



TBT ENGINEERING

HIGH LAKE PROJECT

Water Crossing Report

TBTE # 05-160

Nunavut, Canada

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Statement of Objectives

The purpose of this report is to formalize the procedures and commitments to be adapted throughout the development and operations of the new transportation system for the High Lake Project. This report will identify potential water crossing impacts from the proposed development and provide appropriate mitigation measures to meet the requirements of the governing applicable laws and regulatory agencies. The governing Agencies that have been recognized in the development of this report include; Fisheries and Oceans Canada, Health Canada, Transport Canada, Environment Canada, Natural Resources Canada, Indian and Northern Affairs Canada, and The Government of Nunavut.

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1.0 Scope of Report

The Water Crossing Report (WCR) has been structured to meet the previous commitments made by TBT Engineering within the preliminary design phases of the following four (4) main components:

- 1) Primary All Season Road
- 2) Secondary Access Roads
- 3) Airstrip
- 4) Borrow Sources

A brief description of the project, site conditions, and construction materials have been provided to allow a general understanding of the location, topography, drainage, and material types of the proposed development.

A description of the (4) main components and the potential impacts with respect to drainage, water crossings, and erosion and sediment control have been provided.

To address the identified potential impacts, recommended mitigation plans to be implemented for each component have been developed and provided within this report.

The mitigation measures developed within the WCR have been separated into the following three (3) protection plans:

- 1) Best Management Practices (BMPs) for Erosion and Sediment Control Plan
- 2) Water Crossing Diversion and Dewatering Plan
- 3) General Drainage Plan

The BMPs describes the methods, materials, and overall commitments to be implemented to control/prevent potential negative impacts to the environment during and after construction.

The Water Crossing Diversion and Dewatering Plan will provide four (4) alternatives to protecting the aquatic habitat during the installation of water crossing solutions.

The General Drainage Plan addresses the concern of tertiary drainage and seasonal water flow disruption.

To conclude, a summary table will be developed to present the four (4) main components with recommended protection plans required to mitigate the potential impacts before and after construction.

2.0 Project Description

The High Lake Project consists of a proposed mine adjacent to High Lake, containing copper, zinc, gold and silver reserves in three ore bodies. The following components support the High Lake Project:

- A dock facility at Grays Bay and Coronation Gulf;
- All weather access road from the dock facility and the High Lake mine site;
- Shipping for the purpose of transporting metal/re-supply;
- Sand Lake Airstrip

The proposed High Lake mine site is located in the Kitikmeot Region of Nunavut, at approximately 67° 22" north and 110° 51" west (Map A). It is approximately 50 km (as the Raven flies) south of Grays Bay, and about 175 km east of Kugluktuk. An exploration camp currently exists at the High Lake property. The proposed dock facility is located approximately 53 km north of High Lake Mine at 110° 51" West and 67° 48" North, at Grays Bay on the south side of the Coronation Gulf.

The proposed all-season access road between the dock site (Grays Bay) and the High Lake mine site will be used to haul concentrate to the storage shed at the dock site, and to back-haul re-supply material and equipment for operations at High Lake.

The proposed route for the all-season road follows an approximately north-south route across undulating rugged terrain, interspersed by several prominent rocky escarpments. The route crosses fifteen (15) major water courses (14 rivers and 1 lake), ranging in catchment areas between 60 and 17,000 ha.

Map A - All Season Road Route Location



The all-season access road will be constructed by conventional excavation and filling methods, borrowing material from cuts. A high proportion of the cuts will be in rock and drilling and blasting will generally be required. Road construction in permafrost susceptible soils will consist primarily of fill material placed on undisturbed original ground. Road fills will comprise of rock fill, with a surface of crushed rock. Streams will be crossed by using culverts or bridges suitably configured and sized to meet requirements for fish habitat and passage, and to safely convey anticipated flood flows.

3.0 Pre-Development

3.1 Site Conditions

The proposed all season road will traverse through a general topography consisting of glacial till, granular glaciofluvial mantle, bedrock, and marine deposits. Each of the different topographies will receive different design and construction considerations to limit the possibility of environmental disturbance. The areas that may experience temporary disturbance will be subject to appropriate mitigation plans, as described in the Best Management Practices (BMPs) section of this report.

Due to the regions climatic conditions and the timing window between snow fall and snow melt, the expected construction season will be between mid June and early September. In addition, construction windows of “least risk” will be adopted to reduce the risk of harmful alteration, destruction or disruption to aquatic habitat. The periods of least risk will be defined by others.

3.2 Materials

The proposed construction materials to be used for the new roadway will include:

- | | | |
|----|--|------------------------------|
| 1) | Blast Rock with 600mm Max. particle size | (Rock Fill) |
| 2) | Granular with 150mm Max. particle size | (Granular “B” Type II, III) |
| 3) | Crushed Granular with 37.5mm Max. particle size | (Granular “O”) |
| 4) | Un-graded granular fill with fine particle sizes | (Selected Subgrade Material) |

The expected erodibility classification, as per TAC National Guide to Erosion Control, has been designated as a low soil erodibility rating for the materials (1) to (3) and medium for material (4).

The following typical cross sections display examples of the materials listed above and their overall structure within the All Season Road.

Figure 1

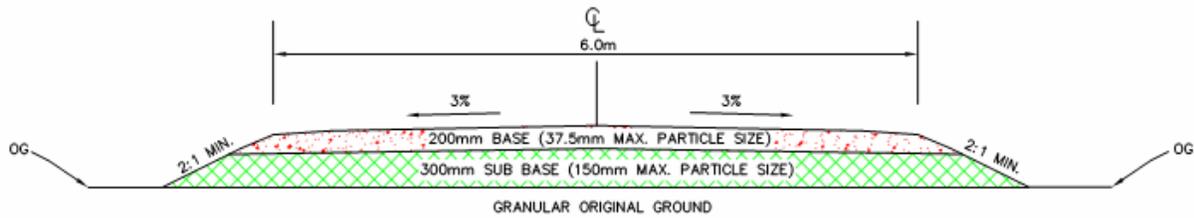


FIGURE 1
TYPICAL SECTION - GRANULAR ON GRANULAR N.T.S.

Figure 2

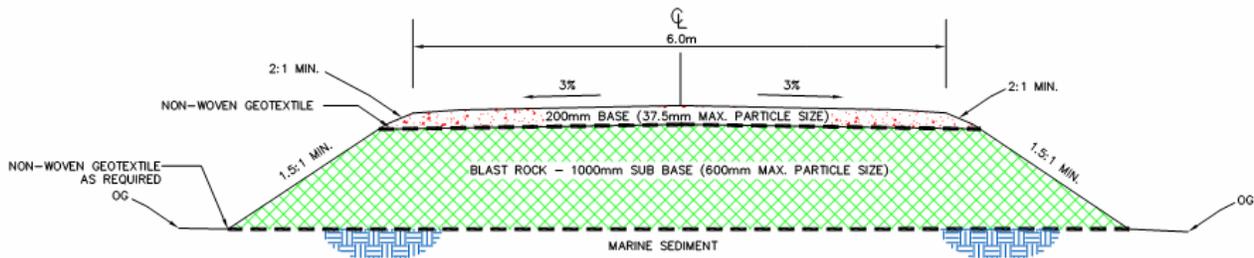


FIGURE 2
TYPICAL SECTION - MARINE SEDIMENT N.T.S.

Figure 3

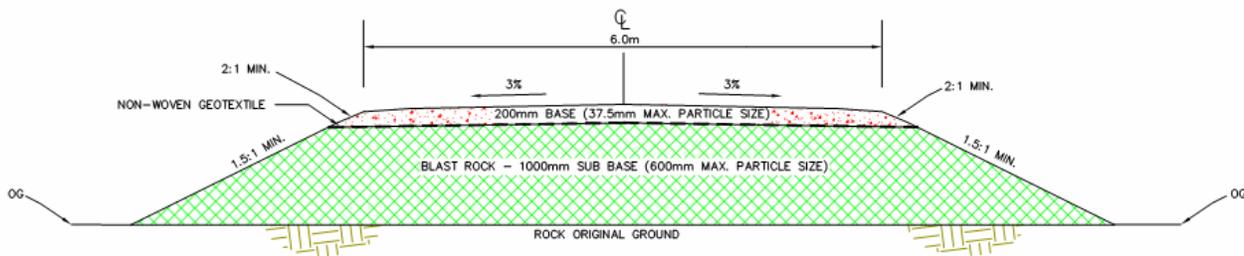


FIGURE 3
TYPICAL FILL SECTION - ROCK ORIGINAL GROUND N.T.S.

Figure 4

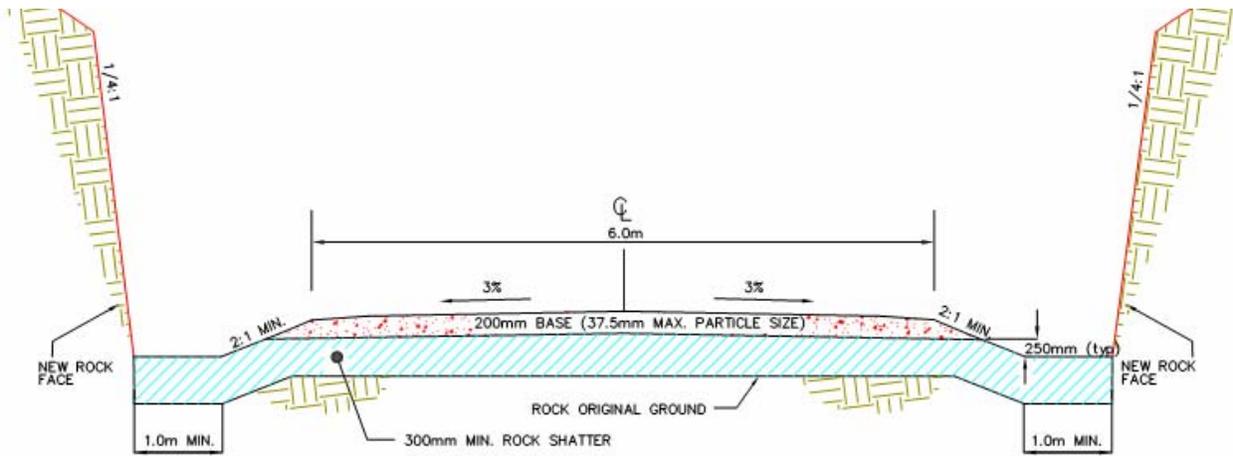


FIGURE 4
TYPICAL CUT SECTION - ROCK ORIGINAL GROUND N.T.S.

4.0 Areas of Potential Impacts

The High Lake Project development consists of four (4) main components, which include a Primary All Season Road, Secondary Access Roads, Borrow Sites, and an Airstrip. The proposed construction of each component has the potential to impact on the natural surrounding environment. Therefore, in order to prevent/control any potential negative impacts, during the construction of each component, all potential impacts will be clearly identified.

4.1 Primary All Season Road

The proposed all season road has (15) major water crossings identified throughout the alignment. In order to design appropriate water crossing solutions, a field reconnaissance was conducted to establish topography, hydraulic conditions, and environmental sensitivities at each of the (15) water crossings.

The water courses identified are (14) rivers and (1) lake. The river crossings have been designed with open or closed bottom culverts and modular bridges. The lake crossing has been designed as a rock causeway. All water crossing have been designed to minimize disruption and alteration to the surrounding environmental integrity.

Detailed conceptual plans have been developed for each crossing, which includes the location, road cross sections and profiles, channel flow data, aquatic habitat, general notes, and photos for each water crossing. The detailed conceptual plans are attached in APPENDIX B and should be read in conjunction with this report to provide a clear understanding of the proposed crossing recommendations.

In addition to the (15) water crossings throughout the all season road, all water bodies within 50m of construction activities have also been identified.

The following is a list of the water bodies identified that will require environmental protection during construction activities.

Station Start	Station End	Side	Distance (m)	Type
10+527	10+618	LT	30 TO 50	Lake
11+085	11+202	RT	8 TO 47	Lake
11+303	11+308	LT	45	Stream
11+615	11+718	LT	5 TO 50	Lake
12+148	12+169	RT	40	Lake
12+220	12+290	RT	23	Lake
12+194	12+532	LT	4	Lake
13+087	13+180	LT	21	Lake
13+239	13+257	RT	45	Lake
13+525	13+618	RT	22	Lake
15+738	15+796	RT	38	Lake
17+200	17+240	LT	27	Lake
18+613	18+636	LT	10	Lake
19+115	19+135	RT	7	Lake
19+354	19+381	LT	30	Lake
19+529	19+568	LT	33	Lake
20+204	20+310	LT	21	Lake
20+259	20+323	RT	5	Lake
20+450	20+726	LT	21	Lake
23+440	23+488	RT	16	Lake
25+744	25+752	RT	47	Lake
28+108	28+195	LT	Through	Swamp
31+121	31+178	RT	18	Lake
37+429	37+473	LT	36	Lake
37+767	37+800	RT	19	Lake
37+948	37+992	LT	22	Lake
39+566	39+622	LT	31	Lake
41+950	42+062	LT	24	Lake
42+430	42+512	LT	47	Lake
42+623	42+707	RT	13	Lake

Station Start	Station End	Side	Distance (m)	Type
42+623	42+707	RT	13	Lake
58+611	58+628	RT	48	Lake
59+096	59+414	RT	0	Stream
59+905	60+325	RT	31	Stream
61+508	61+657	RT	21	Stream
61+933	61+959	RT	46	Stream
63+145	63+149	LT	35-46	Lake
63+160	63+162	LT	38-40	Lake
63+230	63+241	LT	38	Lake
63+520	63+630	LT	5	Stream

Primary All Season Road potential impacts include:

- 1) Sediment transport into the natural streams and water bodies that could potentially affect the aquatic habitat therein.
- 2) Disruption and possible alteration to water courses during the installation of water crossings.
- 3) Overall tertiary drainage patterns experiencing a dam like effect from the proposed alignment.
- 4) Deterioration, in the long and short term, of the newly constructed road structure due to erosion.

The previously mentioned potential impacts will be addressed in Section 5 of the WCR.

4.2 Secondary Access Roads

Secondary access roads include all roads constructed other than the Primary All Season Road, such as:

- 1) Mine access and mine facility roads
- 2) All season access roads
- 3) Temporary tote road

4.2.1 Mine Access and Mine Facility Roads

The mine access roads will be constructed of materials that meet the same standards as the primary all season road. The number of access roads required is currently undefined and they will be developed on an as required basis to meet the needs of the mine facility. Typical cross sections can be viewed in Section 3.2 of this report.

Mine Access Roads potential impacts include:

- 1) Sediment transport into the natural streams and water bodies that could potentially affect the aquatic habitat therein.
- 2) Overall tertiary drainage patterns experiencing a dam like effect from the proposed alignment.
- 3) Deterioration, in the long and short term, of the newly constructed road structure due to erosion.
- 4) Deterioration, in the long and short term, of the newly constructed road structure due to erosion.

The previously mentioned potential impacts will be addressed in Section 5 of the WCR.

4.2.2 All Season Access Roads

Multiple all season access roads will be necessary in order to reach the required borrow sources from the all season road. The borrow sources will be used to provide granular and rock materials for the construction of the new roadway development. Currently two (2) all season access roads have been identified as requiring small water crossings solutions. The water crossings conceptual plans have been attached to this report in APPENDIX F of this report.

