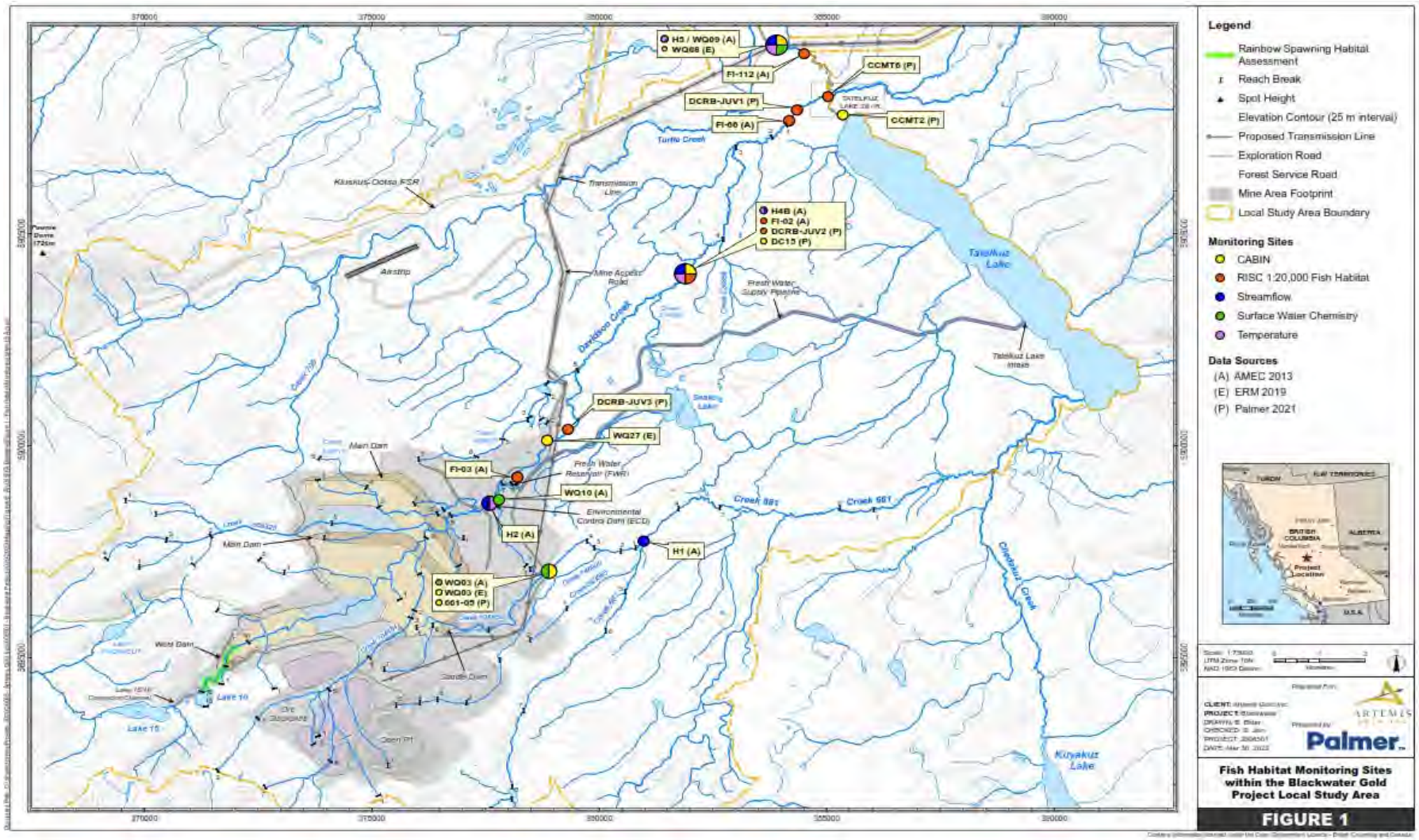

Figure 2.1-1. Fish Habitat Monitoring Sites within the Blackwater Gold Project Local Study Area.

2. Stream Temperature

Temperature data has been collected at stations in Davidson Creek, Chedakuz Creek, and Creek 661 continuously since the baseline study by AMEC (2013). A comparison between updated and baseline stream temperature data is reviewed in this section. A summary of the baseline and updated temperature information collected is shown in Table 2.4-1.

2.1 Upper Davidson Creek

The long-term record of surface water temperature at site H2 in upper Davidson Creek indicates an increase in temperature during spring, with a summer maximum from approximately mid-July to mid-August, and a decrease in temperature in late summer and fall to a winter minimum (Figure 2.1-1). This seasonal cycle is typical of waterbodies located in temperate climates with long cold winters and relatively short warm summers and has been consistently measured over the past ten years in Davidson Creek.

2.1.1 Maximum Yearly Average Daily Temperature

Over the past ten years, the maximum yearly average daily temperature varied from 8.6ºC on August 5, 2011 to 13.6ºC on August 11, 2013, (Figure 2.1-1). Using a non-parametric Mann-Kendall trends test there was a negative trend that was, however, not significant through the period of record (p=0.24). These data indicate that the maximum yearly surface water temperature in upper Davidson Creek has not significantly changed over the past ten years.

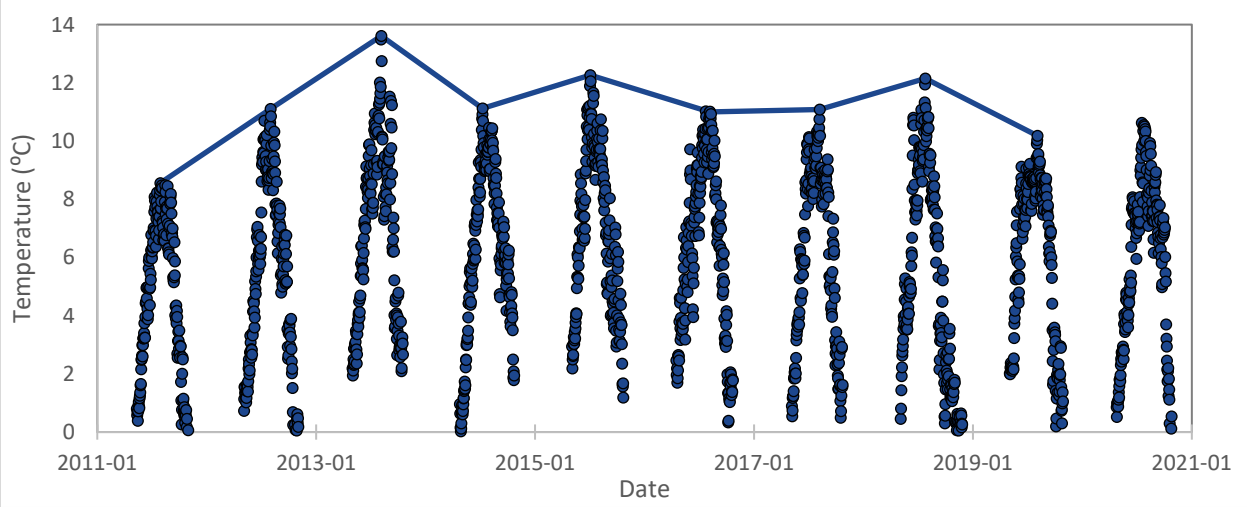

Figure 2.1-1. Average Daily Surface Water Temperature in Upper Davidson Creek at Site H2

2.1.2 Degree Days

Degree days for each year were calculated as the sum of the average daily temperature minus the defined degree day cut-off (10ºC or 4ºC) for each day over the defined cut-off temperature. The degree days at 10ºC varied from 0.0 in 2011 to 24.5 in 2015, and the degree days at 4ºC varied from 269 in 2011 to 549 in 2013 (Figure 2.1-2).

Using a non-parametric Mann-Kendall trends test there was a negative trend in degree days through the period of record that was not significant for both the 4ºC degree days (p=0.12) and for the 10ºC degree days (p=0.36). These data indicate that in upper Davidson Creek there has been no significant trend in degree days over the past nine years (Figure 2.1-2).

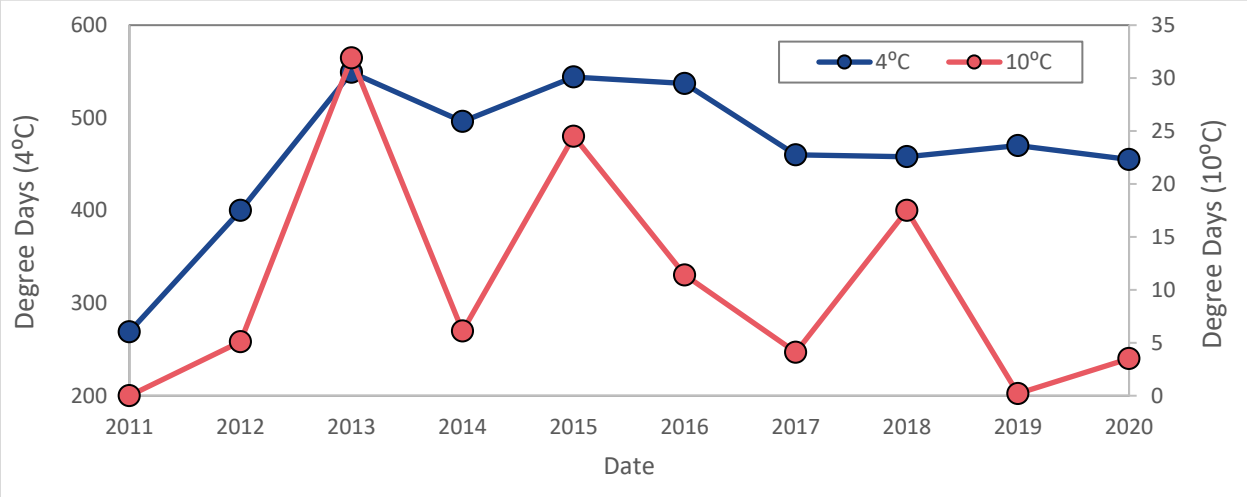

Figure 2.1-2. Degree Days in Upper Davidson Creek at Site H2

2.2 Middle Davidson Creek

2.2.1 Maximum Yearly Average Daily Temperature

The long-term record of surface water temperature at site H4B in middle Davidson Creek indicates, as discussed above, an increase in temperature during spring, with a summer maximum from approximately mid-July to mid-August, and a decrease in temperature in late summer and fall to a winter minimum (Figure 2.2-1). This seasonal cycle is typical of waterbodies located in temperate climates with long cold winters and relatively short warm summers and has been consistently measured over the past nine years in Davidson Creek.

Over the past nine years, the maximum yearly average daily temperature varied from 11.2ºC on August 8, 2019, to 12.8ºC on August 12, 2013 (Figure 2.2-1). Using a non-parametric Mann-Kendall trends test there was a marginally significant negative trend through the period of record (p=0.030). These data indicate that the maximum yearly surface water temperature in middle Davidson Creek has decreased slightly over the past nine years.

The surface water temperature during the summer temperature maximum was slightly warmer in middle Davidson Creek than in upper Davidson Creek, with an approximately 1ºC difference in the maximum daily average temperature (Figure 2.1-1 vs Figure 2.2-1).

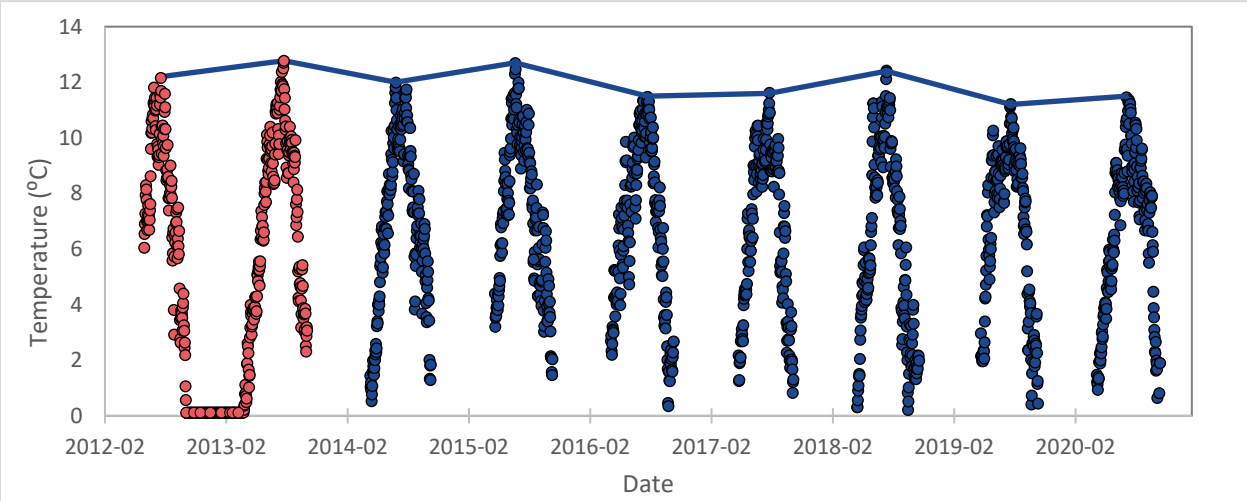

Figure 2.2-1. Average Daily Surface Water Temperature in Middle Davidson Creek at Site H4B

Notes: Coral data were estimated using surface water temperature at ST08-OK and the temperature regression between H4B and ST08-OK (Figure 2.1-1).

2.2.2 Degree Days

Degree days for each year were calculated as the sum of the average daily temperature minus the defined degree day cut-off (10ºC or 4ºC) for each day over the defined cut-off temperature. The degree days at 10ºC varied from 7.2 in 2019 to 42.1 in 2013, and the degree days at 4ºC varied from 513 in 2018 to 637 in 2013 (Figure 2.2-2).

Using a non-parametric Mann-Kendall trends test there was a negative trend in degree days through the period of record that was not significant (p=0.09) for the 4ºC degree days but marginally significant (p=0.014) for the 10ºC degree days. These data indicate that while the 4ºC degree days in middle Davidson Creek have not changed significantly over the past nine years, there has been a small but significant decline in the 10ºC degree days, which is mirrored by a decline in the number of days with an average temperature greater than 10ºC (Figure 2.2-2).

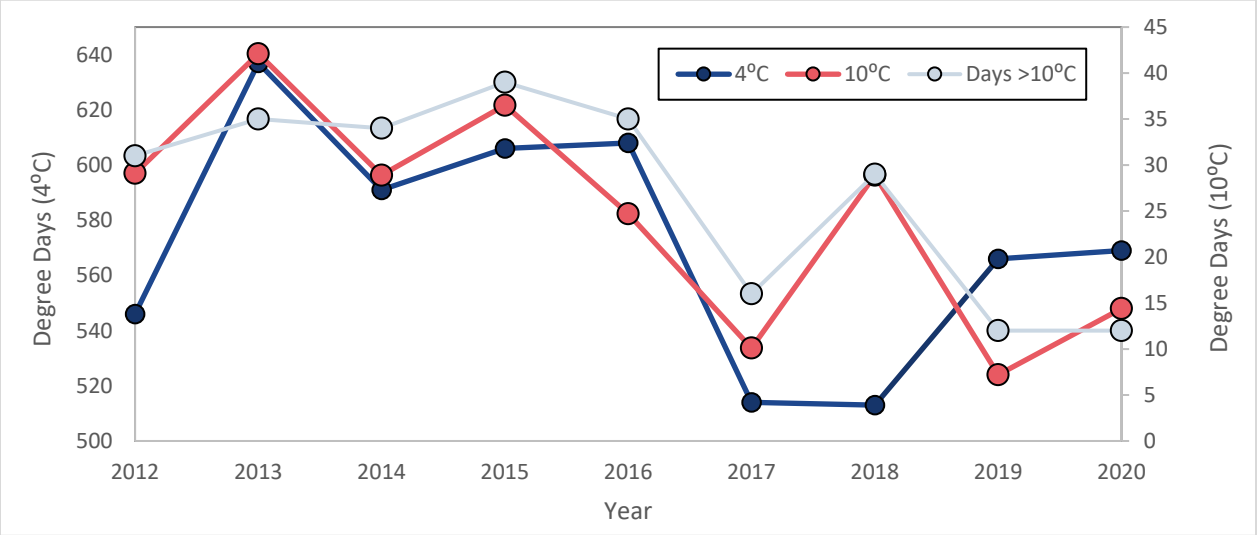

Figure 2.2-2. Degree Days in Middle Davidson Creek at Site H4B

Notes: The 2012 and 2013 data were estimated using surface water temperature at ST08-OK and the temperature regression between H4B and ST08-OK (Figure 2.1-1).

2.3 Chedakuz Creek

Surface water temperature has been monitored in lower Chedakuz Creek at site H5, just downstream of Tatelkuz Lake and the confluence with Davidson Creek. The long-term record of surface water temperature at site H5 in lower Chedakuz Creek indicates, similar to Davidson Creek, an increase in temperature during spring, with a summer maximum from approximately mid-July to mid-August, and a decrease in temperature in late summer and fall to a winter minimum (Figure 2.3-1). As stated, this seasonal cycle is typical of waterbodies located in temperate climates with long cold winters and relatively short warm summers and has been consistently measured over the past ten years in Chedakuz Creek.

2.3.1 Maximum Yearly Average Daily Temperature

Through the period of record, the maximum yearly average daily temperature varied from 14.8 ºC on August 11, 2011, to 19.9ºC on July 7, 2015, (Figure 2.3-1). Using a non-parametric Mann-Kendall trends test there was a positive trend through the period of record that was, however, not significant (p=0.43). These data indicate that the maximum yearly surface water temperature in lower Chedakuz Creek has not changed significantly over the past ten years.

The surface water temperature during the summer temperature maximum was warmer in lower Chedakuz Creek than in upper Davidson Creek, with a consistent 5ºC to 7ºC difference in the maximum daily average temperature (Figure 2.1-1 vs Figure 2.3-1).

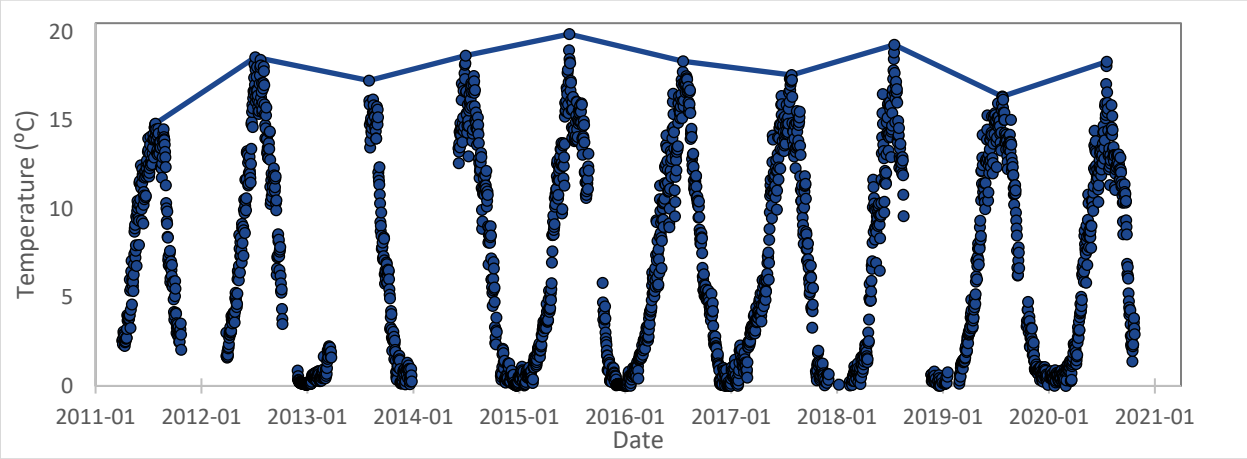

Figure 2.3-1. Average Daily Surface Water Temperature in Chedakuz Creek at Site H5

2.3.2 Degree Days

As for Davidson Creek, degree days for each year were calculated as the sum of the average daily temperature minus the defined degree day cut-off (14ºC, 10ºC, or 4ºC) for each day over the defined cut-off temperature. For lower Chedakuz Creek, however, there were missing temperature data (Figure 2.3-1); these were estimated by using the linear regressions calculated during the spring temperature increase or the fall temperature decrease. Estimates were required for all degree day calculations in 2013, and for calculation of the 4ºC and 10ºC degree days in 2014, 2015, and 2018.

The degree days varied from 6 in 2011 to 114 in 2016 at 14ºC, from 254 in 2011 to 495 in 2014 at 10ºC and from 1009 in 2011 to 1641 in 2014 at 4ºC (Figure 2.3-2). These data again illustrate how much warmer the surface waters are in lower Chedakuz Creek in comparison with upper Davidson Creek: in upper Davidson Creek there were zero degree days at 14ºC, the degree days in upper Davidson Creek were approximately 5% of Chedakuz Creek at 10ºC, and 35% to 45% at 4ºC (Figure 2.1-2 vs Figure 2.3-2).

Visual observation of the data indicates no consistent temporal trends in the degree day data. These data therefore indicate that the surface water temperature in lower Chedakuz Creek downstream of Lake Tatelkuz has not changed significantly over the past ten years.

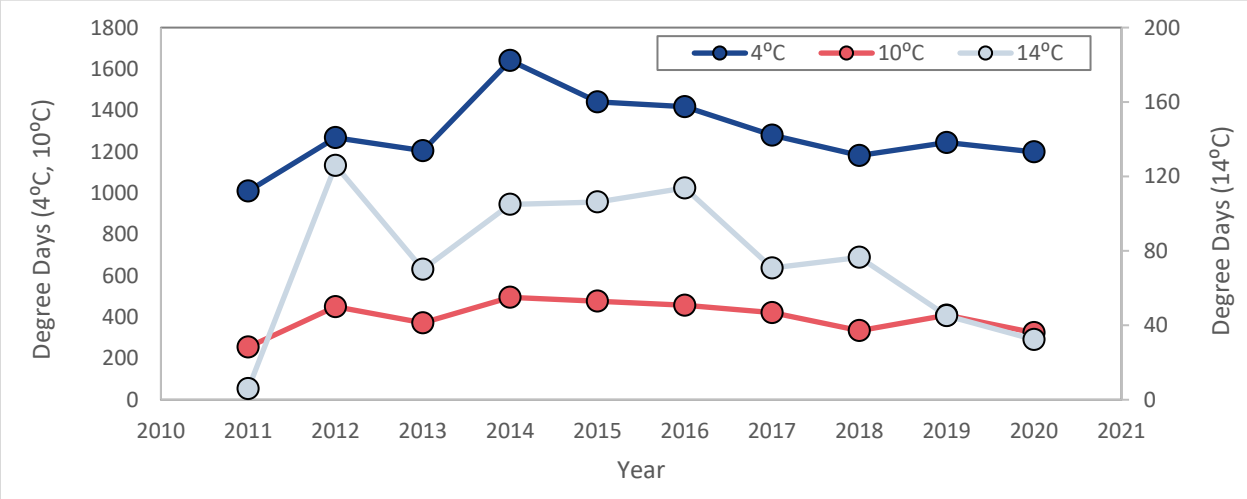

Figure 2.3-2. Degree Days in Chedakuz Creek at Site H5

2.4 Creek 661

2.4.1 Maximum Yearly Average Daily Temperature

From 2011-2020, the maximum yearly average daily temperature varied from 9.0ºC on July 15, 2014 to 19.3ºC on July 31, 2017 (Figure 2.4-1). Using the non-parametric Mann-Kendall trends test, there was a significant positive trend in the yearly maximum daily temperature (p=0.01) during the period of record. These data indicate that the maximum yearly surface water temperature in upper Creek 661 has increased since 2011.

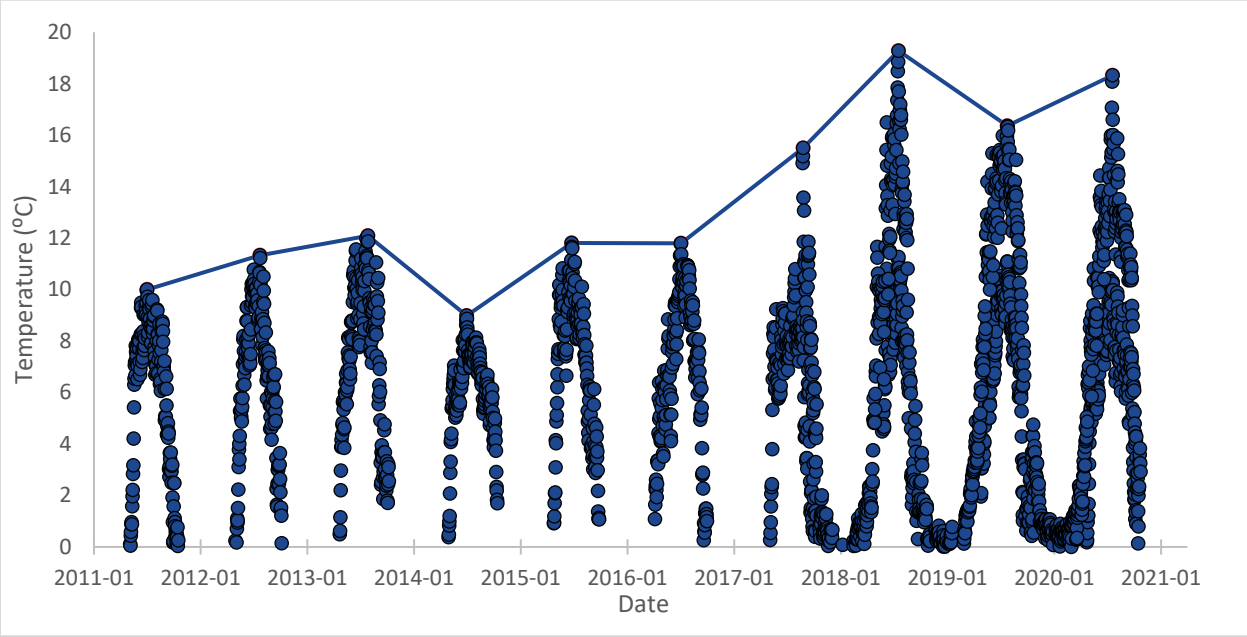

Figure 2.4-1. Average Daily Surface Water Temperature in Creek 661 at Site H1.

2.4.2 Degree Days

Degree days for each year (2011-2020) were calculated as the sum of the average daily temperature minus the defined degree day cut-off (4ºC, 10ºC, or 14ºC) for each day over the defined cut-off temperature. The degree days at 4ºC varied from 349.3 - 643.9ºC (2011-2020), at 10ºC varied from 7.1 – 205.5ºC (2012, 2013, 2015-2020), and at 14ºC varied from 3.6 – 76.5ºC (2017-2020) (Figure 2.2-8).

Using the non-parametric Mann-Kendall trends test, there was a significant positive trend in 4ºC degree days (p=0.02) and 10ºC degree days (p=0.009) during the period of record. There was no significant trend in 14ºC degree day (p=1) during the period of record.

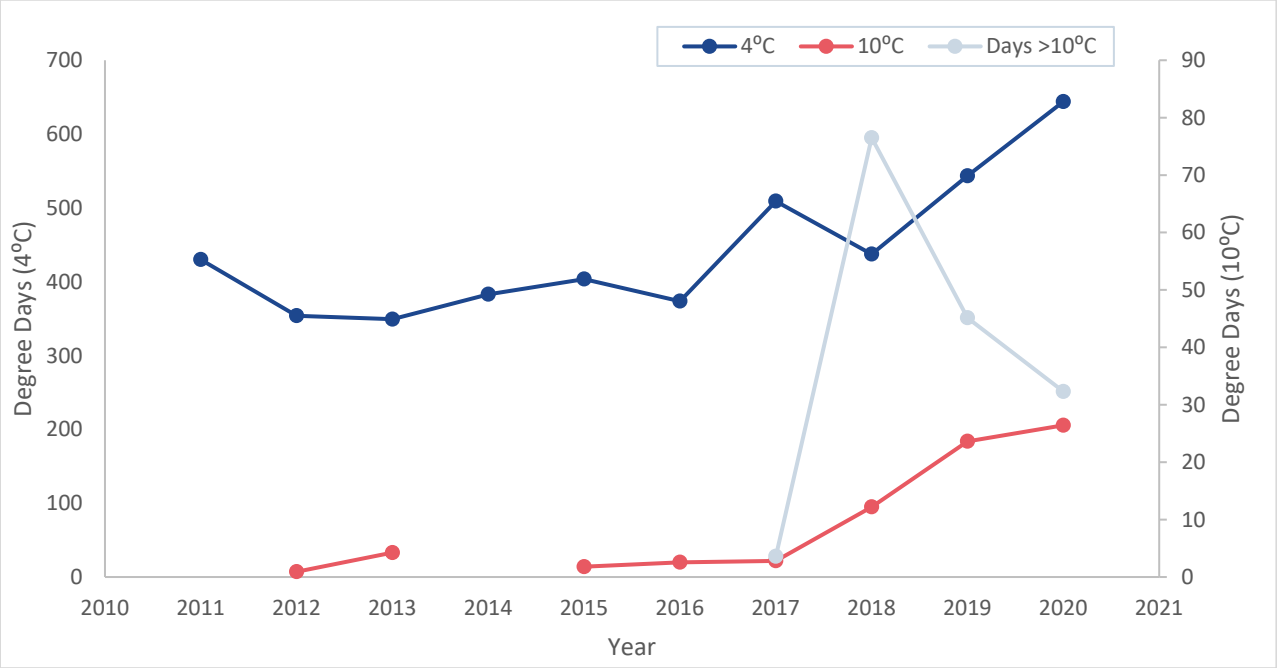

Figure 2.4-2. Degree Days in Creek 661 at Site H1.

Table 2.4-1. Summary table of baseline and current stream temperature information for the Blackwater Project.

Source	Stream	Site ID	Start Year	End Year	Metric	Max. Yearly Average Daily Temperature (ºC)	Degree Days at 14ºC	Degree Days at 10ºC	Degree Days at 4ºC	p-Value
KP[1]	Davidson Creek	H2	2011	2021	Surface Water Temperature	8.6 - 13.6	-	-	-	0.24
KP[1]	Davidson Creek	H2	2011	2020	Degree Days	-	-	0.0 - 24.5	269 - 549	4ºC = 0.12 10ºC = 0.36
KP[1]	Davidson Creek	H4B	2012	2020	Surface Water Temperature	11.2 - 12.8	-	-	-	**0.03**
KP[1]	Davidson Creek	H4B	2012	2020	Degree Days	-	-	7.2 – 42.1	513 - 637	4ºC = 0.09 10ºC = **0.014**
KP[1] Palmer[2]	Chedakuz Creek	H5	2011	2021	Surface Water Temperature	14.8 - 19.9	-	-	-	0.43
KP[1] Palmer[2]	Chedakuz Creek	H5	2011	2020	Degree Days	-	6 - 114	254 - 495	1009 - 1641	NS
KP[1]	Creek 661	H1	2011	2020	Surface Water Temperature	9.0-19.3	-	-	-	**0.01**
KP[1]	Creek 661	H1	2011	2020	Degree Days	-	4-77	7-205	349-644	4ºC = **0.02** 10ºC = **0.009**

1 Knight Piésold Ltd. (KP). 2021. Blackwater Gold Project – 2020 Hydrology and Water Temperature Baseline Report, KP Ref. No. VA101-457/33-3 Rev. 1, dated May 17, 2021.

2 Palmer estimated data using the linear regressions calculated during the spring temperature increase or the fall temperature decrease as there were missing temperature data for lower Chedakuz Creek.

NS = not specified; - = not applicable; **Bold** = significant p-value

3. Streamflow

Streamflow data were assessed for the period from 2011 – 2020 to evaluate if and how it may have changed from baseline conditions. Given considerable variability in streamflow, key periods where streamflow is most relevant to maintaining physical fish habitat were evaluated. The periods considered were:

- **July 15 – September 30 (Summer Low Flows):** Summertime low flows, following spring freshet and before the onset of autumn storms, provide important physical habitat for rearing fish throughout the project area.
- **December 1 – March 31 (Winter Low Flows):** Winter low flows, primarily sustained by groundwater contributions, provide important physical habitat for overwintering fish as well as fish embryos incubating in channel gravels.

Although spring freshet provides peak flows responsible for maintaining channel conditions and flushing fine sediments, it was not evaluated due to its considerable variability and limited relevance to fish habitat.

Given the relatively short period of record, comparisons were conducted by calculating seasonal low flow metrics (i.e., summer and winter low flows) and visually evaluating trends through time. Summer low flow metrics were evaluated using observed hydrometric data (KP, 2021) from the following sites:

- **Davidson Creek, H2:** Davidson Creek near the lower extent of proposed mine infrastructure.
- **Davidson Creek, H4B:** Middle Davidson Creek near the upper extent of Kokanee habitat.
- **Creek 661, H1:** Tributary stream of Creek 661
- **Chedakuz Creek, H5:** Chedakuz Creek below Davidson Creek

Winter low flows were evaluated using the following modelled monthly data representative of baseline conditions, as hydrometric stations are not in operation through winter months. Note, Chedakuz Creek was not evaluated as it is not captured by the baseline hydrological model.

- **Davidson Creek, H2:** Davidson Creek near the lower extent of proposed mine infrastructure.
- **Davidson Creek, H4B:** Middle Davidson Creek near the upper extent of Kokanee habitat.
- **Creek 661, 661-1:** Lower reach of Creek 661.

Seasonal flow metrics were compared by considering unit runoff, which is the sum of streamflow over the period of interest (e.g., July 15 – September 30), divided by watershed area. This produced a seasonal yield (in mm) that is normalized for watershed area and allows for the direct comparison of flows from watersheds of different sizes. A summary of the baseline and updated streamflow information collected can be seen in Table 3.3-1.

3.1 Davidson Creek

The timeseries of annual summer low flows (July 15 – September 30) indicate that there is considerable variability in the magnitude of summer low flows (Figure 3.1-1, Figure 3.1-2). Generally, summertime low flows tend to fluctuate around a constant mean, which suggests that the summertime low flow regime likely has exhibited stationarity over the 2011-2020 period. This is also supported by non-parametric Mann-

Kendall trends tests which indicate that there are no trends in summertime low flows at either H2 or H4B (p-values of 0.86 and 0.39, respectively).