All Season Access Roads potential impacts include:

- 1) Sediment transport into the natural streams and water bodies that could potentially affect the aquatic habitat therein.
- 2) Disruption and possible alteration to water courses during the installation of water crossings.
- 3) Overall tertiary drainage patterns experiencing a dam like effect from the proposed alignment.
- 4) Deterioration, in the long and short term, of the newly constructed road structure due to erosion.

The previously mentioned potential impacts will be addressed in Section 5 of the WCR.

4.2.3 Temporary Tote Road

A Temporary Tote Road will be required from High Lake Mine to Sand Lake airstrip in order to allow for the initial development of the High Lake Mine operations. The road will be constructed of granular fill materials over bedrock, granular, and marine deposits. There are three water crossings identified along this section, which are identified as AS#13, AS#14, AS#15. Although the road will be designed as a temporary measure, all water crossings will be designed as permanent measures.

Temporary Tote Roads potential impacts include:

- 1) Sediment transport into the natural streams and water bodies that could potentially affect the aquatic habitat therein.
- 2) Disruption and possible alteration to water courses during the installation of water crossings.
- 3) Overall tertiary drainage patterns experiencing a dam like effect from the proposed alignment.
- 4) Deterioration, in the long and short term, of the newly constructed road structure due to erosion.

The previously mentioned potential impacts will be addressed in Section 5 of the WCR.

4.3 Airstrip

The airstrip will be constructed in two stages. The first stage will be constructed complete with a granular base for a length of 1460 m. The second stage will be constructed with rock fill materials as a cut/fill type of construction for an additional length of 540 m. There are two water bodies near the airstrip; Sand Lake and the Kenartic River. The Kenartic River runs parallel to the airstrip alignment on the east side and Sand Lake is positioned on the west side. The Kenartic River and Sand Lake have a minimum setback distance to the airstrip footprint of approximately 35m, at the S/E and N/W corners, respectively. A conceptual plan of the airstrip drainage can be reviewed in APPENDIX G of this report.

Airstrip potential impacts include:

- 1) Sediment transport into the natural streams and water bodies that could potentially affect the aquatic habitat therein.
- 2) Overall tertiary drainage patterns experiencing a dam like effect from the proposed alignment.
- 3) Deterioration, in the long and short term, of the newly constructed road structure due to erosion.
- 4) Deterioration, in the long and short term, of the newly constructed road structure due to erosion.

The previously mentioned potential impacts will be addressed in Section 5 of the WCR.

4.4 Borrow Sources

The borrow sources will provide the necessary materials to allow the development of the High Lake roadway system. Ten (10) possible borrow source locations have been identified to date. Borrow sources will be classified as a rock quarry site or a granular site. Rock quarry sites will require drilling and blasting, excavation and loading, and material transporting operations. Granular borrow will require pit face excavation, material stockpiling, and material transportation operations. A general plan of a typical borrow source with recommended protection measures in place is illustrated in APPENDIX E of this report.

Borrow Sources potential impacts include:

- 1) Sediment transport into the natural streams and water bodies that could potentially affect the aquatic habitat therein.

The previously mentioned potential impacts will be addressed in Section 5 of the WCR.

5.0 Mitigation Plans

The following is a breakdown of the previously mentioned potential impacts within Section 4 of this report and the recommended Mitigation Plans to address the potential impacts. The Mitigation Plans listed below will be provided in Section 5.1, 5.2, and 5.3 of this report:

- 1) Any construction within 50m of a water body will include appropriate protection measures as per the **Best Management Practices Plan** (Section 5.1) for erosion and sediment control. Typical details are illustrated in APPENDIX D of this report.
- 2) During the installation of the identified water crossings a water diversion and dewatering technique, as per the **Water Crossing Diversion and Dewatering Plan** (Section 5.2), will be used to control impacts to the natural environment. The recommendations are based on previously measured flow conditions; therefore, if a change in flow is recognized, an alternative construction method may be reviewed. If “dry conditions” (no flow) are observed at the time of construction no flow diversion methods will be necessary.
- 3) To prevent disruption of natural tertiary and seasonal drainage the procedures and methodologies as per the **General Drainage Plan** (Section 5.3) will be implemented.
- 4) As outlined in Section 3.2 of this report, all granular and rock materials should provide a high tolerance to future erosion. The selected subgrade fine materials may have a medium susceptibility to erosion, therefore, to provide protection from erosion the **Best Management Practices Plan** will be implemented, as required.
- 5) A Summary Table of the Water Crossing Report potential impacts and recommended mitigation measures has been provided in APPENDIX A of this report.

5.1 Best Management Practices (BMPs) for Erosion and Sediment Control

Best Management Practices for the WCR are measures taken to prevent erosion and, if erosion occurs, to prevent or reduce the release of sediment and debris to receiving water bodies. BMPs will be selected carefully to ensure that they will achieve their intended purpose. The following tables outline measures to be implemented (when applicable) during construction:

Procedural BMPs

Site Management

Method	No.	Comments
Minimize Exposed Soil	1	By minimizing the total disturbed soil area and the disturbed soil area at any time, the erosion potential is reduced and the quantity of sediment control measures is reduced. Stripping of new areas should be delayed as long as possible and restoration of constructed areas should be done as soon as possible. Grubbing of roots should also be delayed as long as possible based on work schedules - as root systems will help to stabilize soils even after surface vegetation has been cleared.
Perimeter Control	2	During clearing and grubbing, the minimized limits of construction activity should be clearly marked.
Site Access Management	3	The site should be accessible from a limited number of points. Frequently-used access roads should be paved or graveled to minimize the tracking of material off site. Vehicle washing on stabilized worksite entrances will minimize off-site sediment tracking.
StockPile Management	4	Stockpiles should not be located near watercourses, adjacent developed areas or environmentally sensitive areas. Stockpiles should be protected against erosion by water and wind immediately after they are established.
Sensitive Area Signage	5	Areas that are sensitive to disturbance and areas that must not be disturbed should be clearly signed to convey that message. Areas that represent a safety hazard, should be signed as such and barricaded if necessary.

Scheduling

No.	No.	Comments
Maximize Favorable Weather	6	Erosion potential is reduced by working during relatively dry conditions. This includes consideration of the construction season and may require a larger number of resources to complete the project in a shorter time.
Operate During Fisheries Windows	7	It is not acceptable to release sediment to receiving waterbodies at any time. However, scheduling work in or near fish-bearing waterbodies during open fisheries windows is recommended to reduce potential effects on fish and fish habitat. Note that this will not necessarily reduce the risk of harmful alteration, destruction or disruption (HADD) of fish habitat.
Optimize Construction Sequence	8	The sequence of construction should be specified with consideration of site management and scheduling BMPs. The construction sequence should be compatible with plans for progressive reclamation, instream works, stockpile operation, etc.
Install BMPs Early	9	Erosion potential can be minimized by installing ESC BMPs as soon as practical and always before soil is exposed. Early installation may require site access or traffic control considerations.
Restore Early	10	Erosion potential can be minimized by restoring or reclaiming constructed areas as soon as possible by topsoiling and seeding. Temporary works (detention ponds, sediment controls) should be removed as soon as practical when they are no longer needed.

Surface Water Management BMPs

Method	No.	Comments
Divert Clean Water	11	Clean water drainage from upstream areas should be diverted around the construction site wherever practical, to reduce the quantity of water that must be managed on site. This can be done using ditches, berms, pipes, hoses or temporary culverts as appropriate.
Intergrate New Drainage into the Project Design	12	If it is necessary to construct new ditches, pipes or culverts for on-site surface water management, integrating these with the project design will prevent future disturbance due to removal of temporary measures.
Keep Drainage Areas Small	13	Smaller drainage areas generally require less complex erosion control BMP arrangements and smaller drainage channels, so they are preferred if local topography permits. By discharging from a number of small discharge points the magnitude of effects from a potential failure is reduced.

Erosion Control BMPs

Exposed Surface Protection

Method	No.	Comments
Riparian Zone Preservation	14	Watercourse erosion potential is significantly reduced by preserving natural vegetation, to reduce runoff velocity and enhance infiltration.
Riprap armouring	15	Riprap and riverstone provide a flexible channel lining for protection against flowing water and can be used to construct drop structures and energy dissipation structures. Rock structure construction is relatively expensive and labor - intensive.
Gabions	16	Gabions provide a flexible channel lining for protection against flowing water and can be used to construct drop structures and energy dissipation structures.
Aggregate Cover	17	Gravel and rock blankets can stabilize soil surfaces including areas with seepage piping erosion. Rock protections are increasingly used to restore slumping areas in high precipitation regions.
Fibre Rolls and Wattles	18	Fibre rolls and wattles slow runoff and trap silt and can be effective on steep slopes. They function well in freeze-thaw conditions and are biodegradable. They are labor-intensive to install and are applicable to short slope lengths at a maximum slope of 1H:1V.
Check Dams	19	Check dams can be constructed of rock, aggregate-filled sandbags or logs to reduce flow velocities in drainage channels. Regular inspection and maintenance of such structures is essential to their effective operation.
Diversion Ditch	20	Diversion ditches, often combined with berms above steep slopes, can be used to collect runoff at the top of a slope and convey it around exposed areas. Berms on steep slopes should never be built without drainage ditches.
Coffer Dam	21	A temporary dam constructed of earth, sheet piling or other material to enclose a work area and permit the removal of water
Temporary stream diversion	22	Diversion of a watercourse into an artificial channel to permit construction "in the dry" of a culvert or bridge

Sediment Control BMPs

Infiltration Trapping

Method	No.	Comments
Riparian Zone Preservation	23	Natural vegetation can slow runoff through surface vegetation and trap it by infiltration or by settling as the flow velocity reduces within the vegetation. Freshly planted riparian vegetation is not as effective as that in well-established areas.

Settling

Method	No.	Comments
Silt Fence Barrier	24	Silt fences trap fine sediment from runoff by ponding to settle out coarser sediments. They are applicable to sheet flow sediment control only and require space to allow ponds form upstream. Failure of the fence may create flow concentrations and cause erosion. Silt fences have a service life of approximately one year, must have sediment removed frequently. They are susceptible to damage during sediment removal.
Berm (Dykes) Barrier	25	Barriers are constructed of low permeable materials and are installed on contour to intercept and create ponding of sheet or overland flow.
Sand Bag Barriers	26	Sand bag barriers trap fine sediment from runoff by ponding to settle out coarser sediments. They are applicable to sheet flow sediment control and require space to allow ponds to form upstream. Pea gravel in non-woven plastic bags are preferred because they do not result in environment damage if they break.
Check Dams	27	Check dams may be constructed of rock, aggregate-filled sand bags, logs. These reduce upstream flow velocities to control to control channel erosion and encourage settlement of coarse sediments. Check dam installation is labor-intensive and they are susceptible to failure if they are undermined or outflanked.
Turbidity Curtain	28	A geotextile barrier flowing, or quiescent, river, lake, or wetland to contain suspended sediment produced by construction.

In addition to the previously mentioned BMPs, the following measures and methodologies will be utilized during construction as General Environmental Constraints:

- 1) The person(s) performing the work are responsible for protection of people, property and the natural environment from environmental impacts and damage that may result from the work performed.
- 2) Environmental protection during construction will:
 - a. Comply with commitments and conditions of environmental approvals, permits, exemptions, agreements, reports, and clearances provided by the owner.
 - b. Comply with any other formal environmental approvals, permits, exemptions, agreements, reports, and clearances that must be produced by the person(s) performing the work; and
 - c. Be integrated with environmental and other requirements specified.
- 3) Environmental protection will include, but not be restricted to the control of materials, equipment and construction operations in order to avoid and minimize:
 - a. Direct physical damage;
 - b. Sediment, chemical, and other emissions; and
 - c. Interference with local use, access and passage
- 4) Such control will include but not be restricted to selection and management of:
 - a. Materials, equipment and method of construction, including the management of excess and contaminated materials;
 - b. Construction site disturbance limits; construction site access, detours and haul roads; earth aggregate and rock borrow areas; material storage and disposal areas; equipment storage areas; and
 - c. Timing, duration and staging of the work.
- 5) Deleterious materials, such as petroleum products, debris, waste, silt, rubble or concrete should not be allowed into a watercourse, unless otherwise specified. All activities will be controlled to prevent the entry of such materials into the watercourse.

- 6) Controls will include but not be restricted to the following:
 - a. All vegetated cover not specified for removal should be preserved in order to minimize erosion and sedimentation
 - b. Water and sediment discharged as part of the unwatering operations should be controlled to prevent sediment from entering water.
 - c. Construction material, surplus materials, construction debris and empty containers should be stored away from watercourses.
 - d. Maintenance and refueling of all equipment should be conducted away from the watercourses and controlled when required.
 - e. The work to be performed within environmental sensitive areas should be completed in a timely and diligent manner to minimize impacts.

- 7) Anyone undertaking or planning to undertake blasting will ensure the protection of fish and fish habitat in accordance with the requirements of the federal Fisheries Act and as recommended by the Department of Fisheries and Oceans.

- 8) The person(s) performing the work should establish the permanent specified cover materials, as soon as possible after exposing erodible materials.

- 9) Erosion and Sediment control techniques will be installed as per specifications and standards provided.

- 10) Limiting vehicular and machinery movement outside designed construction zones, where possible install in-stream devices, such as silt fence, to minimize the dispersion and extent of possible downstream sediment transport.

- 11) Maintain a standby supply of pre-fabricated silt fence barrier or equivalent ready to install sediment control devices, sufficient to extend a linear distance of 200m, for immediate employment (Contingency Plan).

- 12) Erosion control measures will be maintained until erodible areas have been stabilized and all finished slopes are protected as required.

5.2 Water Crossing Diversion and Dewatering Plan

Plan Objectives

The following water crossing diversion and dewatering plan has been developed with the objective of formalizing the procedures to be employed during the construction of stream crossing installation to provide a standard of care with respect to environmental integrity, fish habitat and passage, and before and after construction impacts.

The following water crossing diversion and dewatering techniques have been developed:

- 1) Dam and Pump Method
- 2) Exterior Temporary Diversion Channel
- 3) Interior Temporary Diversion Channel
- 4) Protection and Cover Method

Each of the four (4) techniques will be reviewed under the following sub-titles:

- Overall Description
- Materials required
- Anticipated Construction sequence
- Potential Impacts
- Mitigation of Impacts

This report will include a typical drawing for the water crossing diversion and dewatering techniques in APPENDIX C, which provides the general positioning and type of protection measures to be taken during the construction of the proposed water crossing solution.

Analysis of Alternatives

The installation of water crossing solutions such as closed or open bottom culverts and modular bridges require a work zone that will enable the construction to be conducted without impacting on the environmental sensitivities of the watercourse, while maintaining optimum “in the dry” working conditions. To accomplish a watercourse friendly work zone an alternative route for the water flow should be provided. Depending on the environmental sensitivities and the general topography of the area, an appropriate water crossing diversion and dewatering technique will be selected.

Technique # 1 – Dam and Pump Method

Description

The dam and pump method consists of constructing a temporary dam at the upstream and downstream ends of the required work zone. The stream flow will then be maintained by utilizing a bypass pumping system, as illustrated in APPENDIX C.

Materials

The dam should be constructed of a very low permeable material that will minimize any seepage into the work zone during construction. Acceptable materials are outlined in the BMPs chart and water-inflated dams. A Water-inflated dam will be illustrated in APPENDIX D.

Anticipated Construction Sequence

- 1) Installation of erosion and sediment control measures, as per BMPs.
- 2) Installation of erosion control measures (if required) at pump outlet.
- 3) Construction of a dam at the upstream end of the required work zone.
- 4) Construction of a dam on the downstream end of the required work zone.
- 5) Installation of bypass pumping system (maintain flow conditions)
- 6) Construction of stream crossing solution.
- 7) Removal of downstream dam
- 8) Removal of bypass pumping system
- 9) Removal of upstream dam

* Note: at multi-culvert installations, once the first culvert has been installed, if the hydraulic conditions can be met, the stream flow can be diverted into first culvert to manage flow during placement of the remaining culverts at this location.

Possible Impacts

The Dam and Pump Method may require the excavation of the streambed depending on the type of required crossing solution. The stream banks upstream and downstream for approximately 3 m to 5 m of the work zone may experience minor disruption. Riparian vegetation may also experience minor short term disruption upstream and downstream for approximately 3 m to 5 m of the work zone. The discharge of sediment or debris into the stream system will be minor/temporary in nature. Fish passage will require temporary blockage, short duration interruption which will depend on the type of crossing solutions.

Mitigation of Impacts

- Streambed: where feasible and hydraulically suitable, a simulated streambed of the original substrate will be constructed with local materials.
- Streambanks: If altered, the streambanks shall be stabilized upstream and downstream of the crossing using boulders or rip rap material (as per BMPs).
- Riparian Vegetation: Minor riparian vegetation alteration is anticipated during this operation and should not warrant replanting. Nevertheless, if riparian vegetation is altered significantly replanting of vegetation will take place.
- Fish passage: Permanent fish passage should be restored within a reasonable amount of time, while maintaining favorable aquatic conditions.
(In-stream construction, if required, will be carried out during the appropriate timing windows)
- Sedimentation: Silt fence sediment control as per BMPs.
- Erosion: Rip rap materials will be used as per BMPs.

Technique # 2 – Temporary Diversion Channel (interior)

Description

The temporary Interior diversion channel consists of narrowing the channel to permit a construction zone on either side of the stream channel for bridges or open bottom culverts. In addition, a temporary crossing may be required to facilitate equipment crossing during construction, as illustrated in APPENDIX C.

Materials

The diversion channel should be constructed of a non erodible material that will not negatively impact the stream habitat. The diversion channel shall be capable of carrying potential stream flows during the construction period (10 yr storm). Acceptable materials include durable sand bags wrapped in non woven geotextile or a water-inflated dam. A water-inflated dam is illustrated in APPENDIX D.

In conjunction with the diversion channel, a temporary crossing may be required such as a culvert with clean fill, to allow temporary equipment access across the stream. Materials include a plastic or steel culverts with clean rock fill.

Anticipated Construction Sequence

- 1) Place the channel boundaries into the water along both stream banks
- 2) Install sediment control measures, as per BMPs.
- 3) Construction of temporary crossing system (if required)
- 4) Placement of erosion control measures, as per BMPs.
- 5) Construction of permanent crossing solution
- 6) Removal of interior diversion materials

7) Removal of temporary crossing system

Possible Impacts

The temporary stream diversion should prevent sedimentation resulting from the construction in and around environmentally sensitive streams. The streambed should only experience minor disruption during the installation of the required crossing solution. The stream banks upstream and downstream for approximately 3 m to 5 m of the work zone may experience minor temporary disruption. Riparian vegetation may also experience minor disruption upstream and downstream from approximately 3 m to 5 m outside the work zone.

5.2.1.1 Mitigation of Impacts

Streambed: where feasible and hydraulically suitable, a simulated streambed of the original substrate will be constructed with local materials.

Streambanks: If altered, the streambanks shall be stabilized upstream and downstream of the crossing using boulders or rip rap material.

Riparian Vegetation: Only Minor riparian vegetation alteration is anticipated during this operation and should not warrant replanting. Nevertheless, if riparian vegetation is significantly altered, replanting of vegetation will take place.

Fish passage: A temporary fish passage will be provided to ensure suitable conditions. (In-stream construction, if required, will be carried out during the appropriate timing windows)

Sedimentation: Silt fence as per BMPs.

Erosion: Rip rap materials will be used as per BMPs

Technique #3	Temporary Stream Diversion (exterior)
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Description

The temporary stream diversion (exterior) channel requires the construction of an artificial channel around the work zone to permit construction on either side of the bridge or culvert, as illustrated in APPENDIX C.

Materials

The diversion channel should be constructed of non erodible materials that will not negatively impact the stream habitat. The diversion channel shall be capable of carrying the potential stream flows during the construction period (10 yr storm). Acceptable materials include durable sand bags wrapped in non woven geotextile, water-inflated dams, and rip rap (rock) lining materials. Water-inflated dam and sandbag barrier typical drawings are illustrated in APPENDIX D.

In conjunction with the diversion channel, a temporary crossing may be required such as a culvert with clean fill, to allow temporary equipment access across the newly constructed diversion channel. Materials include plastic or steel culverts and clean rock fills.

Anticipated Construction Sequence

- 1) Installation of sediment control measures, as per BMPs.
- 2) Construction of diversion channel (excluding inlet and outlet)
- 3) Construction of temporary crossing (if required)
- 4) Installation of a upstream dam on main stream channel
- 5) Installation of sump pump in construction zone (pump through a filter material)
- 6) Installation of downstream dam
- 7) Placement of erosion protection on stream banks/culvert ends of main channel, as per BMPs.

- 8) Construction of stream crossing solution
- 9) Removal of downstream, then upstream dam
- 10) Deconstruction of diversion channel, as per BMPs

Possible Impacts

The temporary stream diversion should prevent sedimentation resulting from the construction in and around environmentally sensitive streams. The streambed may experience minor disruption during the installation of the required crossing solution. The stream banks upstream and downstream for approximately 3 m to 5 m of the work zone may experience minor temporary disruption. Riparian vegetation may also experience minor disruption upstream and downstream from approximately 3 m to 5 m outside the work zone.

Mitigation of Impacts

- Streambed: where feasible and hydraulically suitable, a simulated streambed of the original substrate will be constructed with local materials.
- Streambanks: If altered, the streambanks shall be stabilized upstream and downstream of the crossing using boulders or rip rap material.
- Riparian Vegetation: Minor riparian vegetation alteration is anticipated during this operation and should not warrant replanting. Nevertheless, if riparian vegetation is significantly altered, replanting of vegetation will take place.
- Fish passage: Temporary fish passage will be provided to accommodate suitable conditions.
- Sedimentation: Silt fence as per BMPs.

Erosion: Rip rap materials will be used as per BMPs

Technique #4	Protection and Cover Method
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Description

The Protection and Cover Method is specifically designed to mitigate possible disruption to the flow of water between boulders. A boulder field can produce a unique flow of water between and below the layered boulders which results in an undefined channel. Therefore, in order to carry out construction without negatively disturbing the natural water flow or environmental integrity, it is necessary to implement a flow protection plan. The protection and cover method involves the use of a non woven geotextile cloth to be placed over the existing boulders which is then covered with clean rock fill. The geotextile will eliminate the chance of infill material to obstruct the natural flow. The protection and cover method is illustrated in APPENDIX C of this report.

Materials

The material used as the geotextile will be of non woven type II with a high tensile tear resistance. The material used as cover will be of clean rock fill with a high permeability.

Anticipated Construction Sequence

- 1) Installation of sediment control measures, as per BMPs.
- 2) Installation of erosion control measures, as per BMPs.
- 3) Roll out non woven geotextile of the entire construction zone footprint.
- 4) Place a pad of clean rock fill over work zone.
- 5) Installation of water crossing solution (culvert, bridge, etc).

Possible Impacts

The Protection and cover method should experience no negative affects to the streambed or streambanks. Riparian and vegetation impact should be negligible due to the topography of a boulder field area.

Mitigation of Impacts

- Streambed: The natural streambed will remain as the original substrate.
- Streambanks: If altered, the streambanks shall be stabilized upstream and downstream of the crossing using boulders or rip rap material.
- Riparian Vegetation: No riparian vegetation alteration is anticipated during this operation and should not warrant replanting.
- Fish passage: No negative affects
* Construction will be carried out during the appropriate timing windows.
- Sedimentation: Silt fence will be as per BMPs.
- Erosion: Rip rap materials will be used as per BMPs.

5.3 General Drainage Plan

The proposed alignments of the all season road, secondary access roads, and airstrip will traverse through different watersheds at varying levels of drainage, which include primary (large rivers), secondary (small rivers and streams), and tertiary (overland undefined flow). All primary and secondary levels of drainage have been designed with appropriate water crossing solutions. The majority of fill material will be constructed of “free flowing” rock fill, which presents little concern with respect to disrupting of tertiary drainage patterns. Granular fills consisting of materials with a lower permeability, may experience a disruption in tertiary drainage.

Therefore, in order to maintain the nature drainage of each watershed and reduce surface ponding, the new alignments may require the integration of “free flow” conditions to eliminate the possibility of a dam like situation.

Section (1) and (2) of the General Drainage Plan will outline the measures to be taken for roadway and airstrip impacts, respectively.

Section 1 - Roadway Drainage

To minimize drainage disruption from roadway construction, it is recommended that 600mm diameter CSP culverts be placed, as per standards and specifications, in all areas that warrant application. The placement of “equalizer” culverts will be determined during construction by the contractor and inspection staff as required.

Site conditions that would warrant equalizer installations include the following:

- 1) Areas experiencing saturated conditions
- 2) Areas that display previous flow characteristics
- 3) Areas pre-determined to have possible concern of water ponding

Section 2 – Airstrip Drainage

In addition to road drainage effects, the airstrip has been identified as a potential concern with respect to seasonal and tertiary drainage collection and diversion. The airstrip could potentially act as a dam to the surrounding sheet flow drainage, thus developing into isolated flow conditions. The isolated flow could increase erosion potential and sediment transport to surrounding sensitive water bodies.

Mitigation measures from the Surface Water Management BMPs Plan will be implemented to mitigate the potential of negatively affecting the environment.

In addition, the following measures are recommended:

- 1) Construct a system of primary and secondary ditching
- 2) Provide a retention pond to facilitate the water collected by ditches
- 3) During construction heavy duty silt fence barriers should be used to control sediment from entering watercourses.
- 4) After construction permanent rock berms with geotextile should be used to control sedimentation and to divert water into favorable drainage areas.
- 5) Use riprap protection to reduce potential erosion, as required.

See APPENDIX G for a conceptual plan of the airstrip drainage with recommended mitigation measures.

The general drainage system will be installed as a permanent solution, and therefore, will be designed for long term performance.

6.0 Maintenance and Inspection

Environmental inspection should be carried out to monitor the erosion and sedimentation controls (ESC) on a weekly basis for general compliance during construction and daily for environmental sensitive areas that require detailed inspection. Particular attention should be given to water crossing erosion and sediment control areas under construction during significant rainfall. A contingency plan should be submitted by the owner for dealing with extreme conditions, such as heavy rainfall, flooding, etc. A record of inspection should be kept in a hardbound environmental diary, which should be kept on site.

7.0 Closure

We trust the above addresses the project requirements at this time. Should you have any questions or comments, please do not hesitate to contact TBT Engineering at your convenience.

Yours truly,
For TBT Engineering

Prepared by:



Adam Rose, EIT
TBT Engineering

May 1, 2007

Date

Reviewed by:

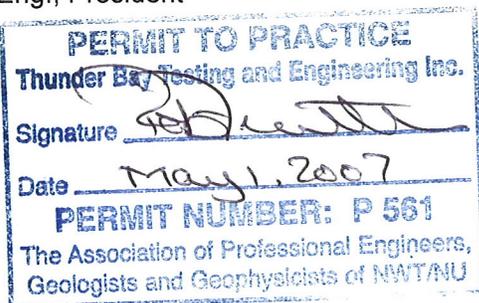


R. J. Frenette, P. Eng., President
TBT Engineering



May 1, 2007

Date



8.0 References

1. Environmental Guide to Erosion and Sediment Control during Construction of Highway Projects, February 2007. Ministry of Transportation Ontario.
2. B.C. Ministry of Forests. 2002. Fish-stream crossing guidebook. For. Prac. Br., Min. For., Victoria, B.C. Forest Practices Code of British Columbia guidebook.
3. Ministry of Transportation Ontario. Drainage Management Manual, 1995-1997.
4. National Guide to Erosion and Sediment Control on Roadway Projects. May 2005.
5. Ontario Provincial Standards for Roads and Public Works. Volume 1 to Volume 4. Nov 2006.