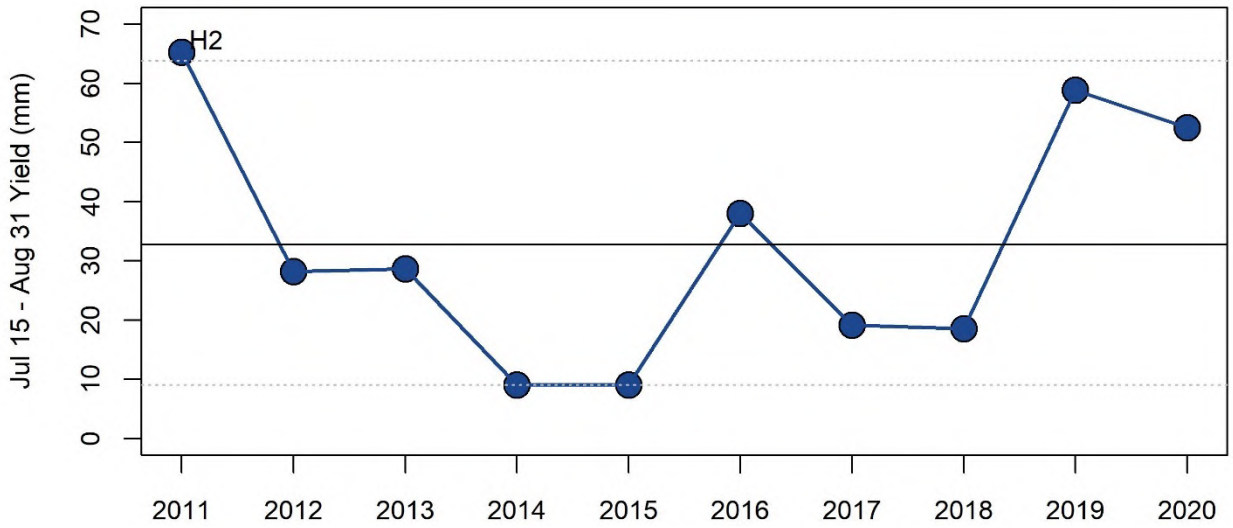

Figure 3.1-1. Timeseries of summertime low flow yield (July 15- September 30) observed at H2. Dotted grey lines indicated the 2.5% and 97.5% percentile yield and the solid black line represents the mean yield over this period.

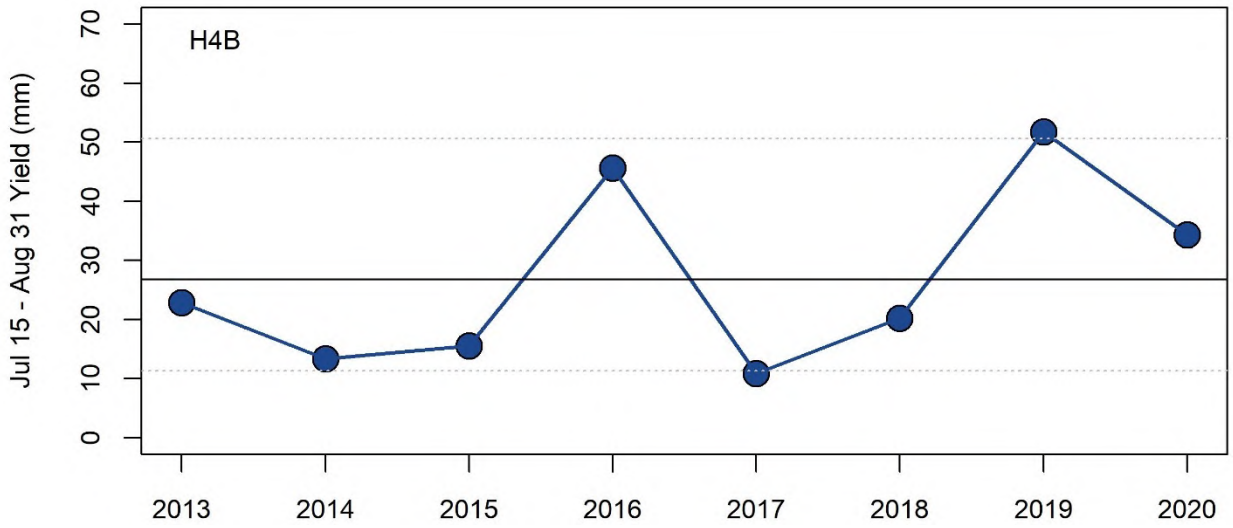

Figure 3.1-2. Timeseries of summertime low flow yield (July 15- September 30) observed at H4B. Dotted grey lines indicated the 2.5% and 97.5% percentile yield and the solid black line represents the mean yield over this period.

The timeseries of annual winter low flows (December 1 – March 31) indicate that winter low flows have tended to increase over the 2011-2020 period (Figure 3.1-3, Figure 3.1-4). This is supported by non-parametric Mann-Kendall trends tests which indicate a statistically significant increase in winter low flows at H4B (p-value of 0.049); however, the Mann-Kendall trends test for H2 indicates this trend is not significant (p-value of 0.15). The apparent increases in winter temperatures that have occurred over the previous decade have likely been caused by more frequent mid-winter snowmelt events, or earlier onset of spring freshet.

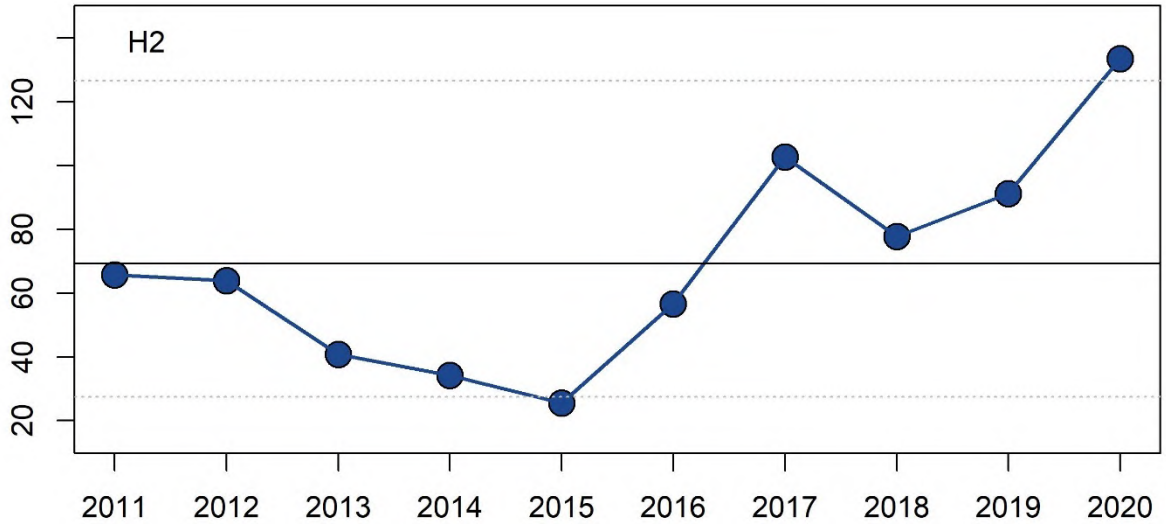

Figure 3.1-3. Timeseries of winter low flow yield (mm) (Dec 1- Mar 31) observed at H2. Dotted grey lines indicated the 2.5% and 97.5% percentile yield and the solid black line represents the mean yield over this period.

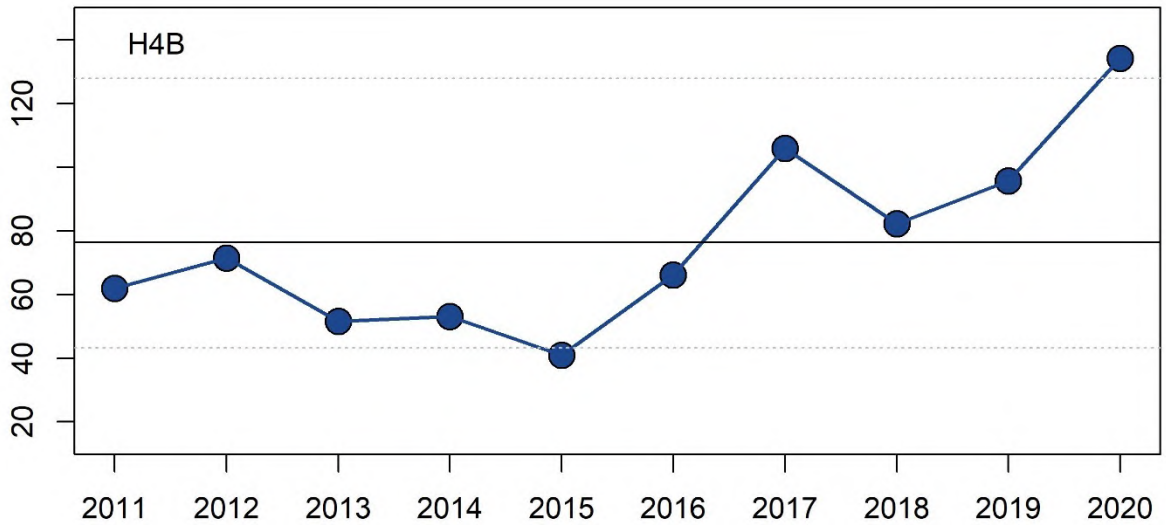

Figure 3.1-4. Timeseries of winter low flow yield (mm) (Dec 1 – Mar 31) observed at H4B. Dotted grey lines indicated the 2.5% and 97.5% percentile yield and the solid black line represents the mean yield over this period.

3.2 Chedakuz Creek

The timeseries of annual summer low flows (July 15 – September 30) indicate that there is considerable variability in the magnitude of summer low flows (Figure 3.2-1). Generally, summertime low flows tend to fluctuate around a constant mean, which suggests that the summertime low flow regime likely has exhibited stationarity over the 2011-2020 period. This is also supported by a non-parametric Mann-Kendall trends test which indicate that there are no trends in summertime low flows at H5 (p-values = 1.0). Results from Chedakuz Creek do not follow the same trends as Davidson Creek and Creek 661, likely because of the influence that Tatelkuz Lake has on moderating peak and low flow events. No data were available to assess winter flows from Chedakuz Creek.

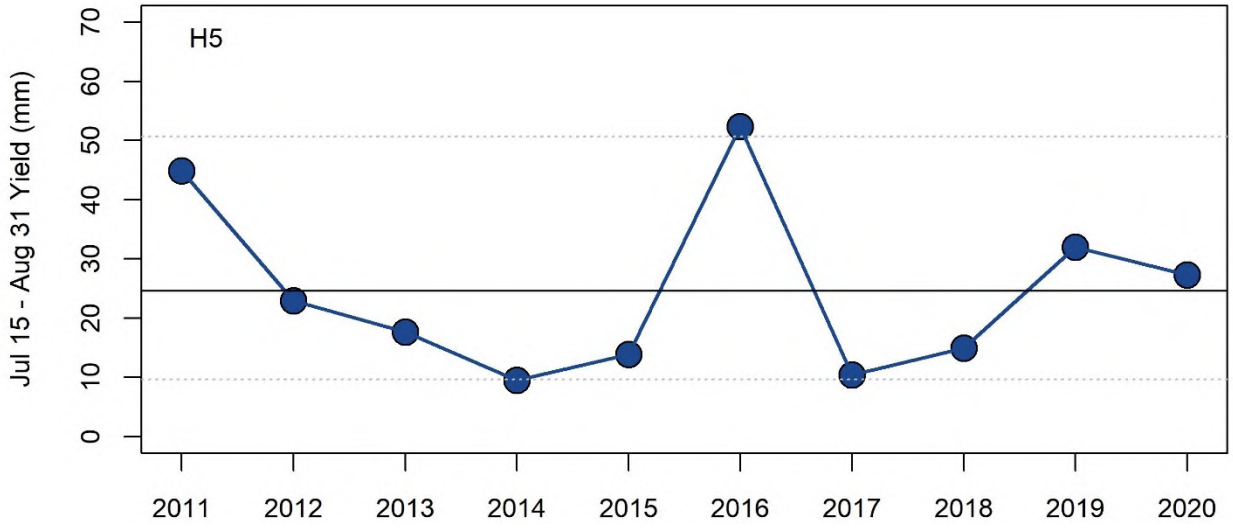

Figure 3.2-1. Timeseries of summertime low flow yield (July 15- September 30) observed at H5 in Chedakuz Creek. Dotted grey lines indicated the 2.5% and 97.5% percentile yield and the solid black line represents the mean yield over this period.

3.3 Creek 661

The timeseries of annual summer low flows (July 15 – September 30) indicate that there is considerable variability in the magnitude of summer low flows (Figure 3.3-1). Generally, summertime low flows tend to fluctuate around a constant mean, which suggests that the summertime low flow regime likely has exhibited stationarity over the 2011-2020 period. This hydrometric station is in a headwater portion of the Creek 661 watershed, such that zero flow conditions have occurred during dry years (e.g., 2014). This is also supported by a non-parametric Mann-Kendall trends test which indicate that there are no trends in summertime low flows at H1 (p-values = 0.53).

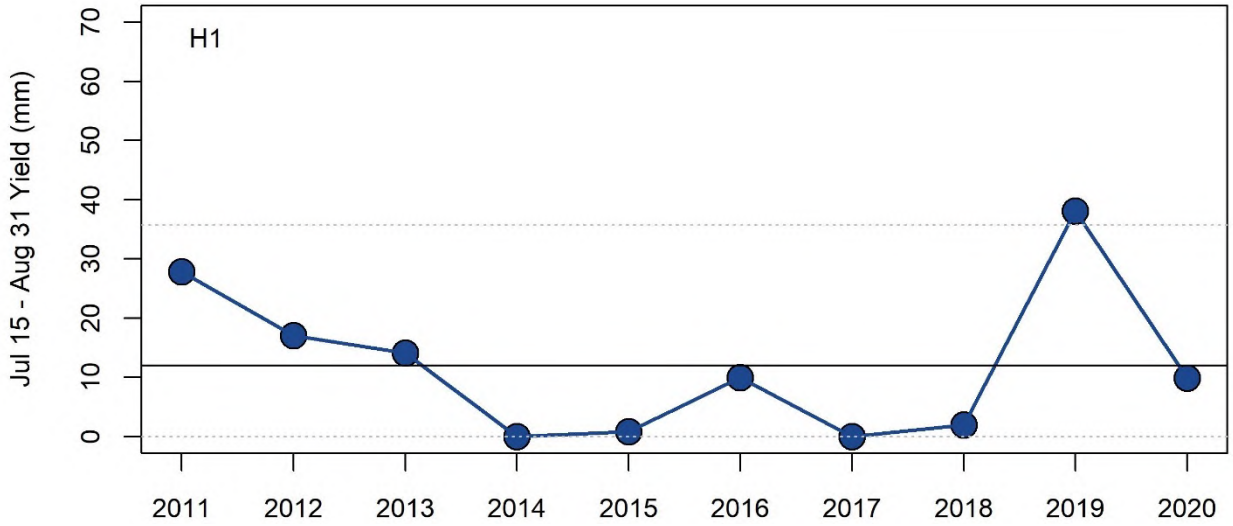

Figure 3.3-1. Timeseries of summertime low flow yield (July 15- September 30) observed at H1 in Creek 661. Dotted grey lines indicated the 2.5% and 97.5% percentile yield and the solid black line represents the mean yield over this period.

The timeseries of annual winter low flows (December 1 – March 31) indicate that winter low flows have tended to increase over the 2011-2020 period (Figure 3.3-2). This is supported by non-parametric Mann-Kendall trends tests which indicate a statistically significant increase in winter low flows at H1 (p-value of 0.049). This increase is likely due to increasing winter temperatures that have occurred over the previous decade, which may have caused more frequent mid-winter snowmelt events or the earlier onset of freshet.

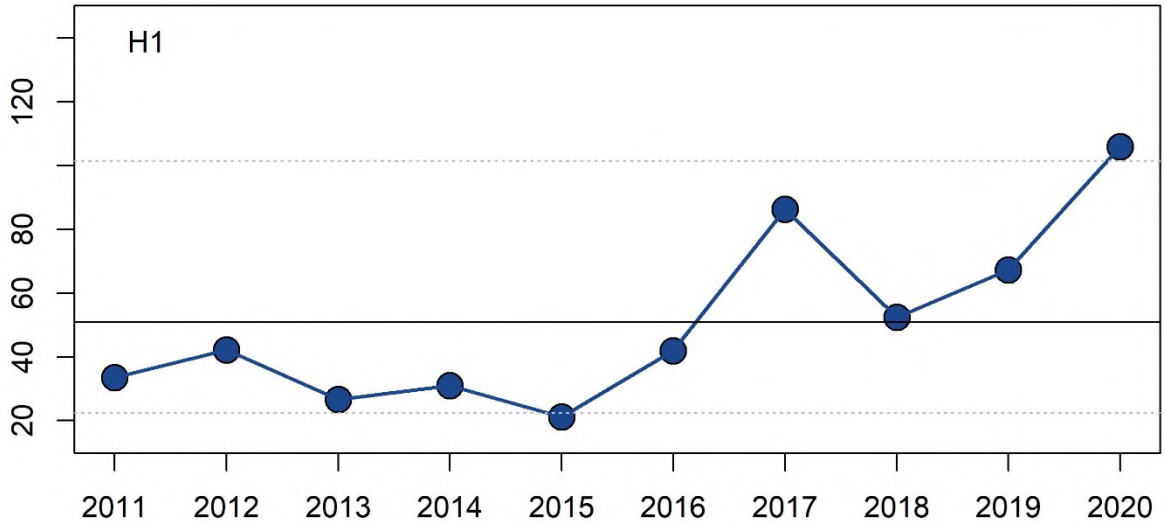

Figure 3.3-2. Timeseries of winter low flow yield (Dec 1 – Mar 31) observed at H1. Dotted grey lines indicated the 2.5% and 97.5% percentile yield and the solid black line represents the mean yield over this period.

Table 3.3-1. Summary table of observed streamflow metrics from 2011-2020 for the Blackwater Project.

Stream	Site ID	Time Frame (Summer = Jul 15-Sept 30; Winter = Dec 1 – Mar 31)	Observed Range of Seasonal Yield (mm)[1]	p-value
Davidson Creek	H2	Summer Low Flows	9-65	0.86
Davidson Creek	H2	Winter Low Flows	25-133	0.15
Davidson Creek	H4B	Summer Low Flows	11-52	0.39
Davidson Creek	H4B	Winter Low Flows	41-134	**0.049***
Chedakuz Creek	H5	Summer Low Flows	10-52	1.0
Creek 661	H1	Summer Low Flows	0-38	0.53
Creek 661	H1	Winter Low Flows	21-106	**0.049***

1 Knight Piésold Ltd. (KP). 2021. *Blackwater Gold Project – 2020 Hydrology and Water Temperature Baseline Report, KP Ref. No. VA101-457/33-3 Rev. 1, dated May 17, 2021.*

* = significant p-value using non-parametric Mann-Kendall trends analysis

4. Surface Water Chemistry

Surface water chemistry data has been collected at stations within each impacted watershed during 2017-2020, since the baseline data collection in 2011-2014. A comparison between recent (2017-2020) and baseline (2011-2014) surface water chemistry data is reviewed in this section. A summary of the baseline and updated surface water chemistry information is shown in Table 4.3-1.

4.1 Upper Davidson Creek

The following section presents and interprets surface water conductivity, pH, and sulphate data from samples collected approximately monthly from 2011 to 2020 in upper Davidson Creek. The surface water data are from Site WQ10, which is close to hydrometric station H2 (see Section 2.2 Temperature).

Through the period of record, conductivity ranged from a low of approximately 20 microSiemens per centimeter (µS/cm) to a high of approximately 125 µS/cm (Figure 4.1-1). The surface water conductivity (Figure 4.1-1) data indicate that the range in conductivity was distributed seasonally in Davidson Creek and that the timing of the seasonal cycles has not changed through the period of record:

- Spring freshet begins sometime between Day 110 (April 19/20) and Day 125 (May 4/5) and ends some time after Day 173 (June 21/22), with conductivity of approximately 20 µS/cm to 40 µS/cm,
- Summer recession begins sometime after Day 173 (June 21/22) and ends before Day 273 (September 29/30), with conductivity increasing from approximately 35 µS/cm to 125 µS/cm,
- After the summer recession, there is a variable period of reduced conductivity that lasts through the Fall until late December, possibly caused fall rain events,
- The winter baseflow begins sometime after Day 352 (December 16/17) and ends before Day 110 (April 19/20), with conductivity ranging from approximately 70 µS/cm to 120 µS/cm.

Conductivity has not changed during the spring freshet or the summer recession through the period of record (2011 to 2020). However, the conductivity during the fall rains and winter baseflow has been lower in the 2017-2020 period in comparison with the 2011-2014 period (Figure 4.1-1).

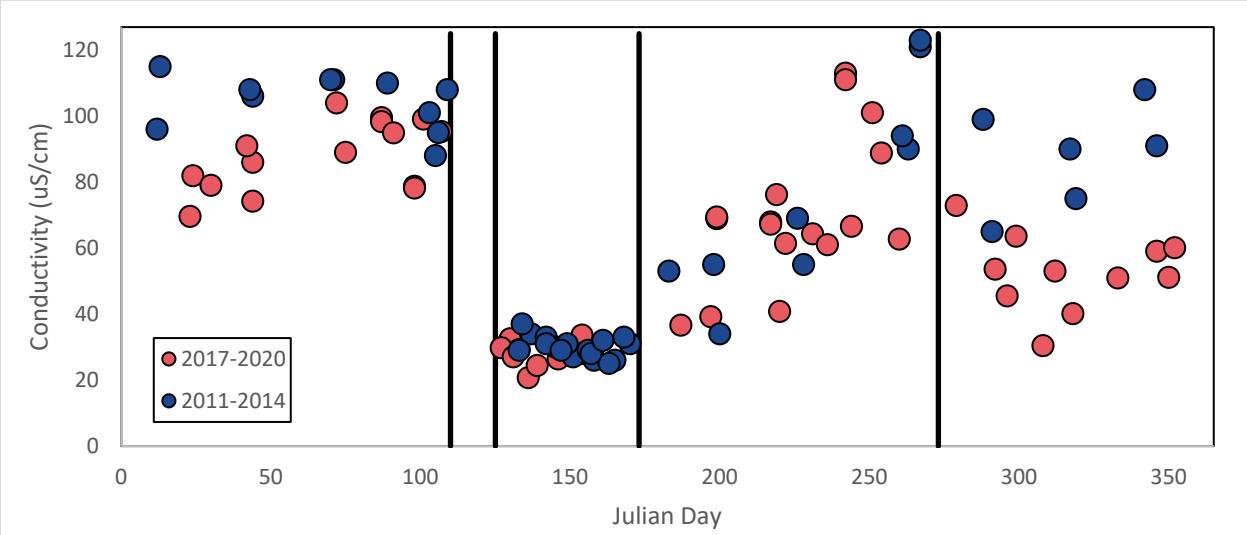

Figure 4.1-1. Seasonal Series of Conductivity in Upper Davidson Creek (Site WQ10)

Through the period of record the pH ranged from approximately 6.8 to 8.1, which indicates that the waters in upper Davidson Creek are circumneutral (6.5 to 7.5) to slightly alkaline (Figure 4.1-2).

The data indicate that there are seasonal cycles in pH in Davidson Creek comparable to conductivity (Figure 4.1-2). In contrast with conductivity, however, the pH in upper Davidson Creek has not changed through the period of record, with comparable data between 2011-2014 and 2017-2020 for spring freshet, summer recession, fall, and winter baseflow (Figure 4.1-2).

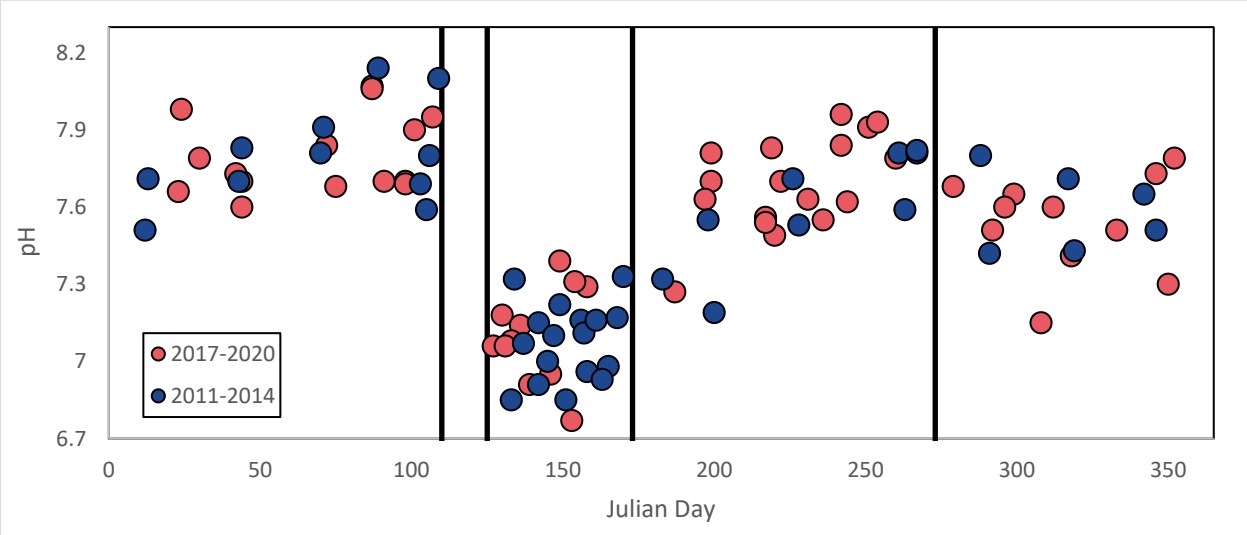

Figure 4.1-2. Seasonal Series of pH in Upper Davidson Creek (Site WQ10)

The sulphate concentration in upper Davidson Creek ranged from approximately 0.5 mg/L to approximately 4 mg/L through the period of record and was correlated with conductivity (Figure 4.1-3). Seasonal cycles and temporal trends measured for conductivity (see above) therefore also apply to sulphate.

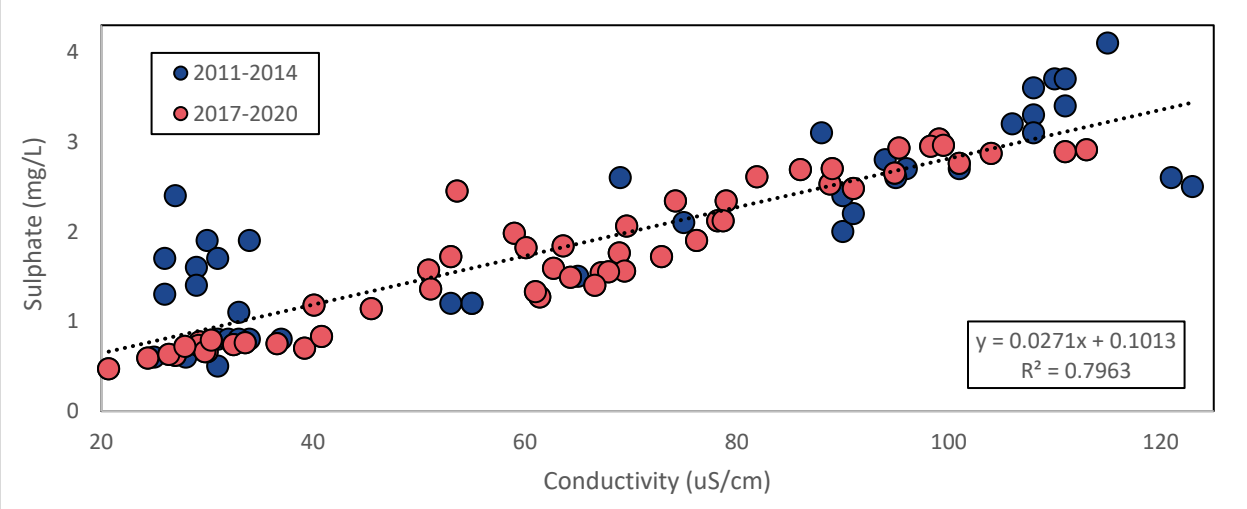

Figure 4.1-3. Correlation between Conductivity and Sulphate in Upper Davidson Creek (Site WQ10)

These surface water data indicate that there are seasonal cycles in water chemistry in upper Davidson Creek but that there have been no substantive alterations in water chemistry through the period of record from 2011 to 2020.

4.2 Chedakuz Creek

The following section presents and interprets surface water conductivity, pH, and sulphate data from samples collected approximately monthly from 2011 to 2020 in lower Chedakuz Creek. The surface water data for Chedakuz Creek are from Site WQ09, which is downstream of the confluence with Davidson Creek and close to hydrometric station H5 (see Section 2.2 Temperature).

Through the period of record, conductivity ranged from a low of approximately 100 µS/cm to a high of 160 µS/cm (Figure 4.2-1). This is higher than the conductivity in upper Davidson Creek, where the conductivity ranged from a low of approximately 20 µS/cm to a high of approximately 125 µS/cm (Figure 4.1-1).

The surface water conductivity (Figure 4.2-1) data indicate that the range in conductivity through the period of record was distributed seasonally in Chedakuz Creek and that the timing of the seasonal cycles has not changed:

- Spring freshet begins sometime between Day 92 (March 1/2) and Day 125 (May 4/5) and ends some time after Day 173 (June 21/22), with conductivity of approximately 100 µS/cm to 130 µS/cm,
- Summer recession begins sometime after Day 173 (June 21/22) and ends before Day 273 (September 29/30), with conductivity increasing to approximately 150 µS/cm,
- After the summer recession, there is a variable period of reduced conductivity that lasts through the Fall until late December, possibly caused fall rain events,
- The winter baseflow begins sometime after Day 352 (December 16/17) and ends before Day 110 (April 19/20), with conductivity ranging from approximately 145 µS/cm to 160 µS/cm.

Conductivity has not changed during the spring freshet, summer recession, or winter baseflow through the period of record (2011 to 2020). However, the conductivity during the fall rains has been lower in the 2017-2020 period in comparison with the 2011-2014 period (Figure 4.2-1).

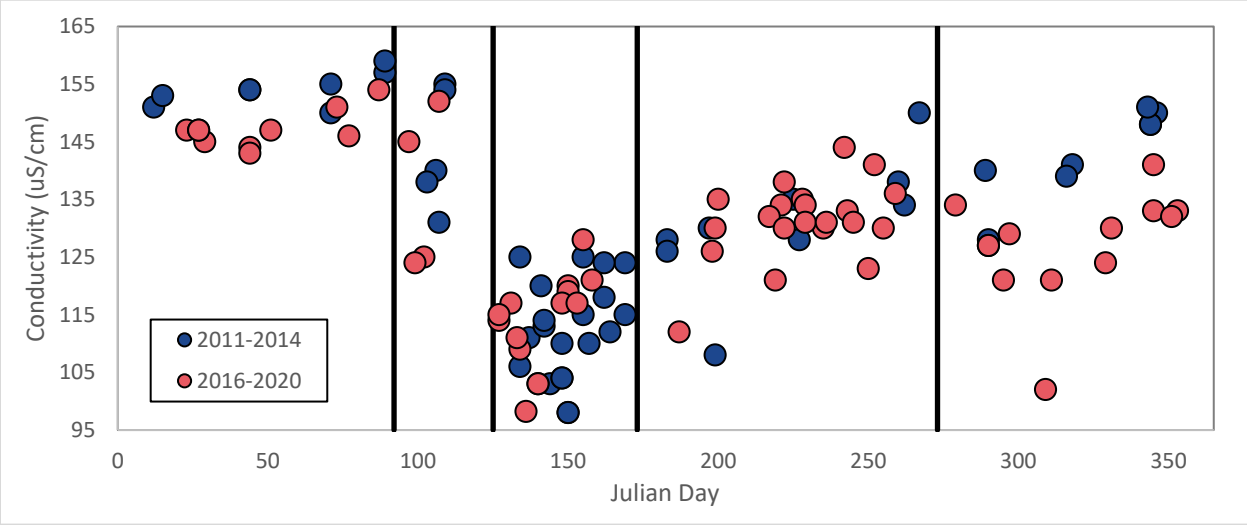

Figure 4.2-1. Seasonal Series of Conductivity in Lower Chedakuz Creek (Site WQ09)

There were no consistent seasonal cycles in pH in lower Chedakuz Creek. Through the period of record the pH normal range was estimated to be 7.6 to 8.3, which indicates that the waters in lower Chedakuz Creek are slightly alkaline (Figure 4.2-2). This pH range is higher than in upper Davidson Creek, where the pH was circumneutral to slightly alkaline and ranged from approximately 6.8 to 8.1 (Figure 4.1-2).

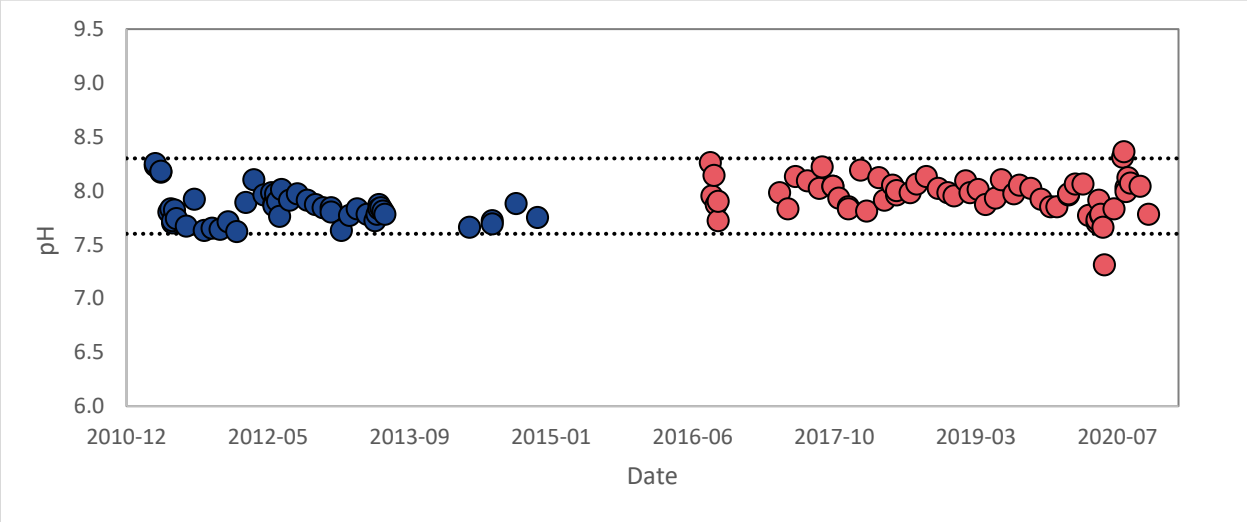

Figure 4.2-2. Surface Water pH in lower Chedakuz Creek (Site WQ09)

The sulphate concentration in lower Chedakuz Creek ranged from approximately 2.8 mg/L to 5.6 mg/L from 2011 to 2014, and from approximately 2.8 mg/L to 4.8 mg/L in 2017 to 2020 (Figure 4.2-3). There were, therefore, no consistent temporal changes in sulphate concentration through the period of record.

The sulphate concentrations in lower Chedakuz Creek were higher than in upper Davidson Creek, where sulphate was measured from approximately 0.5 mg/L to 4 mg/L (Figure 4.1-3). The difference in concentration highlights the increase in dissolved salts moving downstream in the watershed.

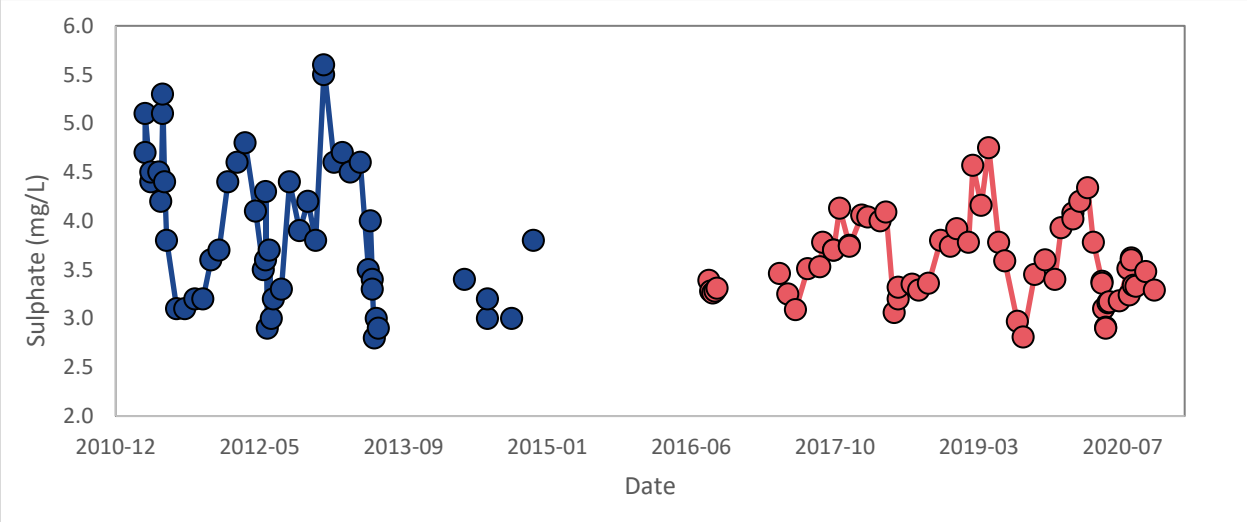

Figure 4.2-3. Surface Water Sulphate in Lower Chedakuz Creek (Site WQ09)

4.3 Creek 661

The following section presents and interprets surface water conductivity, pH, and sulphate data for samples collected quarterly to monthly from 2011 to 2020 in the upper Creek 661 watershed. The surface water data are from Site WQ03, which is located on Creek 505659.

There were seasonal cycles in conductivity recorded during the 2011 to 2013 time period (Figure 4.3-1). However, after 2013 the frequency of sample collection was quarterly at best, so it was not possible to assess seasonal cycles through the entire period of record or to compare the 2011 to 2013 period with the 2017 to 2020 period.

Between 2011 and 2014, conductivity ranged from approximately 35 µS/cm to 110 µS/cm, with one spike in conductivity to approximately 150 µS/cm. Between 2017 and 2020, conductivity ranged from approximately 40 µS/cm to 100 µS/cm. There has, therefore, been to consistent temporal trend in conductivity in the upper Creek 661 watershed through the entire period of record.

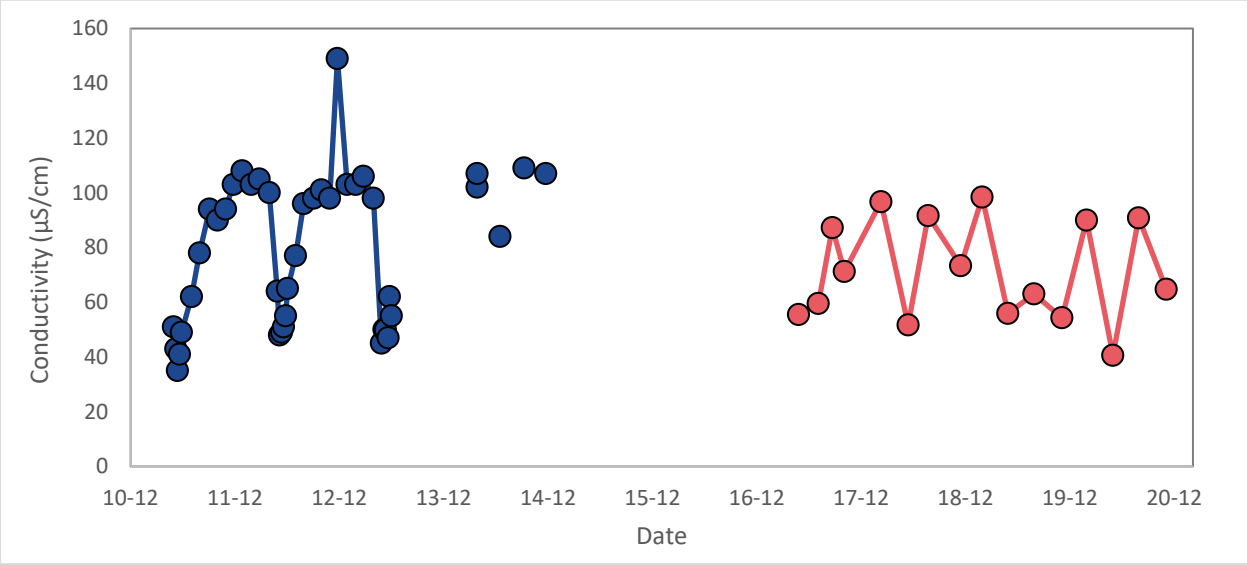

Figure 4.3-1. Surface Water Conductivity in the Upper Creek 661 Watershed (Site WQ03)

There were no consistent seasonal cycles in pH in the upper Creek 661 watershed. Through the period of record the pH normal range was estimated to be 7.0 to 7.9, which indicates that the waters in the upper Creek 661 watershed are circumneutral to slightly alkaline (Figure 4.3-2). This pH range is comparable to upper Davidson Creek (Figure 4.1-2), and lower than in Chedakuz Creek (Figure 4.2-2).

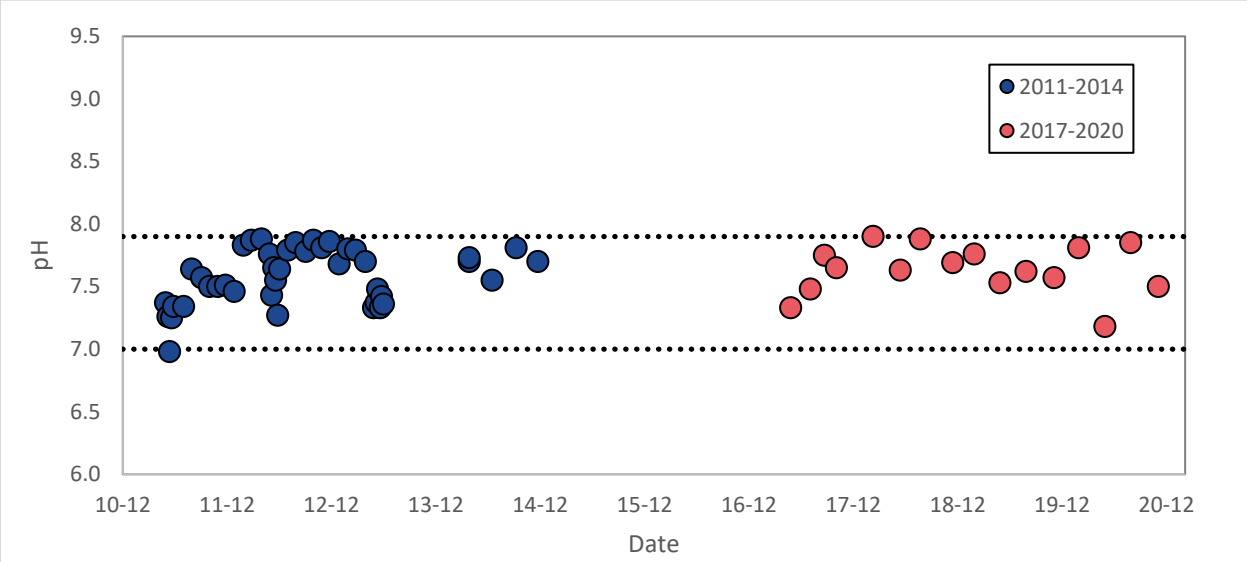

Figure 4.3-2. Surface Water pH in the Upper Creek 661 Watershed (Site WQ03)

It was not possible to characterize seasonal cycles for sulphate in the upper Creek 661 watershed because the data were not consistent from 2011 to 2014, and there were not enough data from 2017 to 2020.

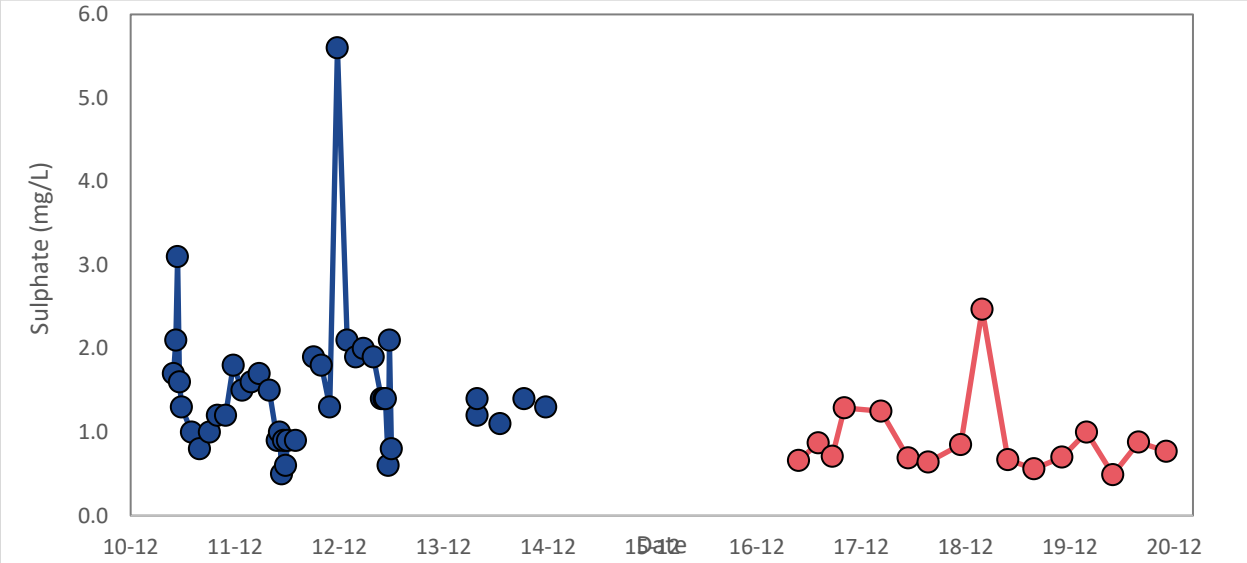

Figure 4.3-3. Surface Water Sulphate in the Upper Creek 661 Watershed (Site WQ03)

Through the period of record the sulphate concentration ranged from approximately 0.5 mg/L to 3 mg/L from 2011 to 2014, and from approximately 0.5 mg/L to 2.5 mg/L from 2017 to 2018 (Figure 4.3-3). A t-test of 2011-2014 vs 2017-2020 was significantly different (p=0.01), which indicated that there has been a significant reduction in sulphate concentration over time. The reduction in sulphate, however, was not matched by a reduction in either conductivity (Figure 4.3-1) or strontium (Figure 4.3-4). Strontium is a conservative ion that reflects geochemical watershed processes and groundwater/surface water interaction, and the lack of consistency between the sulphate concentration and the strontium concentrations suggests an alteration in watershed geochemical processes specific to sulphate.

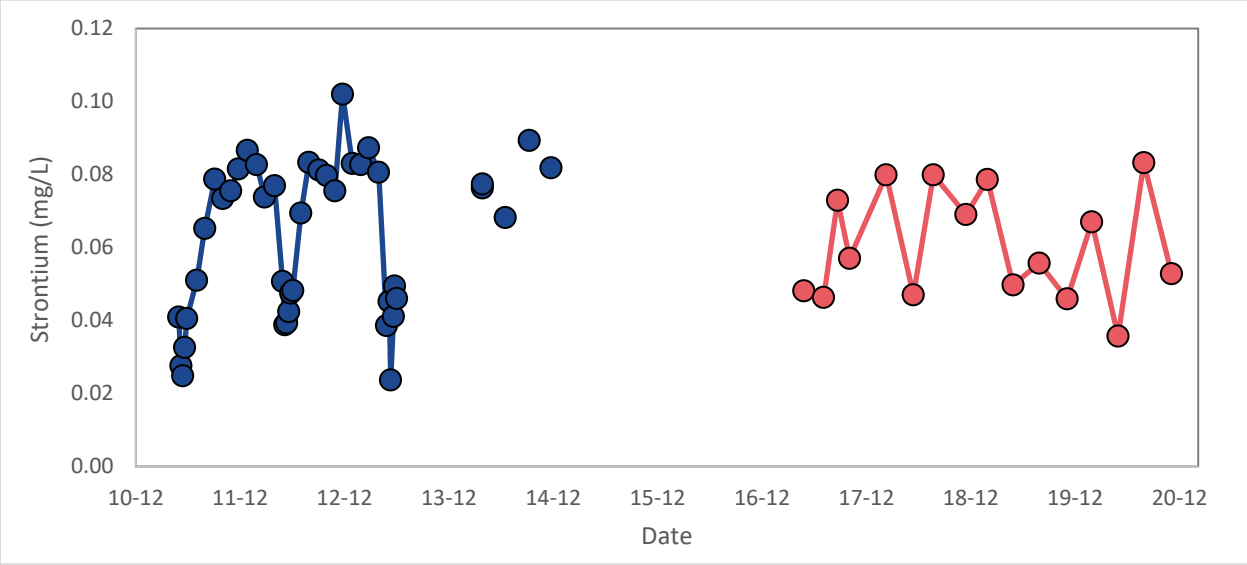

Figure 4.3-4. Surface Water Strontium in the Upper Creek 661 Watershed (Site WQ03)

Table 4.3-1. Summary table of baseline and current surface water chemistry information for the Blackwater Project.

Source	Stream	Site ID	Start Year	End Year	Conductivity (µS/cm)			pH	Sulphate Concentration (mg/L)	p-value
					Spring	Summer	Winter			
ERM[1]	Davidson Creek	WQ1	2011	2014	20 - 40	35 - 125	70 - 120	6.8 - 8.1	0.5 - 4	NS
ERM[1]	Davidson Creek	WQ1	2017	2020	20 - 40	35 - 125	70 - 120	6.8 - 8.1	0.5 - 4	
ERM[1]	Chedakuz Creek	WQ09	2011	2014	100 - 130	130 - 150	145 - 160	7.6 - 8.3	2.8 - 5.6	NS
ERM[1]	Chedakuz Creek	WQ09	2017	2020	100 - 130	130 - 150	145 - 160	7.6 - 8.3	2.8 - 4.8	
ERM[1]	Creek 661	WQ03	2011	2014	35 - 110 except one spike at 150			7.0 - 7.9	0.5 - 3	Sulphate concentration = **0.01**
ERM[1]	Creek 661	WQ03	2017	2018	40 - 100			7.0 - 7.9	0.5 - 2.5	

1 Environmental Resources Management (ERM) surface water chemistry data collected in 2011-2020 (unpublished).

NS = not specified; **bold** = significant p-value

5. Stream Fish Habitat

Recent (2017, 2021) and baseline (2011-2013) fish habitat information are compared in the following sections, where appropriate. Sites are shown in Figure 2.1-1.

5.1 Data Sources

5.1.1 Fish Habitat Surveys

During baseline (2011-2013) and recent (2021) fish habitat assessments, fish habitat information was recorded for 100-m-long stream sections (as per RISC method) and included stream morphology, flow pattern, stream bed and bank characteristics, instream and overhead cover, and habitat availability and quality. Additionally, habitat quality was ranked (Table 5.1-1).

Table 5.1-1. Criteria for rating habitat quality for salmonids in streams.

Habitat Quality Ranking	Criteria
None	No habitat present for any life history stage
Poor	Most of the necessary physical/biological components of the habitat are missing or severely deficient (e.g., no pools, little stream cover, fast flow, little spawning gravel)
Fair	Some of the necessary physical/biological components of the habitat are present, but a key component is missing
Good	All of the necessary physical/biological components of the habitat are present

Source: AMEC Environment and Infrastructure (AMEC). (2013). *Blackwater Gold Project Application for an Environmental Assessment Certificate/Environmental Impact Statement - Assessment of Potential Environmental Effects: Fish and Aquatic Resources 2011-2012 Baseline Report (Appendix 5.1.2.6A)*

5.1.2 CABIN Surveys

Habitat characterization was completed in September 2017 as part of benthic invertebrates sampling in the local study area (LSA) (ERM, 2019). The benthic sampling was completed using CABIN field protocols (Environment Canada, 2012), and therefore included collection of the following habitat information: reach data (canopy cover, streamside vegetation, periphyton coverage), channel data (slope, wetted width, velocity, etc.) and substrate data (100-pebble count, embeddedness).

5.1.3 Aerial Imagery

Unmanned aerial vehicle (UAV)-based orthoimage mapping was completed for Davidson Creek Reaches 1 to 4, during freshet (May 2021) and during low flow conditions (August 2021). Habitat information from the imagery has been compared to the earlier baseline habitat information, where possible.

5.1.4 Spawning Habitat Assessments

A rapid assessment approach was used by AMEC (2014) to quantify the available spawning habitat for the isolated headwater population of Rainbow Trout in Lake 01682LNRS (Lake 16) which included Reach 12 and part of Reach 11 (upstream of the cascade barrier) in Davidson Creek. During the stream walks,

potential Rainbow Trout spawning habitat was identified based on measurements and/or visual observations of the following characteristics:

- Substrate sizes (Rainbow Trout prefer gravels between 10 -100 mm diameter) and absence of fine substrates (prefer < 5%);
- Gravel permeability;
- Water depths estimated to be between 0.15 m and 2.5 m during the spring spawning period;
- Water velocities estimated to be between 0.5 m/s and 0.9 m/s during the spawning period; and
- Evidence of hyporheic flows (i.e., groundwater upwelling or localized down welling through stream gravels caused by localized channel hydraulics).

The timing of the baseline spawning habitat surveys (September) left some uncertainty about the available spawning habitat because it was completed during low water and several months after the Rainbow Trout spawning period. An updated habitat assessment was completed using the same rapid assessment methodology in June 2021 to provide a more current and accurate estimation of spawning habitat availability. Baseline rapid spawning assessment data are shown alongside recent data, in Table 5.6-3.

5.2 Upper Davidson Creek (Spawning Habitat Assessments)

A spawning habitat assessment was completed in upper Davidson Creek in June 2021 (i.e., immediately after the Rainbow Trout spawning period) using the same methods as AMEC (2014). This assessment was completed with the aim of obtaining a more accurate estimation of spawning habitat area. Baseline and recent rapid spawning assessment data are described and compared in the following sections and summarized in Table 5.6-3.

5.2.1 Baseline Data

Potential rainbow trout spawning habitat was identified in Reach 11 (Site FI-09) of Davidson Creek and no spawning habitat was identified in Reach 12 (Site FI-10) of Davidson Creek due to the lack of suitable spawning gravels (Figure 2.1-1). Substrates in this reach were dominated by cobbles and boulders.

Survey of Reach 11 (Site FI-09) of Davidson Creek identified 7 locations of a total of 9 m^2 of potential spawning habitat which was approximately 1% of habitat suitable for spawning within the entire reach of 1456 m^2 and 850 m in length (Table 5.6-3).

5.2.2 Recent Data

Potential rainbow trout spawning habitat was identified in Reach 11 (Site DC-R11) and Reach 12 (DC-R12) of Davidson Creek (Figure 2.1-1). Survey of Reach 11 of Davidson Creek identified a total of 3.81 m^2 of potential spawning habitat. Survey of Reach 12 of Davidson Creek identified a total of 3.13 m^2 of potential spawning habitat (Table 5.6-3).

5.2.3 Comparison

Rapid spawning habitat assessment in 2021 observed spawning habitat for Rainbow Trout in Reach 11 of Davidson creek, same as the assessment performed in 2013, although the amount determined was different. As well, the 2021 assessment also found spawning habitat in Reach 12 of Davidson Creek which was not found during the baseline sampling. In 2013, 9 m^2 of potential spawning habitat was found in Reach 11 (Site FI-09) of Davidson Creek. However, in 2021, 3.13 m^2 of potential spawning habitat was found in Reach 11 (Site DC-R11) of Davidson Creek. Additionally, 3.13 m^2 of potential spawning habitat was found in Reach 12 (Site DC-R12) of Davidson Creek where in 2013 no spawning habitat was found in Reach 12 (Site FI-10). A summary of the baseline and updated habitat information collected can be seen in Table 5.6-3Table 5.6-1 and the conclusions of whether conditions are similar or different summarized in Table 5.6-1.

Photograph 5.2-1. Reach 11 of Davidson Creek, photograph taken in 2011 (left) (AMEC,2013). (Photo B) Reach 11 of Davidson Creek, photograph taken in 2021 (right) (Palmer, 2021, unpublished).

5.3 Middle Davidson Creek (RISC Fish Habitat Surveys)

5.3.1 Baseline Data

Riffle habitat (79%) dominated Reach 5 (Site FI-02) of Davidson Creek, with smaller amounts of pool (13%) and glide (7%) habitat (Table 5.6-1). The mean gradient was 3.17%, the mean bankfull width was 5.14 m,

the mean wetted width was 4.55 m, the mean residual pool was 0.30 m and the mean bankfull depth was 0.43 m. Dominant and sub-dominant substrate types were cobbles and gravels, respectively. All habitat units contained sections with low to high amounts of spawning gravels. The highest values for mean total LWD tally (40) and mean functional LWD tally (14) in Davidson Creek existed in riffle habitats within this reach. LWD and undercut banks were the dominant and sub-dominant cover types (total stream cover was greater than 20%), respectively, while infrequent side channels provided the only off-channel habitat. Riparian vegetation generally consisted of mature conifers, with some mature mixed species forest. Habitat quality for salmonids was rated as fair for overwintering and migration and good for spawning and rearing in Reach 5 (Site FI-02) of Davidson Creek.

Reach 6 (Site FI-03) contained predominantly riffle (55%) and glide (41%) habitats, while pool (4%) habitat distribution was limited (Table 5.6-1). The mean gradient was 0.63%, the mean bankfull width was 4.72 m, the mean wetted width was 4.75 m, the mean residual pool was 0.21 m and the mean bankfull depth was 0.40 m. Substrate composition was similar to that observed in Reaches 5 (mostly cobble with some gravel, low to high amounts of spawning gravels). Dominant cover types were undercut banks, deep pools, and overhanging vegetation. Total stream cover was between 5 and 20%. Mature conifers comprised the majority of riparian vegetation, with smaller amounts of shrubs. Habitat quality for salmonids was rated as fair for overwintering and rearing and good for migration and spawning in Reach 6 (Site FI-03) of Davidson Creek.

5.3.2 Recent Data

A 100-metre section of Reach 5 (Site DCRB-JUV2) in middle Davidson Creek was assessed in July 2021 (Table 5.6-1). This stream reach was frequently confined, had a 3 % gradient with a riffle-pool morphology where mean channel width was 5.2 m and mean wetted width was 4.3 m. The dominant bed material was cobble and the subdominant was boulder. Cover was moderate with 5-20% SWD, >20% LWD , >20% functional LWD (≥1 per bankfull width), 5-20% undercut banks, 5-20% boulders, 5-20% overhanging vegetation and <5% instream vegetation. Banks were mostly undercut with a steep vertical slope and bank texture was made up of gravel and cobble. Crown closure was 21-40% with dominant coniferous ranging from young to mature. Evidence of recent disturbance included abandoned channels, minimal pool area and homogenous bed texture. Habitat quality for Reach 5 (Site DCRB-JUV2) was assessed and ranked as per AMEC (2013) (Table 5.1-1). Spawning habitat was rated as good with an abundance of gravels with slow moving water despite the gradient and riffle morphology. Rearing habitat was good with abundant, well-complexed instream cover for fish and good low gradient flow. Overwintering habitat was fair due to limited pooling throughout the reach. Migration habitat was rated as good with abundant cover and LWD providing disturbance instream to provide sections with lower flow.

A 100-metre section of Reach 6 (Site DCRB-JUV3) in middle Davidson Creek was assessed according to RISC (2001) in July 2021 (Table 5.6-1). This stream reach was confined, had a 2 % gradient with a riffle-pool morphology where mean channel width was 6.9 m, mean wetted width was 4.7 m, and a residual pool depth of 0.35 m. The dominant bed material was cobble and the subdominant was gravel. Cover was abundant with >20% SWD, >20% LWD, with >20% functional LWD (≥1 per bankfull width), <5% boulder

cover, >20% undercut banks, 5-20% overhanging vegetation and <5% instream vegetation. Banks were mostly undercut with a steep vertical slope and bank texture was made up of fines. Crown closure was 41-70% with dominant mature coniferous forest. Evidence of recent disturbance included extensive riffles with relatively shallow pools and minimal pool area. Habitat quality for Reach 6 (Site DCRB-JUV3) was assessed and ranked according to AMEC (2013) (Table 5.1-1). Spawning habitat was rated as good with an abundance of gravels with slow moving water despite the gradient and riffle morphology. Rearing habitat was good with abundant, well-complexed instream cover for fish and good low gradient flow. Overwintering habitat was fair due to limited pooling throughout the assessed reach. Migration habitat was rated as good with abundant cover and LWD providing disturbance instream to provide sections with lower flow.

5.3.3 Comparison

Habitat information collected during the 2021 reconnaissance-level habitat assessment in Reach 5 of Davidson Creek matched the habitat characteristics described by AMEC (2013). The stream morphology remained the same with the 2011 sampling (AMEC, 2013) at Site FI-02 and the 2021 sampling at Site DCRB-JUV2 (Palmer, 2021, unpublished) describing the stream as riffle-pool (Figure 2.1-1). The gradient (3%) remained the same with cobble identified as the dominant bed material in both 2011 and 2021 sampling events (AMEC, 2013; Palmer, 2021, unpublished). However, the subdominant bed material was classified as gravel in 2011 (AMEC, 2013), where in 2021 (Palmer, 2021, unpublished) it was identified as boulder. Additionally, conifers were the dominant riparian vegetation in both 2011 and 2021. Mean bankfull width and wetted width from the 2021 habitat assessment were all within 10% of the baseline information. Habitat quality for rearing and spawning salmonid life stages was rated as good in 2021 and matched the findings of the baseline habitat assessment. Habitat quality for overwintering salmonid life stage was rated as fair in 2021 and matched the findings of the baseline habitat assessment. However, habitat quality for migration salmonid life stage went from fair to good from 2011 to 2021 (AMEC, 2013; Palmer, 2021, unpublished). Another key difference in habitat between the baseline and recent assessments is loss of total cover in 2021 (5-20%) compared to the baseline (21-40%). A summary of the baseline and updated habitat information collected can be seen in Table 5.6-1 and the conclusions of whether conditions are similar or different summarized in Table 5.6-1.

Habitat information collected during the 2021 reconnaissance-level habitat assessment in Reach 6 of Davidson Creek was different from the habitat characteristics described by AMEC (2013). The stream morphology remained the same with the 2011 sampling (AMEC, 2013) at Site FI-02 and the 2021 sampling (Palmer, 2021, unpublished) at Site DCRB-JUV3 describing the stream as having riffle-pool morphology (Figure 2.1-1). The gradient, however, was different where in 2011 sampling it was 0.63%, in 2021 it was 2%. The dominant and subdominant bed material was identified as cobble and gravel, respectively in both 2011 and 2021 sampling events (AMEC, 2013; Palmer, 2021, unpublished). Additionally, conifers were the dominant the riparian vegetation and banks remained undercut in 2011 as well as 2021. Mean bankfull width and stream cover were considerably different between the baseline and updated sampling, where in 2011 the mean bankfull width was 4.72 m, it was 6.85 m in 2021; as well, where stream cover was 5-20% in 2011, it was 41-70% in 2021. Mean wetted width remained relatively similar, however. Although habitat quality for overwintering, spawning ,migration salmonid life stages rated in 2021 matched the rating in the

baseline study, habitat quality for rearing salmonid life stages did not. Overwintering salmonid life stage was rated fair and spawning as well as migration were rated as good during both assessments. However, rearing salmonid life staged was rated as fair in 2011 and rated as good in 2021. Another key difference in habitat between the baseline and updated assessments is the increase of total cover in 2021 (>20%) compared to the baseline (5-20%). Site FI-03 and Site DCRB-JUV3 are in different locations within Reach 6 which may attribute to the differences found between the baseline and 2021 assessments. A summary of the baseline and updated habitat information collected can be seen in Table 5.6-1 and the conclusions of whether conditions are similar or different summarized in Table 5.6-1.

5.4 Lower Davidson Creek (RISC Fish Habitat Surveys, Aerial Imagery)

5.4.1 Baseline Data

Reach 1 (Site FI-66) of Davidson Creek consisted of low-gradient (<1%), riffle-pool habitat that flowed unconfined through a broad floodplain (Table 5.6-1). Habitat in Reach 1 of Davidson Creek was dominated by pools (45%), with smaller amounts of riffle (31%) and glide habitat (24%). The mean gradient was 1%, the mean bankfull width was 5.94 m, the mean wetted width was 5.30 m, the mean residual pool was 0.42 m, the mean bankfull depth was 0.53 m, and the stream cover was <5%. Abundant high-quality spawning gravel for salmonids was present in riffles and glides in this reach, and lower quality gravel in pool sections. A mixture of riparian vegetation types was present in Reach 1, including shrubs, deciduous, coniferous, and mixed forest. Habitat quality for all four salmonid life stages (overwintering, rearing, spawning, and migration) was rated as good in Reach 1 of Davidson Creek.

5.4.2 Recent Data

Recent fish habitat information was collected in Reach 1 of Davidson Creek (Site DCRB-JUV1) in June 2021 (Table 5.6-1). This stream reach was unconfined, had a 1 % gradient with a riffle-pool morphology where mean channel width was 5.8 m, mean wetted width was 4.9 m, and mean residual pool depth was 0.5 m. The dominant bed material was gravel and the subdominant was cobble. Cover was abundant with 30% small woody debris (SWD), 10% LWD with less than 1 piece of functional LWD per bankfull width, 25% undercut banks, 20% deep pools, 15% overhead vegetation. Banks were mostly sloping with undercut sections and bank texture was made up of fines. Crown closure was 21-40% with dominant deciduous forest (*Salix* sp.) in the pole-sapling stage, with mixed vegetation types including shrubs, grasses, and a small amount of coniferous vegetation. Evidence of recent disturbance included clearing of riparian vegetation, recently formed debris jams, and eroding banks.

Instream and riparian habitat characteristics were compared on a macro-scale using ortho-image maps produced from georeferenced 2021 UAV imagery, and historical ESRI satellite imagery. For lower Davidson Creek no obvious differences in stream morphology and adjacent land use were noted with the exception of Reach 1 and most of Reach 2. Significant alterations in riparian and upland vegetation were evident: nearly all mature coniferous forest identified during the stream habitat assessments completed by AMEC (2013) has been cleared. Thin and sparse sections of *Salix* species remain in the lower reaches and in the recently cleared section upstream of the Tatelkuz Lake Ranch access road the entirety of upper Reach 1

and Reach 2 have been cleared up to the waters edge, with significant new debris jams from the felled trees and few dispersed individual young trees remaining. A comparison of the 2013 imagery and the UAV-orthoimage from 2021 can be seen in Figure 5.4-1.

Figure 5.4-1. 2021 UAV orthoimage map of Reach 1 and 2 of Davidson Creek compared to 2013 satellite imagery.

5.4.3 Comparison

Habitat information collected during the 2021 reconnaissance-level habitat assessment in Reach 1 (Site FI-66 and DCRB-JUV-1) of Davidson Creek (Figure 2.1-1), and from the UAV-based orthoimage for Reaches 1 and 2 (Figure 5.4-1) matched the habitat characteristics described by AMEC (2013). The stream morphology (riffle-pool) and gradient (1.00 %) remained the same with gravel and cobble identified as the dominant and subdominant bed material, respectively. Mean bankfull width, wetted width and residual pool depth measurements from the 2021 habitat assessment were all within 10% of the baseline information. Habitat quality for all salmonid life stages was rated as good for overwintering, rearing, spawning and migration in 2021 and matched the findings of the baseline habitat assessment. The key difference in between the baseline and current conditions is the substantial loss of riparian and upland vegetation in reaches 1 and 2, due to clear-cutting within the ranch area, and a large increase into total cover in 2021 (>20%) compared to the baseline (<5%), due to the increase in LWD debris jams likely caused by the clear-cutting. A summary of the baseline and updated habitat information collected is shown in Table 5.6-1 and the conclusions of comparison are summarized in Table 5.6-1.

5.5 Chedakuz Creek (RISC Fish Habitat Surveys, CABIN)

Three habitat assessments were completed in lower Chedakuz Creek between the oultlet of Tatelkuz Lake and the confluence with Davidson Creek in 2021. These assessments were conducted to broadly characterize the habitat. The habitat data collected in 2021 were compared to the corresponding metrics from the baseline habitat assessments conducted by AMEC (2013) and ERM (2019).

5.5.1 Baseline Data

Site FI-112 (AMEC 2013) of Chedakuz Creek (Figure 2.1-1) contained predominantly riffle-pool with gravel habitat morphology (Table 5.6-1). The mean gradient was 0.13%, the mean bankfull width was 13.62 m, the mean wetted width was 13.33 m, the mean residual pool was 1 m, and the mean bankfull depth was 0.8 m. The dominant bed material was fine sediment with a total stream cover between 5 and 20%. Habitat quality for all four salmonid life stages (overwintering, rearing, spawning, and migration) was rated as good at Site FI-112 of Chedakuz Creek.

At Site WQ8 (ERM, 2019) of Chedakuz Creek (Figure 2.1-1), the stream had a 0% slope with a run morphology where the mean bankfull width was 15.2 m, the mean wetted width 11.4 m, the average depth was 0.327 m, mean bankfull-wetted depth 0.35 m and the mean water velocity was 0 m/s (Table 5.6-2). The dominant bed material was coarse sand with the subdominant fine sand/silt/clay. Canopy coverage was 0%, the dominant riparian vegetation was grasses and included coniferous trees, deciduous trees, shrubs, and ferns. Instream macrophyte coverage was 1-25%.