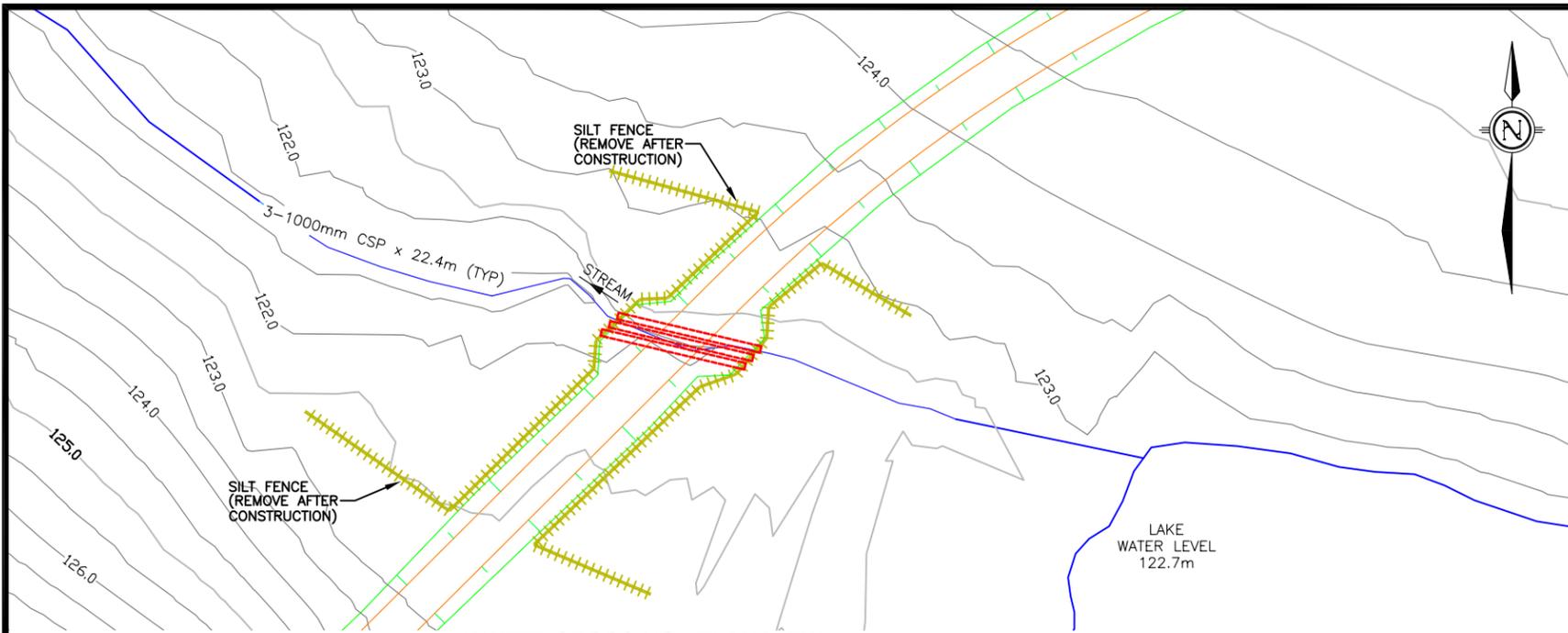
APPENDIX A

Summary Table

Potential Impacts	Recommended Mitigation Plans			
	Minor Components	Best Managements Practices Erosion and Sediment Control	Stream Diversion and Dewatering Plan	General (Tertiary) Drainage Plan
All Season Road	AS#1	BMPs # 1 - 11, 24, 26	Technique # 1	N/A
	AS#2	BMPs # 1 - 11, 24, 25, 26	Technique # 2	
	AS#3	BMPs # 1 - 11, 22, 24, 25, 26, 17	Technique # 3	
	AS#4	BMPs # 1 - 11, 15, 24	Technique # 4	
	AS#5	BMPs # 1 - 11	N/A	
	AS#6	BMPs # 1 - 11, 24, 26	Technique # 1	
	AS#7	BMPs # 1 - 11, 15, 24	Technique # 4	
	AS#8	BMPs # 1 - 11, 15, 24	Technique # 4	
	AS#9	BMPs # 1 - 11, 24, 25, 26	Technique # 2	
	AS#10	BMPs # 1 - 11, 17, 24	Technique # 4	
	AS#11	BMPs # 1 - 11, 24, 26	Technique # 1	
	AS#12	BMPs # 1 - 11, 24, 25, 26	Technique # 2	
	AS#13	BMPs # 1 - 11, 15, 22, 24, 25, 26	Technique # 3	
	AS#14	BMPs # 1 - 11, 15, 24, 25, 26	Technique # 2	
	AS#15	BMPs # 1 - 11, 24, 26	Technique # 1	
Road Construction	BMPs # 1-10 will be maintained during all construction activities. Areas within 50m of a water body BMPs # 15, 19, 20, 24, as required	N/A	In areas of granular road base construction, Section (1) will be followed as required.	
Major Components	Location and Alignment	Construction activities will maintain BMPs # 1-10 Permanent measures for water diversion and erosion and sediment control should be placed as per BMPs # 12, 13, 19, 20, 25, 27 Locations of minimum setback distances to the Kenartic River and Sand Lake will implement permanent erosion and sediment control.	N/A	As per Section (2) See APPENDIX G of the Water Crossing Report for a conceptual plan drawing
	Mining Facility Roads	BMPs # 1-10 will be maintained during all construction activities. Areas within 50m of a water body BMPs # 17, 19, 20, 24 as required.	N/A	In areas of granular road base construction, Section (1) will be followed Rock fill situations will provide acceptable free flow conditions, therefore, will not require additional drainage support
Secondary Roads	Permanent Access Roads	BMPs # 1-10 will be maintained during all construction activities. Areas within 50m of a water body BMPs # 17, 19, 20, 24 as required Water crossings as per BMPs # 1 - 11, 24, 26 .	Two (2) water crossings have been identified. Culverts will be installed at each crossing (See APPENDIX F) for detailed conceptual plans Technique # 1	In areas of granular road base construction, Section (1) will be followed Rock fill situations will provide acceptable free flow conditions, therefore, will not require additional drainage support
	Temporary Tote Roads	BMPs # 1-10 will be maintained during all construction activities. Areas within 50m of a water body BMPs # 17, 19, 20, 24	Water Crossing AS #13,14,15 - As per All season Road	In areas of granular road base construction, Section (1) will be followed as required.
Borrow Site	Various Locations	BMPs # 1-10 will be maintained during all construction activities. Areas within 50m of a water body BMPs # 17, 19, 20, 24, 25 See APPENDIX E within Water Crossing Report, to review a typical drawing illustrating erosion and sediment control measures.	N/A	N/A

APPENDIX B

Detailed Conceptual Plans (Water Crossings)



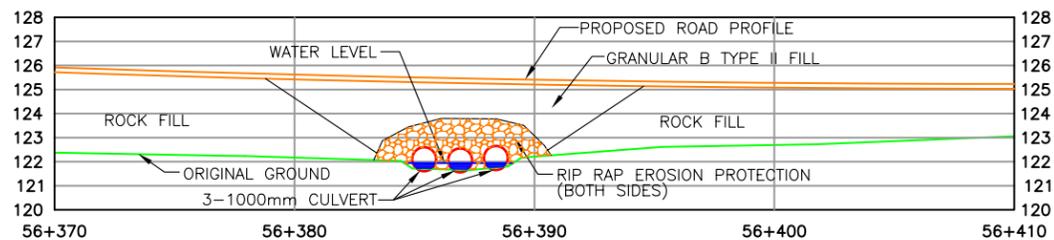
WATER CROSSING - PLAN VIEW

SCALE 1:1000

REFERENCE	AS#01
CROSSING	4
SUBSTRATE	FINES
FISH HABITAT (Y/N)	Y
WATERSHED AREA	377.32 ha
MEASURED DISCHARGE	3.77 km ³ /s
DISCHARGE - 100 YR	0.264 m ³ /s
DISCHARGE - 10 YR	2.4
CROSSING TYPE	1000 mm CULVERT

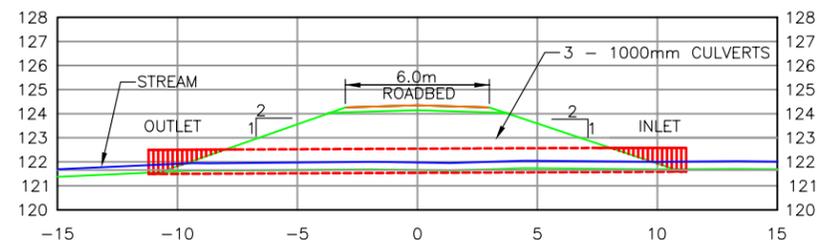
NOTES:

1. THIS CROSSING IS CATEGORIZED AS A LOW TO MODERATE FISH HABITAT, AS IT HAS SEASONAL REARING HABITAT ONLY.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. THE BOTTOM OF THE CULVERT SHALL BE BURIED INTO THE STREAMBED NOT LESS THAN 10% OF THE CULVERT HEIGHT.
4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
6. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.



ROAD CL PROFILE - ELEVATION VIEW

SCALE 1:300



CULVERT CL CROSS-SECTION

SCALE 1:300



PHOTO AS#01 - LOOKING DOWNSTREAM WESTERLY

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
 STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

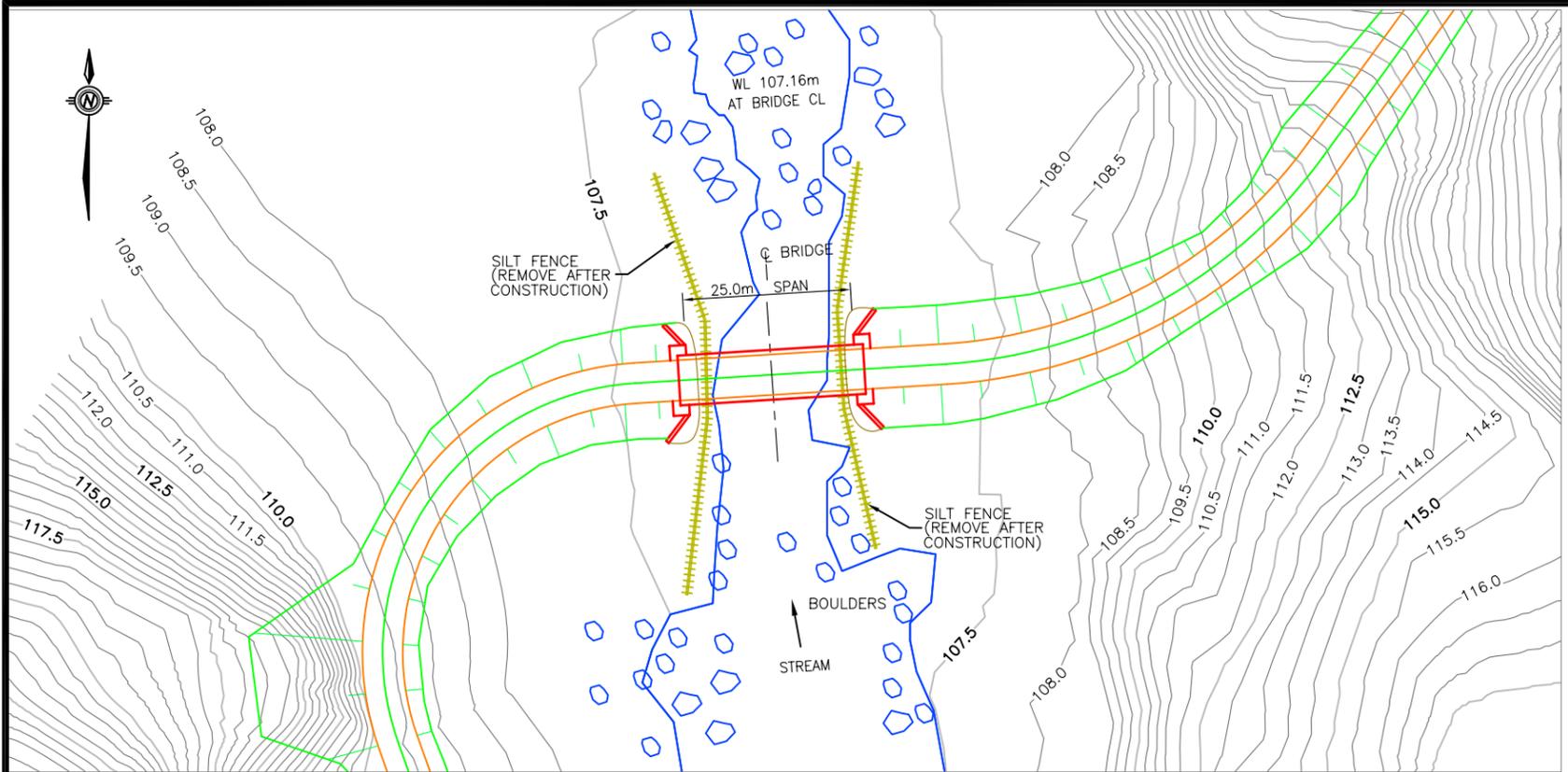
NOT FOR CONSTRUCTION

20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ
DATE	REVISION	BY

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PROJECT:	ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT

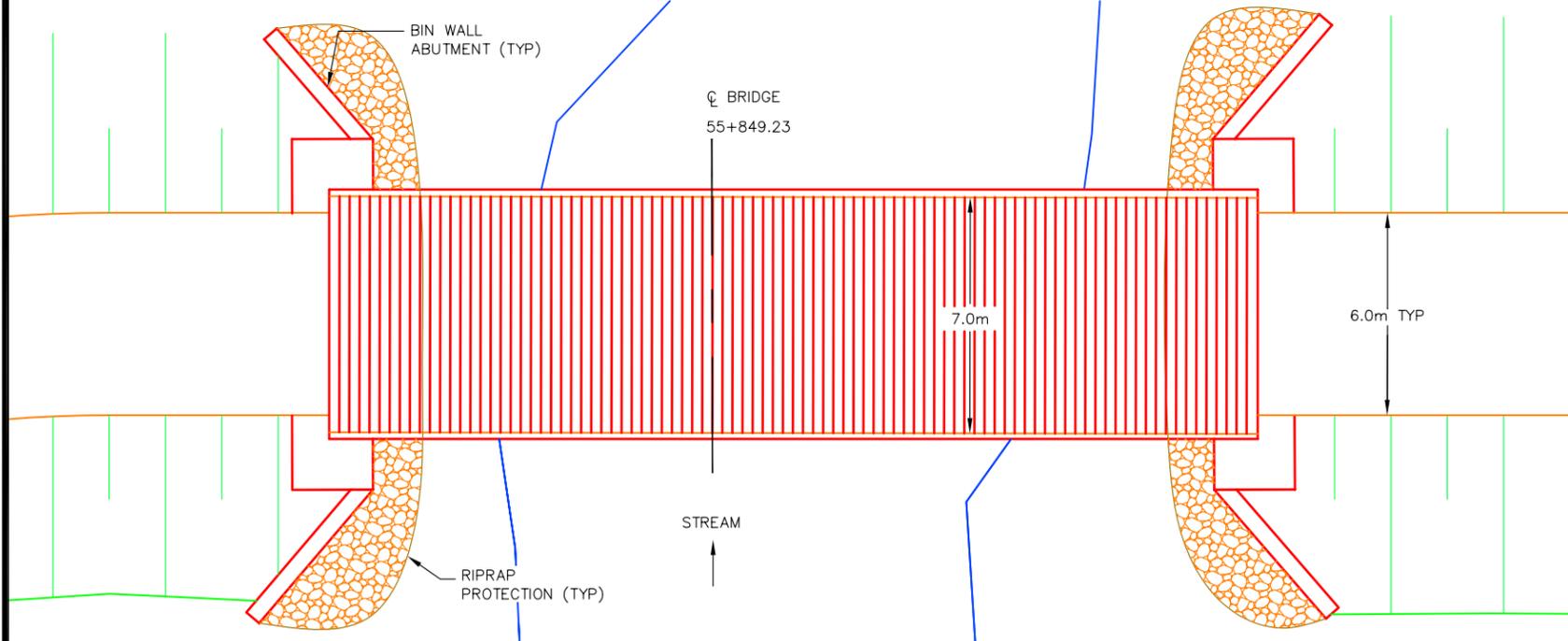
CLIENT:	TBT ENGINEERING	DRAWN BY:	D.Mc./T.B.	PROJECT NO.:	05-160
		APPROVED BY:	R.F.	DATE:	APRIL 2007
		SCALE:	AS SHOWN	ENCLOSURE:	1

CAD REF. NO.: AS#01



WATER CROSSING - PLAN VIEW

SCALE 1:1000



WATER CROSSING DETAIL - PLAN VIEW

SCALE 1:200

NOTES:

1. THIS CROSSING IS CATEGORIZED AS MODERATE FISH HABITAT, AS IT HAS LIMITED MIGRATION AND SEASONAL REARING HABITAT.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. BRIDGE CONSTRUCTION TO CONFORM TO REQUIREMENTS OF THE FISHERIES ACT.
4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
6. BRIDGE STRUCTURE WILL BE ABOVE THE ORDINARY HIGH WATER MARK AND AWAY FROM BANKS.
7. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.