5.5.2 Recent Data

At site CCMT2 of Chedakuz Creek (Figure 2.1-1) (Palmer, 2021 unpublished) the mean bankfull width was 12.1 m, the mean wetted width was 12.1 m, and the average depth was 0.33 m (Table 5.6-1). The bed

material was composed of fines (50%), sand (25%), gravel (12.5%) and cobble (12.5%). Canopy coverage was ~13% consisting of vascular plants, small woody debris, and undercut banks.

Site CCMT6 (Palmer, 2021 unpublished) of Chedakuz Creek had a mean bankfull width of 18.5 m, the mean wetted width was 13.2 m, and the mean residual pool was 0.24 m (Table 5.6-2). The bed material was composed of sand (60%) gravel (30%), and cobble (10%). The total stream cover was approximately 12% due to small woody debris and an undercut left bank.

5.5.3 Comparison

The habitat documented in 2021 in Chedakuz Creek generally matches the habitat characteristics described by AMEC (2013). The mean wetted width remained roughly the same between the 2011 RISC 1:20,000 habitat assessment at Site FI-112 (AMEC, 2013) and the 2021 RISC 1:20,000 habitat assessment at CCMT6 (Palmer, 2021, unpublished) (Figure 2.1-1 and Table 5.6-1). The stream cover observed in 2021 during the CABIN assessment at Site CCMT2 was similar to the RISC 1:20,000 habitat assessment in 2011 at Site FI-112 (AMEC, 2013) but dissimilar from the CABIN assessment in 2017 at Site WQ08 (ERM, 2017) (Figure 2.1-1, Table 5.6-1, and Table 5.6-2). Additionally, the dominant bed material was similar, with fines at FI-112 in 2011, coarse sand at WQ8 in 2017, and predominantly sands/fines between the two sites (CCMT2 and CCMT6) in 2021 (Figure 2.1-1, Table 5.6-1, and Table 5.6-2). There are differences in the mean bankfull width and the mean residual pool between the sampling events. In 2011, at FI-112, the mean bankfull width was 12.62 m and the mean residual pool was 1 m, while in 2021, at CCMT6, the mean bankfull width was 18.5 m and the mean bankfull width was 0.24 m. In 2017, at WQ8, the mean bankfull width was 15.2 m, while in 2021, at CCMT2 the mean bankfull width was 12.1 m. A summary of the baseline and updated habitat information collected is shown in Table 5.6-1 and Table 5.6-2. The conclusions of whether conditions are similar or different are summarized in Table 5.6-1.

5.6 Creek 661 (CABIN)

5.6.1 Baseline Data

Although the 2017 CABIN assessment completed by ERM (2019) was not part of the initial Baseline Program completed by AMEC (2013), it will be considered the baseline condition for the purpose of site comparison.

At site WQ3 of Creek 661 (ERM, 2019) (Figure 2.1-1) the stream had a 0.02% slope with a riffle-run morphology where the mean bankfull width was 1.7 m, the mean wetted width was 1.6 m, the average depth was 0.047 m, mean bankfull-wetted depth was 0.10 m, and the mean water velocity was 0.51 m/s (Table 5.6-2). The dominant bed material was small cobble with the subdominant material large pebble. Canopy coverage was 51-75%, the dominant riparian vegetation was coniferous trees and included deciduous trees, shrubs, ferns and grasses. Instream macrophyte coverage was 51-75%.

5.6.2 Recent Data

At site 661-05 on Creek 661 (Palmer, 2021 unpublished) (Figure 2.1-1) the stream had a 2% slope with a riffle-run-shallow pool morphology. The mean bankfull width was 1.4 m, the mean wetted width was 1.6 m, the average depth was 0.07 m. Mean bankfull-wetted depth was 0.12 m, and the mean water velocity was 0.23 m/s (Table 5.6-2). The dominant bed material was small pebble, and the subdominant material was large pebble. Canopy coverage was 51-75%, the dominant riparian vegetation was coniferous trees and included shrubs, ferns, and grasses. Instream macrophyte coverage was 1-25%.

5.6.3 Comparison

Habitat information collected in 2021 in Creek 661 generally matches the habitat characteristics documented by ERM (2019). The mean bankfull width, mean wetted width, mean bankfull depth remained roughly the same between the 2017 sampling at Site WQ03 (ERM, 2019) and the 2021 sampling at Site 661-05 (Palmer, 2021, unpublished) (Figure 2.1-1). The stream cover (51-75%) observed in 2021 was the same as what was observed in the CABIN assessment in 2017 and the dominant riparian vegetation matched the baseline (coniferous trees, shrubs, ferns, and grasses). Although the dominant bed material was different in the baseline sampling (small cobble) compared with recent sampling (small pebble), the subdominant material of large pebble was the same. In 2017, the mean water velocity was observed to be 0.51 m/s, while in 2021, the mean water velocity was 0.23 m/s. However, stream velocity is highly variable spatially in a stream reach or transect. Lastly, in 2017, instream macrophyte coverage was 51-75%, while in 2021, the instream macrophyte coverage was 1-25%. A summary of the baseline and updated habitat information collected is shown in Table 5.6-2 and the conclusions of whether conditions are similar or different are summarized in Table 5.6-1.

Table 5.6-1. Summary table of baseline (2011-2012) and recent (2021) stream fish habitat information for the Blackwater Project.

Source	Stream	Reach No.	Site ID	Sampling Date	Stream Morphology/ Habitat Type	Mean Gradient (%)	Mean B_fW (m)	Mean WW (m)	Mean Res. Pool (m)	Mean B_fD (m)	Bed Materials	Stream Cover (%)	Habitat Quality[3]			
													OW	Rearing	Spawning	Migration
AMEC[1]	Davidson Creek	1	FI-66	Aug 2012	Riffle-pool with cobble	1.00	5.94	5.30	0.42	0.53	Gravel	<5	G	G	G	G
Palmer[2]	Davidson Creek	1	DCRB-JUV1	Jun 2021	Riffle-pool	1.00	5.80	4.90	0.47	NS	Gravel	>20	G	G	G	G
AMEC[1]	Davidson Creek	5	FI-02	Aug 2011	Riffle-pool with cobble	3.17	5.14	4.55	0.30	0.43	Cobble	>20	F	G	G	F
Palmer[2]	Davidson Creek	5	DCRB-JUV2	Jul 2021	Riffle-pool with cobble	3.00	5.23	4.27	NS	NS	Cobble	5-20	F	G	G	G
AMEC[1]	Davidson Creek	6	FI-03	Aug 2011	Riffle-pool with cobble	0.63	4.72	4.75	0.21	0.40	Cobble	5-20	F	F	G	G
Palmer[2]	Davidson Creek	6	DCRB-JUV3	Jul 2021	Riffle-pool with cobble	2.00	6.85	4.73	0.35	NS	Cobble	>20	F	G	G	G
AMEC[1]	Chedakuz Creek	0	FI-112	Sep 2011	Riffle-pool with gravel	0.13	13.62	13.33	1.00	0.80	Fines	5-20	G	G	G	G
Palmer[2]	Chedakuz Creek	-	CCMT6	Jul 2021	NS	NS	18.5	13.20	0.24	NS	Predominantly Sand	~12	NS	NS	NS	NS

1 AMEC Environment and Infrastructure (AMEC). (2013). *Blackwater Gold Project Application for an Environmental Assessment Certificate/Environmental Impact Statement - Assessment of Potential Environmental Effects: Fish and Aquatic Resources 2011-2012 Baseline Report (Appendix 5.1.2.6A)*

2 Palmer fish habitat data collected in 2021 (unpublished).

3 Habitat Quality: G = good; F = fair; P = poor; N = none; NS = not specified

BfW = bankfull width; BfD = bankfull depth; ID = identification; NS = not specified; NVC = non-visible channel; % = percent; Res. = Residual; WW = Wetted Width; OW = overwintering

Table 5.6-2. Summary table of 2017 and 2021 CABIN habitat information for the Blackwater Project.

Source	Stream	Site ID	Sampling Date	Stream Morphology/ Habitat Type	Dominant Streamside Vegetation	Mean B_fW (m)	Mean WW (m)	Mean B_fD (m)	Mean Velocity (m/s)	Dominant Substrate	Wolman D50	Stream Cover (%)
ERM[1]	Chedakuz Creek	WQ08	Sep 2017	Run	Grasses	15.2	11.4	0.35	0.00	Coarse Sand	5	0
Palmer[2]	Chedakuz Creek	CCMT2	July 2021	NS	NS	12.1	12.1	NS	NS	Predominantly Fines	NS	~13
ERM[1]	Creek 661	WQ03	Sep 2017	Riffle	Coniferous trees	1.7	1.6	0.10	0.51	Small Cobble	5	51-75
Palmer[2]	Creek 661	661-05	Aug 2021	Riffle-Run-Shallow Pool	Coniferous trees	1.4	1.6	0.12	0.23	Small Pebble	NS	51-75

1 Environmental Resources Management (ERM). (2019). *Blackwater Gold Project 2017 Cumulative Aquatic Resources Baseline Report.*

2 Palmer CABIN habitat data collected in 2021 (unpublished).

3 Habitat Quality: G = good; F = fair; P = poor; N = none; NS = not specified

CABIN = Canadian Aquatic Biomonitoring Network; BfW = bankfull width; BfD = bankfull depth; ID = identification; NS = not specified; % = percent; WW = Wetted Width; Wolman D50 =median diameter of 100 pebble data

Table 5.6-3. Summary table of baseline and current rapid spawning habitat assessment information for the Blackwater Project.

Source	Stream	Reach No.	Site ID	Sampling Date	Reach Length (m)	Reach Area (m^2)	Spawning Habitat Area Identified (m^2)
AMEC[1]	Davidson Creek	11	FI-09	Sept 2013	850	1456	9
Palmer[2]	Davidson Creek	11	DC-R11	June 2021	NS	NS	3.81
AMEC[1]	Davidson Creek	12	FI-10	Sept 2013	980	4244	0
Palmer[2]	Davidson Creek	12	DC-R12	June 2021	NS	NS	3.13

1 AMEC Environment and Infrastructure (AMEC). (2013). *Blackwater Gold Project Application for an Environmental Assessment Certificate/Environmental Impact Statement - Assessment of Potential Environmental Effects: Fish and Aquatic Resources 2011-2012 Baseline Report (Appendix 5.1.2.6A)*

2 Palmer fish habitat data collected in 2021 (unpublished).

NS = not specified

6. Summary

Based on the available long-term continuous or semi-continuous datasets, stream habitat conditions within the Project site are considered similar to baseline conditions. A summary of the findings of the comparison of all habitat metrics discussed in the memorandum can be seen in Table 5.6-1.

No significant trends in stream temperature were found for Chedakuz Creek and Upper Davidson Creek. Middle Davidson Creek showed a marginally significant negative trend in annual maximum daily average temperature and degree days above 10ºC indicating a decrease in temperature over the period of record. Creek 661 showed a significant positive trend for annual maximum daily average temperature and degree days above 4ºC and 10ºC indicating an increasing trend in stream temperature in Creek 661 over the period of record.

Streamflow conditions remained similar with no significant trends observed over the period of record with the exception of a marginally significant increase in winter low flows for Middle Davidson Creek (H4B) and Creek 661 (H1). Overall, streamflow conditions appear to have remained consistent with those collected during baseline conditions.

Surface Water Chemistry for physical water quality parameters (i.e., conductivity, pH and sulphate concentration) remained similar to baseline conditions across all assessed streams with the exception of a significant reduction in sulphate concentration over time in Creek 661. All other parameters remained similar to baseline conditions for Creek 661.

Stream fish habitat conditions using RISC and CABIN habitat assessment methods was similar to baseline conditions. Some differences were observed for middle Davidson Creek but this was attributed to different stream sections used for the habitat assessment. Habitat in this reach of Davidson Creek (Reach 6) based on bank-walks during the summer of 2021 appeared consistent with what was described in the baseline program (AMEC 2013). One difference identified for stream fish habitat was a difference in spawning habitat area for the upper two reaches of Davidson Creek (Reach 11 and 12) where slightly less usable spawning habitat area was identified in 2021 (~7 m^2) compared to the baseline (9 m^2). However this difference is marginal and could be attributed to differences in the time of year (June in 2021 vs September in 2013) or to differences in observer opinion on usable spawning habitat. In lower Davidson Creek there was a significant observable difference in land-use from the baseline conditions with the recent and wide-spread clear-cut in Reach 1 and 2 of the creek.

It appears that stream habitat conditions with Davidson Creek and Chedakuz Creek have remained constant since the baseline study by AMEC (2013) and conditions within Creek 661 are slightly altered from baseline conditions with significantly increasing trends in stream temperature, winter low flows, and sulphate concentration over time

Table 5.6-1. Summary table of the findings of the comparison of baseline and current fish habitat metrics for the Blackwater Project.

Habitat Metric	Waterbody	Site	Baseline and Current Comparison	Comments
Stream Temperature				
Temperature	Davidson Creek	H2	Similar	No significant difference from baseline.
Degree Days	Davidson Creek	H2	Similar	No significant difference from baseline.
Temperature	Davidson Creek	H4B	Marginally Different	Marginally significant negative trend through the period of record (p=0.030).
Degree Days	Davidson Creek	H4B	Marginally Different	Marginally significant negative trend (p=0.014) for the 10ºC degree days.
Temperature	Chedakuz Creek	H5	Similar	No significant difference from baseline.
Degree Days	Chedakuz Creek	H5	Similar	No significant difference from baseline.
Temperature	Creek 661	H1	Different	Significant positive trend through the period of record (p=0.01).
Degree Days	Creek 661	H1	Different	Significant positive trend (p=0.02) for the 4ºC degree days and (p=0.009) for the 10ºC degree days.
Streamflow				
Streamflow	Davidson Creek	H2	Similar	No significant difference from baseline.

Habitat Metric	Waterbody	Site	Baseline and Current Comparison	Comments
Streamflow	Davidson Creek	H4B	Marginally Different	Statistically significant increase (p-value = 0.049) in winter low flows at H4B
Streamflow	Chedakuz Creek	H5	Similar	No significant difference from baseline.
Streamflow	Creek 661	H1	Marginally Different	Statistically significant increase in winter low flows at H1 (p-value = 0.049)
Surface Water Chemistry				
Surface Water Chemistry	Upper Davidson Creek	WQ1	Similar	No significant difference from baseline.
Surface Water Chemistry	Chedakuz Creek	WQ09	Similar	No significant difference from baseline.
Surface Water Chemistry	Creek 661	WQ03	Different	Significant reduction (p=0.01) in sulphate concentration over time.
Stream Fish Habitat				
RISC 1:20,000 Fish Habitat	Davidson Creek	FI-66 / DCRB-JUV1	Similar	Stream morphology, gradient, bed material, bankfull width, wetted width and mean residual pool depth remained largely the same or within 10% of the baseline information. Habitat quality for all salmonid life stages in 2021 matched the baseline habitat assessment.
RISC 1:20,000 Fish Habitat	Davidson Creek	FI-02 / DCRB-JUV2	Similar	Stream morphology, gradient, dominant bed material, bankfull width, wetted width and dominant riparian vegetation remained largely the same or within 10% of the baseline information. Habitat quality for overwintering, rearing and spawning salmonid life stages in 2021 matched the baseline habitat assessment.

Habitat Metric	Waterbody	Site	Baseline and Current Comparison	Comments
RISC 1:20,000 Fish Habitat	Davidson Creek	FI-03 / DCRB-JUV3	Similar	Slight ifferences in gradient, mean bankfull width, stream cover and total cover. Change in Rainbow Trout rearing habitat qualitative assessment. Habitat assessment location within same reach break but not the same section of reach so overall conditions considered to be similar to baseline conditions.
Rapid Spawning Habitat Assessment	Davidson Creek	FI-09 / DC-R11	Different	Spawning habitat found in 2021 less than baseline.
Rapid Spawning Habitat Assessment	Davidson Creek	FI-10 / DC-R12	Different	Spawning habitat found in 2021 which was not found during collection of baseline information.
Chedakuz Creek	RISC 1:20,000 Fish Habitat	FI-112 / CCMT6	Similar	Mean wetted width, stream cover, and dominant bed material remained similar to the baseline information.
Chedakuz Creek	CABIN	WQ08 / CCMT2	Similar	Mean bankfull width, mean wetted width, and dominant bed material remained similar to the baseline information
Creek 661	CABIN	WQ03 / 661-05	Similar	Mean bankfull width, mean wetted width, mean bankfull depth, stream cover, dominant riparian vegetation, and subdominant bed material remained roughly the same from baseline information.

References

AMEC Environment and Infrastructure (AMEC). (2014). *Blackwater Gold Project Application for an Environmental Assessment Certificate/Environmental Impact Statement - Assessment of Potential Environmental Effects: Fisheries Mitigation and Offsetting Plan (Appendix 5.1.2.6C). Annex B Lake 16 Spawning Habitat and Diversion Routing Assessment.*

AMEC Environment and Infrastructure (AMEC). (2013). *Blackwater Gold Project Application for an Environmental Assessment Certificate/Environmental Impact Statement - Assessment of Potential Environmental Effects: Fish and Aquatic Resources 2011-2012 Baseline Report (Appendix 5.1.2.6A)*.

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Appendix G

Rainbow Trout Productivity (DFO IR #13 Memo)

Stantec

Memo

To:	Ryan Todd, Travis Desormeaux Black Water Gold	From:	Lacey AuCoin, Brad Horne Stantec Consulting Ltd.
File:	123222037	Date:	March 24, 2022

Reference: Response to DFO Information Request #13 Related to the Blackwater Mine Project

CONTEXT

Stantec has been retained Blackwater Gold (BW Gold) to provide environmental services support during the regulatory permitting phase of the Blackwater Mine Project (the Project). As part of the work plan, Stantec is pleased to assist BW Gold with the development of responses to Information Requests (IRs) provided by Fisheries and Oceans Canada (DFO). Stantec has been working collaboratively with BW Gold's consultant, Palmer Environmental Consulting Group (Palmer), to develop strategies to respond to DFO's IRs based on the previously filed Application for Authorization under the *Fisheries Act*, previous response to IRs submitted by Indigenous Nations and the federal government, and the Environmental Impact Statement (EIS) material.

This memo has been prepared to provide a response to IR 13, which can be integrated into BW Gold's overall submission to DFO.

INFORMATION REQUEST 13

Information Request from DFO

"Table 8-3 indicates 10,189 HU of spawning habitat, 61,485 HU of rearing habitat, and 17,381 HU of overwintering habitat (each representing a greater area in m2) will be lost as a result of the project. The report also states "The productivity of rainbow trout in the Project area appears to highly depend on the survivorship and growth of fry and juveniles rearing and overwintering in Davidson Creek and Creek 661." Provide information regarding the effects on rainbow trout productivity in these watersheds as a result of the loss of these habitats."

Blackwater Gold Response

Productivity of rainbow trout in Davidson Creek and Creek 661 will be negatively affected by construction of the Project. However, quantifying the potential reduction of rainbow trout productivity in these creeks due to the Project was not considered in the EIA and nor is it attempted here. This is because such an analysis would require not only a detailed understanding of the natural variability of the rainbow trout population in both creeks, but also a detailed understanding of the physical factors (e.g., temperature, flow, substrate composition) and biological factors (e.g., benthic invertebrate prey availability, parasite and disease rates, density-dependent competition for food and territories) influencing the growth, survival, and reproductive rates of these rainbow trout populations. Ultimately, a true estimate of the change in rainbow trout productivity caused by the Project would depend on being able to predict a change in trout density (e.g., number of fish per m^2), trout biomass (e.g., kg of trout per m^2) or trout production (i.e., kg of trout per m^2 per year) in the watersheds. Such an estimate is beyond what is possible from the data collected for Project's fish and fish habitat baseline, and what is typically collected for mining projects in British Columbia.

In absence of quantitative modelling, qualitative inferences have been made about the potential effects of the Project on rainbow trout productivity in Davidson Creek and Creek 661 based on the proportion of affected

and unaffected habitats in both watersheds and the likely importance of affected habitats to the long-term sustainability of the populations.

Habitat within the local study area (LSA) can generally be characterized as steep, sub-alpine headwater tributaries that drain into progressively larger, lower gradient reaches that ultimately drain into larger streams (i.e., Chedakuz Creek) or lakes (i.e., Tatelkuz Lake). The lower gradient reaches of Davidson Creek and Creek 661 generally provide more diverse and higher quality habitat for rainbow trout overwintering, rearing, and spawning life stages than in the headwater reaches. This includes a greater abundance of riffles and pool tail-outs with suitably sized gravels for spawning, a greater diversity of cover types for fry and juvenile rainbow trout for rearing (e.g., uncut banks, large and small woody debris, cobbles and boulders, instream and overhanging vegetation), and a greater frequency of pools with sufficient residual depths for overwintering.

In the spring, migratory rainbow trout migrate from Chedakuz Creek and Tatelkuz Lake into Davidson Creek and Creek 661 to spawn. Habitat in Davidson Creek and Creek 661 is used for egg incubation and juvenile rearing during the summer period. Some rainbow trout overwinter in Davidson Creek and Creek 661 where adequate pools are available while other rainbow trout will migrate downstream to overwinter in Chedukuz Creek or Tatelkuz Lake. However, the headwater areas of Davidson Creek and Creek 661 (i.e., the affect habitat) have limited pools with adequate size or depth for overwintering while spawning habitat is limited by the availability of riffles with gravels small enough for constructing redds (Sections 5.8.1 and 5.8.3 of the EIA Baseline Report, Fish and Aquatic Resources). Lower gradient areas (i.e., the unaffected habitat) offer more habitat opportunity for rainbow trout spawning, egg incubation and rearing when compared to the higher-gradient areas that will be affected by the Project (Sections 5.8.1 and 5.8.3 of the EIA Baseline Report, Fish and Aquatic Resources).

While some spawning, rearing, and overwintering habitat will be lost because of the mine footprint, suitable habitat for all life stages of rainbow trout will remain in the middle to lower reaches of Davidson Creek and Creek 661. The portion of habitat that will be lost under the mine footprint represents only a portion of the habitat available within these creeks for rainbow trout to carry out their life stages.

Table 1 compares the abundance and proportion of affected and unaffected rainbow trout fry rearing, juvenile rearing and overwintering habitat units in the Davidson Creek and Creek 661 mainstems. This analysis suggests that most of the rainbow trout fry and juvenile rearing and overwintering habitat in Davidson Creek and the vast majority of rainbow trout fry and juvenile rearing and overwintering habitat Creek 661 will be available following construction and operation of the Project infrastructure. This is partially due to the wider channels and larger area of stream habitat in the middle and lower reaches of Davidson Creek and Creek 661 that will be unaffected by the Project infrastructure than in the smaller, narrower headwater reaches that will be affected by the Project infrastructure but is also partially due to the greater complexity and diversity of habitat in the middle and lower reaches, an attribute common to most fluvial systems in the interior British Columbia where decreasing gradient and increasing discharge with increasing longitudinal length are two of the primary factors influencing channel geometry and morphology.

Table 1 Comparison of Rainbow Trout Habitat Units in Affected and Unaffected Portions of the Davidson Creek and Creek 661 Watersheds[1]

Waterbody	Rainbow Trout Life Stage	Habitat Units (HU)				Area (m^2)			
		Affected Habitat (HU)		Unaffected Habitat (HU)	Proportion of Habitat Affected[5] (%)	Affected Habitat (m^2)		Unaffected Habitat (m^2)	Proportion of Habitat Affected[6] (%)
		FAAA	FCP			FAAA	FCP		
Davidson Creek Mainstem[2]	Overwintering	4,240	3,864	29,433	21.6	16,957	22,148	91,662	29.9
	Fry Rearing	8,028	7,887	50,436	24.0				
	Juvenile Rearing	8,976	5,164	34,132	24.6				
	Spawning	4,012	13,538	28,446	38.2				
Creek 661 Mainstem[3]	Overwintering	0	0	12,204	0.0	n/a	n/a	56,102	n/a
	Fry Rearing	0	0	16,615	0.0				
	Juvenile Rearing	458[4]	0	23,713	1.9				
	Spawning	0	0	17,372	0.0				
Creek 661 Mainstem[3], Creek 661 Tributary, Creek 146920, Creek 505659, and Creek 5050659 Tributary	Overwintering	3,555	0	12,204	22.6	24,847	1,181	39,451	39.8
	Fry Rearing	3,018	0	16,615	15.4				
	Juvenile Rearing	8,048[4]	327	23,713	26.1				
	Spawning	1,183	0	17,372	6.4				

NOTES:

FAAA – Fisheries Act Authorization Application

FCP – Fish Compensation Plan, a component of the application for amendment of Schedule 2 of the Metal and Diamond Mining Effluent Regulation

1. Values have been extracted from HADD calculations included in the Application for Authorization under the Fisheries Act.
2. For the purposes of this discussion, Davidson Creek 'affected' habitat includes areas within reaches 6 through 12, and unaffected areas include reaches 1 through 5.
3. Creek 661 'affected' habitat includes habitat units of reach 5 lost due to flow reduction and 'unaffected' habitat includes areas within reaches 1 through 12.
4. No direct loss of instream area is anticipated in Creek 661. The Juvenile Rearing HU value lost is calculated based on the SEFA flow analysis model.
5. Proportion of habitat affected is calculated as: affected HU / total (i.e., affected HU + unaffected HU)
6. Proportion of habitat affected is calculated as: affected m^2 / total (i.e., affected m^2 + unaffected m^2)

Based on the assessment above, BW Gold does not expect that the Project will affect the sustainability or substantially reduce the long-term productivity of rainbow trout in the LSA. This conclusion is based on the contention that rainbow trout will continue to be able to utilize habitat in the middle and lower reaches of Davidson Creek and Creek 661 for all of their life processes, that none of the habitat types affected by the Project infrastructure are not also found elsewhere in the watersheds, and that the Project will not have a disproportionate effect on any one habitat type used by any particular rainbow trout life stage. Further, BW Gold's fish habitat offset plan includes habitat creation, restoration, or enhancement projects in the Davidson Creek watershed that will partially offset the effects the Project infrastructure on rainbow trout productivity and includes measures to benefit other rainbow trout populations in the region. Overall, it is BW Gold's opinion that the reduction in rainbow trout productivity in Davidson Creek and Creek 661 will be counterbalanced with an increase in rainbow trout productivity, as well as other valued fish populations, in the region when the offsets are built and fully functioning.

CLOSING

We trust that the information contained in this memo can serve to support a discussion with DFO regarding the IRs and can be integrated into a revised submission of the Application for Authorization under the Fisheries Act. Stantec would be pleased to assist BW Gold with revisions or an expansion on the material that has been presented herein.

Stantec Consulting Ltd.

<original signed by>

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Appendix H

Project Construction Environmental Management Plan (CEMP, DFO IR #8 Memo)

H1. IR 8 Memo
H2. Construction Environmental Management Plan

470 Granville Street, Suite 630, Vancouver, BC V6C 1V5
Tel: 604-629-9075 | www.pecg.ca

Memorandum

Date: May 10, 2022
Project #: 2006504

To: Dave Carter and Kevin DeBoer, DFO

From: Ian MacLeod, Palmer Environmental Consulting Group
Kirsten Seymour, ERM Consultants Canada

Re: 21-HPAC-01447 Construction Environmental Management Plan Requirements

---

BW Gold Inc (BW Gold) submitted an Application for an Authorization under the Fisheries Act (the Application) for the Blackwater Gold Project (the Project) on December 6, 2021 (21-HPAC-01447). Subsequent to DFO's initial review for completeness, DFO determined that the application was incomplete and requested clarification or additional information to complete the application. This memo has been prepared to address information request (IR) 8 from that letter.
The information request reads:

8. Provide a Construction Environmental Management Plan that includes:

- *a. a detailed description of the measures and standards that will be implemented, including an analysis of the effectiveness of those measures to avoid or mitigate the death of fish and the harmful alteration, disruption, or destruction of fish habitat;*
- *b. a detailed description of the monitoring measures (environmental monitoring, monitoring for injury or death of fish, etc.) that will be implemented to assess the effectiveness of the measures and standards listed above; and*
- *c. a detailed description of the contingency measures that will be implemented if the measures and standards listed above do not meet their objectives.*

In response to this request, BW Gold is pleased to submit the Blackwater Gold Project Construction Environmental Management Plan (CEMP) in support of the Application. The CEMP supersedes the previous "Early Works Construction Environmental Management Plan" for works conducted under *Mines Act* Permit M-246 and *Environmental Management Act* Permit 110602.

The CEMP summarizes the specific mitigation and management measures and protocols that will be employed to reduce impacts to the environment during construction of the Project. A number of stand-alone management plans are associated with the CEMP that are relevant to the Application, including the Aquatic Effects Monitoring Program, Fuel Management and Spill Control Plan, and Surface Erosion Prevention and Sediment Control Plan. Other relevant plans attached to the CEMP include the Fish Salvage and Relocation Plan (Palmer 2022).

BW Gold is committed to following relevant guidelines and best management practices for the protection of fish and fish habitat, as well as to offsetting the harmful alteration, disruption, and destruction (HADD) of fish habitat through the development of the Blackwater Gold Fish Offsetting Plan (Palmer 2022). Section 9 of the CEMP (Mitigation and Management Measures) includes details of the specific mitigation and management measures that will be implemented to reduce impacts to fish and fish habitat. A Fish Salvage and Relocation Plan is provided in Appendix F. Environmental monitoring details are provided in Section 9 and Section 15 (Monitoring Plan). In the event that mitigation and management measures do not meet their objectives, environmental monitors will have stop-work authority to halt construction and apply adaptive management (Section 5) to bring the construction back into compliance. DFO will be notified if any works, undertaking, or activities result in unauthorized death of fish or impacts to fish and fish habitat. In the event that additional offsetting is required, Artemis Gold will revisit the Blackwater Gold Project Fish Offsetting Plan to identify additional opportunities for habitat offsetting. Table 1 provides a concordance document that summarizes the locations of specific IRs within the CEMP.

Table 1. Table of Concordance with IR8

Comment No.	Comment	Document and Section
8	Provide a Construction Environmental Management Plan that includes:	Blackwater Gold Project Construction Environmental Management Plan
8a	(a) a detailed description of the measures and standards that will be implemented, including an analysis of the effectiveness of the those measures to avoid or mitigate the death of fish and the harmful alteration, disruption, or destruction of fish habitat;	Blackwater Gold Project Construction Environmental Management Plan: Section 4.4 - Guidelines and Best Management Practices Section 4.5 - Compensation and Offsetting Programs Section 5 - Adaptive Management Framework Section 9 - Mitigation and Management Measures Section 9.2 - Site-specific Erosion and Sediment Control Section 9.3 - Drainage and Water Management Section 9.6 - Metal Leaching/Acid Rock Drainage Section 9.12 - Fish and Fish Habitat Section 15 - Monitoring Program Appendix F - Fish Salvage and Relocation Plan
8b	(b) a detailed description of the monitoring measures (environmental monitoring, monitoring for injury or death of fish, etc.) that will be implemented to assess the effectiveness of the measures and standards listed above; and	Blackwater Gold Project Construction Environmental Management Plan: Section 9 - Mitigation and Management Measures Section 9.12 - Fish and Fish Habitat Section 15 - Monitoring Program
8c	(c) a detailed description of the contingency measures that will be implemented if the measures and standards listed above do not meet their objectives.	Blackwater Gold Project Construction Environmental Management Plan: Section 5 - Adaptive Management Framework

We hope that this information satisfies DFO's request for information. If further clarification is required, please do not hesitate to contact us.

<original signed by>

Prepared By:

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Senior Fisheries Biologist

Reviewed By: <original signed by>

Joshua Jodoin, B.Es, EP
Project Manager

BW GOLD LTD
a subsidiary company of Artemis Gold Inc

Blackwater Gold Project

Construction Environmental Management Plan

March 2022

This document supersedes the Early Works Construction Environmental Management Plan for works conducted under the *Mines Act* Permit M-246 and *Environmental Management Act* Permit 110602.

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ACRONYMS AND ABBREVIATIONS

Aboriginal Groups	Ulkatcho First Nation, Lhoosk'uz Dené Nation, Nadleh Whut'en First Nation, Stellat'en First Nation, Saik'uz First Nation, and Nazko First Nation (as defined in the Project's Environmental Assessment Certificate #M19-01)
AEMP	Aquatic Effects Monitoring Program
AQDMP	Air Quality and Fugitive Dust Management Plan
Artemis	Artemis Gold Inc.
BC	British Columbia
Blackwater or Project	Blackwater Project or Blackwater Gold Project
BW Gold	BW Gold LTD.
CEMP	Construction Environmental Management Plan
CEO	Chief Executive Officer
CM	Construction Manager
CMMP	Caribou Mitigation and Monitoring Plan
CMSTHP	Chemicals and Materials Storage, Transfer and Handling Plan
Code	Health, Safety and Reclamation Code for Mines in British Columbia
COO	Chief Operating Officer
CPD	Certified Project Description
DFO	Fisheries and Oceans Canada
DS	Decision Statement
EAC	Environmental Assessment Certificate
EAO	BC Environmental Assessment Office
EAO	Environmental Assessment Office
ECCC	Environment and Climate Change Canada
EIR	Environmental Incident Report
EM	Environmental Manager
EMBC	Emergency Management BC
EMC	Environmental Management Committee
EMLI	Ministry of Energy, Mines and Low Carbon Innovation
EMS	Environmental Management System
ENV	Ministry of Environment and Climate Change Strategy
EOR	Engineer of Record

EPCM	Engineering, Procurement, and Construction Management
ERT	Emergency Response Team
ESC	Erosion and Sediment Control
FLNRORD	Ministry of Forests, Lands, Natural Resource Operations, and Rural Development
FMSCP	Fuel Management and Spill Control Plan
FSR	Forest Service Road
FWR	Freshwater Reservoir
GM	General Manager
IECD	Interim Environmental Control Dam
IFC	Issued for Construction
Indigenous groups or Aboriginal Peoples	Lhoosk'uz Dené Nation, Ulkatcho First Nation, Nadleh Whut'en First Nation, Saik'uz First Nation, Stellat'en First Nation, Nazko First Nation, Skin Tyee Nation, Tŝilhqot'in Nation, Métis Nation British Columbia, and Nee-Tahi-Buhn Band (as defined in the Project's federal Decision Statement)
IPMP	Invasive Plants Management Plan
IRTB	Independent Tailings Review Board
JAIR or Joint MA/EMA Application	Joint Application Information Requirements for *Mines Act and Environmental Management Act* Permits
km	Kilometer
kV	Kilovolt
LDN	Lhoosk'uz Dené Nation
LPU	Local Population Unit
m	Meter
MAR	Mine Access Road
MASL	meters above sea level
MERP	Mine Emergency Response Plan
ML/ARD	Metal Leaching/Acid Rock Drainage
ML/ARDMP	Metal Leaching/Acid Rock Drainage Management Plan
MSDP	Mine Site Water and Discharge Monitoring and Management Plan
MSTCP	Mine Site Traffic Control Plan
Mtpa	Million tonnes per annum
NAG	Non acid generating
New Gold	New Gold Inc.

NPR	Neutralization potential ratio
NTU	Nephelometric turbidity unit
NVMP	Noise and Vibration Management Plan
PAG	Potentially acid generating
PASS	Passive Air Sampling System
PCR	Project Completion Report
PFZ	Pesticide Free Zone
PPE	Personal Protective Equipment
QA/QC	Quality assurance/quality control
RCP	Reclamation and Closure Plan
RMA	Riparian Management Area
RoW	Right-of-Way
SCP	Sediment Control Pond
SEPSCP	Surface Erosion Prevention and Sediment Control Plan
SMP	Soil Management Plan
SOP	Standard Operating Procedure
t/d	Tonnes/day
TARP	Trigger Action Response Plan
TSF	Tailings Storage Facility
TSS	Total suspended solids
UFN	Ulkatcho First Nation
VMP	Vegetation Monitoring Plan
VP	Vice President
WMMP	Wildlife Mitigation and Monitoring Plan
WMOP	Wetland Management and Offsetting Plan
WMP	Waste (Refuse and Emissions) Management Plan
WTP	Water Treatment Plant

1. PROJECT OVERVIEW

The Blackwater Gold Project (the Project) is a gold and silver open pit mine located approximately 112 kilometres (km) southwest of Vanderhoof, 160 km southwest of Prince George, and 446 km northeast of Vancouver, British Columbia (BC).

The Project site is presently accessed via the Kluskus Forest Service Road (FSR), the Kluskus-Ootsa FSR and an exploration access road, which connects to the Kluskus-Ootsa FSR at km 142. The Kluskus FSR joins Highway 16 approximately 10 km west of Vanderhoof. A new, approximately 13.8 km road (Mine Access Road; MAR) will be built to replace the existing exploration access road, which will be decommissioned. The new planned access is at km 124.5. Driving time from Vanderhoof to the mine site is about 2.5 hours.

Major mine components include a tailings storage facility, ore processing facilities, waste rock, overburden and soil stockpiles, borrow areas and quarries, water management infrastructure, water treatment plants, accommodation camps and ancillary facilities. The gold and silver will be recovered into a gold-silver doré product and shipped by air and/or transported by road. Electrical power will be supplied by a new approximately 135 km, 230 kilovolt (kV) overland transmission line that will connect to the BC Hydro grid at the Glenannan substation located near the Endako mine, 65 km west of Vanderhoof.

The Blackwater mine site is located within the traditional territories of Lhoosk'uz Dené Nation (LDN), Ulkatcho First Nation (UFN), Skin Tyee Nation and Tsilhqot'in Nation. The Kluskus and Kluskus-Ootsa FSRs and Project transmission line cross the traditional territories of Nadleh Whut'en First Nation, Saik'uz First Nation, and Stellat'en First Nation (collectively, the Carrier Sekani First Nations) as well as the traditional territories of the Nazko First Nation, Nee-Tahi-Buhn Band, Cheslatta Carrier Nation and Yekooche First Nation (BC EAO 2019a, 2019b).

Project construction is anticipated to take two years. Mine development will be phased with an initial milling capacity of 15,000 tonnes per day (t/d) or 5.5 million tonnes per annum (Mtpa) for the first five years of operation. After the first five years, the milling capacity will increase to 33,000 t/d or 12 Mtpa for the next five-years, and to 55,000 t/d or 20 Mtpa in Year 11 until the end of the 23-year mine life. The Closure phase is 24 to approximately 45 years, ending when the Open Pit has filled and the Tailings Storage Facility (TSF) is allowed to passively discharge to Davidson Creek, and the Post-closure phase is 46+ years.

New Gold Inc. (New Gold) received Environmental Assessment Certificate #M19-01 (EAC) on June 21, 2019 under the *Environmental Assessment Act* (2002) (BC EAO 2019c) and a Decision Statement (DS) on April 15, 2019 under the *Canadian Environmental Assessment Act, 2012* (CEA Agency 2019). In August 2020, Artemis Gold Inc. (Artemis) acquired the mineral tenures, assets and rights in the Blackwater Project that were previously held by New Gold Inc. On August 7, 2020, the Certificate was transferred to BW Gold LTD. (BW Gold), a wholly-owned subsidiary of Artemis, under the *Environmental Assessment Act* (2018). The Impact Assessment Agency of Canada notified BW Gold on September 25, 2020 to verify that written notice had been provided within 30 days of the change of proponent as required in Condition 2.16 of the DS, and that a process had been initiated to amend the DS.

2. PURPOSE AND OBJECTIVES

The purpose of the Construction Environmental Management Plan (CEMP) is to identify measures to minimize and manage potential environmental risks during initial Project construction (Year -1 and Year -2) and during any subsequent construction projects with similar potential risks to environment on site during operations, closure and post-closure. Prime contractors may also have their own environmental management plans, which will be reviewed by BW Gold for alignment with, at a minimum, the requirements in the CEMP. Construction projects are expected to occur at discrete project sites throughout the life of mine, and this CEMP can be adapted to support such discrete operational construction projects.

The objectives of the CEMP are to:

- Identify procedures and mitigation measures to manage construction-related environmental impacts; and
- Identify roles and responsibilities associated with environmental management.

The CEMP addresses the requirements in Section 9.4 of the Joint Application Information Requirements (JAIR) for *Mines Act* and *Environmental Management Act* Permits (EMPR & ENV 2019). Standalone construction environmental management plans will be developed for specific components in conjunction with Issued for Construction plans and the construction execution plan.

The management plans referenced in the CEMP are listed below and provided as attachments, in the order listed below. Standard Operating Procedures (SOP) have been appended to some plans and are also referenced in the CEMP. Many of the plans are a requirement of the JAIR and therefore refer to *Mines Act* and *Environmental Management Act* Application [hereafter referred to as the Application] components.

Attachment List

- Attachment 1: Air Quality and Fugitive Dust Management Plan (AQDMP) [Appendix 9-O of the Application];
- Attachment 2: Aquatic Effects Monitoring Program (AEMP) [Appendix 7-A of the Application];
- Attachment 3: Caribou Mitigation and Monitoring Plan (CMMP);
- Attachment 4: Chemicals and Materials Storage, Transfer and Handling Plan (CMSTHP; includes the Cyanide Management Plan as Appendix A) [Appendix 9-M of the Application];
- Attachment 5: Cultural and Spiritual Resources Management Plan;
- Attachment 6: Fuel Management and Spill Control Plan (FMSCP) [Appendix 9-L of the Application];
- Attachment 7: Invasive Plant Management Plan (IPMP) [Appendix 9-G of the Application];
- Attachment 8: Metal Leaching/Acid Rock Drainage (ML/ARD) Management Plan (ML/ARDMP) [Appendix 9-D of the Application];
- Attachment 9: Mine Emergency Response Plan (MERP) [Appendix 9-J of the Application];
- Attachment 10: Mine Site Traffic Control Plan (MSTCP) [Appendix 9-K of the Application];
- Attachment 11: Mine Site Water and Discharge Management Plan (MSDP) [Appendix 9-E of the Application];
- Attachment 12: Noise and Vibration Management Plan (NVMP);
- Attachment 13: Occupational Health and Safety Program [Chapter 8 of the Application];
- Attachment 14: Reclamation and Closure Plan (RCP) [Chapter 4 of the Application];

- Attachment 15: Soil Management Plan (SMP) [Appendix 9-B of the Application];
- Attachment 16: Surface Erosion Prevention and Sediment Control Plan (SEPSCP) [Appendix 9-A of the Application];
- Attachment 17: Vegetation Management Plan (VMP) [Appendix 9-F of the Application];
- Attachment 18: Waste (Refuse and Emissions) Management Plan (WMP) [Appendix 9-N of the Application];
- Attachment 19: Wetland Management and Offsetting Plan (WMOP); and
- Attachment 20: Wildlife Mitigation and Monitoring Plan (WMMP) [Appendix 9-H of the Application].

3. ROLES AND RESPONSIBILITIES

BW Gold has the obligation of ensuring that commitments are met and that relevant obligations are made known to mine personnel and site contractors during all phases of the mine life. A clear understanding of the roles, responsibilities, and level of authority that employees and contractors have when working at the mine site is essential to meet EMS objectives.

Table 3.1-1 provides an overview of general environmental management responsibilities during construction and operations life for key positions that will be involved in environmental management. Other positions not specifically listed in Table 3.1-1 but who will provide supporting roles include independent environmental monitors, an Engineer of Record (EOR) for each tailings storage facility and dam, an Independent Tailings Review Board (ITRB), TSF qualified person, geochemistry qualified professional, and other qualified persons and qualified professionals.

Table 3.1-1: Blackwater Roles and Responsibilities

Role	Responsibility
Chief Executive Officer (CEO)	The CEO is responsible for overall Project governance. Reports to the Board.
Chief Operating Officer (COO)	The COO is responsible for engineering and Project development and coordinates with the Mine Manager to ensure overall Project objectives are being managed. Reports to CEO.
Vice President (VP) Environment & Social Responsibility	The VP Environment & Social Responsibility is responsible for championing the Environmental Policy Statement and EMS, establishing environmental performance targets and overseeing permitting. Reports to COO.
General Manager (GM) Development	The GM is responsible for managing project permitting, the Project's administration services and external entities, and delivering systems and programs that ensure Artemis's values are embraced and supported, Putting People First, Outstanding Corporate Citizenship, High Performance Culture and Rigorous Project Management and Financial Discipline. Reports to COO.
Mine Manager	The Mine Manager, as defined in the *Mines Act*, has overall responsibility for mine operations, including the health and safety of workers and the public, EMS implementation, overall environmental performance and protection, and permit compliance. The Mine Manager may delegate some of their responsibilities to other qualified personnel. Reports to GM.
Construction Manager (CM)	The CM is accountable for ensuring environmental and regulatory commitments/ and obligations are being met during the construction phase. Reports to GM.
Environmental Manager (EM)	The EM is responsible for the day-to-day management of the Project's environmental programs and compliance with environmental permits, updating EMS and MPs. The EM or designate will be responsible for reporting non-compliance to the CM, and Engineering, Procurement and Construction Management (EPCM) contractor, other contractors, the Company and regulatory agencies, where required. Supports the CM and reports to Mine Manager.
Departmental Managers	Departmental Managers are responsible for implementation of the EMS relevant to their areas. Report to Mine Manager.
Indigenous Relations Manager	Indigenous Relations Manager is responsible for Indigenous engagement throughout the life of mine. Also responsible for day-to-day management and communications with Indigenous groups. Reports to VP Environment & Social Responsibility.
Community Relations Advisor	Community Relations Advisor is responsible for managing the Community Liaison Committee and Community Feedback Mechanism. Reports to Indigenous Relations Manager.

Role	Responsibility
Environmental Monitors	Environmental Monitors (includes Environmental Specialists and Technicians) are responsible for tracking and reporting on environmental permit obligations through field-based monitoring programs. Report to EM.
Aboriginal Monitors	Aboriginal Monitors are required under EAC condition 17 and will be responsible for monitoring for potential effects from the Project on the Indigenous interests. Indigenous Monitors will be involved in the adaptive management and follow-up monitoring programs. Report to EM.
Employees and Contractors	Employees are responsible for being aware of permit requirements specific to their roles and responsibilities. Report to departmental managers.
Qualified Professionals and Qualified Persons	Qualified professionals and qualified persons will be retained to review objectives and conduct various aspects of environmental and social monitoring as specified in EMPs and social MPs.

BW Gold will employ a qualified person as an EM who will ensure that throughout the construction phase the EMS requirements are established, implemented and maintained, and that environmental performance is reported to management for review and action. The EM is responsible for retaining the services of qualified persons or qualified professionals with specific scientific or engineering expertise to provide direction and management advice in their areas of specialization. The EM will be supported by a staff of Environmental Monitors that will include Environmental Specialists and Technicians and by a consulting team of subject matter experts in the fields of environmental science and engineering.

During the Construction phase, BW Gold will be entering into multiple EPCM contracts, likely for the Transmission Line, Process Plant, Tailings and Reclaim System, and 25kV Power Distribution. Each engineer/contractor will have their own CM and there will be a BW Gold responsible PM and/or Superintendent who ultimately reports to the GM Development. Some of the scope, such as the TSF and Water Management Structures will be self-performed by BW Gold, likely using hired equipment. Other smaller scope packages may be in the form of EPCM contracts. The EPCM contractors will report to the CM's who will ultimately be responsible for ensuring that impacts are minimized, and environmental obligations are met during the Construction phase. For non-EPCM contractors, who will perform some of the minor works on site, the same reporting structure, requirements, and responsibilities will be established as outlined above. BW Gold will maintain overall responsibility for management of the construction and operation of the mine site and will therefore be responsible for establishing employment and contract agreements, communicating environmental requirements, and conducting periodic reviews of performance against stated requirements.

The CM is accountable for ensuring that environmental and regulatory commitments/obligations are being met during the construction phase. The EM will be responsible for ensuring that construction activities are proceeding in accordance with the objectives of the EMS and associated MPs. The EM or designate will have the authority to stop any construction activity that is deemed to pose a risk to the environment, or is conducted without regard to established SOPs; work will only proceed when the identified risk and concern have been addressed and rectified.

Environmental management during Construction of the Project will be integrated under the direction of the EM. Pertaining to this CEMP specific personnel will have defined responsibilities defined below.

The Construction Manager will be responsible for:

- Overall ownership of the CEMP; and
- Participation in Project meetings.

The EM will be responsible for:

- Implementation of compensation and offsetting programs;
- Coordination of the monitoring program in association with the Environmental Monitor or relevant qualified professional;
- Plan revisions; and
- External reporting.

The Environmental Monitor will be responsible for:

- Review and/or establishment of no-work boundaries around any sensitive areas in the proximity of construction activities in advance of the start of work;
- Inspect the work for compliance with the CEMP and relevant federal/provincial environmental regulations or Project-specific permit conditions;
- Participation in Project meetings; and
- Internal reporting.

The EPCM Contractor will be responsible for:

- All aspects of the work which have the potential to impact the environment;
- Adherence to relevant federal/provincial legislation and Project-specific permit conditions as they pertain to the scope of work;
- Implementation of all construction mitigation/management measures unless otherwise noted;
- Fuel management and spill response; and
- Participation in Project meetings and reporting.

Pursuant to Condition 19 of the Project's EAC, BW Gold has established an Environmental Monitoring Committee (EMC) to facilitate information sharing and provide advice on the development and operation of the Project, and the implementation of EAC conditions, in a coordinated and collaborative manner. Committee members include representatives of the Environmental Assessment Office (EAO), LDN, UFN, Nadleh Whut'en First Nation, Saik'uz First Nation, Stellat'en First Nation, Nazko First Nation, Ministry of Energy, Mines and Low Carbon Innovation (EMLI), Ministry of Environment and Climate Change Strategy (ENV) and Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD).

4. COMPLIANCE OBLIGATIONS, GUIDELINES AND BEST MANAGEMENT PRACTICES

4.1 Legislation and Regulations

Federal legislation applicable to the CEMP includes:

- *Canadian Environmental Protection Act*, 1999
  - *On-road Vehicle and Engine Emission Regulations*
  - *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations*
- *Explosives Act*
  - *Explosives Regulation*
- *Fisheries Act*
  - *Authorizations Concerning Fish and Fish Habitat Regulations*
- *Impact Assessment Act*
- *Migratory Birds Convention Act*, 1994
- *Seeds Act*
- *Species at Risk Act*
- *Transportation of Dangerous Goods Act*
  - *Transportation of Dangerous Goods Regulations*
- *United Nations Declaration on the Rights of Indigenous Peoples Act*

Provincial legislation applicable to the CEMP includes:

- *Building Act*
  - *British Columbia Building Code Regulation*
  - *British Columbia Fire Code Regulation*
  - *Building Act General Regulation*
- *Declaration on the Rights of Indigenous Peoples Act*
- *Environmental Assessment Act*
- *Environmental Management Act*
  - *Contaminated Sites Regulation*
  - *Hazardous Waste Regulation*
  - *Open burning Smoke Control Regulation*
  - *Petroleum Storage and Distribution Facilities Storm Water Regulation*
  - *Spill Reporting Regulation*
  - *Spill Preparedness Response and Recovery Regulation*
  - *Waste Discharge Regulation*
- *Forest Act*

- *Forest and Range Practices Act*
  - *Forest Planning and Practices Regulation*
  - *Invasive Plants Regulation*
- *Forest Practices Code of British Columbia Act*
- *Heritage Conservation Act*
- *Integrated Pest Management Act*
  - *Integrated Pest Management Regulation*
- *Mines Act*
  - *Health, Safety and Reclamation Code for Mines in British Columbia* (Code; EMLI 2021)
- *Transport of Dangerous Goods Act*
  - *Transport of Dangerous Goods Regulations*
- *Water Sustainability Act*
- *Weed Control Act*
  - *Weed Control Regulation*
- *Wildfire Act*
  - *Wildfire Regulation*
- *Wildlife Act*
  - *Wildlife Act Permit Regulation, BC Reg.253/2000*
- *Workers Compensation Act*
  - *Occupational Health and Safety Regulation*

4.2 Environmental Assessment Certificate (EAC) and Federal Decision Statement (DS) Conditions

The CEMP addresses EAC Condition 13 and DS conditions 3.1 and 3.2. Concordance tables identifying where the requirements in EAC Condition 13 and DS conditions 3.1 and 3.1 are addressed, are provided in Appendix A and Appendix B, respectively.

4.3 Existing Permits

BW Gold received *Mines Act* Permit M-246 on June 22, 2021, authorizing early construction works (Early Works) within a permitted area encompassing 1, 018.9 hectares, *Environmental Management Act* Authorization 110662 authorizing discharges associated with the Early Works and Special Use Permit SP0001 authorizing construction of the MAR. The requirements in this CEMP will augment and in some instances may supersede construction-related requirements in Permit M-245 and Authorization 110662 with the issuance of *Mines Act* and *Environmental Management Act* permits based on this Application.

4.4 Guidelines and Best Management Practices

Guidelines and best management practices that have informed the development of the CEMP include:

- Developing a Construction Environmental Management Plan for Mines in British Columbia (BC MEMPR 2019);
- Riparian Management Area Guidebook (BC MOF1995);
- Forested Wetlands-Functions, Benefits, and the Use of Best Management Practices (Welsch et al. 1995);
- Archaeological Impact Assessment Guidelines (BC Ministry of Small Business, Tourism and Culture Archaeology Branch 1998);
- Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia (Price and Errington 1998);
- Policy for Metal Leaching and Acid Rock Drainage in British Columbia (BC MEM and BC MELP 1998);
- Traffic Control Manual for Work on Roadways (BC MOT 1999);
- Engineering Section Report: Construction Noise (WCB 2000);
- A Field Guide to Fuel Handling, Transportation, and Storage (BC MWLAP 2002);
- Invasive Plant Prevention Guidelines (Clark 2003);
- British Columbia Field Sampling Manual (BC MWLAP 2003);
- Terms and Conditions for Changes in and about a Stream Specific by MOE Habitat Officers, Omineca Region (BC FLNRO 2004);
- BC Hazardous Waste Legislation Guide (BC MOE 2005a);
- Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia (BC MOE 2005b);
- Handbook for Pesticide Applicators and Dispensers (BC MOE 2005c);
- Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia (Cox and Cullington 2009);
- Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (Price 2009);
- Invasive Alien Plant Program: Reference Guide (BC MOFR 2010a);
- Invasive Plant Chemical and Mechanical Treatment Record (BC MOFR 2010b);
- Pest Management Plan for Invasive Alien Plants on Provincial Crown Lands in Central and Northern British Columbia (BC MOFR 2010c);
- CCME Environmental Quality Guidelines for the Protection of Aquatic Life (CCME 2011);
- Fish-stream Crossing Guidebook BC (FLNRO 2012);
- Environmental Code of Practice for Metal Mines (EC 2012a);
- BC Ambient Air Quality Objectives and Standards (BC MOE 2013);
- Best Practices for Preventing the Spread of Invasive Plants During Forest Management Activities: a Pocket Guide for British Columbia's Forest Workers, 2013 Edition (BC FLNRO and ISCBC 2013);

- A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (BC FLNRO 2014);
- Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia (Government of British Columbia 2014);
- Develop With Care, Environmental Guidelines for Urban and Rural Land Development in British Columbia (BC MOE 2014a);
- BC Water Quality Guidelines (BC MOE 2014b);
- Management Plan for the Western Toad (*Anaxyrus boreas*) in British Columbia (BC MOE 2014c);
- Best Management Practices for Amphibian and Reptile Salvages in British Columbia (BC FLNRO 2016);
- Best Management Practices for Bats in BC (Holroyd and Craig 2016);
- Cariboo Chilcotin Coast Invasive Plant Committee Regional Strategic Plan. Version 3.1 (CCCIPC 2017);
- Fossil Management Framework (BC Fossil Management Office 2017);
- Best Practices for Managing Invasive Plants Along Roadsides: A Pocket Guide for British Columbia's Maintenance Contractors (ISCBC 2019);
- Fish and Fish Habitat Protection Policy Statement (DFO 2019a);
- Measures to Protect Fish and Fish Habitat (DFO 2019b);
- Guidelines to Reduce Risk to Migratory Birds (EC 2019);
- Interim Code of Practice: Temporary Stream Crossings (DFO 2020);
- Invasive Plant Pest Management Plan for Provincial Public (Crown) Lands in the Southern Interior of British Columbia (BC FLNRORD 2020);
- Interim Code of Practice: End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater (DFO 2021); and
- Field Guide to Noxious Weeds and Other Selected Invasive Plants of British Columbia, 12th Edition (ISCBC 2021).

4.5 Compensation and Offsetting Programs

In accordance with the federal DS and EAC Certificate issued for the Project, compensation/offsetting plans have been prepared to mitigate Project impacts to fish and fish habitat (DS Condition 3.11), wetlands (DS Condition 5.3 and EAC Condition 24) and southern mountain caribou (DS Condition 8.18 and EAC Condition 22). Bat habitat compensation is also proposed.

While development and implementation of these compensation programs (as distinct Project-level mitigation measures) are largely outside of the scope of this CEMP, they are included here because they are a key component of offsetting project impacts (i.e., mitigations). Summaries of the compensation plans are provided below.

4.5.1 Fish and Fish Habitat

The Project will require an Authorization under section 35(2)(b) of the *Fisheries Act*, and a Schedule 2 amendment of the Metal and Diamond Mining Effluent Regulations (under section 36 of the *Fisheries Act*).

The Blackwater Fish Habitat Offsetting Plan (Palmer 2021a) and Fish Compensation Plan (Palmer 2021b) have been developed to meet the requirements of these authorizations.

The Blackwater Fish Habitat Offsetting Plan includes the following measures:

- Channel restoration and enhancement of fish habitat at Murray Creek and Greer Creek. Construction of two off-channel ponds to help address the availability of overwintering habitat as a limiting factor for rainbow trout abundance in the study area, including at Creek 661 Upper Pond; and Mid-Mathews Pond 2. The Freshwater Reservoir (FWR) will function to augment flows in Davidson Creek downstream of the Project, and thereby offset the loss of habitat in Davidson Creek that would otherwise occur from development of the Project in the upper catchment and subsequent reduction in catchment area. Creation of a connector channel between Lake 16 (the headwater lake of Davidson Creek) and Lake 15 (to the west of Lake 16) to offset the loss of fish habitat in upper Davidson Creek, and provide additional habitat for the rainbow trout population in Lake 16 which would otherwise become isolated.

The Blackwater Fish Compensation Plan includes the following measures:

- Mathews Creek channel restoration/enhancement; and
- Mathews Creek off-channel pond creation.

4.5.2 Wetlands

EAC Condition 24 and DS Condition 5.3 require BW Gold to develop a Wetlands Management and Offsetting Plan prior to construction, in consultation with Indigenous groups, FLNRORD and Environment and Climate Change Canada (ECCC). The Wetlands Management and Offsetting Plan is intended to offset the Project's impacts on wetland functions during the Construction, Operations, and Closure phases. The development of the plan must take into account Canada's Federal Policy on Wetland Conservation (Environment Canada 1991), Canada's Operational Framework for Use of Conservation Allowances (Environment Canada 2012b), and habitat needs for migratory birds, moose and listed species at risk.

BW Gold initiated pre-construction wetland surveys within the Certified Project Description (CPD) boundary (with the exception of the transmission line which was surveyed in 2017) during the summer and fall of 2021 to fulfill DS Condition 5.5.1. Further field studies are planned for 2022 to finish pre-construction surveys and identify additional offsetting sites.

Currently the Mathews Creek wetland complex is the primary wetland offsetting site. It was selected because there has been intensive agriculture and livestock grazing for the past 50 years which has resulted in degradation of the natural wetland ecosystem.

4.5.3 Caribou

The mine site overlaps the eastern boundary of the Tweedsmuir local population unit (LPU) of mountain caribou (*Rangifer tarandus caribou*). The LPU is listed as threatened under Schedule 1 of the *Species at Risk Act*, a special concern by Committee on the Status of Endangered Wildlife in Canada, and blue-listed by the province.

BW Gold has developed a Caribou Mitigation and Monitoring Plan (CMMP) to avoid, reduce, and offset the Project's adverse effects on caribou and its critical habitat. While BW Gold acknowledges potential uncertainty, the weight of evidence indicates that the Project will not interact with caribou or consistently occupy caribou habitat. This result notwithstanding, BW Gold recognizes that the Project will have a residual effect on caribou habitat in the Tweedsmuir LPU and concerns that underscore recent declines, primarily associated with natural disturbances and forestry across the Tweedsmuir LPU. As a result,

BW Gold is taking a conservative approach and proposing a habitat securement-based offsetting plan for caribou habitat as well as non-habitat measures as described in the August 12, 2021 CMMP.

As part of the habitat-based offsetting measures, BW Gold committed to offset for impacts at an offsetting ratio of 5:1. The habitat-based offset is proposed to include a land securement within BW Gold's mineral tenures and restoration within the land securement. The non-habitat measures are not intended to specifically address the Project's residual effects on caribou habitat loss and alteration, but rather act as a commitment by BW Gold to collaborate on caribou stewardship initiatives with Indigenous groups and provincial and federal governments.

4.5.4 Bats

Where pre-construction surveys identify the loss of little brown myotis and northern myotis roosting habitat, the loss will be offset through installation of new roosting structures (i.e., bat boxes), within suitable habitat.

Pre-construction surveys were conducted during summer 2021 to identify potential roosting habitats (e.g., snags and wildlife trees) and bat recorders were used to identify whether sites were occupied. Following DS 8.15, BW Gold will install structures (bat boxes) to mitigate loss of roosting habitat prior to construction. Plans for distribution and timing of constructing roosting offsets will remain flexible based on construction progress each year.

5. ADAPTIVE MANAGEMENT FRAMEWORK

The CEMP is a living document that will evolve during the Construction phase in response to monitoring results. The CEMP incorporates adaptive management as follows:

- Plan
  - Identify compliance obligations;
  - Identify pre-construction requirements (e.g. pre-clearing surveys) through application of appropriate and applicable risk windows for fish, wildlife, birds, etc.;
  - Provide a framework for environmental risk management;
  - Provide a spill response framework and equipment inventory;
  - Establish records database; and
  - Prepare monitoring schedules.
- Do
  - Conduct pre-construction and pre-clearing surveys subject to timing windows;
  - Develop site orientation and training procedures; and
  - Identify record keeping procedures and logs.
- Monitor
  - Conduct monitoring;
  - Complete and maintain monitoring records; and
  - Report on findings or incidents.
- Adjust
  - Review effectiveness of mitigation measures;
  - Identify new and/or alter mitigation measures based on review of plan measures and incorporate into monitoring program and reporting; and
  - Revise the CEMP as new and/or altered measures are introduced.

6. CONSTRUCTION SCHEDULE

A preliminary Project construction schedule is presented in Table 6-1 which includes site preparation and construction activities. Construction will take approximately 18 to 24 months. Early Works construction activities on the mine site are authorized by *Mines Act* Permit M-246 and Special Use Permit SP0001.

The EPCM Contractors will oversee the delivery of certain specific aspects of the construction and will be managed by BW Gold with oversight from both in-house and external qualified professionals. Workforce scheduling will be closely coordinated between BW Gold mine personnel and the EPCM Contractors.

Table 6-1: Preliminary Project Construction Schedule

Year	Activities Proposed as Approved or Pending Approval by Permit/Authorization or Other Requirement (e.g., EAC plan approval)
Early Works (Authorized by *Mines Act* Permit M 246 and *Environmental Management Act* Permit 110602)	■ Clear, grub and construct mine site roads. ■ Clear mine access borrow area and Southern Site C borrow area. ■ Clear TSF Site C starter dam footprint and borrow and preparation area. ■ Clear FWR footprint. ■ Clear the Low Grade Ore Stockpile footprint. ■ Clear Open Pit (20.6 ha of new disturbance). ■ Clear Upper Waste Stockpile site. ■ Clear explosives storage, truck shop, operations camp, and ready line and bulk fuel storage. ■ Clear, grub and construct plant site pad. ■ Clear, grub and construct the Mine Access Road (approximately 8 km located on the mine site). ■ Construct bridges for MAR and mine site roads
Year -2 & Year -1 (Timing to be confirmed based on approvals)	■ Clear and grub the footprints of all major mine components (pit, roads, stockpile base, TSF C starter dam, FWR, process plant, crushers). ■ Prepare for and commence infrastructure construction. ■ Strip sites for the waste and topsoil stockpiles. ■ Construct water diversion, WMP, and management structures. ■ Main Dam C – Excavation of cut-off-trench and initial fill placement (Year -2) followed by Main Dam C Stage 1 construction to 1,273 meters above sea level (masl). ■ TSF C Pond – Starter pond initiation at the diversion berm. ■ Construct mine site roads and haul road from the pit to the stockpiles, crusher, and tailings dam. ■ Establish construction camp, operations camp, and services. ■ Establish explosives storage facility. ■ Excavate construction borrow pit mined down to 1,510 masl bench and starter pit down to 1,610 masl bench. ■ Deliver construction rock to the process area for use in the conveyor pads and to Site C Dam. ■ Stockpile Low Grade Ore beginning in Year -1 on the ROM pad for use in mill commissioning. ■ Construct the Metals Water Treatment Plant (WTP). ■ Construct processing plant infrastructure - foundations, buildings, services. ■ Construct the transmission line, mine site substation, and electrical distribution system. ■ Energize site with electrical power from grid connection. ■ Install site security, communications, first aid and emergency response facilities. ■ Decommissioning of Exploration Access Road.

7. ENVIRONMENTAL CONSTRAINT MAPPING

Preliminary environmental constraint mapping for the mine site is presented in Figures 7-1 and 7-2 at 1:25,000 for the following values:

- Whitebark pine habitat;
- High elevation ungulate winter range;
- Old growth forest;
- Wetlands;
- Watercourses (with fish-frequented status);
- Protected riparian areas; and
- Known archaeological and cultural heritage resource sites (within 150 m of facility footprint).

The mapping reflects the mine site footprint as of the end of the Construction phase. The environmental constraints mapping will be updated to incorporate 2021 and 2022 baseline surveys, when available. This mapping will inform construction planning activities, site specific CEMPs, tailgate meetings, and any seasonal work constraints. Maps at greater detail (e.g., 1:5,000) will be prepared to support site specific CEMPs.