REFERENCE	AS#02
CROSSING	5
SUBSTRATE	BOULDER/COBBLE
FISH HABITAT (Y/N)	Y
WATERSHED AREA	7840.07 ha
AREA	78.40 km ² /s
MEASURED DISCHARGE	1.98 m ³ /s
DISCHARGE - 100 YR	50.7
DISCHARGE - 10 YR	39.1
CROSSING TYPE	25m BRIDGE

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
 STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

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15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

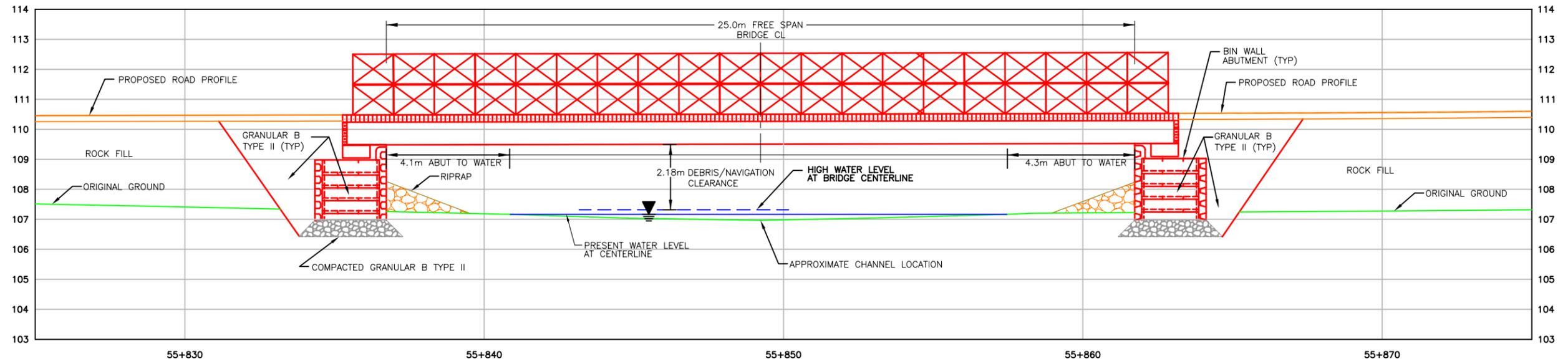
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PROJECT: **ALL-SEASON ROAD DESIGN**

HIGH LAKE, NUNAVUT

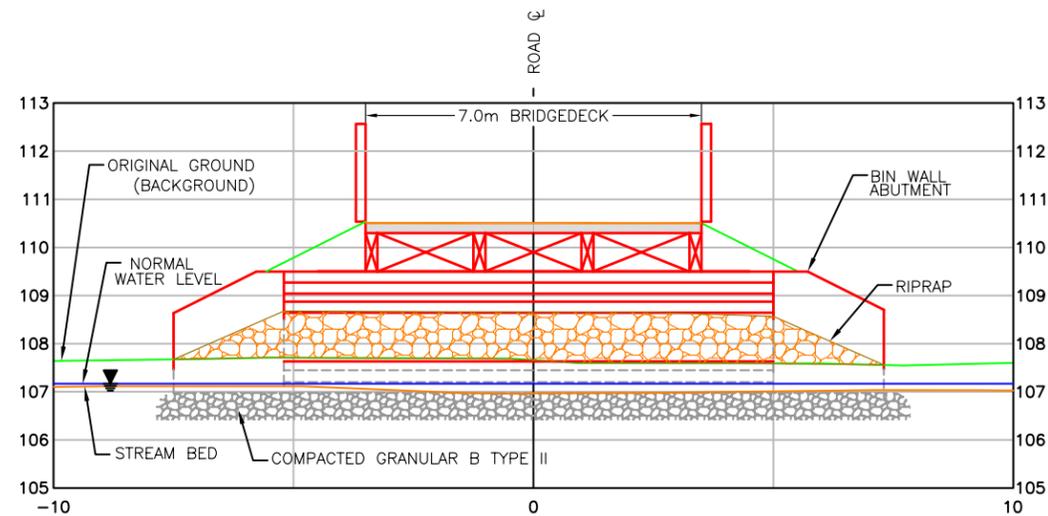
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	APPROVED BY: R.F.	DATE: APRIL 2007
SCALE: AS SHOWN	ENCLOSURE 2	

CAD REF. NO. A8124TB



ROAD CL PROFILE - ELEVATION VIEW

SCALE 1:150



BRIDGE CL CROSS-SECTION

SCALE 1:150



PHOTO AS#02 - LOOKING UPSTREAM NORTHERLY

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
 STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

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15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

DWG. TITLE: **WATER CROSSING LOCATION PLAN AS#02**

PROJECT: **ALL-SEASON ROAD DESIGN**

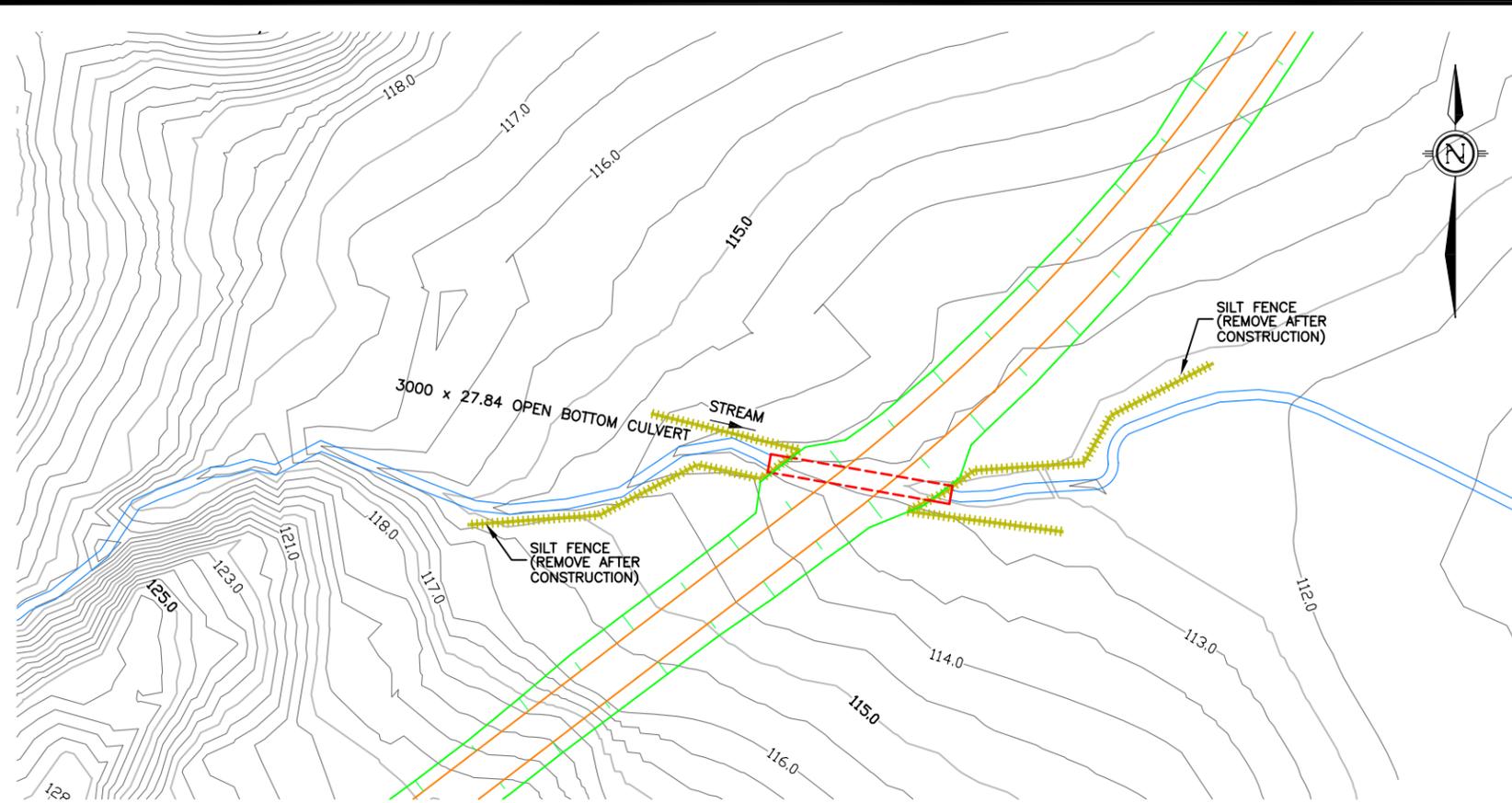
HIGH LAKE, NUNAVUT

TBT ENGINEERING

CLIENT: **WOLFDEN Resources Inc.**

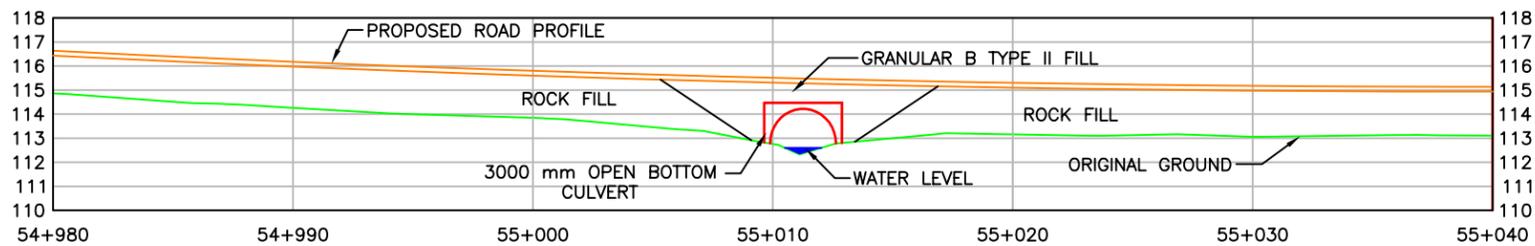
DRAWN BY: D.Mc./T.B.	PROJECT NO. 05-160
APPROVED BY: R.F.	DATE: APRIL 2007
SCALE: AS SHOWN	ENCLOSURE 3

CAD REF. NO.: AS124TB



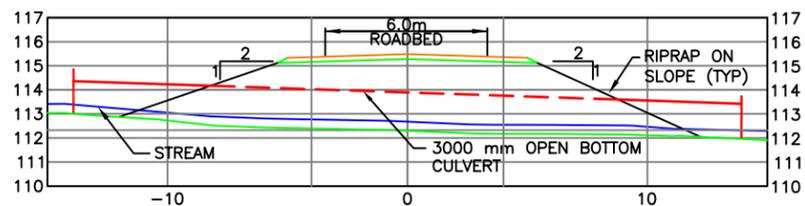
WATER CROSSING - PLAN VIEW

SCALE 1:1000



ROAD CL PROFILE - ELEVATION VIEW

SCALE 1:300



CULVERT CL CROSS-SECTION

SCALE 1:300

REFERENCE	AS#03
CROSSING	6
SUBSTRATE	FINES/COBBLE/BOULDER
FISH HABITAT (Y/N)	Y
WATERSHED AREA	381.69 ha
AREA	3.82 km ² /s
MEASURED DISCHARGE	0.13 m ³ /s
DISCHARGE - 100 YR	2.4
DISCHARGE - 10 YR	1.9
CROSSING TYPE	3000 mm OPEN BOTTOM CULVERT

NOTES:

1. THIS CROSSING IS CATEGORIZED AS LOW TO MODERATE FISH HABITAT, AS IT HAS SEASONAL REARING HABITAT ONLY.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. NO DISTURBANCE TO THE STREAMBED WILL BE ENCOUNTERED DURING CONSTRUCTION OR OPERATION. OPEN BOTTOM CULVERT FOOTINGS TO BE PLACED OUTSIDE OF STREAMBED FOOTPRINT.
4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
6. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.



PHOTO AS#03 - LOOKING WESTERLY

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005. STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

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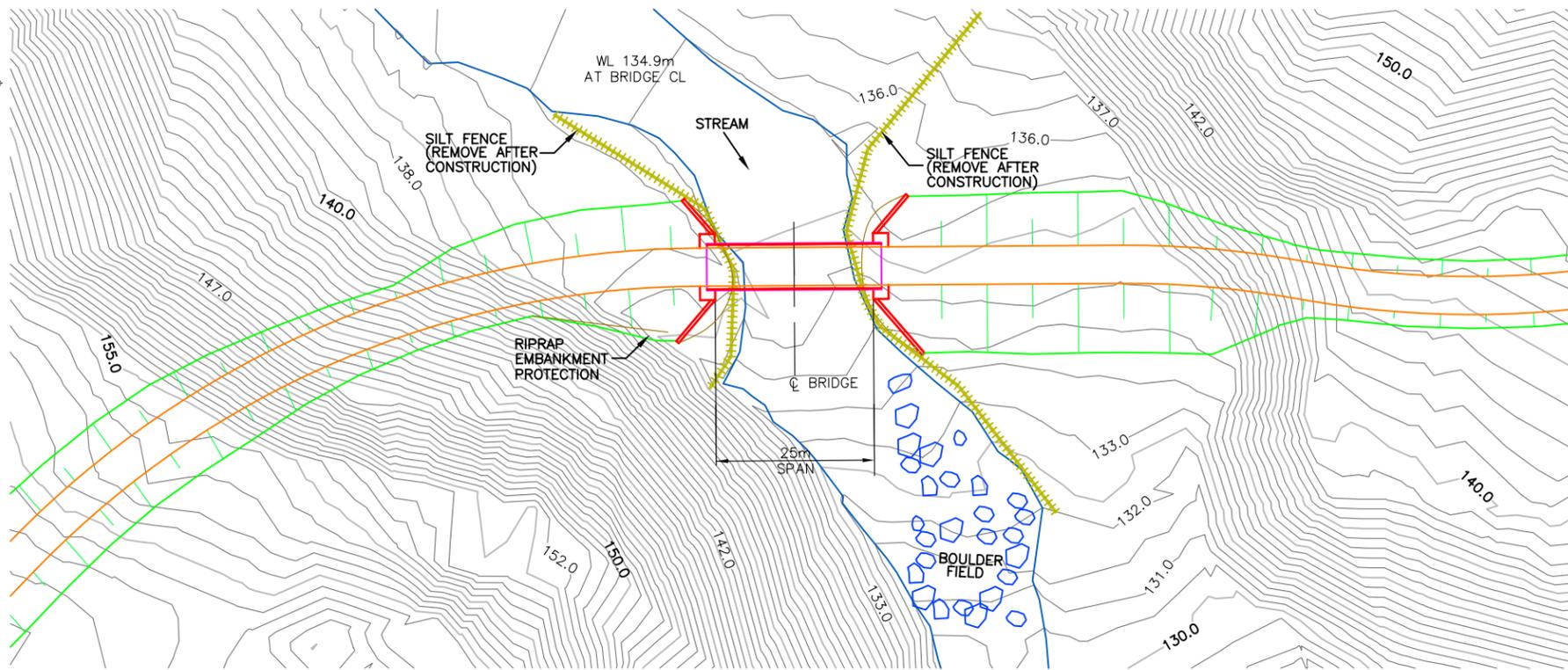
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PROJECT:	ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT

TBT ENGINEERING

CLIENT: WOLFDEN Resources Inc.