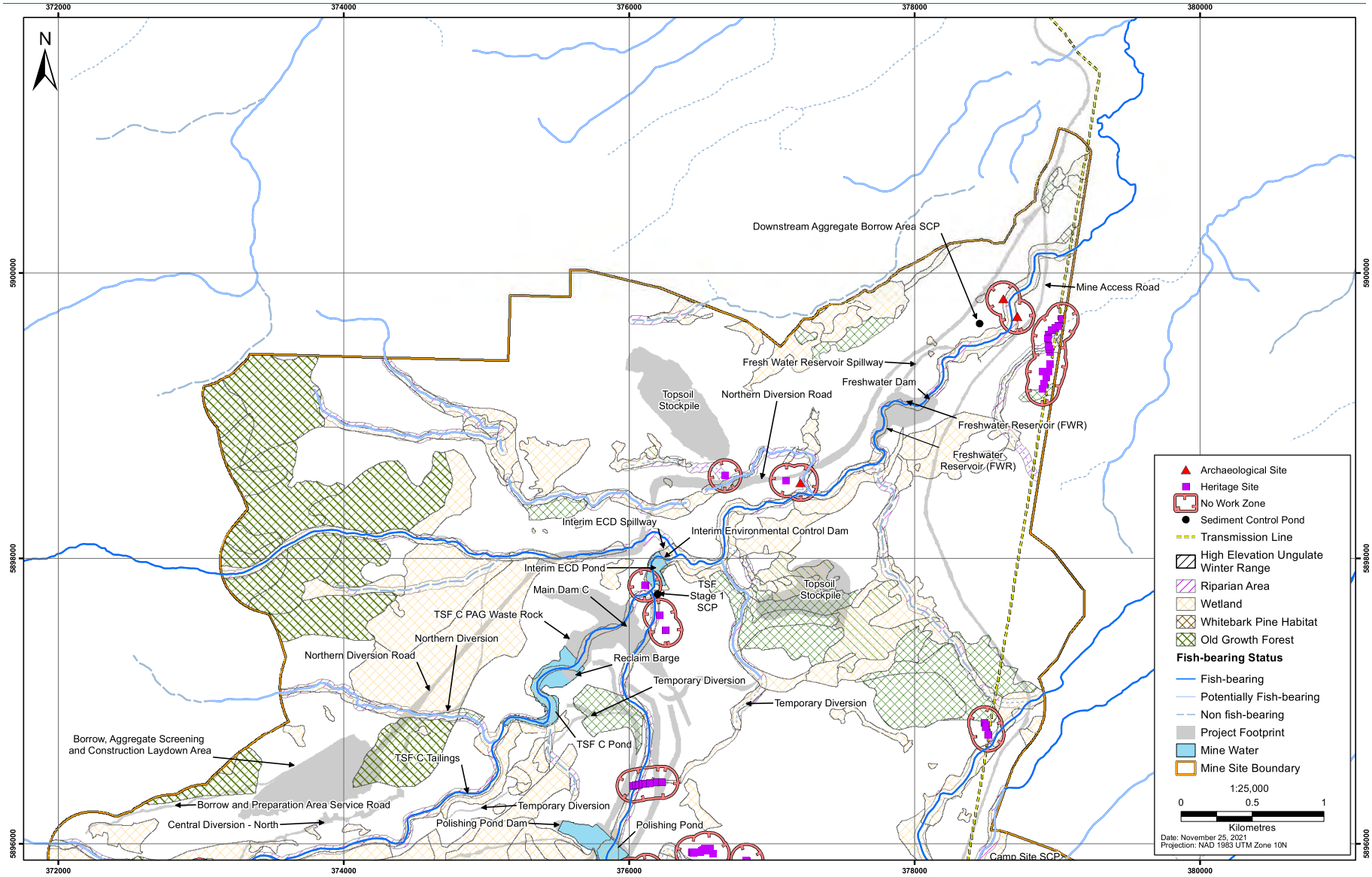

Figure 7-1: Environmental Constraints within Mine Site Certified Project Description Boundary (1 of 2)

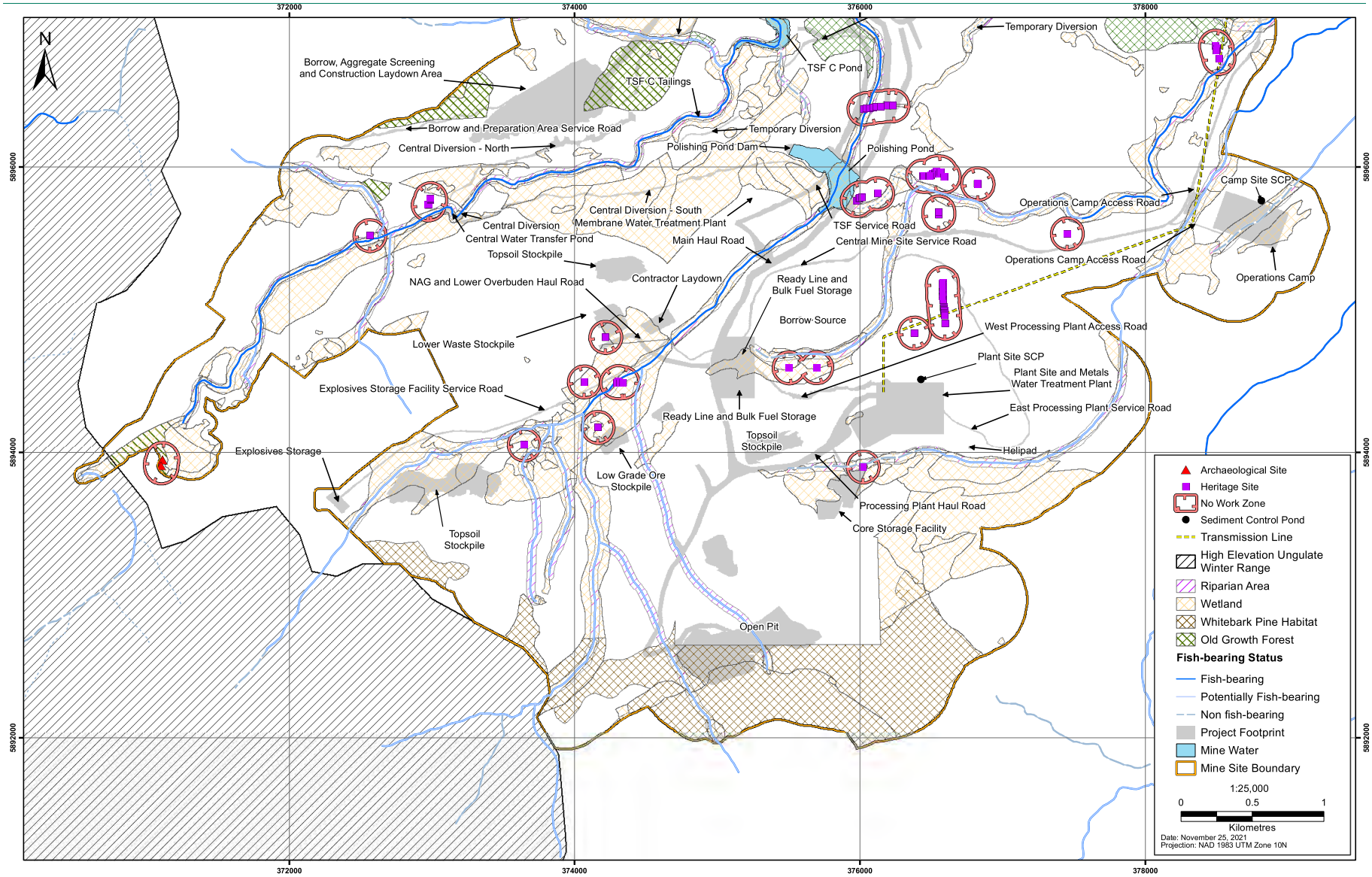

Figure 7-2: Environmental Constraints within Mine Site Certified Project Description Boundary (2 of 2)

8. RISK MANAGEMENT

Environmental risk is managed by applying reduced risk or timing windows for fish and wildlife species, wherever possible. These windows often overlap throughout most of a calendar year when multiple fish and wildlife species are considered. Therefore, BW Gold proposes to use a risk-based approach in the event that Project activities outside of least risk windows is necessary, subject to regulatory requirements and the implementation of additional mitigation measures.

With respect to known heritage resource values, the *Heritage Conservation Act* provides automatic protection for artifacts, features, materials or other physical evidence of human habitation or use on or before 1846 as well as petroglyphs, petroforms, heritage wrecks, and burials regardless of age. Given the protection provided by the *Heritage Conservation Act*, these values are not considered in the risk management approach described below. The Archaeological and Cultural Heritage Resource Management Plan (Appendix 9-I) describe measures to mitigate impacts on known and unknown archaeological and cultural heritage resources.

Table 8-1 provides an example decision hierarchy ranking that BW Gold will implement to guide construction planning and the mitigation measures that will be implemented. This ranking is based on relative strength of legislation and guidance (for instance, the *Fisheries Act* is stronger legislation than the *Migratory Bird Convention Act*) and cultural values. In the hierarchy, a valued component with a ranking of “1” would take precedent over a valued component with a ranking of ‘2’ or ‘3’, for which mitigation measures would be implemented to limit the effect.

Table 8-1: Risk Management Ratings

Value	Decision Hierarchy	Example Mitigation Approach
Fish and Fish Habitat	1	■ Avoidance measures ■ Adhere to timing windows ■ Follow Department of Fisheries and Oceans (DFO) mitigation procedures ■ Fish salvage
Species at Risk (e.g., caribou)	2	■ Avoidance measures in high elevation winter and summer range, matrix habitat ■ Monitor and temporarily stop-work when caribou observed
Breeding Birds	3	■ Conduct pre-construction surveys if work planned between April 15 and August 31 ■ No work zones for occupied nests
Seasonal Habitat for Important/Sensitive Wildlife	4	■ Avoidance measures ■ Pre-construction surveys
Red-listed Ecosystems/Wetlands	5	■ Avoidance measures ■ Pre-construction surveys

If there is a conflict between two environmental values, the EM will apply the mitigation hierarchy to decide which value will be prioritized and identify the mitigation measure(s) that will be applied to reduce the risk to the lowest ranked environmental value possible, if necessary. Relevant qualified professionals will be consulted in the event that the decision hierarchy process is used, where there is a credible risk of impacts to the environment as determined by site environmental staff and Aboriginal Groups will be notified or otherwise consulted. Additional qualified professionals such as the Environmental Monitor and federal or provincial government agencies may also be consulted.

9. MITIGATION AND MANAGEMENT MEASURES

This section identifies measures that will be implemented during the Construction phase to mitigate the Project's environmental effects. Relevant management plans are referenced in each section.

Prior to the start of construction related activities the CM, Environmental Monitor, and the EPCM Contractor(s) will meet onsite and review site-specific environmental and safety requirements and areas of potential concern (see Section 14.1 for further details).

9.1 General Measures

Table 9.1-1 presents general mitigation measures and best management practices that will be implemented to mitigate environmental impacts and help keep employees and contractors safe during construction.

Table 9.1-1: General Mitigation and Management Measures

Category	Mitigation/Management Measure
Site Tidiness	Keep work areas clean, tidy, organized and left in good condition.
	Construction material will not be stockpiled within a Riparian Management Area (RMA), in accordance with the Riparian Area Standard Operating Procedure.
	Remove construction debris and unused material from the work area upon completion of work to designated areas in accordance with the WMP (Section 8.1.1).
Waste Management	Promote workplace cleanliness through on-boarding training by reinforcing the expectation to keep areas free of uncontained refuse and placing litter, including cigarette butts, into appropriate waste containers.
	Locate and secure portable sanitary facilities at minimum 15 m from the top bank of a watercourse.
	Dispose of authorized putrescible refuse (i.e., camp waste, paper, cardboard, and lumber scraps) in a diesel-fired incinerator as per *Environmental Management Act* Permit 106530 or as otherwise permitted.
	Collect and dispose of recyclable material offsite (WMP, Sections 7.1 Recycling Policy and 7.3 Waste Transfer Areas).
	Store domestic non-hazardous wastes (i.e., food, food-covered packaging, and other non-recyclables) in sealed, wildlife-resistant containers for disposal (WMP, Sections 7.1 Recycling Policy, 8.1.2 Domestic Waste and Section 7.3 Waste Transfer Areas).
	Store non-combustible industrial waste in designated areas for recycling or disposal of off-site (WMP, Section 7.1 Recycling Policy and Section 8.1.1 Industrial Waste)
	Collect and dispose of hazardous waste offsite in accordance with the CMSTHP (Section 8.4 Transfer Offsite).
Traffic and Site Access	Restrict site access to authorized personnel in accordance with the MSTCP (Section 7.4 Access Control and Security).
	Require the use of busses to transport non-management workers to the mine site along the Kluskus and Kluskus-Ootsa FSRs.
	Provide authorized personnel with road use training in accordance with Section 6.1 of the MSTCP.
	Project vehicles will be restricted to designated roads and trails. Signage will be used on all roads to indicate access and road restrictions will be a part of training. Private vehicle access will be limited to authorized personnel only. If personal vehicles are used for site access, they will be prohibited from use on mine site roads.

Category	Mitigation/Management Measure
	Use radios for road and traffic control (MSTCP, Table 7.6-1 Traffic and Vehicle Management Protocols).
	Prior to road commissioning install signage as determined by the engineering design report (Allnorth 2013; MSTCP, Table 7.6-1 Traffic and Vehicle Management Protocols).
	Complete formal reporting for all environmental incidents (including human-wildlife interactions where there is active deterrence and direct harm, injury, damage, or wildlife mortality occurs). The report will document the following: ■ A summary of the event, response action, and means of implementation; ■ Copies of internal and external communications; and ■ Follow up monitoring results, and any adaptive management outcomes. (WMMP, Section 5.1.1 Incident Response Records; CEMP Section 9.1 Reporting)
	Apply water (preferred) to control dust on Project roads during dry periods (less than 0.25 mm/day of precipitation in the previous week and temperatures are above freezing) in accordance with Section 5 of the Fugitive Dust Management Standard Operating Procedure (AQDMP Appendix D). Chemical dust suppressant (e.g., calcium chloride) shall only be used on roadways following approval from the Mine Manager or their designate.
Orientation and Training	Hold daily tailgate meetings in accordance with Section 8.4.4 of the Occupational Health and Safety Program.
	Provide site personnel with orientation that is appropriate for their roles and responsibilities. Orientation topics will include but are not limited to: ■ Access road use and haulage operating protocols; ■ No hunting / no fishing / no gathering policy; ■ Wildlife observation and interaction reporting procedures; ■ Caribou awareness program; ■ Bear awareness program; ■ Whitebark pine awareness and identification; ■ Waste management procedures; ■ Wildlife-human interaction procedures, including management of wildlife attractants; ■ Wildlife sensitive locations/timing as applicable; ■ Hazardous material management; ■ Onsite waste procedures; ■ Erosion prevention and sediment control; ■ Best management practices for working in environmentally sensitive areas; ■ Archaeological and Cultural Heritage Chance Find Procedure; and ■ Emergency procedures including spill response and incident reporting.
Equipment Use	Maintain equipment in good working condition as determined by the manufacturer's recommendations. Lock and tag out equipment for servicing, repairs, tests or general maintenance. Remove unserviceable equipment from use.
	Develop maintenance and operations procedures designed to keep machinery clean and free of excess oil and grease, and leak-free.
	Operate equipment as determined by the manufacturer specifications and capacities (i.e., do not overload machines).
	Equipment will not idle, unless operational requirements and ambient temperatures require engines to continue running (e.g., extreme cold conditions where there is a risk the machine may not restart) or if the equipment or vehicle is being used for refuge (e.g. warming or cooling and lunch breaks).

Category	Mitigation/Management Measure
	Select equipment with industry standard noise abatement technology, including exhaust, and compressor/fan noise.
	Use a noise-attenuating jacket around jackhammers.
	Mobile equipment should arrive on site clean and free of all material, debris, and vegetation, or be cleaned in a designated location prior to unloading (IPMP, Section 8.2.1).
	Maintain spill response kits on mobile equipment and at active drill and water supply pump sites. Generators, pumps, and pump fuel supplies shall use absorbent mats and containment devices to contain spills (FMSCP, Section 10.3).
	Prohibit use of hand-held cellular communication devices (i.e., smartphones) while operating mobile equipment and light vehicles.
Geological and Terrain Hazards	Visually assess cleared areas and cut/fill slopes after significant precipitation events (*24-hr storm events > 44 mm rain precipitation 2-Year return period)* for signs of instability or erosion in areas of terrain class 4 or 5.
Adverse Weather Shutdown	The Site Supervisor will check the weather forecast daily, and current weather conditions if applicable, to anticipate the need for adverse weather shutdown (i.e., extreme high or low temperatures, strong winds, high rainfall or snowfall, lightning) depending on activities.
	Establish clear lines of communication to facilitate shutdown in adverse weather conditions.
	Shutdown soil salvage activities during periods of ongoing or recent heavy rain (greater than 73 mm/day), or high winds (typically > 30 km/h) (SMP, Table 9.1-3).

Notes:

CMSTHP = Chemicals and Materials Storage, Transfer and Handling Plan [incl. Cyanide Management Plan]; FMSCP = Fuel Management and Spill Control Plan; IPMP = Invasive Plant Management Plan; MSTCP = Mine Site Traffic Control Plan; SMP = Soil Management Plan; WMP = Waste (Refuse and Emissions) Management Plan, WMMP = Wildlife Mitigation and Monitoring Plan

9.2 Site-specific Erosion and Sediment Control

The SEPSCP has been developed to provide the erosion and sediment control framework that will be implemented during all Project phases, including Construction. The SEPSCP provides the overall approach BW Gold will take; site-specific erosion and sediment control plans and associated activities will be provided on the Issued for Construction (IFC) drawings which are not available at this time. The EM will monitor the status of erosion and sediment control measures and report on any increased risk at specific sites to the Mine Manager. Erosion and Sediment Control (ESC) measures will be field-fit by the EPCM Contractor based on conditions encountered in the field.

9.3 Drainage Control and Water Management

The mitigation and management measures presented in this section are consistent with the following management plan(s):

- Mine Site Water and Discharge Management Plan; and
- Surface Erosion Prevention and Sediment Control Plan.

9.3.1 Sediment Control Ponds

Water management during Project construction will be in accordance with the MSDP. Surface runoff from plant site grading, open pit development, TSF construction and waste rock storage area development will

be directed to the TSF basin or other designed sediment control structures. Four sediment control ponds (SCP) will be constructed during construction to capture and manage surface water runoff; these are key pieces of water management infrastructure during this phase while infrastructure is constructed and commissioned. The sediment control ponds incorporate perimeter ditching to capture local runoff and direct it to the pond. Final drainage control across the mine site will be in accordance with IFC site plans and specifications.

Mitigation responses will be implemented if discharge quality does not meet required proposed targets for the TSF Stage 1 SCP discharge (MSDP, Table 8.2 2), Camp Site and Plant Site SCP discharge (MSDP, Table 8.2.3), and Downstream Aggregate Borrow Area SCP discharge (MSDP, Table 8.2-4).

The MSDP and SEPSCP describe the discharge water monitoring program to assess water quality and water levels in the SCPs (MSDP, Section 8.3). If measured concentrations exceed discharge criteria (as will be defined the discharge permit and/or Table 9-1 in the SEPSCP), a qualified professional will determine the appropriate adaptive management measures, which may include (see MSDP, Table 10-1):

- Implementing additional sediment transport and erosion controls;
- Implementing localized pH-adjustment and/or flocculant or other settling aids (if required) through third party contract support; and
- Routing water to contact water management pond (e.g., water management pond, supernatant ponds in the TSF) for temporary containment.

9.3.2 Mine Water Management

Construction of the TSF will commence in Year -2 with the diversion of Davidson Creek and construction of the TSF C Diversion Berm, TSF C Stage 1 SCP, and the Interim Environmental Control Dam (IECD) and pond. During Construction, site contact and non-contact water will be collected and stored within the TSF (supernatant pond, TSF C Pond) and/or the water management pond. Water stored within the TSF C Pond will be used to inundate the PAG/NAG3 waste rock to limit oxidation and subsequent acid generation and minimize metal leaching (see Section 9.6). The water supply sources to the TSF during Construction include:

- Runoff from within the TSF catchment and direct precipitation onto the TSF;
- Flows not collected and diverted by the Central Diversion System (see KP 2021c);
- Water pumped back from the IECD pond; and
- Overflow through the culverts and spillway from the water management pond.

The supernatant pond (TSF C Pond) is designed with a nominal supernatant pond volume up to approximately 2 Mm^3 with allowance for seasonal fluctuations of approximately 3 Mm^3 without impacting freeboard available for storage of the Environmental Design Flood (i.e., most severe flood that is to be managed without release of untreated water to the environment). Mine water stored in TSF C Pond is estimated to be 1 Mm^3 by Year -1.

The water management pond will be constructed in Year -2 downslope of the Open Pit and stockpiles area and within the ultimate footprint of TSF C to manage runoff from contributing areas. The water management pond will have a capacity of approximately 825,000 m^3. Sources of water to the water management pond during construction include:

- Precipitation on the pond;
- Non-contact runoff and groundwater discharge from the up-gradient catchment;

- Diverted (non-contact) flow from the Central Diversion;
- Effluent from the metals WTP in construction, which conveys treated flows from the pit dewatering system and the Lower Waste Stockpile;
- Effluent from the membrane WTP, once operational; and
- Seepage from the Lower Waste Stockpile.

Management of unplanned water release and water quality within the TSF C Pond and water management pond will be in accordance with the MSDP (Sections 7.2.2, 7.2.5, and 11.0).

9.4 Visual Resources

Potential impacts to visual resources as a result of construction activities are due to tree clearing, creation of new forest openings, temporary presence of heavy equipment and development of infrastructure, including transmission line towers and power lines, which alter and may degrade the viewshed in publicly-accessible areas. The Project's visual impacts have largely been mitigated by engineering design and infrastructure siting. Key design mitigation include:

- Developing site-specific measures and designs to screen views of structures and/or soften the effect of structures breaching natural ridgelines when viewed from identified vantage points;
- Locating facilities outside of viewsheds with publicly accessible vantage points, where technically feasible;
- Locating facilities near existing infrastructure to avoid additional surface disturbance;
- Following existing landscape contours to avoid interrupting natural landscape lines or edges;
- Minimizing contrast between areas impacted by the Project activities and facilities, and the surrounding natural environment; and
- Application of mitigation measures to minimize the effect of artificial light in accordance with Section 3.1 of the WMMP.

9.5 Noise and Vibration

The mitigation and management measures presented in this section are consistent with the following management plan(s):

- Noise and Vibration Effects Monitoring and Mitigation Plan.

Major noise and vibration sources during construction include heavy equipment movement and blasting. Smaller impact equipment material handling equipment (e.g., concrete trucks), and auxiliary equipment (e.g., pumps and generators) will also generate noise. Increases in helicopter flights and fixed wing aircraft to the airstrip will increase air traffic noise. Noise and vibration have the potential to impact land users, recreationalists, and fish and wildlife. During construction, noise and vibration will be managed in accordance with the NVEMP (EAC Condition 21). Measures (including best management practices) to mitigate potential noise and vibration impacts during construction are presented in Table 9.5-1 (NVEMP, Section 10.1).

Table 9.5-1: Noise and Vibration Mitigation and Management Measures

Category	Mitigation/Management Measure
Noise and Vibration	Machinery and equipment will be fitted with a properly maintained muffler or other noise reducing device, in accordance with Section 2.6.1 of the Health, Safety and Reclamation Code for Mines in British Columbia.
	Conduct blasting between 6 AM and 6 PM.
	Employees involved in material handling or management will receive training by a qualified person on the importance of minimizing material drop height (from excavator to truck, conveyor to stockpile, etc.) to reduce fugitive dust, noise, and vibration.
	Perform monthly inspections of vehicles and equipment to ensure that noise abatement components (e.g., mufflers) are working as determined by manufacturer specifications. Complete manufacturers specified maintenance, and replace worn parts and apply lubricants, to meet manufacturers' noise output specifications.
	Select and use low-noise portable ground support equipment (e.g., power generators, pumps) whenever possible.
	Implement airstrip construction noise mitigation measures the same as those for the mine site.

9.6 Metal Leaching/Acid Rock Drainage

During construction, Metal Leaching / Acid Rock Drainage (ML/ARD) will be managed in accordance with the ML/ARDMP, which includes SOPs for construction and operations, including; waste rock and ore blast hole monitoring, waste rock and ore grade control monitoring, tailings monitoring, overburden monitoring, and verification monitoring. Of particular relevance to Project construction is the Overburden Monitoring SOP that includes procedures for overburden testing as well as frequency. This Overburden Monitoring SOP has been included as Appendix C for implementation during Construction.

The Project will produce five types of waste rock, differentiated by acid generating and metal leaching (ML) potential, in addition to tailings (not produced during construction Year -2 and Year -1), overburden and topsoil. Mine waste is classified based on whether it is predicted to be potentially acid generating (PAG) or non-acid generating (NAG) as shown by the calculated neutralization potential (NPR). The NAG waste rock is further classified using ML potential based on zinc concentration. Zinc is a parameter of interest for the Project (pyrite and sphalerite are correlated with mineralization) and its mobility was found to be correlated with its solid-phase content under neutral pH conditions (AMEC 2014). Selenium a parameter of interest, which was found to be elevated in 36% of the samples, has a systematically higher content in samples with zinc concentrations > 1,000 ppm, which is the basis for defining NAG3.The overall classification criteria are as follows: ore and tailings (PAG); low grade ore (PAG); waste/overburden (NAG); waste rock is divided into five classes for ML/ARD management purposes (Table 9.6-1).

Table 9.6-1: Waste Rock Segregation Criteria

Rock Type	NPR	Zinc (mg/kg)
PAG 1	≤1	n/a
PAG 2	1 - ≤2	n/a
NAG 3	> 2	≥ 1,000
NAG 4	> 2	600-1,000
NAG 5	> 2	< 600

Source: Section 4.2 ML/ARD Management Plan.
Note: NPR = Neutralization Potential Ratio, n/a = not applicable.

From Year -2 to Year -1, approximately 1.2 Mt of PAG (PAG1, PAG2) and potentially metal leaching non-acid generating (NAG3) waste rock will be mined and placed in the designated pre-production PAG disposal area at TSF C. The waste rock placement will be monitored in accordance with the Waste Rock and Ore Grade Control SOP to ensure it is not inadvertently re-directed to other construction sites. All PAG1, PAG2, and NAG3 waste rock will be stored under saturated conditions in the TSF. The expected exposure periods during construction (Year -1 and Year -2) are less than a month (see ML/ARD Management Plan, Table 6.1-1). Based on the results from the kinetic test program (AMEC 2014), it is expected that ARD may develop locally in PAG domains within the TSF basin before flooding is achieved. This scenario is accounted for in the source term and water quality model.

Waste rock classified as NAG3 will be used in construction of the TSF dams or otherwise stored in the TSF and submerged within five years of mining to reduce metal leaching.

Overburden across the mine site is largely expected to be NAG with low ML potential. The majority of the overburden will be used for the construction of TSF embankments. The volume of overburden requiring active management is expected to be minor and limited to zones near the bedrock contact in the vicinity of the ore deposit.

Waste rock material classified as NAG4 and NAG5 will be used in the construction of unsaturated and downstream portions of the TSF embankments. While the difference in zinc leaching potential between NAG4 and NAG5 is small to negligible (AMEC 2014), NAG5 will be used preferentially for construction (in accordance with ML/ARD Management Plan, Figure 6.1-1: Flow Chart Illustrating the Decision Sequence and ML/ARD Management Strategies that will be Employed for Waste Rock and Overburden). Excess NAG overburden as well as NAG4 and NAG5 waste rock that is not used for construction purposes will be deposited in waste stockpiles.

Infrastructure such as road alignments, construction pads, and laydown areas are part of the operational mine site layout and will be constructed with excess waste rock and/or borrow source material. To prevent ML/ARD release from construction sites that contain waste rock fill, only NAG4 and NAG5 material will be used for unsaturated construction locations across the mine site.

9.7 Soil Management

The mitigation and management measures presented in this section are consistent with the following management plan(s):

- Soil Management Plan;
- Air Quality and Fugitive Dust Management Plan; and
- Surface Erosion Prevention and Sediment Control Plan.

Broad-scale earthworks are required to construct Project facilities. Suitable soils will be salvaged and stockpiled for reclamation in accordance with the SMP. A Soil Salvage SOP will be developed prior to Construction to include the soil salvage procedures provided below.

Measures (including best management practices) to mitigate potential effects on soils are presented in Table 9.7-1.

Table 9.7-1: Soil Mitigation and Management Measures

Category	Mitigation/Management Measure
Soil Handling	Avoid salvage during dry (less than 0.25 mm/day of precipitation in the previous week) and/or windy (consistently greater than 30 km/h) conditions to prevent loss of fine-textured material and dust deposition on adjacent areas. If it is necessary to conduct salvage under these conditions, field-fit mitigation measures will be implemented to minimize erosion and dust generation (e.g., water application) as determined by a qualified professional (SEPSCP Section 7.3; AQDMP Section 8.2 and Appendix D).
	Soil salvage may occur under frozen conditions with the benefit of reducing soil compaction, but snow should be removed prior to salvaging to reduce undesired settling or erosion in stockpiles or reclamation areas. Avoid salvage where frost penetrates greater than 75% of the target soil profile, making it challenging to accurately segregate soils causing admixing.
	Where the water table is within 50 cm of the surface (e.g., wetlands), drain areas targeted for soil salvage using trenching[1] prior to salvage and manage salvage operations in accordance with the SEPSCP, as follows: ■ Establish erosion and sediment controls on stripped areas to reduce erosion risk and protect water quality, such as: ○ Temporary covers, such as coconut matting can also be applied in high-risk erodible areas (e.g., slopes); ○ Use berms, waterbars, and ditches to direct runoff away from rivers and streams; ○ Create sediment ponds to allow settling of sediments during higher-runoff events; and ○ Install silt fencing, straw wattles and check dams for additional sediment capture.
Soil Stockpiles	Salvage and stockpile soils in accordance with the Trigger Action Response Plan (TARP; Table 9.1-3) presented in the SMP to prevent loss of fine materials due to erosion and degradation of soil structure.

Notes:

AQDMP = Air Quality and Dust Management Plan

SEPSCP = Surface Erosion Prevention and Sediment Control Plan.

[1] Trenches are dug along the edges of a salvageable wetland area and allowed to fill with water. Drained soil can then be salvaged and stockpiled.

9.7.1 Soil Salvage Procedures

Detailed soil suitability mapping and salvage procedures are provided in the SMP (Figure 8.2-1 and Section 9.1 respectively). The following is a summary of the soil salvage procedures:

- There is a surplus of available mixed-mineral surface soils for salvage relative to reclamation demands, therefore sufficient volumes can be obtained from the upper 0.3 m and there is no need to salvage the lower-quality deeper soils. Two exceptions exist for the 0.3 m salvage depth:
  - First, to meet volume demands, glaciofluvial surface soils will be salvaged to a depth of 0.5 m. While this extends beyond the most active biotic zone of the soil profile, the physical properties of glaciofluvial surface soils at this depth are still desirable and levels of organic matter and nutrients are still elevated compared to overburden[1].

[1] Overburden is defined as unconsolidated soil that underlies surface soils (> 0.5 m below the interface between organic and mineral soil horizons). These materials have not undergone pedogenesis, except the uppermost overburdern (e.g., 0.5 to 1.0 m below the interface between organic and mineral soil horizons), which has undergone a lesser degree of pedogenesis than surface soil and has lower organic-matter content. Overburden within the Project area consists primarily of morainal deposits. Overburden, in the context of reclamation materials, does not include any waste rock material.

- Second, organic surface soils will be salvaged to an average depth of 1.3 m. In the Project footprint, organic soils occur in wetlands that form in depressions and on floodplains.

- Stripping of overburden for engineered facility construction will be in accordance with geotechnical design specifications. The organic horizons of mineral soils will be salvaged with the underlying mineral horizons in one lift.

Organic, glaciofluvial and mixed-mineral surface soils will be segregated by qualified professionals based on parent-material characteristics. Maps of parent-material polygons will also be available to guide operators and supervising qualified professionals in delineating areas of the different reclamation materials. Supervising qualified professionals can additionally support the operators to delineate reclamation-material types through use of flagging and in-field signage.

9.7.2 Soil Stockpile Procedures

Soil stockpile design details, including consideration of stability and water management, are provided in the Stockpiles Geotechnical and Water Management Design Report (KP 2021b) and a Supplemental Stability Assessment Report (KP 2022). Soil stockpile locations will be in accordance with Figure 10.1-1 of the SMP.

Best management practices for operators with respect to soil stockpiles construction include:

- Stockpiles will be located at least 10 m from any materials that could negatively impact the quality of the stored reclamation materials, such as tailings, waste rock, or low-grade ore that may have elevated elemental concentrations;
- Segregate different classes of reclamation materials into separate stockpiles (overburden, glaciofluvial surface soil, mixed-mineral surface soil, and organic surface soil; see also Figure 10.1-1 of the SMP); and
- Construct stockpiles in accordance with the geotechnical stability standards required by the Code and engineering design (see Section 10.2 of the SMP).

9.8 Air Quality

The mitigation and management measures presented in this section are consistent with the following management plan(s):

- Air Quality and Fugitive Dust Management Plan.

Fugitive dust is the Project's primary source of air emissions. Potential dust sources include material handling/re-handling, construction and use of unpaved roads, blasting, compaction, drilling, grading, material (including ore) loading and unloading, crushing and ore processing. Erodible surface areas such as stockpiles and the TSF beach) are also potential sources of fugitive dust. Non-dust air emission sources include mine fleet exhaust (multiple), backup diesel generators, NO_x and SO_2 from blasting and the existing diesel-fired putrescible waste incinerator.

Measures (including best management practices) to mitigate potential air quality effects during construction are presented in Table 9.8-1.

Table 9.8-1: Air Quality Mitigation and Management Measures

Category	Mitigation/Management Measure
All	Implement the TARP for fugitive dust in accordance with Table 9-1 of the AQDMP.
Material Handling	Employees involved in material handling or management will receive training by a qualified person on the importance of minimizing material drop height (from excavator to truck, conveyor to stockpile, etc.) to reduce fugitive dust, noise, and vibration.
Aggregate crushing and screening areas	Equip the crusher and/or screener circuits with onboard water dosing during times of the year above freezing temperatures or other dust suppression measures (e.g. reagents) systems.
	Apply water when temperatures are above freezing and there are very dry conditions (less than 0.25 mm/day of precipitation in the previous week).
	Stockpiles should form low piles that extend horizontally as determined by the Construction Manager, where practical.
	Use screener and crusher covers.
	Check cover for tears, holes and cracks on a monthly basis.
Borrow areas	Apply water when temperatures are above freezing and there are very dry conditions (less than 0.25 mm/day of precipitation in the previous week).
	Develop new borrow areas only when and as required (to be determined by the Mine Manager).
Project roads	Speed limits will be established based on road design class, with the maximum speed limit of 50 km/h on all Project roads.
	Reduce speed limits on Project-owned roads if weather conditions cause fugitive dust emissions and dust cannot be controlled by watering.
	Speed limits are clearly marked through signage and enforced by site security through periodic checks using a radar speed gun. Personnel caught speeding will be provided with constructive instruction on the importance of adhering to speed limits to limit dust generation. Repeat offenders may face disciplinary measures.
	Manage dust emissions from roadways in accordance with the Fugitive Dust Management SOP.
	Water roads in accordance with Section 5.1.1 (Watering) of the Fugitive Dust Management SOP.
	Apply dust suppressant reagents after spring melt (e.g., calcium chloride, magnesium chloride or other equivalent) as approved by the Mine Manager.
	Use coarse aggregate on roads with low silt content to reduce silt loading on roads.
Vehicles	Maintain equipment in good working condition according to manufacturer's recommendations.

Notes: AQDMP = Air Quality and Fugitive Dust Management Plan; SOP = Standard Operation Procedure; TARP = Trigger Action Response Plan

9.9 Vegetation Management

The mitigation and management measures presented in this section are consistent with the following management plan(s):

- Invasive Plant Management Plan;
- Surface Erosion Prevention and Sediment Control Plan;
- Soil Management Plan; and
- Vegetation Management Plan.

Clearing, grubbing and earthworks will result in the loss of ecosystem functions. Fugitive dust deposition resulting from construction activities has the potential to affect plants, wildlife and fish, and may be elevated

during periods of high winds and dry conditions. This is particularly relevant to areas adjacent to mine site roads. Table 9.9-1 presents measures (including best management practices) that will be implemented during construction to mitigate potential effects on vegetation in accordance with the VMP. Table 9.9-2 presents mitigation measures (including best management practices) that will be implemented to mitigate potential effects to riparian areas in accordance with the VMP.