DRAWN BY:	D.Mc.J.T.B.	PROJECT NO.:	05-160
APPROVED BY:	R.F.	DATE:	APRIL 2007
SCALE:	AS SHOWN	ENCLOSURE:	4

CAD REF. NO.: AS022B



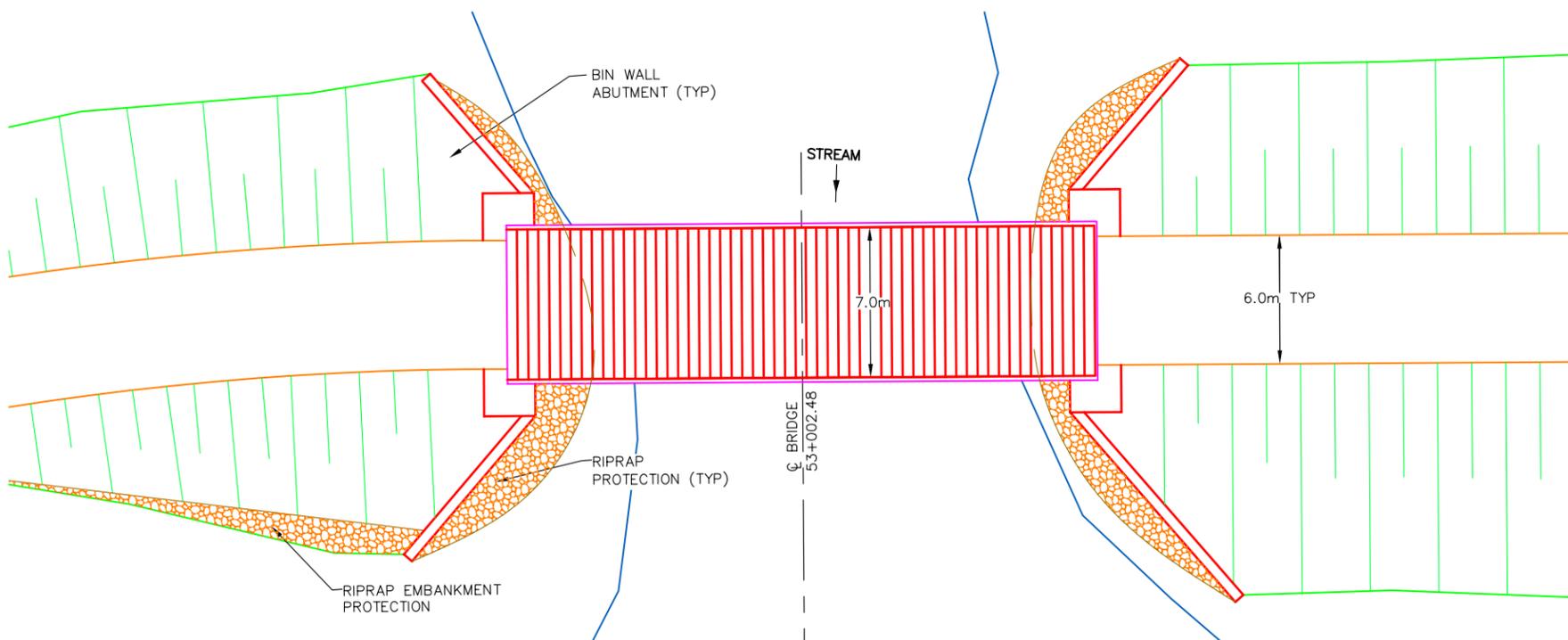
WATER CROSSING - PLAN VIEW

SCALE 1:1000

NOTES:

1. THIS CROSSING IS CATEGORIZED AS LOW TO MODERATE FISH HABITAT, AS IT HAS LIMITED MIGRATION AND SEASONAL REARING HABITAT.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. BRIDGE CONSTRUCTION TO CONFORM TO REQUIREMENTS OF THE FISHERIES ACT.
4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
6. BRIDGE STRUCTURE WILL BE ABOVE THE ORDINARY HIGH WATER MARK AND AWAY FROM BANKS.
7. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.

REFERENCE	AS#04
CROSSING	7
SUBSTRATE	BOULDERS/COBBLES
FISH HABITAT (Y/N)	Y
WATERSHED AREA	7067.23 ha
AREA	70.67 km ² /s
MEASURED DISCHARGE	2.84 m ³ /s
DISCHARGE - 100 YR	46.2
DISCHARGE - 10 YR	35.6
CROSSING TYPE	25m BRIDGE



WATER CROSSING DETAIL - PLAN VIEW

SCALE 1:300

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
 STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

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15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ
DATE	REVISION	BY

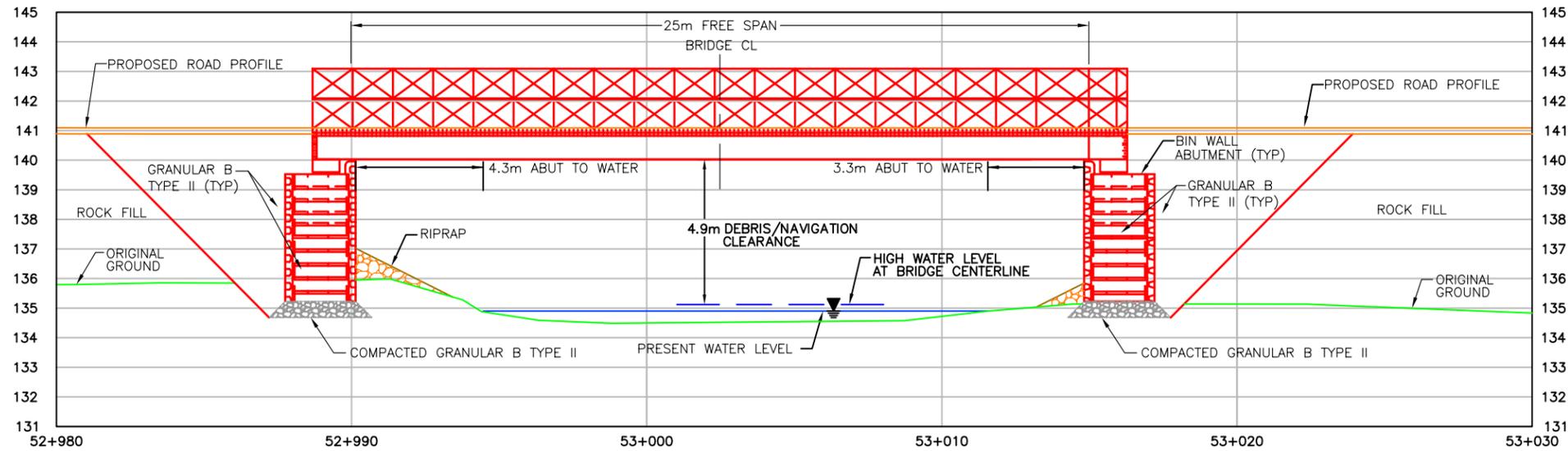
DWG. TITLE: **WATER CROSSING LOCATION PLAN AS#04**

PROJECT: **ALL-SEASON ROAD DESIGN**

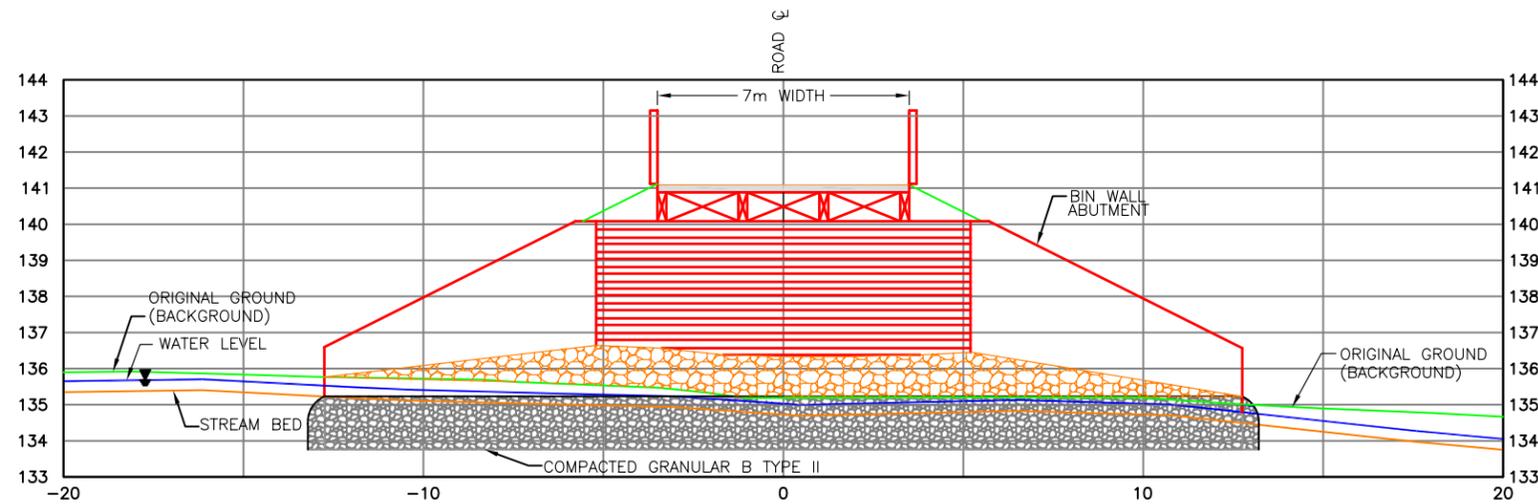
HIGH LAKE, NUNAVUT

 TBT ENGINEERING	DRAWN BY:	PROJECT NO.
	D.Mc./T.B.	05-160
 CLIENT: WOLF DEN Resources Inc.	APPROVED BY:	DATE:
	R.F.	APRIL 2007
SCALE:	ENCLOSURE	
AS SHOWN	5	

CAD REF. NO.: AS0421B



ROAD CL PROFILE
SCALE 1:200



BRIDGE CL CROSS-SECTION
SCALE 1:200



PHOTO AS#04 - LOOKING UPSTREAM NORTHERLY

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

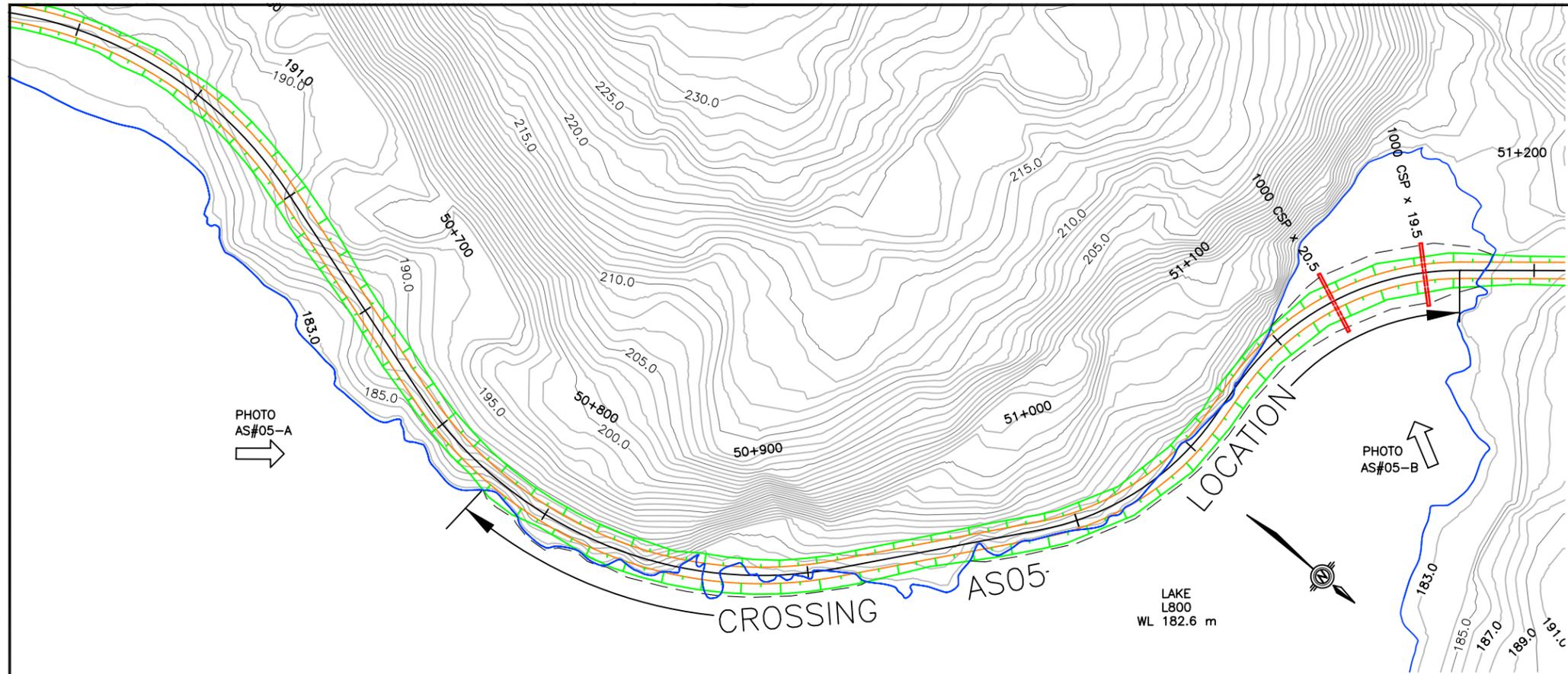
NOT FOR CONSTRUCTION

DATE	REVISION	BY
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#04
PROJECT:	ALL-SEASON ROAD DESIGN
	HIGH LAKE, NUNAVUT

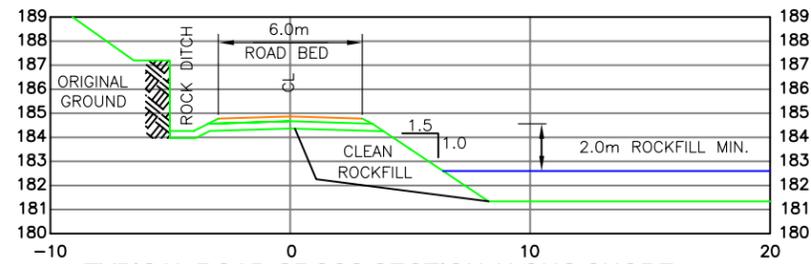
	DRAWN BY:	T.B.	PROJECT NO.	05-160
	APPROVED BY:	R.F.	DATE:	APRIL 2007
	SCALE:	AS SHOWN	ENCLOSURE	6

CAD REF. NO.: AS04-218



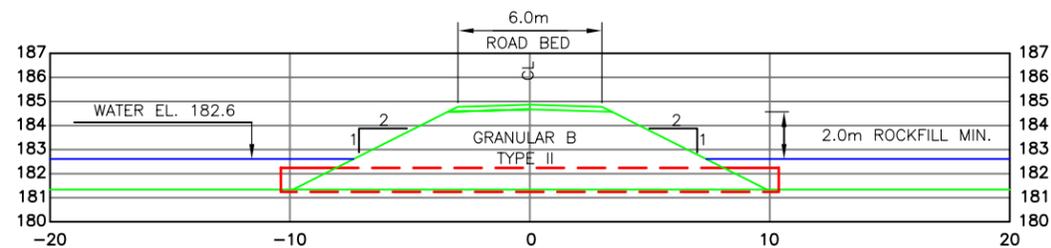
WATER CROSSING - PLAN VIEW

SCALE 1:2000



TYPICAL ROAD CROSS SECTION ALONG SHORE

SCALE 1:300



TYPICAL CULVERT CROSS SECTION

SCALE 1:300

NOTES:

1. THIS LAKE HAS NOT BEEN ASSESSED.
2. ROAD WIDTH TO BE 12.0m WIDE ON LAKE CROSSING.
3. ONLY CLEAN ROCK BACKFILL TO BE USED IN LAKE.
4. CLEAN ROCK BACKFILL TO EXTEND 2.0m ABOVE WATER SURFACE.
5. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
6. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
7. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.