Table 9.9-1: Vegetation Mitigation and Management Measures

Activity	Mitigation/Management Measure
Pre-clearing	Use setbacks of at least 10 m from the edge of non-impacted gullies or channels to avoid destabilization, as identified by the Environmental Monitor.
	Cutting prescriptions for each site will consider best management practices in Soil Conservation Planning and Practices in the Quesnel and Vanderhoof Forest Districts (FPB 2010; specifically Appendix C Timber Harvesting Practices Extension Note #1).
	Limit soil disturbance in non-cleared areas.
	Conduct vegetation clearing in accordance with the Fire Danger Class in the *Wildfire Regulation*.
	Conduct clearing around sensitive environmental features in accordance with the relevant SOP (Old-growth forest Management SOP, Rare and At-Risk Plant Species Management SOP, Riparian Area Management SOP, Wetland Management SOP).
	In areas with sensitive features where clearing cannot be avoided and soil disturbance is not required (e.g., for road edges, or to create safe setbacks from forest to buildings), use low-disturbance methods and removal techniques that are most appropriate, such as pruning, mowing, girdling, topping, hand-falling, or clearing on frozen ground.
	In areas where only tree removal is required, retain shrub and herbaceous vegetation to encourage a self-sustaining, native shrub community. Limit soil disturbance, as determined by the supervising qualified professional, through practices such as winter falling and machine work on snow, using low ground pressure machinery, and avoiding clearing during periods of high soil moisture.
	Avoid damage to residual tree roots or stems as this can increase risk of windthrow and disease.
	Salvage and retain woody debris in accordance with the Coarse Woody Debris Management SOP.
	Maintain clearing dimensions to areas approved by the Project *Mines Act* permit and Occupant Licence To Cut
Post-Clearing	Minimize soil degradation and erosion by leaving stumps and understory vegetation intact where possible and adhering to the SMP, SEPSCP and RCP.
	Manage fugitive dust on roads in accordance with the Fugitive Dust Management SOP and the TARP provided in the AQDMP (Table 9-1).
	Vegetation management on Project roads (Mine Access Road and mine site roads) will be maintained to provide sightlines. Vegetation will be selectively brushed to prefer low growing species to maintain a vegetated cover. Revegetate roadsides with native species that avoid attraction of wildlife (e.g., no clover or other highly palatable species), in accordance with the VMP to reduce wildlife incidents. Species selection will be implemented by the EM in consultation with a qualified professional.
	A qualified professional will assess new edge areas adjacent to roads, work areas, and the transmission line for windthrow risk and hazard trees, and if risk levels are too high site-specific measures to reduce risk to an acceptable level will be developed. Measures will be consistent with relevant best management practices in Section 7 of the BCTS Windthrow Manual (Zielke et al. 2010), as determined by the qualified professional.

Notes: AQDMP = Air Quality and Fugitive Dust Management Plan; SEPSCP = Surface Erosion Prevention and Sediment Control Plan; SMP = Soil Management Plan; SOP = Standard Operating Procedure; TARP = Trigger Action Response Plan

Table 9.9-2: Riparian Area Mitigation Measures

Category	Mitigation/Management Measure
Buffers	A RMA will be preserved around wetlands, watercourses, and waterbodies located within the mine site, excluding the footprint of Project components and associated activities required to construct them, in accordance with the Riparian Area Management SOP. Work or activity within the RMA will only occur to the extent necessary for safety reasons to control invasive plants, or to install and maintain erosion or sediment run-off control measures.
Clearing Activities	Retain streamside vegetation wherever possible, including trees, shrubs, and ground cover, in accordance with the Riparian Area Management SOP.
	Remove all slash and debris that lands within the RMA to minimize the amount of disturbance to trees, shrubs or grass species, unless its removal will result in more damage than leaving it in place.
	Fall trees directionally away from stream banks and aquatic areas to minimize disturbance to riparian areas.
Construction Activities	Protect natural drainages and watercourses by constructing appropriate on-site sediment control devices (including but not limited to silt fencing, hay bales, multi barrier approaches where necessary, diversion ditches, sediment traps, sediment ponds) in accordance with the SEPSCP.
	Within the RMA, preferentially use heavy equipment with low-pressure tires over tracked equipment.
Equipment and Fueling	Machine inspections will occur daily when working in the RMA to determine if they are in good operating condition, clean, free of leaks, excess oil, and grease.
	No equipment refuelling or servicing (machines or hand tools) within an RMA to minimize risk of aquatic contamination in accordance with the Riparian Area Management SOP.
	Ensure all hydraulic machinery entering an RMA uses environmentally sensitive hydraulic fluids that are non-toxic to aquatic life and that are readily or inherently biodegradable.
	Keep a spill containment kit readily accessible onsite in the event of a release of a deleterious substance to the environment. Onsite staff will be trained in emergency response and spill reporting procedures in accordance with Fuel Management and Spill Control Plan. Any spill of a substance that is toxic, polluting, or deleterious to aquatic life of reportable quantities will be immediately reported to the Provincial Emergency Program 24-hour phone line at 1-800-663-3456. See Section 9 in FMSCP for further details on the Spill Response Plan.
Herbicides	To protect fish and wildlife, riparian areas and wildlife habitat, herbicide use in riparian areas will be avoided and a Pesticide Free Zone established in accordance with Table 8.2-3 of the IPMP.
	Comply with the Stellat'en First Nation and Nadleh Whut'en First Nation herbicide policies in their Traditional Territories (applicable to the transmission line).
	The SEPSCP will be implemented and will identify erosion control measures (e.g., proper ditching, reducing slopes and placement of soil salvage piles, diversion and runoff collection ditches, sediment control ponds, erosion control mats).
Timing Windows	All instream construction at stream crossings will consider Reduced Risk Timing Windows (July 15 to August 31) for Fish and Wildlife in Region 7 - Omineca (BC MWLAP 2004b). Any variances to complete in-stream works that are required will be pursued through FLNRORD authorization at the direction of a fisheries qualified professional.
	To protect nesting birds, vegetation clearing will only be undertaken during the period of August 1 through to April 30 to avoid contravention of Section 34 of the *Wildlife Act,* unless otherwise required and by completing pre-clearing surveys under the direction of a qualified professional. See Section 3.3 in WMMP for additional information on timing windows.

Notes: RMA = Riparian Management Area; SEPSCP = Surface Erosion Prevention and Sediment Control Plan; SOP = Standard Operating Procedure; IPMP = Invasive Plant Management Plan

Invasive plants are non-native or alien to the ecosystem under consideration. Their introduction causes, or is likely to cause, economic or environmental damage, or harm to human health. In BC, the term invasive plant is synonymous with invasive alien plant. Noxious weeds are any invasive plant species designated by regulation to be noxious under the BC *Weed Control Act* and *Regulations*. Mitigation measures (including best management practices) that will be implemented to prevent the establishment of invasive plants is presented in Table 9.9-3. Detailed measures to control and eradicate invasive plants are provided in the IPMP.

Table 9.9-3: Invasive Plant Mitigation and Management Measures

Category	Mitigation/Management Measure
Prevention	Site Security will perform a visual inspection for cleanliness (free of excessive dirt and debris above and beyond that reasonably expected from transport to site) on all earth moving equipment and vehicles upon arrival to the mine site.
	Maintain equipment storage areas free of invasive species in accordance with the Invasive Plant Management SOP.
	Through onboarding training, ensure to inspect clothing and vehicle/equipment undercarriages for seeds and plant tissue when working in, and prior to leaving, areas known to contain invasive plants in accordance with the Invasive Plant Management SOP.
	Maintain newly disturbed sites free of invasive plants in accordance with the Invasive Plant Monitoring SOP.
	Stabilize exposed soils and consider the drainage and gradient, length of time that areas would be left exposed to evaluate the need to re-seed with native seed mix, in accordance with the RCP.
	Restrict equipment and vehicle use to Project roads, trails and pullouts through a combination of training, mapping and signage.
Treatment	Use spot applications and avoid broad spraying of herbicides, especially adjacent to listed plant communities or plants and riparian zones in accordance with the Invasive Plant Management SOP.
	Comply with the StFN and NWFN Nation herbicide policy in their Traditional Territories.
Cleaning Equipment	After working in areas with known infestations, clean vehicles and equipment at the infested site or in an area where contamination and seed spread is unlikely, such as a mud-free, gravel, concrete, or other hard surface. If this is not possible, a regularly maintained area will be used for cleaning, such as the truck washing bay.
	Equipment cleaning will be located outside any Riparian Management Area in accordance with the Riparian Area Management SOP. After cleaning, operators will inspect vehicle and equipment to ensure excess mud, soil, vegetation and debris is removed and left at the site of infestation.
	If vehicles or earth moving equipment are causing the spread of invasive plants, subject to the direction of a qualified person, a quarantine area may be established which may include blocking off the infestation, implementing treatment and control measures, and using portable wash stations.

Notes: RCP = Reclamation and Closure Plan; SOP = Standard Operating Procedure

9.10 Wetlands

The mitigation and management measures presented in this section are consistent with the following management plan(s):

- Wetland Management and Offsetting Plan.

Potential effects to wetlands due to construction include loss of wetland extent/function resulting from site clearing, grubbing, and altered hydrological processes resulting in water table drawdown, and diversion of

surface and seepage water. Potential causes of wetland degradation relevant to the discrete activity of construction include fugitive dust deposition, water quality degradation, noise pollution, and potentially light pollution.

Table 9.10-1 presents mitigation measures and best management practices that BW Gold will implement to mitigate potential effects to wetlands during the Project's Construction phase in accordance with the Wetland Management and Offsetting Plan. The Wetland Management and Offsetting Plan has been developed in accordance with EAC Condition 24 to include, among other items, the methods by which wetland conditions will be documented and monitored as well as the wetland offsetting plan for impacted identified wetlands.

Table 9.10-1: Wetland Mitigation Measures

Category	Mitigation Measure
Wetland Function	BW Gold acknowledges that the current WMOP does not enable the Project to achieve its no-net-loss of wetland function obligation. To that end, no wetlands will be impacted until additional baseline studies are completed in 2022. Until additional baseline studies in the mine site and the offsetting site are complete and the baseline data is reported to all required groups, BW Gold will not conduct any activities within 30 m of a wetland delineated by a qualified professional. Where wetlands have not been delineated by a qualified professional, BW Gold will not conduct any activities within 30 m of any Terrestrial Ecosystem Mapping polygon having the potential to contain a wetland.
	Maintain drainage pathways and wetland hydrology by installing appropriately sized culverts for stream and wetland crossings in accordance with the respective engineering design report (e.g., Allnorth 2013).
	Avoid clearing in wetland RMA, unless the wetland is within the mine site footprint in accordance with the Wetland Management SOP to protect wetland function.
	Locate fuel storage and refuelling activities outside any wetland RMA, in accordance with the Riparian Area Management SOP.
	Place soil salvage stockpiles in locations where they will have no impact on natural drainages.
	Direct surface runoff from plant site grading, open pit development, TSF construction and waste rock storage area development to the TSF basin or other designed sediment control structures.
	Control metal leaching by separating contact and non-contact surface water through diversion dams and collection trenches.
	Minimize pesticide and fertilizer use around aquatic resources and before precipitation events to limit chemical runoff from entering wetlands.
	Replant native vegetation to expedite succession in accordance with the RCP.
	Use low ground pressure equipment or tracked equipment for work in areas with saturated soils.
	Use timber mats, driving mats, or log corduroys or other means of ground protection where necessary (e.g., to prevent vegetation disturbance, saturated conditions, etc.) to minimize disturbances to vegetation and reduce rutting.
	Minimize unnecessary soil disturbance where possible.
	Minimize the width of roads and trails consistent with maintaining safety and road design considerations.
	Design approaches to wetlands so that the surface runoff carrying potential sediment is diverted before entering the wetland.
	Manage unauthorized use of roads during and after construction and operations to minimize impacts to wetlands.
	Maintain road running surfaces, ditches and cross drains to minimize erosion and sediment delivery.

Category	Mitigation Measure
	Temporary and permanent road construction will follow guidance outlined for the appropriate soil conditions.
	Activities and works in and around wetlands will be designed and planned to minimize loss or disturbance of wetlands.
	Approaches to wetlands will be designed and constructed such that they are perpendicular to the margin of the wetland to minimize loss or disturbance of wetland vegetation.
	Plan and implement activities occurring near adjacent wetlands as determined by the SEPSCP to ensure deleterious substances (e.g., sediment, solvent, fuel, etc.) do not enter the wetland by installing sediment and erosion control mitigation measures such as, but not limited to silt fencing, hay bales, multi-barrier approaches, at the direction of the environmental monitor and supported by the QP (CEPSPC).
	Clearing of wetland vegetation will be minimized to the extent practical. Pruning or topping of vegetation will be utilized instead of grubbing.
	Machinery will be washed, refueled and serviced in accordance with the Riparian Area Management SOP as to prevent any deleterious substances from entering the wetland.
	Machinery will be operated on land above the high water mark of wetlands as determined by the Environmental Monitor in a manner that minimizes disturbance to the wetland.
Wetland Extent	Establish 30 m of undisturbed vegetation buffer zone around wetlands located outside the Project footprint.
	Flag or otherwise identify clearing limits in accordance with the Wetland Management SOP.

Notes: IPMP = Invasive Plant Management Plan; RMA = Riparian Management Area; SEPSCP = Surface Erosion Prevention and Sediment Control Plan; RCP = Reclamation and Closure Plan; SOP = Standard Operating Procedure

9.11 Wildlife Protection

The mitigation and management measures presented in this section are consistent with the following management plan(s):

- Wildlife Mitigation and Monitoring Plan;
- Invasive Plant Management Plan;
- Vegetation Management Plan;
- Mine Site Traffic Control Plan;
- Air Quality and Fugitive Dust Management Plan; and
- Noise and Vibration Effects Monitoring and Mitigation Plan.

9.11.1 Mitigation and Management Measures

Project infrastructure has been designed to avoid or reduce potential effects on wildlife and wildlife habitat, including sensory disturbance (e.g., noise and light). Mitigation measures involving design changes are discussed in the WMMP and not discussed further.

Potential effects to wildlife and wildlife habitat during construction include alteration and loss of habitat, changes to wildlife movement, indirect and direct mortality, introduction of potential attractants, and changes to health. Table 9.11-1 identifies mitigation measures and best management practices that will be implemented to mitigate construction-related impacts to wildlife and wildlife habitat.

Table 9.11-1: Wildlife Mitigation and Management Measures

Category	Mitigation/Management Measure
General Wildlife Mitigation Measures and Best Management Practices	
Habitat Loss and Alteration	The EM in consultation with a qualified professional will implement the following measures in accordance with WMMP, Section 3.3.2 to minimize overall clearing and ground disturbance during construction: ■ Flag sensitive habitats adjacent to the construction footprint; ■ To retain the topsoil and vegetation root mat, grubbing, stripping, or removal of shrubs and herbaceous species will not be completed unless it is required for operations; ■ Progressively reclaim roads and infrastructure in accordance with the RCP when no longer required, including decommissioning of the existing exploration access road (during Project construction); ■ Use existing roads and cleared / disturbed areas rather than disturbing new areas; and ■ Retain coarse woody debris in accordance with the Coarse Woody Debris Management SOP (Locations of coarse woody debris piles/retention will be directed by a site supervisor on a site-specific basis).
	Riparian Area Management SOP will be implemented by the Construction Supervisor. The Riparian Area Management SOP identifies the safe and efficient work practices to manage and protect riparian areas adjacent to wildlife habitats.
	During clearing of the forest, the Construction Supervisor will implement mitigations for edge effects in accordance with WMMP, Section 3.3.2.
	Mitigation measures identified in Section 8 of the VMP will be implemented by the Construction Supervisor during clearing activities to minimize the overall clearing and ground disturbance.
Transportation and Access	The Site Supervisor will implement the following access road use and haulage operating protocols; ■ When transiting to/from camp on the Kluskus FSR - check in with main office in Vanderhoof or at the camp before leaving, and when arriving at camp; ■ Radio positions along the FSR; ■ No speeding on the FSR; ■ Report any wildlife sightings, incidents or accidents on the FSR; and ■ Additional details are included in the Journey Management Package given to all Personnel.
	Other commercial users of Kluskus FSR will be notified regarding relevant wildlife safety provisions along roadways through signage and participation in the industrial road users group, with relevant measures incorporated into road use agreements.
	BW Gold will participate in the Kluskus FSR industrial road users group and safety groups throughout the Construction phase.
Wildlife Activity on Roadways	All mine vehicles and mobile equipment, including authorized private vehicles, will be equipped with or escorted by vehicles with two-way radios when travelling along Project-controlled roads.
	Wildlife logs will be maintained on site to include all recorded wildlife sightings, interactions, and incidents (and reported annually in the WMMP report). The EM will inform all staff/contractors of any locations of high animal activity on access roads and the appropriate actions to be taken, including seasonal changes in wildlife behaviour or presence. The EM, in consultation with a qualified professional, will determine appropriate actions depending on the circumstance and maintain overall responsibility for implementation of the recommendations.
	Wildlife will be given the right of way along all Project-controlled roads, and site orientation will include measures for avoidance of vehicle/wildlife encounters.

Category	Mitigation/Management Measure
	Wildlife crossing signs will be posted where identified wildlife corridors intersect project roads, as identified through pre-construction surveys. This includes identification of amphibian crossings, such as near potential western toad breeding sites: ■ Wildlife crossings have been identified during pre-construction habitat surveys conducted during summer of 2021 and signs will be installed prior to initiating construction activities; ■ Two crossing have been identified on the Kluskus and Kluskus-Ootsa FSRs, BW Gold will notify FLNRORD and offer to install wildlife crossing signs prior to initiating construction activities; ■ Signage will be maintained and adaptively managed through all phases of the Project; ■ Signs will be posted along Project access roads to identify caribou sensitive areas, including migration routes and seasonal feeding areas; and ■ Cameras may be used to document trails where wildlife cross the road, or at locations where breaks have been plowed to allow crossing by moose.
	Wildlife incidents or mortalities will be addressed with adaptive management measures indicated in Section 1.4 of the WMMP, including potential adaptive management measures.
	If amphibian mortality on roadways is identified, adaptive management measures will be implemented in accordance with the WMMP such as additional consideration for amphibian passage (e.g., tunnel and fence systems or limitations on timing of traffic movement in that area).
	Speed limits on all Project roads are set at 50 km/h. Speed limits are clearly marked through signage and enforced by site security through periodic checks using a radar speed gun. Personnel caught speeding will face disciplinary measures, and if violators are encountered they will be provided with constructive instruction on the importance of adhering to speed limits to avoid wildlife incidents.
Road Condition Management	Vegetation management on Project roads (Mine Access Road and mine site roads) will be maintained to provide sightlines. Vegetation will be selectively brushed to prefer low growing species to maintain a vegetated cover. Revegetate roadsides with native species that avoid attraction of wildlife (e.g., no clover or other highly palatable species), in accordance with the VMP to reduce wildlife incidents. Species selection will be implemented by the EM in consultation with a qualified professional.
	Road salts will not be used for de-icing, unless as determined by the Mine Manager (in consultation with a qualified professional), other methods for de-icing and traction control do not meet safety requirements.
	All staff (including contractors) will be required to report carrion observed on roads. Once reported, carrion will be removed from roads promptly. Carrion management methods will be established in consultation with relevant authorities, and Aboriginal Groups. The EAC specifies relocating carrion to nearby areas to serve as a food source for wildlife, unless FLNRORD is not able to authorize removal and relocation. Industry best-practice is to incinerate road kill. FLNRORD will be notified via email within 72 hours of carrion resulting from mine activities.
	Dust suppression measures will be implemented by the EM to allow good line of sight, as defined in the Fugitive Dust Management SOP (Appendix D of the Air Quality and Fugitive Dust Management Plan). The Fugitive Dust Management SOP provides the safe and efficient work practices to manage fugitive dust emissions from use of the Mine Access Road, haul and service roads. The SOP provides guidance to personnel to assess working conditions to prevent excessive dust from equipment or processes
	The CM will implement the management of snow bank heights using blading or other clearing techniques, and maintenance of escape pathways at wildlife corridors along roadways to keep banks and pathways within heights decided in consultation with regulators, and Aboriginal and Indigenous groups once the road is constructed.

Category	Mitigation/Management Measure
Species-specific Mitigation Measures and Best Management Practices	
Amphibians (WMMP Section 4.1)	Avoidance of amphibian breeding ponds will include no-work buffers surrounding known breeding ponds and taking into account BC *Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia* (MOE 2014b), which recommends a 30-150 m buffer zone. The no-work buffer will be flagged in consultation a qualified professional.
	If avoidance of breeding ponds is not possible and salvage is required, it will be conducted following *Best Management Practices for Amphibian and Reptile Salvages in British Columbia* (MFLNRO 2016) and in consultation with a qualified professional as follows (in accordance with DS Condition 8.11): ■ Obtain a salvage permit under the *Wildlife Act*; ■ Conduct a baseline inventory and assessment, including a comprehensive risk assessment; ■ Consider habitat type when determining capture techniques, inventory and salvage timing, and capture effort; ■ Conduct salvage during the time of year when the least number of species and life stages will be affected; and ■ Where possible, create a compensation site (e.g., construct or restore a wetland) instead of using naturally occurring habitat for release.
	Under the supervision of a qualified professional, toads will be salvaged from on-site breeding ponds prior to clearing activities that cannot be scheduled outside of sensitive periods in accordance with DS Condition 8.11. Prior to an amphibian salvage, an Amphibian Salvage SOP will be produced by a qualified professional.
	All staff will follow vehicle and equipment cleaning procedures, after working in areas with known invasive plants in accordance with IPMP Section 8.2.1.
	Effluent will meet effluent quality criteria (as defined in discharge permits) prior to discharge to the receiving environment. Refer to MSDP (Section 10) for potential nonconformities and corresponding corrective actions (i.e., mitigation measures) associated with mine site discharges.
Bats (WMMP Section 4.2)	Clearing work will be planned for outside of the sensitive period for bats (see Table 13.1-1).
	If clearing must occur during the sensitive period for bats (see Table 13.1-1), then the inventory of potential hibernacula and roost features identified during pre-construction surveys will be reviewed by a qualified professional prior to disturbance to determine whether bats are using the area and provide direction to the CM.
	Buffer zones will be established by a qualified professional around active hibernacula and active roosts, in consultation with Aboriginal Groups and relevant authorities, and considering recommendations in the *Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area* (BC FLNRO 2014).
	Site-specific buffer distances will be recommended by a qualified professional to the CM to be implemented during clearing. The buffer distances will depend on the species present and intensity level of activity (BC MFLNRO 2014; Holroyd and Craig 2016).
Caribou	Refer to the Caribou Mitigation and Monitoring Plan.
Moose (WMMP Section 4.4)	Construction activities should avoid moose habitat, such as salt licks and wetlands, where possible.
	To limit disruption to moose during construction, mitigation measures will be implemented in accordance with the NVMP (as determined by a qualified professional) including: ■ Use noise abatement; ■ Schedule construction activities at noise sensitive locations and times; and ■ Avoid low altitude flights except on final approach and take-off.

Category	Mitigation/Management Measure
Furbearers (WMMP Section 4.5)	Construction activities should avoid sensitive wildlife seasons for American marten, fisher, and wolverine (13.1-1). Construction activities will be planned outside of this period unless not technically feasible, as determined by the Mine Manager.
	If activity is being proposed during sensitive time periods for furbearers (13.1-1), no work buffer zones will be established by a qualified professional and implemented by the EM. The buffer zones will take into account FLNRO (2014) and dens identified during pre-construction surveys; recommended buffer zones vary according to species and activity. Mitigations will be completed as required by DS Condition 8.10.
	■ If a no work buffer zone is established, Table 1 minimum buffer zones of 50 m indicated in EAC Condition 23c will be used surrounding identified dens. ■ If a buffer zone is not possible a qualified professional will determine mitigation measures based on site-specific characteristics including the size of the feature, the species involved, and the intensity level of planned activities. This may include rescheduling of work. Mitigation measures will also be in accordance to EAC Condition 23c: *"Should the survey or assessment determine that there is furbearer denning habitat within the Project Area, the plan must identify mitigation measures to be applied during the denning period, as determined by a Qualified Professional, if avoidance is not possible, and in consideration of BC Environmental Mitigation Policy, including Procedures for Mitigating Impacts on Environmental Values (BC EMP)."*
Grizzly Bear (WMMP Section 4.6)	Construction activities should avoid sensitive wildlife seasons for grizzly bear as defined in the *Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area* (MFLNRO 2014). The sensitive wildlife seasons for grizzly bear is provided in Table 13.1-1.
	■ A minimum buffer distance of 60 m distance will be established if an active grizzly bear den is identified during Project construction. Buffers will be determined by a qualified professional and will be based on site-specific characteristics including the intensity level of planned activities, and may exceed 60 m in some circumstances. ■ If activities must occur within the buffer zone of a potential den, additional assessment may be conducted to determine occupancy, in consultation with a qualified professional, FLNRORD Indigenous groups and Aboriginal Groups.
	Two dens were identified in a boulder field within mature forest was located during field surveys at the southwest corner of the mine site (northwest corner of Mt. Davidson) which has high suitability for grizzly bear denning (see Figure 4.5-2 in the WMMP). The den site in the boulder field will be avoided with a buffer of 200 m in all directions; if avoidance is not possible during the denning season, additional monitoring may be done to determine occupancy, such as reviewing the wildlife camera footage and using a Forward Looking Infrared (FLIR) camera.
	Waste management practices will be implemented by the EM to reduce attractiveness to bears, including measures for food preparation and storage, and waste storage and disposal.
Birds (WMMP Section 4.7)	Avoid vegetation clearing during the breeding season for birds in accordance with Table 13.1-1, unless otherwise authorized. If vegetation clearing must occur during the breeding season, a qualified professional will conduct pre-clearing surveys, and determine no-work setbacks around any nests.
	Wildlife trees will be retained as snags if they pose little to no risk to human safety.

Notes:

DS = Federal Decision Statement; EAC = Environmental Assessment Certificate; FLNRORD = Ministry of Forests, Lands, Natural Resource Operations, and Rural Development; FSR = Forest Service Road; IPMP = Invasive Plant Management Plan; MSTSP = Mine Site Traffic Control Plan; RCP = Reclamation and Closure Plan; SOP = Standard Operating Procedure; VMP = Vegetation Management Plan; WMMP = Wildlife Mitigation and Monitoring Plan

9.11.2 Preventative Protocols

Preventative protocols have been developed to protect wildlife against introduced pathogens or invasive species. These protocols primarily apply to cleaning and transport of equipment between sites, which applies for any pre-clearing and construction work in aquatic habitats (for amphibians) and forested habitats (for bats) and disturbed habitats, such as roadsides (for invasive plants). Survey and monitoring protocol references are included, and may be required if handling wildlife or in-water work is required.

9.11.2.1 Chytridiomycosis Prevention Protocol

Chytridiomycosis is an infectious disease in amphibians transmitted by the aquatic-spreading chytrid fungus. Prevention protocols require cleaning and possibly disinfecting equipment brought to the site that might work in wetland areas, including construction and clearing equipment following protocols provided in Appendix D.

General cleaning protocols for field work around wetlands (i.e., amphibian surveys, salvage, wetlands surveying) will follow BC MOE (2008): *Standard Operating Procedures: Hygiene Protocols for Aquatic Field Research*.

9.11.2.2 White Nose Syndrome Prevention Protocol

Bat populations are threatened by white nose syndrome, a deadly and rapidly spreading disease caused by a fungus (*Pseudogymnoascus destructans*). Prevention protocols, including reporting and cleaning procedures are provided in Appendix E: *Western Canada White Nose Syndrome Transmission Prevention* (CWHC 2015).

Any signs of sick/infected animals will be reported to supervisory personnel and regulators will be promptly notified. Reporting procedures for wildlife sighting and signs will be covered in the Site Orientation and training.

9.12 Fish and Fish Habitat

The mitigation and management measures presented in this section are consistent with the following management plan(s):

- Surface Erosion Prevention and Sediment Control Plan; and
- Fish Salvage and Relocation Plan (Appendix F).

Construction activities such as clearing and grubbing, excavation and soil handling in close proximity to waterbodies have the potential to result in the harmful alteration, disruption or destruction of fish habitat due to in-water works, alteration of flows and sediment release, and fugitive dust. Construction may also create conditions that could result in trapping or stranding of fish. The below mitigation measures have been developed.

Table 9.12-1 identifies measures that will be implemented to mitigate potential effects on fish and fish habitat during Project construction when undertaking activities near water.

Table 9.12-1: Fish and Fish Habitat Mitigation Measures

Category	Mitigation/Management Measure
Reduced Risk Timing Windows	If in-stream construction works and activities are scheduled outside of reduced risk timing windows (Omineca Region is July 15 to April 15 [rainbow trout]), a qualified professional will be engaged to determine specific mitigation measures to be implemented in accordance with provincial and federal requirements for working outside of timing windows.
Clearing	If clearing activities including the final clearing footprint (e.g., machinery and equipment movement, or clearing and grubbing) are planned to occur adjacent to or within riparian areas, the Riparian Area Management SOP will be implemented by the Construction Supervisor. The Riparian Area Management SOP identifies the safe and efficient work practices to manage and protect riparian areas.
	During all clearing activities, the SEPSCP will be implemented by the EPCM Contractor and other contractors that report to the CM. The SEPSCP identifies erosion control measures to prevent exposed soils from being entrained by water or wind, sediment controls to prevent sediment mobilizing into natural waterbodies impacting fish and aquatic life and the removal of sediment suspended in water once erosion has occurred. This includes proper ditching, installation of silt fencing and reducing slopes and placement of soil salvage piles, diversion and runoff collection ditches, sediment control ponds, erosion control mats and use of flocculants.
Angling	No angling is permitted by employees or contractors while they are on the mine site or travelling to/from the mine site.
Aquatic Resources	The EPCM contractor and other contractors that report to the CM will ensure that DFO's Measures to Protect Fish and Fish Habitat (DFO 2019) as determined by a qualified professional are implemented. Measures may include: ■ Prevent the death of fish by avoiding use of explosives in or near water, planning in water work, undertaking or activity to respect timing windows to protect fish, including: their eggs, juveniles, spawning adults, and the organisms upon which they feed and migrate. ■ Maintain riparian vegetation by: ○ maintaining an undisturbed vegetated buffer zone between areas of on-land activity and the high water mark of any water body ○ using existing trails, roads or cut lines wherever possible ○ avoiding tree removal ○ using methods to prevent soil compaction, such as swamp mats or pads ■ Prevent the harmful alteration, disruption or destruction of fish habitat by avoiding: ○ conducting any work, undertaking or activity in water ○ placing fill or other temporary or permanent structures below the high water mark ○ fording of the watercourse ○ disturbing or removing materials from the banks, shoreline or waterbody bed, such as: ▪ sand ▪ rocks ▪ aquatic vegetation ▪ natural wood debris ○ building structures in areas that: ▪ may result in erosion and/or scouring of the stream bed or banks ▪ are inherently unstable, like: • bends • meanders • floodplains • alluvial fans • braided streams

Category	Mitigation/Management Measure
	■ Maintain fish passage by avoiding changing flow or water level or obstructing or interfering with the movement and migration of fish. ■ Implement the SEPSCP.
	Approved Work Practices for Managing Riparian Vegetation (BC Hydro et al. 2003) will be implemented by EPCM Contractor and other contractors that report to the CM. The main methods for managing riparian vegetation include pruning, slashing, mowing, topping, girdling, hinging and hazard/danger tree removal. The EM in consultation with a qualified professional will determine the appropriate prescriptions for the construction activity.
	■ The Riparian Area Management SOP will be implemented by the Construction Supervisor that will identify the safe and efficient work practices to manage and protect riparian areas. ■ Adhere to mitigation measures identified on environmental constraint mapping.
	To prevent entry of contaminant materials in water: ■ Implement spill response plan immediately in the event of a spill of contaminant materials. ■ Maintain spill response kits on site with the appropriate type and volume of material specific for each piece of equipment that handles or transports contaminant materials (including fuel), including: ○ Pickup trucks; ○ Dump trucks; ○ Commercial transport trucks; ○ Excavation equipment; and ○ Fuel trucks. ○ Fuel Stations and bulk fuel farms ○ Chemical storage areas ○ Secondary containment berms ■ Stop work and contain contaminant materials to prevent dispersal. ■ Report any spills of sewage, oil, fuel or other contaminant materials whether near or directly into a water body. ■ Ensure clean-up measures are suitably applied so as not to result in further alteration of the bed and/or banks of the watercourse. ■ Clean up and appropriately dispose of the contaminant materials. ■ Plan activities near water such that materials and chemicals don't enter the watercourse. ■ Maintain all machinery on site in a clean condition and free of fluid leaks to prevent any contaminant materials from entering the water. ■ Wash down tools and equipment at designated wash facilities, refuel and service machinery and store fuel and other materials for the machinery in outside of the RMA and areas with significant downslope to a watercourse to prevent any contaminant materials from entering the water. ■ Provide containment facilities for wash-down water and appropriate disposal of material. ■ Dispose all waste materials above the high water mark of nearby waterbodies to prevent entry.
Crossing of Fish-Frequented Streams	■ Fording of a stream for the purpose of moving equipment (i.e., one-time crossing only, over and back) will be authorized by the EM in consultation with a qualified professional. Fording of streams will only be completed if the channel width at the crossing is no greater than 5 m from the ordinary high water mark to ordinary high water mark (as per DFO Interim Code of Practice: Temporary Stream Crossings [DFO 2020]). ■ Should fording be required, the EM in consultation with a qualified professional will provide measures to protect fish and fish habitat in accordance with 1) DFO Interim Code of Practice: Temporary Stream Crossings (DFO 2020) and 2) Fish-stream Crossing Guidebook (FLNRO 2012). ■ For works identified in Part 3 of the Water Sustainability Regulation (B.C. Reg. 11/2021), the EM in consultation with a qualified professional will submit notification(s) to relevant authorities prior to undertaking Authorized Changes.

Category	Mitigation/Management Measure
Fish Salvage (Palmer 2021c)	Fish salvage efforts will be staged according to the construction schedule.
	Fish barriers (e.g., permanent fish fences, barrier nets) will be erected immediately downstream of all planned construction activities in Reach 6 of Davidson Creek, Creek 661 tributaries (Creek 505659 - Reach 5; Creek 146920 - Reach 3; Creek 543585 - Reach 2), and the outlet of Lake 1682. These barriers will be erected after spring freshet ends and water levels are low enough to construct temporary and permanent fences. This timing will prevent adult rainbow trout from migrating upstream from Lake Tatelkuz or downstream from Lake 1682 to spawn in areas where fish are to be removed and relocated.
	The preferred timing for fish salvages in the main stems of Davidson Creek and Creek 661 will be when stream temperatures are above 5°C, as determined by temperature-related restrictions for electrofishing. It is possible to secure salvage permits for periods outside the reduced risk window including variances to the 5°C threshold for electrofishing with MFLNRORD stressing the use of passive methods first (QP discretion). Salvages later in the year become more labor intensive and time consuming since salvage methods will be restricted to minnow trapping and netting methods. This might be further complicated once streams become ice covered which will likely require ice to be cleared prior to salvage. If BW Gold were to request a variance there would be the provision of clearly outlining how fish mortality would be mitigated during sampling and transport.
	All water bodies requiring fish salvage will be salvaged, with the majority of the salvage targeted to occur occurring in Year -2, but pending receipt of the *Fisheries Act* Authorization and fish salvage permits.
	Remove fish from streams and wetlands/ponds to be dewatered, by removing fish until catch-per-unit-effort reaches near-zero, as determined by a qualified professional.
	All captured fish will be temporarily held in clean containers holding water from the watercourse where the fish were captured. In situ water quality data (e.g., temperature, pH, dissolved oxygen, conductivity) will be collected during salvages. Captured fish will be visually checked for signs of stress, and where necessary, measures will be applied to ensure fish health such as aeration, changing the water, expedited release at designated release location, and provision of cover within holding containers.
	Under the guidance of and determined by a qualified professional: ■ Captured/collected fish will be transferred and released at designated locations in lower Davidson Creek, lower Creek 661, and Lake 1682 based on available access. ■ The duration for which fish are held in containment will be minimized and adjusted, as required based on fish health. ■ Precautions will be taken to ensure fish are minimally affected by the transfer process (e.g., driving slowly and ensuring road surface is in good condition so as to avoid shaking/vibration of fish tanks, cooling water with ice during hot weather, and aerating fish tanks to ensure adequate dissolved oxygen). ■ Fish will be released in suitable locations based on habitat suitability, fish density and other considerations. ■ Use of several release sites will avoid potential issues with local increased competition for food and increased predation by birds and mammals. ■ Release fish into slow-moving areas such as pools and back eddies to allow them time to acclimatize. Prior to release, water quality will be measured in situ at release locations, to ensure conditions are similar to the capture locations and holding tanks.
	During the dewatering process, deep pools will be inspected and, where necessary, any remaining fish will be collected and transferred.
	Stop nets will be placed across the stream to prevent fish re-entry to salvaged areas that have not yet been dewatered.