PHOTO AS#05-A - LOOKING WEST



PHOTO AS#05-B - AERIAL VIEW NW CORNER LAKE L800

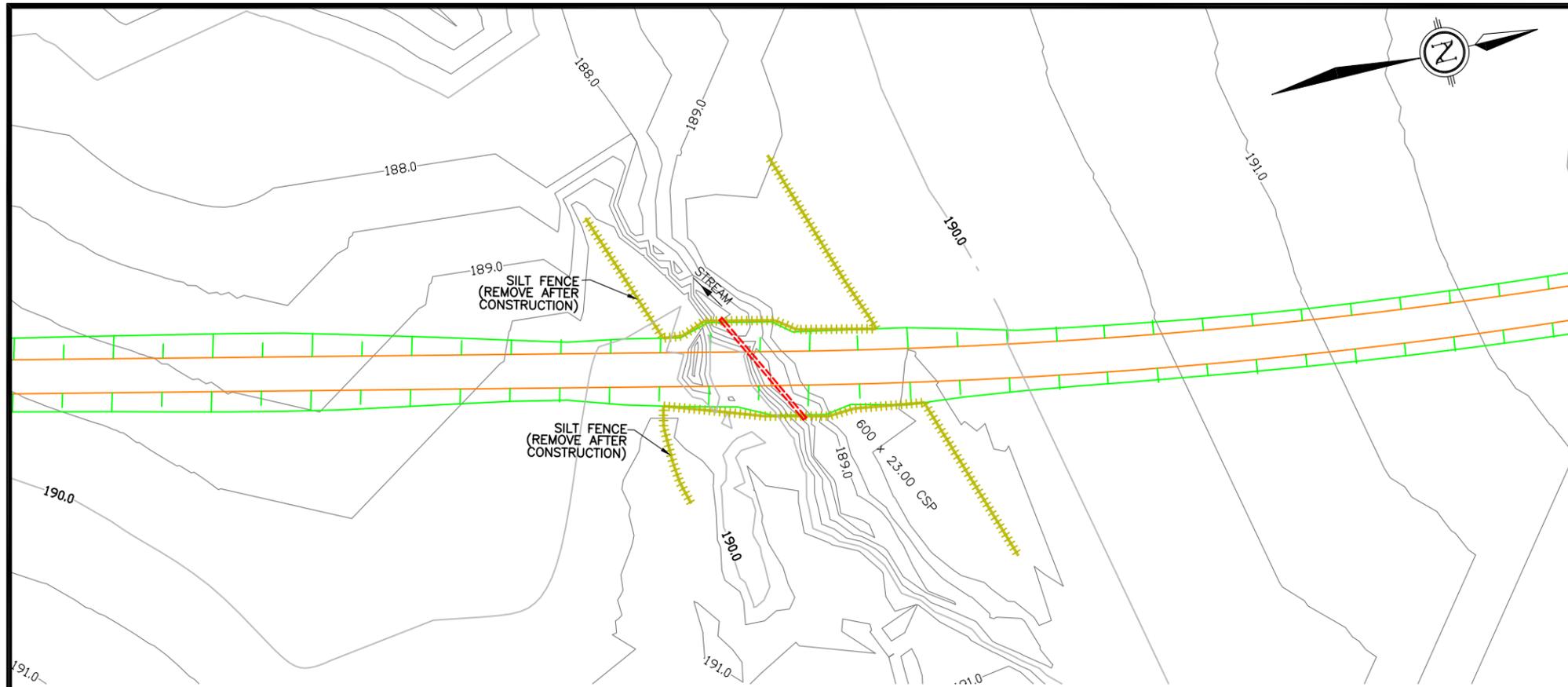
WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005. STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

DATE	REVISION	BY
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#05
PROJECT:	ALL-SEASON ROAD DESIGN
	HIGH LAKE, NUNAVUT

TBT ENGINEERING CLIENT: WOLFDEN Resources Inc.	DRAWN BY:	D.M./T.B.	PROJECT NO.:	05-160
	APPROVED BY:	R.F.	DATE:	APRIL 2007
	SCALE:	AS SHOWN	ENCLOSURE:	7



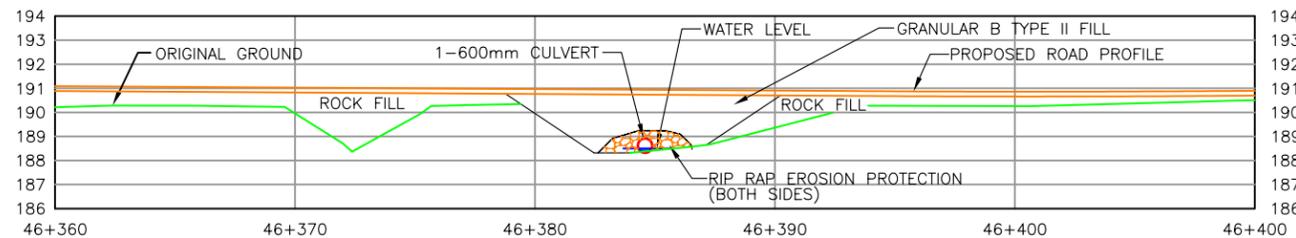
WATER CROSSING - PLAN VIEW

SCALE 1:1000

NOTES:

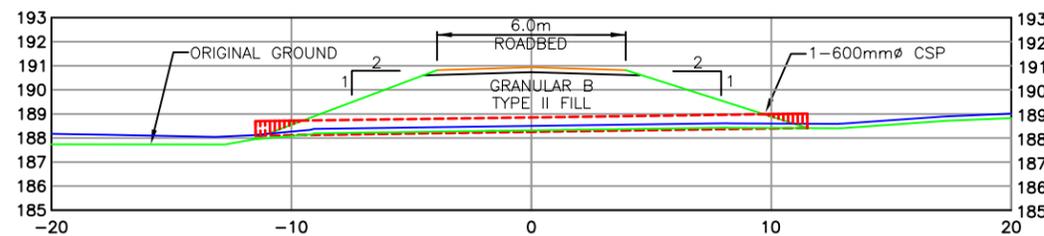
1. THIS CROSSING IS CATEGORIZED AS NO FISH HABITAT, DUE TO POOR CHANNEL DEVELOPMENT AND LOW FLOW.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. THE BOTTOM OF THE CULVERT SHALL BE BURIED INTO THE STREAMBED NOT LESS THAN 10% OF THE CULVERT HEIGHT.

REFERENCE	AS#06
CROSSING	10
SUBSTRATE	FINES
FISH HABITAT (Y/N)	N
WATERSHED AREA	86.37 ha
AREA	0.86 km ² /s
MEASURED DISCHARGE	0.021 m ³ /s
DISCHARGE - 100 YR	0.3
DISCHARGE - 10 YR	0.2
CROSSING TYPE	600mm CULVERT



ROAD CL PROFILE

SCALE 1:300



CULVERT CL CROSS-SECTION

SCALE 1:300



PHOTO AS#06 - LOOKING EASTERLY

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005. STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ
DATE	REVISION	BY

DWG. TITLE: **WATER CROSSING LOCATION PLAN AS#06**

PROJECT: **ALL-SEASON ROAD DESIGN**

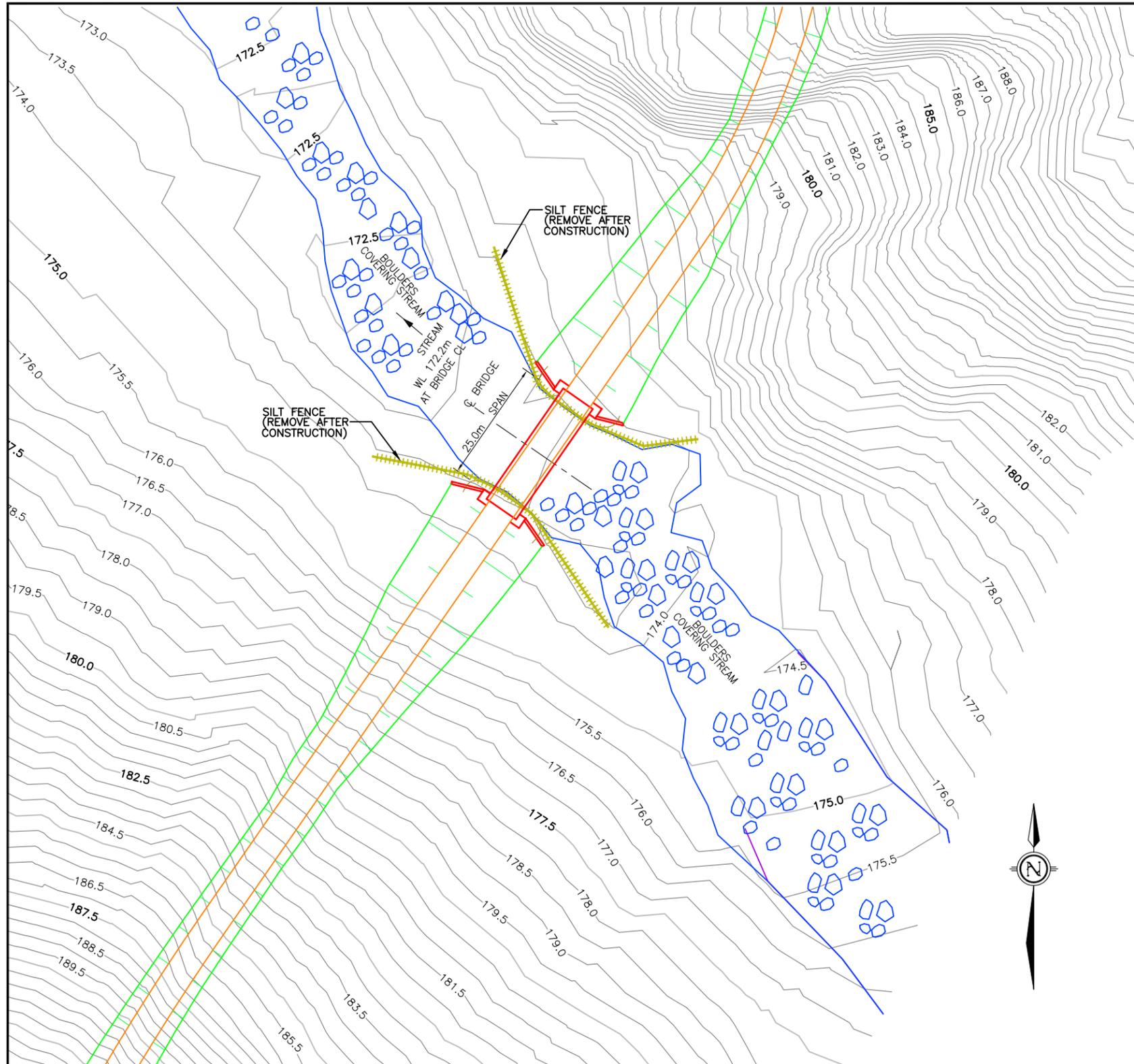
HIGH LAKE, NUNAVUT

TBT ENGINEERING

CLIENT: **WOLFDEN Resources Inc.**

DRAWN BY:	D.M./T.B.	PROJECT NO.:	05-160
APPROVED BY:	R.F.	DATE:	APRIL 2007
SCALE:	AS SHOWN	ENCLOSURE:	8

CAD REF. NO.: A813 FINAL

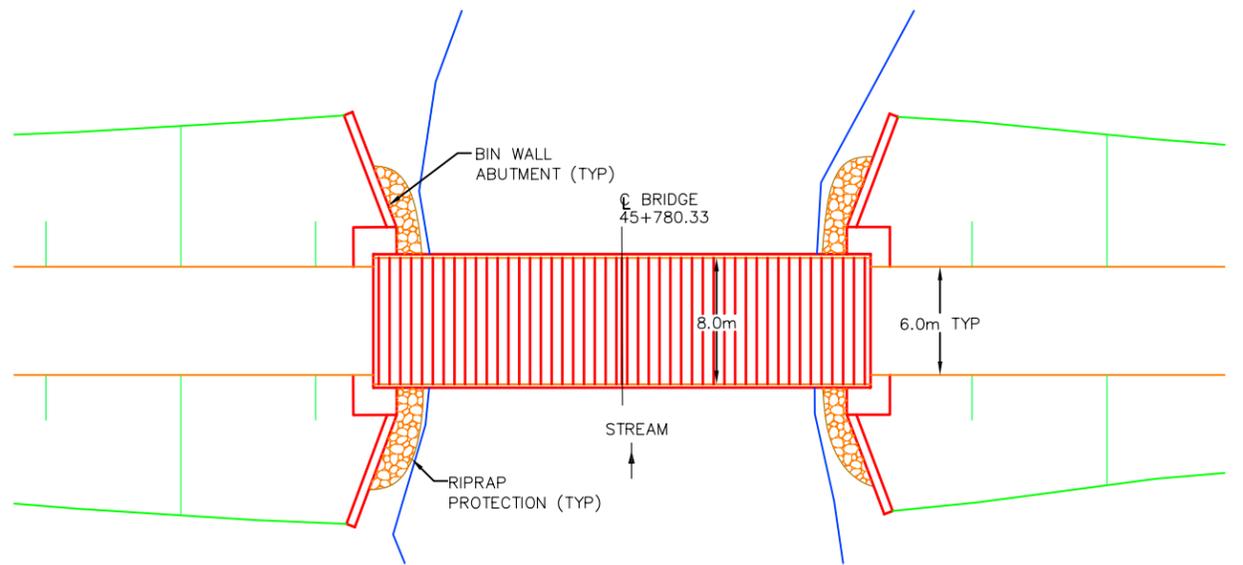


WATER CROSSING - PLAN VIEW
SCALE 1:1000



- NOTES:**
1. THIS CROSSING IS CATEGORIZED AS MODERATE FISH HABITAT, AS IT HAS SEASONAL REARING HABITAT ONLY.
 2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
 3. BRIDGE CONSTRUCTION TO CONFORM TO REQUIREMENTS OF THE FISHERIES ACT.
 4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
 5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
 6. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.
 7. BRIDGE STRUCTURE WILL BE ABOVE THE ORDINARY HIGH WATER MARK AND AWAY FROM BANKS.

REFERENCE	AS#07
CROSSING	11
SUBSTRATE	BOULDER/COBBLE
FISH HABITAT (Y/N)	Y
WATERSHED AREA	2387.56 ha
AREA	23.88 km ² s
MEASURED DISCHARGE	0.866 m ³ /s
DISCHARGE - 100 YR	16.4
DISCHARGE - 10 YR	12.6
CROSSING TYPE	25m BRIDGE



WATER CROSSING DETAIL - PLAN VIEW
SCALE 1:400

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ
DATE	REVISION	BY

DWG. TITLE:
WATER CROSSING LOCATION PLAN AS#07

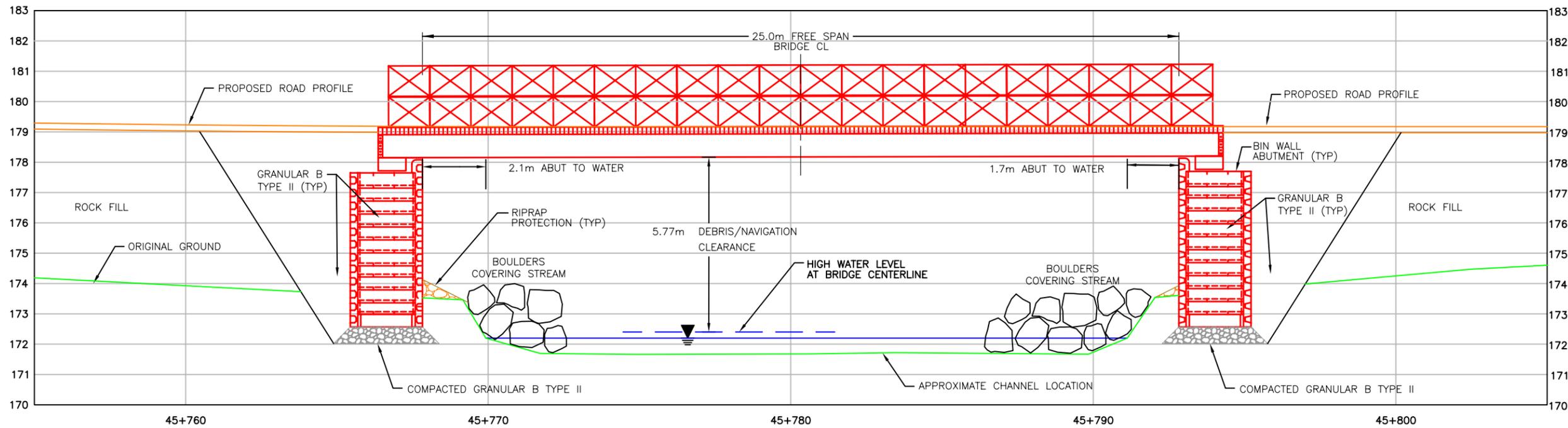
PROJECT:
ALL-SEASON ROAD DESIGN
HIGH LAKE, NUNAVUT

TBT ENGINEERING

CLIENT:
WOLFDEN
Resources Inc.