Category	Mitigation/Management Measure
	Once fish salvage is complete, a semi-permanent fish barrier will be erected immediately downstream of the Lake 1682 outlet to prevent fish movement downstream until the lake is isolated during construction.

Notes: RMA = Riparian Management Area; SEPSCP = Surface Erosion Prevention and Sediment Control Plan; SOP = Standard Operating Procedure

9.13 Non-traditional Land Use

The mitigation and management measures presented in this section are consistent with the following management plan(s):

- Invasive Plant Management Plan;
- Vegetation Management Plan;
- Mine Site Traffic Control Plan; and
- Noise and Vibration Effects Monitoring and Mitigation Plan.

Construction activities may interfere with the use and access to Crown and third party tenures held by other parties or public access. Table 9.13-1 identifies measures that will be implemented to mitigate potential effects with respect to non-traditional land use during construction on the mine site and off-site infrastructure.

Table 9.13-1: Non-traditional Land Use Mitigation Measures

Category	Mitigation/Management Measure
Livestock and Agriculture	If livestock access to water supply is curtailed with construction of mine infrastructure or habitat offsetting (e.g. cattle exclusion fencing from fish habitat offsetting): ■ The EM will Identify alternative watering locations in discussion with the land and/or livestock owner(s).
	Cattle movement into the transmission line right of way (ROW; Land File 0194075) and fisheries habitat offsetting works will be restricted with: ■ The installation of temporary/permanent fencing along active pastures, in consultation with the relevant landowner.
	Facilitate movement of livestock and farm machinery across ROW corridors, where applicable.
	To minimize compaction of agricultural soil: ■ Project vehicles will be restricted to use the ROWs and designated access roads near Project development areas through training and signage.
	To minimize the introduction and spread of invasive plants: ■ The EM will implement the general mitigation measures, vehicle and equipment cleaning protocols, in accordance with the Invasive Plant Management Plan. ■ The Departmental Manager will implement the Invasive Plant Management SOP relevant to their area.
	To avoid potential impacts to livestock during construction activities, livestock owners will be notified of the construction schedule and activities to allow livestock to be moved to other pastures if necessary and/or where applicable.
Groundwater	Protect groundwater wells during construction activities with temporary fencing within 2 m of the well.

Category	Mitigation/Management Measure
Timber	To minimize the potential escape of beetles from infested logs during clearing, handling, and hauling of beetle infested wood the Site Supervisor will implement the following mitigations as guided by a qualified professional and in accordance with guidance provided by FLNRORD: ■ Determine if woody debris stored on site have bark beetles and if noted, adopt measures to control infestation and spread (determined by a qualified professional). ■ Assess windthrow to determine if bark beetles require salvage of downed trees. ■ Prior to hauling beetle infested wood, determine the high beetle flight period and reduce transport windows accordingly.
	Provide timber from transmission line clearing to the Fraser Lake Community Forest.
Access	Public access to recreational and snowmobiling trails that are affected by construction activities will be managed by: ■ Adjustment of construction activity schedule; or ■ Erect appropriate signage (as determined in consultation with FLNRORD) on affected recreational and snowmobiling trails, if adjusting scheduling is not possible.
	If temporary closures on affected access routes, including water access (e.g., put-in places and points) are required the EM will: ■ Implement temporary access restrictions in accordance with the MSTCP where necessary to protect human health. ■ Erect appropriate signage to provide notice of temporary closures.
Noise	To limit disruption to sensitive receptors (hunting, guide outfitting and trapping) mitigation measures will be implemented in accordance with the NVMP (as determined by a qualified professional) including: ■ Use noise abatement. ■ Schedule construction activities at noise sensitive locations and times. ■ Avoid low altitude flights except on final approach and take-off.
Schedule	Provide the construction schedule to tenure holders and recreational groups (e.g., Northwest Brigade Paddling Club, nearby lodges and the local offices of BC FLNRORD) overlapping the Project, 30 days prior to the start of construction and resolve any issues related to access as per appropriate industry and provincial standards, guidelines and best practices.

Notes:
FLNRORD = Ministry of Forests, Lands, Natural Resource Operations, and Rural Development;
MSTCP = Mine Site Traffic Control Plan; NVMP = Noise and Vibration Effects Monitoring and Mitigation Plan;
SOP = Standard Operating Procedure

9.14 Archaeological and Cultural Heritage Resources

The mitigation and management measures presented in this section are consistent with the following management plan(s):

- Cultural and Spiritual Resources Management Plan.

Table 9.14-1 identifies measures that will be implemented to mitigate potential effects with respect to known and unknown archaeological and cultural heritage resources during construction. As new resources may be discovered during the course of construction, a Chance Find Procedure has been developed and is included as Appendix G.

Table 9.14-1: Archaeological, Heritage and Spiritual Resource Mitigation Measures

Category	Mitigation/Management Measure
Known Archaeological Sites	The following measures will be completed when Project activities are located within 0 to 50 m of a known site: ■ The Project archaeologist will flag or delineate an area of at least 30 m around the site and mark as a “No Work Zone” from the site boundary to align with Archaeology Branch’s Remote Access to Archaeological Data areas of high archaeological potential. ■ If the site is impacted, the EM contacts the Indigenous groups and the Project Archaeologist to determine if additional mitigation measures are required. The EM will be engaged on the proposed mitigation measures. ■ Sites that are identified by Indigenous groups as confidential will be depicted as polygons, including an area of at least 50 m around the site, on Project maps and marked as a “No Work Zones” around the site but will not be delineated on the ground. ■ If the impacts to the site will occur, then mitigation must be conducted prior to impact. Procedures to record, analyse and mitigate effects on a site will be determined in consultation with the BC Archaeology Branch and affected Indigenous groups as per the *Heritage Conservation Act* permit and carried out by an archaeologist under a *Heritage Conservation Act* (Section 12.2 heritage investigation and/or Section 12.4 site alteration permits). Mitigation measures will be dependent on the specifics of the archaeological site and the levels of impact. Mitigations generally involve detailed mapping, photography, and systematic data recovery through surface collection and controlled excavations of evaluative units if subsurface deposits are present. ■ Any artifacts collected during archaeological assessment will be sent to the Exploration Place Museum and Science Centre in Prince George, BC or another approved repository identified in the relevant Section 12.2 or 12.4 permit under the *Heritage Conservation Act*.
	The following measures will be completed when Project activities located within 50 and 150 m of a known site: ■ The Project Archaeologist will flag or delineate an area of at least 30 m around the site and mark as a “No Work Zone” from the site boundary. ■ Should impacts to the vegetation or ground surface since the previous observation be observed at sites, the Project Archaeologist and the Archaeology Branch will be contacted to determine mitigation measures. ■ Should impacts be observed at heritage sites, the EM will contact Indigenous Knowledge Holder(s) to discuss mitigation measures.
Known Historic, Cultural, Spiritual, and Paleontological Sites	There is one documented historic cabin site within the mine site. If avoidance is not possible through final design and permitting, and artifacts or features associated with this site will be impacted, Aboriginal Groups and the local museum will be consulted and given the opportunity to collect/preserve artifacts associated with this site.
Culturally Modified Tree Sites (CMTs)	■ Prior to alteration to post-1846 CMTs the relevant/affected Indigenous communities will be consulted to determine possible preferred mitigation measures. ■ Common mitigation measures for post-1846 CMTs with cultural significance include: detailed measurements and photography, removing and preserving the modified portion of the tree, or removing a cross-section (cookie) of the modified portion of the tree.
Trails	If a trail is encountered during construction: ■ The relevant/affected Indigenous communities will be consulted to determine possible preferred mitigation measures prior to the alteration of a trail. ■ Possible mitigation measures for recording trails include photography and detailed mapping of the route and surrounding features.

Category	Mitigation/Management Measure
Paleontological Sites	If paleontological sites are encountered: ■ Work will be stopped pending consultation with the Fossil Management Office to determine an appropriate repository; and ■ The Project Archeologist will flag or delineate the site by an area of at least 30 m around the site and marked as a “No Work Zone” from the site boundary.
Chance Finds	The Project Archaeologist will implement the Archaeological and Cultural Heritage Chance Find Procedure (Appendix G) if there is a suspected discovery of archaeological, heritage, cultural, spiritual, or paleontological resources.

10. FUEL MANAGEMENT AND SPILL RESPONSE STRATEGY

During construction, there is potential for spills of substances that are deleterious to fish and fish habitat, wildlife, vegetation and soil quality. Common substances that pose a risk include gasoline, diesel, hydraulic fluid, transmission fluid, engine oil and lubricants (grease). Chemicals and materials stored onsite include janitorial cleaning products for the exploration camp, lubricants, hydraulic fluids, and greases for mobile equipment, pressurized gases for welding, paints and solvents for the exploration camp. During construction, small quantities of these chemicals and materials will be stored and used onsite. Bulk fuels will be stored for the construction equipment fleet.

Requirements for the storage, transfer, and handling of chemicals and fuels are outlined in:

- A Field Guide to Fuel Handling, Transportation, and Storage. 3rd Edition 1.0. (MWLAP 2002);
- Environmental Code of Practice for Metal Mines (EC 2009); https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/publications/code-practice-metal-mines/chapter-4.html;
- *Health, Safety and Reclamation Code for Mines in British Columbia* (the Code; MEM 2017), specifically the following sections in the Code:
  - Section 2.3.4 – Proper Containers;
  - Sections 2.13.1 to 2.13.20 – Workplace Hazardous Materials Information Systems; and
  - Sections 2.3.3 – Storage of Hazardous Materials.

Relevant management plans associated with spill prevention response include:

- Fuel Management and Spill Control Plan; and
- Chemicals and Materials Storage, Transfer and Handling Plan (including the Cyanide Management Plan).

Table 10-1 presents measures that will be implemented to prevent and respond to spills during Construction.

Table 10-1: Spill Prevention and Response Mitigation and Management Measures

Topic/Activity	Mitigation/Management Measures
Transportation	Fuel will be transported in containers and vehicles that comply with the federal *Transportation of Dangerous Goods Act* and the provincial *Transport of Dangerous Goods Act* hazard classification.
	Tank trucks must be inspected by a facility registered by Transport Canada. Visual inspections will be done every two years and pressure tests will be done every five years.
	Containers for the transportation of fuel will be labelled to communicate the hazard the material represents, made of a material that is compatible with the transported fuel, and in good condition (not damaged, rusting or leaking).
	Vehicles for the transportation of fuels will be labelled to communicate the hazard the material represents.
	Tanks and containers with a capacity of greater than 50 gallons (230 litres) used for the transportation of flammable liquids or combustible liquids, shall conform to the requirements for the construction of cargo tanks on tank vehicles.
	Fuels will be transported separately from other hazardous or non-compatible materials.
	Transportation route plans will be designed to minimize the chance of a potential spill and to minimize the effect of a spill, should one occur.

Topic/Activity	Mitigation/Management Measures
	Transport containers will be properly secured and positioned to allow safe access and handling of containers.
	Containers of 5 gallons (23 litres) or less should be stored in an equipment box (Truck box/slip, Tidy Tanks) of a vehicle, reducing the risk of the container to bounce and spill.
	The slip tank will be regularly inspected for leaks and cracks. The slip tank will be repaired or replaced as required to maintain tank integrity.
	The spill response plan and a spill response kit, capable of containing and absorbing fuel spills will be available in all vehicles that are used for the transportation of fuel.
	Employees will be prohibited from smoking in and around fuel transport containers and vehicles.
	All bulk fuel drivers will: ■ Be trained and have CPPI Drivers Certification Training and Transportation of Dangerous Goods certification course or equivalent; ■ Be trained in the relevant sections of the TDG Regulations as applicable to their job and have ready access to their certification; ■ Be trained on the Spill Response Plan and spill reporting requirements both within and outside the mine site boundary; ■ Ensure no smoking or open flames are used around the fuel stations at any time; ■ Wear a hardhat and safety glasses at all times; ■ Yield to larger traffic; ■ Obey all posted speeds within and outside the mine site boundary; ■ Have all lights and markers turned on; and ■ Follow the designated route.
Storage and Inventory Control	Fuel tanks will be CSA approved and comply with regulations and recommended practices described in A Field Guide to Fuel Handling, Transportation, and Storage (BC MWLAP 2002) and the BC Fire Code. Tanks will bear a current Underwriters Laboratories of Canada certification plate or label.
	The Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products (CCME 2003) states that all aboveground storage tank systems containing petroleum products and having a single or total capacity of more than 4,000 litres (880 gallons) at a site shall register all storage tanks of the system with the authority having jurisdiction.
	Storage tanks must be installed on firm foundations designed to minimize uneven settling and corrosion. Multiple tanks must be separated by a minimum of 1 m.
	All fuel storage vessels will include a secondary containment in accordance with Section 2.2 or 3.2 of the Field Guide to Fuel Handling, Transportation, and Storage (BC MWLAP 2002).
	Tanks and sumps will have high-level alarms.
	Fuel will be stored in containers in good condition that are designed and constructed for fuel storage.
	To minimize the risk of fuel leaks during storage of fuel: ■ All equipment used to store or dispense fuel will be free of leaks. ■ Fuel storage locations and equipment will be inspected according to a developed inspection program. Fuel storage locations will be visually inspected daily for leaks, spills, and obvious abnormal conditions. Any leakage will be repaired immediately. If tanks are resting on the ground, daily measurements of fuel levels by tank dip and calculation of fuel gain or loss will be taken. ■ Tanks will be physically protected from collision. ■ All tanks will be regularly serviced. ■ Tanks will be filled to an acceptable safe filling level of approximately 90% capacity (MWLAP 2002).
	Fuels will be stored separately from corrosive materials.

Topic/Activity	Mitigation/Management Measures
	Smoking in and around fuel storage and fuel dispensing facilities will be prohibited. Signage will be placed adjacent to all such locations.
	Fuel storage and dispensing will occur at least 30 m from watercourses and wetlands.
	Any tank that will be out of service for more than 180 days must have all liquid and vapour removed from the tank and its connected piping, isolated by closing and locking valves or pipping from the tank, and the contents shipped to an appropriate facility for storage or use. The tank must also be clearly marked by signs to indicate they are empty.
	Liquid levels in tanks containing flammable or combustible liquids will be measured at intervals no greater than one month.
Handling and Dispensing	All operators will remain with the fuel nozzle while refueling.
	Ignition will be turned off while the vehicle is being refueled or during any other fueling facilities.
	Two approved and current 10 lb BC fire extinguishers must be available within 9 m of the work area while handling fuel.
	At least one approved and current 20 lb portable fire extinguisher within the tank vehicle.
	Overflow protection must be installed for all tanks where loading and dispensing operations occur.
	After refueling, hose and nozzle and will be stored in a secure and safe position to prevent unnecessary spillage. Hoses will be kept off the ground and valves closed and locked when not in use.
	Do not fuel or service equipment within a riparian management area of a stream or wetland, or within 30 m of a shoreline.
	All storage and transfer locations will also be equipped with appropriate spill kits.
Inspections and Preventive Maintenance	Stationary fuel and dispensing stations and generator facility and fuel storage areas will be visually inspected on a daily basis. Inspections will be based on the type of tank and associated piping and include: ■ Checking pipes, valves, flanges, connections and pumps for leaks, discoloration or corrosion; ■ Checking the secondary containment is dry and clean of residue; ■ Checking the integrity of the liner and containment berm (fuel storage areas); and ■ Testing high-level, leak detection, and low pressure alarms and vacuum monitoring gauges to confirm they are working.
	Inspections will be documented in a logbook and will meet the requirements of Section 4.4 of the BC Fire Code.
	Reviewing inspection findings on an incident-by-incident basis with operators, transporters, and off-site contractors to correct deficiencies, maintain awareness and communication, and recognize negative or positive performance.
	Reporting and record keeping will be in accordance with Section 12 of the FMSCP.

Note: FMSCP = Fuel Management and Spill Control Plan

10.1 Spill Response

Spill response measures shall be in accordance with the FMSCP and additional response is provided through provisions of the MERP. Table 10.1-1 identifies spill reporting thresholds. The following immediate response actions will be implemented in the event of a spill of fuels, oils, lubricants, or other harmful substances:

1. Make the area safe – identify the substance, evaluate immediate risk and warn personnel in the vicinity of the spill.
2. Stop the flow (when possible and safe).

Table 10.1-1: Spill Reporting Thresholds and Requirements

Substance	Quantity	Regulatory External Reporting Requirements*	BW Gold Reporting Requirements[1]
Any Spill	Any amount in aquatic habitat	Emergency Management BC (EMBC), DFO and ENV	Environmental Incident Report (EIR)
Fuel and Oil	≥ 100 litres	EMBC	EIR
	Any amount off property	ENV and local authority	EIR
Flammable or Non-Flammable Gas	≥ 10 kilograms	EMBC	EIR
Toxic or Corrosive Waste	≥ 5 litres or kilograms	EMBC	EIR
Hazardous Waste	≥ 5 litres or kilograms	EMBC	EIR
Explosives	Any quantity that could pose a danger to the public, or ≥ 50 kilograms	EMBC	EIR

** Notification processes to other parties for environmental incidents is outlined in the Accidents and Malfunctions Administration and Communications Plan.*

10.2 Spill Reporting Contact Numbers

Not all contact numbers provided in Table 10.2-1 require notification for a particular spill. These numbers are intended to be a quick reference for the EPCM Contactor and EM who will determine the appropriate calls to make based on the particular spill's requirements. Other contact numbers may be added to this table for reference as needed.

Table 10.2-1: Spill Reporting Contact Numbers

Contact	Phone Number
Mine Manager (or delegate)	TBD
Environmental Department	TBD
Environmental Monitor	TBD
Chief Inspector of Mines	250-952-0494
Deputy Chief Inspector of Mines	250-952-0471
BC Wildfire: ■ Phone ■ Cell	 250 565 6124 *5555
Conservation Office – Vanderhoof	250 567 6304
Emergency Management BC	1 800 663 3456
WorkSafe BC: ■ General ■ After Hours	 1 888 621 7233 1 866 922 4357
Poison Control	911
Spills - BC Environment	1 800 663 3456
Department of Fisheries and Oceans (Prince George)	250-627-3499

TBD = to be determined.

10.3 Spill Response Equipment

These supplies and equipment are to be used only for their intended purpose. Under no circumstances will emergency supplies be used in non-emergency situations. Spill response equipment will be located at sites where fuels, oil, cyanide, and other hazardous materials are stored. They are maintained, inspected, and replenished so that they are available for immediate use. Any equipment or materials used during a spill will be replaced within 2 weeks following a spill. A review and inspection program has been developed and will be applied in accordance with the FMSCP.

The Health and Safety Manager or their designate will inspect and maintain the emergency supplies. The inspection will be documented and records retained.

Heavy equipment resources available at the Mine Site to control, contain, and clean up spills include:

- Rock/haul trucks;
- Dozers;
- Front-end loaders;
- Motor graders;
- Excavators; and
- Pumps and storage vessels.

Three types of spill kits are kept at BW Gold facilities and sites as described in the following sections.

10.3.1 Level "A" Spill Response Kit – Mine Site

A large supply of spill response equipment, including personal protective equipment (PPE) for both oil and chemical spills, is kept in a container that is immediately available should a large incident occur. It will be clearly identified and readily accessible. Spills of several hundred litres or more can be cleaned up using this equipment. Refer to Table 10.3-1 for Level "A" Spill Response Kit contents and Table 10.3-2 for PPE.

Table 10.3-1: Level "A" Main Spill Response Depot – Mine Site

Quantity	Item	Quantity	Item
1	Container with lid or shed, includes inventory list	40	Heavy-duty oil spill disposal bags
8 bales	Sorbent booms (4 per bale) (10' × 5")	2	"No Smoking" signs
1 length	PVC 6x6 River Boom (25')	1 roll	"Caution Do Not Enter" tape
10 bales	Sorbent pads (100 pads to a bale)	4	Safety triangles
6 bales	Sorbent socks (12 per bale) (3" × 4')	2	Poly tarps (18' × 20')
1	Sorbent roll (150' × 30")	1 jar	Plug N' Dike
1	Sledge hammer (6 lbs)	4	Round-nose shovel
1 set	Tool kit (example tools: wire cutters, pliers, hammer, utility knife , nails)	200 feet	Polypropylene rope (1/4")
1	Watergate® Barrier or equivalent	1 box	Rags

Note: SCBAs and chemical suits are also located at the Mine Site proper (see Table 10.3-2).

Table 10.3-2: Personal Protective Equipment – Mine Site

Item	Quantity/Size	Early Works	Major Works
Coveralls (Tyvek or Saranex)	12-XL, 12-XXL	NA	X
Oil-resistant rubber boots	12 pairs	4 pairs	X
Chemical splash goggles with side shields- A/O (fit eyeglasses)	12 pairs	4 pairs	X
PVC, rubber, leather, and nitrile gloves	12 pairs	4 pairs	X
Dust respirators (NIOSH-approved)	12	NA	X
Cartridge respirators (NIOSH-approved)	12	NA	X
Cartridges for respirators (organic vapour, acid, base)	12	NA	X
SCBA, positive pressure full face piece	6	NA	X
Level B chemical suits (Hazmat)	6	NA	X
Life vests (Personal Flotation Devices)	6	2 PFD's	X
Rain gear sets	6XL, 2-XXL, 3XXXL	4 sets of rain gear	X
High visibility vests	6	4 vests	X
Fire proximity suit	6	NA	X
Gas monitors/detectors	3	NA	X
Hearing protection	5 packages	X	X
Sunblock	12-75 ml – SPF 60	X	X

10.3.2 Level "B" Spill Response Kit – Secondary Fuelling and Storage

Smaller caches of spill response materials will be kept at all fuel storage and transfer areas and clearly identified and readily accessible. Spills of up to several hundred litres can be cleaned up using this kit. Refer to Table 10.3-3 Level "B" Spill Response Kit contents. Level B kits will be maintained at the Bulk Fuel and Ready Line site during construction.

Table 10.3-3: Level "B" Spill Response Kit – Fuel Storage and Dispensing Areas

Quantity	Item	Quantity	Item
1	Container to store all major response items , inventory list	1	Poly tarp (18' x 20')
10	Sorbent socks (3" × 4')	2	"No Smoking" signs
3 bales	Sorbent pads (18" × 18" × 3/8"; 1 bale in kit, 2 to be stored)	1 roll	"Caution Do not Enter" tape
20	Heavy duty oil spill disposal bags	200 feet	Polypropylene rope (1/4")
1	Round-nose shovel	1 box	Rags
1 pair	Chemical goggles - A/O (fit eyeglasses)	1 unit	Plug N' Dike
2 pair	PVC gloves		

10.3.3 Level "C" Spill Response Kit – Mobile Equipment Kit

Small caches of spill response materials will be kept in a carrying case or other container with all slip tanks, on each piece of mobile equipment, and near small fuel-powered equipment (e.g., trash pumps, generators, etc.). They will be clearly identified and readily accessible. Spills up to several tens of litres can be cleaned up. Refer to Table 10.3-4 Level "C" Spill Response Kit contents.

Table 10.3-4: Level "C" Spill Response Kit – Mobile Equipment Kit

Quantity	Item	Quantity	Item
1	Carrying bag or case, inventory list	1 pair	Chemical goggles - A/O (fit eyeglasses)
4	Sorbent socks (3" × 4')	1 pair	PVC gloves
20	Sorbent pads (18" × 18" × 3/8"; 10 Oil, 10 Universal)	1 roll	"Caution Do not Enter" tape
5	Heavy duty oil spill disposal bags	1 unit	Plug N' Dike

10.4 Petroleum Tanks

Petroleum products will be used at all Project locations and minor to significant spills may occur at any mine site area. To reduce the risk of a spill, site fuel tanks will be built and installed to comply with all regulatory requirements and relevant guidelines, including the Field Guide to Fuel Handling, Transportation and Storage (BC MWLAP 2002). All storage vessels will be double-walled. Permanent storage vessels greater than 75,000 L will be located within a secondary containment, and be equipped with oil/water separator and high-level alarms.

10.5 Dangerous Goods and Hazardous Materials

The proper storage and handling procedures described in the Chemicals and Materials Storage, Transfer, and Handling Plan will be followed to minimize the risk of spills of chemicals and materials. Hazardous materials will be clearly labelled and stored in proper containers in secure locations, where they will be accessed by trained personnel only. Secondary containment will restrict the spread of any spilled product and conveniently located Safety Data Sheet and spill kits will facilitate safe and timely cleanup.

10.6 Effectiveness Monitoring

Post-spill evaluation, monitoring and remediation requirements are provided in Section 11 of the FMSCP.

11. EMERGENCY RESPONSE

An Emergency Response Team (ERT) has been assembled from Project personnel to implement the MERP, organized and led by the Health and Safety Manager. It outlines the responsibilities and duties of the Emergency Response Team in the event of an emergency. The ERT will receive training in:

- Incident Command System;
- Communication protocol;
- First aid;
- Firefighting;
- Rescue techniques; and
- Hazardous material handling and clean up.

The MERP covers all of the Project facilities and work areas, is applicable to all Project phases, and will be activated if a Project-related emergency and/or relevant incident occurs.

12. PROJECT ORIENTATION

Training and communication are essential to the successful application of the CEMP. All Project site personnel are expected to understand the CEMP's primary objectives and key mitigation measures, and their responsibilities in order to successfully implement the plan. Relevant site personnel (i.e., management and supervisors) are expected to have a comprehensive understanding of the CEMP and its requirements as it relates to their job function. Other personnel are expected to have a basic understanding of the CEMP, with knowledge specific to their job function.

To achieve broad awareness of this CEMP, all mine-site personnel must attend a one-time orientation session upon arrival at the Project site that includes site-specific safety and environmental components. Orientation materials specific to the environment will be prepared by BW Gold, and delivery of the orientation sessions will be a collaboration between BW Gold staff and the EPCM contractor's EHS Representatives. Refresher training intervals for site on-boarding are to be determined, however, regular crew tailgate meetings will cover the relevant seasonal aspects of the topics below as a result of on-site observations, seasonal risks and throughout an annual period.

Personnel must sign and date the orientation record confirming that they have received the indoctrination materials and presentation. Signed environmental orientation meeting records must be provided to the HSE Department designate and retained on record as required by the Code.

From an environmental perspective, the orientation will include but not be limited to the following topics:

- CEMP and Management Plan orientation;
- MERP orientation;
- Access road use and haulage operating protocols;
- Restricted access and recreation rules;
- No hunting / no fishing policy;
- Wildlife observation and interaction reporting procedures;
- Caribou awareness program;
- Bear awareness program;
- Whitebark pine awareness;
- Fish habitat and wetland awareness;
- Waste management procedures;
- Wildlife-human interaction procedures including management of wildlife attractants;
- Wildlife sensitive locations/timing as applicable;
- Hazardous material management;
- Onsite waste procedures;
- Erosion prevention and sediment control;
- Soil conservation awareness;
- Best management practices for working in environmentally sensitive areas;
- Chance Find Procedure; and
- Emergency procedures including spill response and incident reporting.

Refresher training will be provided to all employees following a significant incident warranting refresher training to all staff. Additional site- and task-specific training will be provided to site workers as required.

13. TIMING AND PRE-CONSTRUCTION PLANNING

A critical element in minimizing impacts on environmental features while advancing construction is coordination between the construction schedule, wildlife restriction periods, pre-clearing surveys, and planning for mitigation measure implementation. Contractors will be required to provide accurate and timely construction and mobilization schedules in advance of work so that pre-clearing surveys, if required, can be carried out and the findings incorporated into construction planning. Contractors will be required to furnish BW Gold with these materials several months ahead of construction. In addition, routine day-to-day scheduling coordination between contractors, BW Gold staff, and Environmental Monitors will be required.

A mechanism for posting and distributing live schedules will be established.

13.1 Fish and Wildlife Restriction Periods

Timing restriction periods exist for certain fish and wildlife species that require management during construction activities. These periods, and associated mitigation activities for the selected fish and wildlife species are summarized in Table 13.1-1. The table includes timing restrictions from the following sources:

- Federal and provincial legislation;
- Commitments recorded in the Blackwater Mitigation Table submitted to the BC Environmental Assessment Office in accordance with Condition #43 of the EAC;
- The federal DS;
- Mitigation measures associated with pre-construction surveys recorded in Condition #23 of the EAC; and
- BC guidelines and Best Management Practices (BMPs), including:
  - *A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia* (BC FLNRO 2014);
  - Best Management Practices for Amphibian and Reptile Salvages in British Columbia. BC Ministry of Forests, Lands and Natural Resource Operations (BC FLNRO 2016);
  - Best Management Practices for Bats in British Columbia (BC MOE 2016);
  - General Nesting Periods of Migratory Birds (ECCC 2017);
  - Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia (BC MOE & BC FLNRO 2014);
  - Guidelines to Reduce Risk to Migratory Birds (ECCC. 2019);
  - Management Plan for the Western Toad (*Anaxyrus boreas*) in Canada [Proposed]. Environment and Climate Change Canada: Ottawa (ECCC 2016);
  - Nesting Calendar Query Tool (Birds Canada. 2021); and
  - Terms and Conditions for changes in and about a stream specified by MWLAP Habitat Officers, Omineca Region (FLNRO 2004).

13.2 Pre-Construction Surveys

Project construction activities that may disturb wildlife (e.g., vegetation clearing), will be avoided during activity restriction periods wherever possible (Table 13.1-1). If avoidance is not possible during these periods, pre-construction surveys will be conducted in accordance with EAC Condition #23 and the

WMMP to identify features that must be avoided and mitigation measures implemented. Pre-construction surveys will be completed under the direction of qualified professionals.

The site Environmental Monitor will be familiar with pre-construction survey requirements and management plans which may require pre-construction surveys, and ensure that construction scheduling incorporates sufficient lead time for qualified professionals to complete surveys.

Surveys will be specific to the season using species-specific survey methods to locate nests. The Environmental Monitor will keep a log of when pre-construction surveys were conducted and the results, including a log of all mitigation actions applied. These include set-backs established around habitat features such as dens and nests.

Table 13.1-1: Timing Windows for Fish and Wildlife Species during Construction

Valued Component	Specified Period	Season/Habitat for Feature	Summary of Mitigation	Guideline Buffers (m)	References
Rainbow trout	July 15 - April 15	All Watercourses	■ No in-water work (includes all water bodies: watercourses, lakes, wetlands etc.)	30 m	*Fisheries Act* *Water Sustainability Act* BC FLNRO 2004
Amphibians: Western Toad	Apr 1 - Sept 30	Wetlands (breeding habitat)	■ If clearing is required during the breeding season, conduct pre-construction surveys to identify breeding habitat, and pre-clearing surveys to confirm occupancy ■ Establish buffer zones around breeding habitat ■ Amphibian salvage will be conducted if necessary, in consultation with ECCC and Aboriginal Groups	30 m	BC MOE & BC FLNRO 2014; ECCC 2016; BC FLNRO 2016
Bats: Little Brown Myotis and Northern Myotis	Roosts: May 15 - Sept 30 Hibernacula: Oct 1 - May 31	Roosts (summer), Hibernacula (winter)	■ Pre-construction surveys to determine the distribution of little brown myotis and northern myotis ■ Establish buffer zones around active hibernacula and active roosts ○ Contact FLNRORD if Project activities will occur within a roost buffer. ○ Monitor buffer zones for ongoing use. ■ If surveys identify loss of little brown myotis and northern myotis roosting habitat, implement offsetting through roosting structures maintained throughout the life of the mine	100 m - 1 km	BC FLNRO 2014; Holroyd and Craig 2016
Birds: Forest and Grassland Birds, and Waterbirds	April 15 - August 31 Clark's Nutcracker (Whitebark Pine habitat only): Mar 15 - Jul 30	Nests, eggs, young, and mature	■ Pre-construction surveys for habitat of species at risk ■ If clearing required during breeding bird window, conduct pre-clearing surveys for bird nests ○ surveys will include habitat considerations and protocols for species at risk, see Section 4.1.7 ■ Establish buffer zones around active nests	30 m - 100 m	ECCC 2017, 2019; Birds Canada 2021

Valued Component	Specified Period	Season/Habitat for Feature	Summary of Mitigation	Guideline Buffers (m)	References
Raptors	Mar 15 - Aug 15	Nests, eggs, and young	■ If clearing required during raptor breeding window, conduct pre-clearing surveys to identify raptor nests in suitable habitat: mature forest, riparian, or cliff areas ■ Establish buffer zones around active nests ■ Apply for permits to remove or relocate unoccupied nests if necessary	100 m - 500 m	BC *Wildlife Act* 1996b BC MOE 2013; Birds Canada 2021
Caribou	Jan 15 - Jul 15	Ungulate Winter Range	■ Conduct pre-construction surveys for caribou habitat and mineral licks ■ If caribou are observed on site during construction or operations, work will be stopped or managed (by the Environmental Manager) in accordance with the WMMP and CMMP to reduce disturbance to caribou ■ Aircraft minimum altitude 400 m in the UWR where possible	-	BC FLNRO 2014
Furbearers and Grizzly Bear	Fisher: Mar 15 - Jun 30 Wolverine: Feb 1 - Jun 30 Grizzly Bear: Oct 1 - Apr 15	Dens	■ If clearing required during denning period, conduct pre-construction surveys for denning habitat of: ○ American marten ○ Fisher ○ Grizzly bear ○ Wolverine ■ Establish buffer zones around denning features, including suitable denning habitat for fisher or marten denning, although dens will not be individually identified (section 8.5, WMMP)	60 m (Grizzly Bear) – 500 m (Wolverine)	BC FLNRO 2014