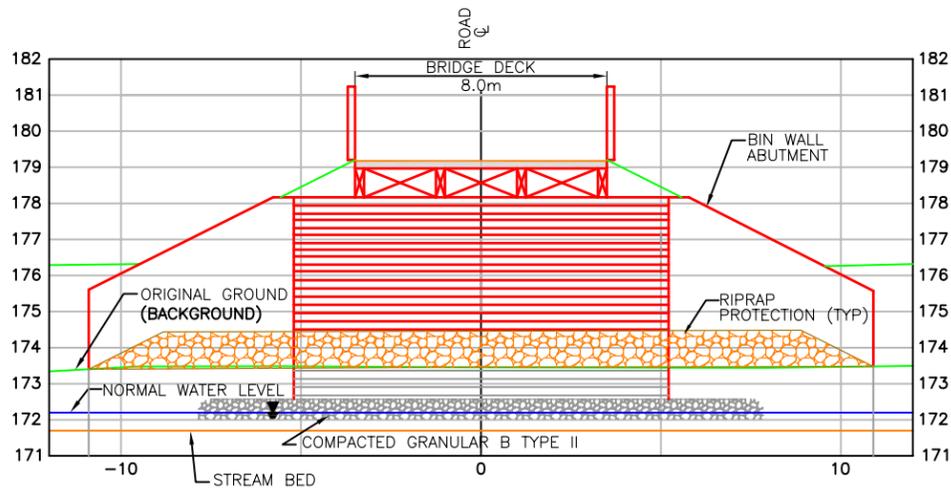
DRAWN BY: D.Mc./T.B.	PROJECT NO. 05-160
APPROVED BY: R.F.	DATE: APR 2007
SCALE: AS SHOWN	ENCLOSURE 9

CAD REF. NO. AS1247B



ROAD CL PROFILE - ELEVATION VIEW

SCALE 1:150



BRIDGE CL CROSS-SECTION

SCALE 1:200



PHOTO AS#07 - LOOKING UPSTREAM

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
 STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

DATE	REVISION	BY
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

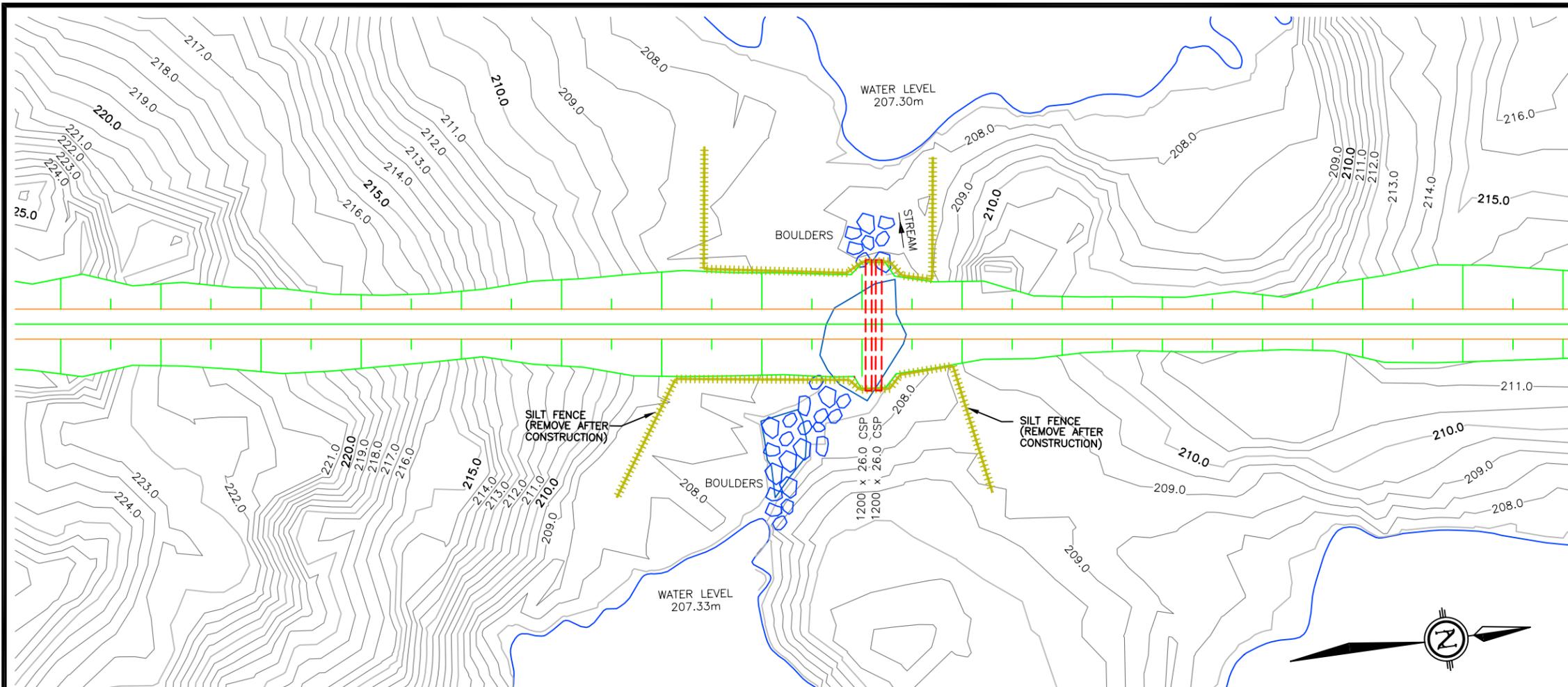
DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#07
PROJECT:	ALL-SEASON ROAD DESIGN
	HIGH LAKE, NUNAVUT

TBT ENGINEERING

CLIENT: WOLFDEN Resources Inc.

DRAWN BY:	D.M./T.B.	PROJECT NO.:	05-160
APPROVED BY:	C.Z.	DATE:	APRIL 2007
SCALE:	AS SHOWN	ENCLOSURE:	10

CAD REF. NO.: AS04-17B



WATER CROSSING - PLAN VIEW
SCALE 1:1000

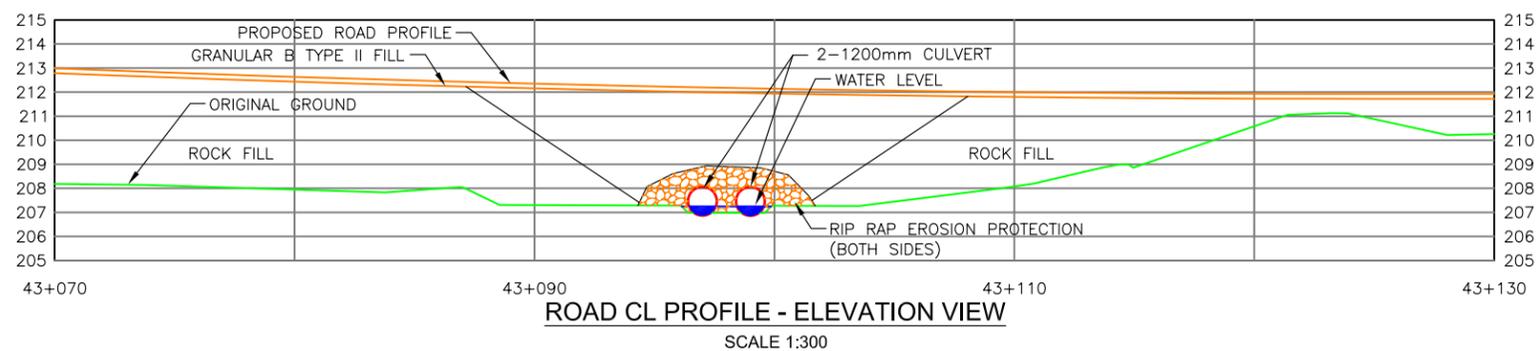
NOTES:

1. THIS CROSSING IS CATEGORIZED AS LOW FISH HABITAT, AS IT HAS LIMITED MIGRATION AND SEASONAL REARING HABITAT WITH LOW TO NO FLOW DURING MUCH OF THE YEAR.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. THE BOTTOM OF THE CULVERT SHALL BE BURIED INTO THE STREAMBED NOT LESS THAN 10% OF THE CULVERT HEIGHT.
4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
6. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.

WATER CROSSING DATA

REFERENCE	AS#08
CROSSING	12
SUBSTRATE	BOULDER
FISH HABITAT (Y/N)	Y
WATERSHED AREA	228.83 ha
AREA	2.29 km ² s
MEASURED DISCHARGE	
DISCHARGE - 100 YR	1.3
DISCHARGE - 10 YR	1.0
CROSSING TYPE	1200 mm CULVERT

*REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.



ROAD CL PROFILE - ELEVATION VIEW
SCALE 1:300

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ
DATE	REVISION	BY

DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#08
PROJECT:	ALL-SEASON ROAD DESIGN
	HIGH LAKE, NUNAVUT

 TBT ENGINEERING	DRAWN BY:	D.Mc./T.B.	PROJECT NO.	05-160
	APPROVED BY:	R.F.	DATE:	APRIL 2007
 WOLF DEN Resources Inc.	SCALE:	AS SHOWN	ENCLOSURE	11

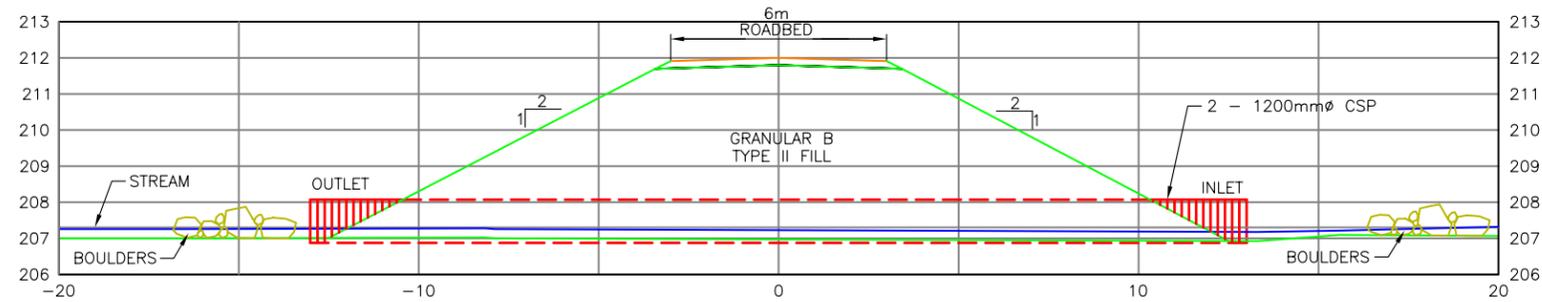
CAD REF. NO. AS13 FINAL



PHOTO AS#8 - LOOKING EAST



PHOTO AS#8 - LOOKING NORTH



CULVERT CL CROSS-SECTION
SCALE 1:200

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

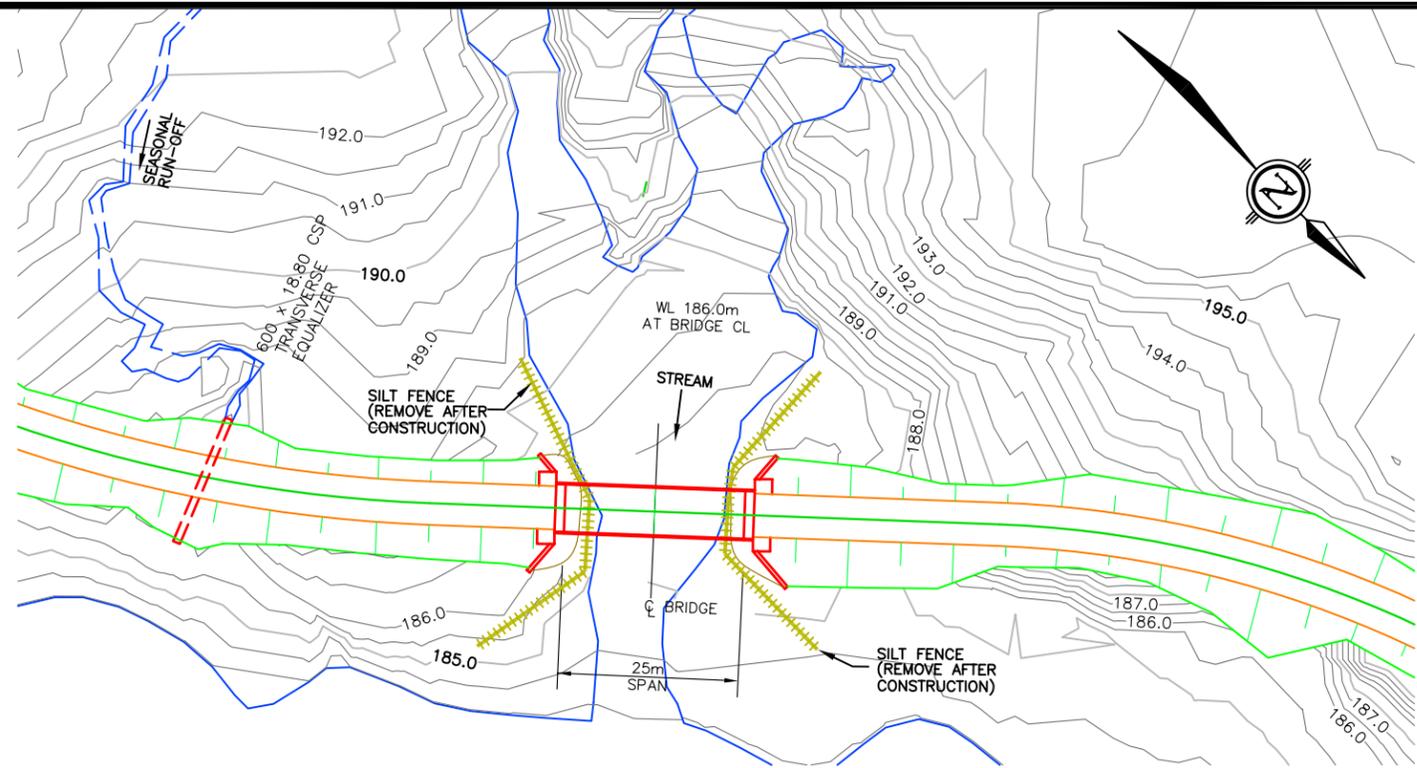
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ	
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ	
DATE	REVISION	BY	

DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#08
PROJECT:	ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT

 **TBT ENGINEERING**
 CLIENT:
 **WOLFDEN**
 Resources Inc.

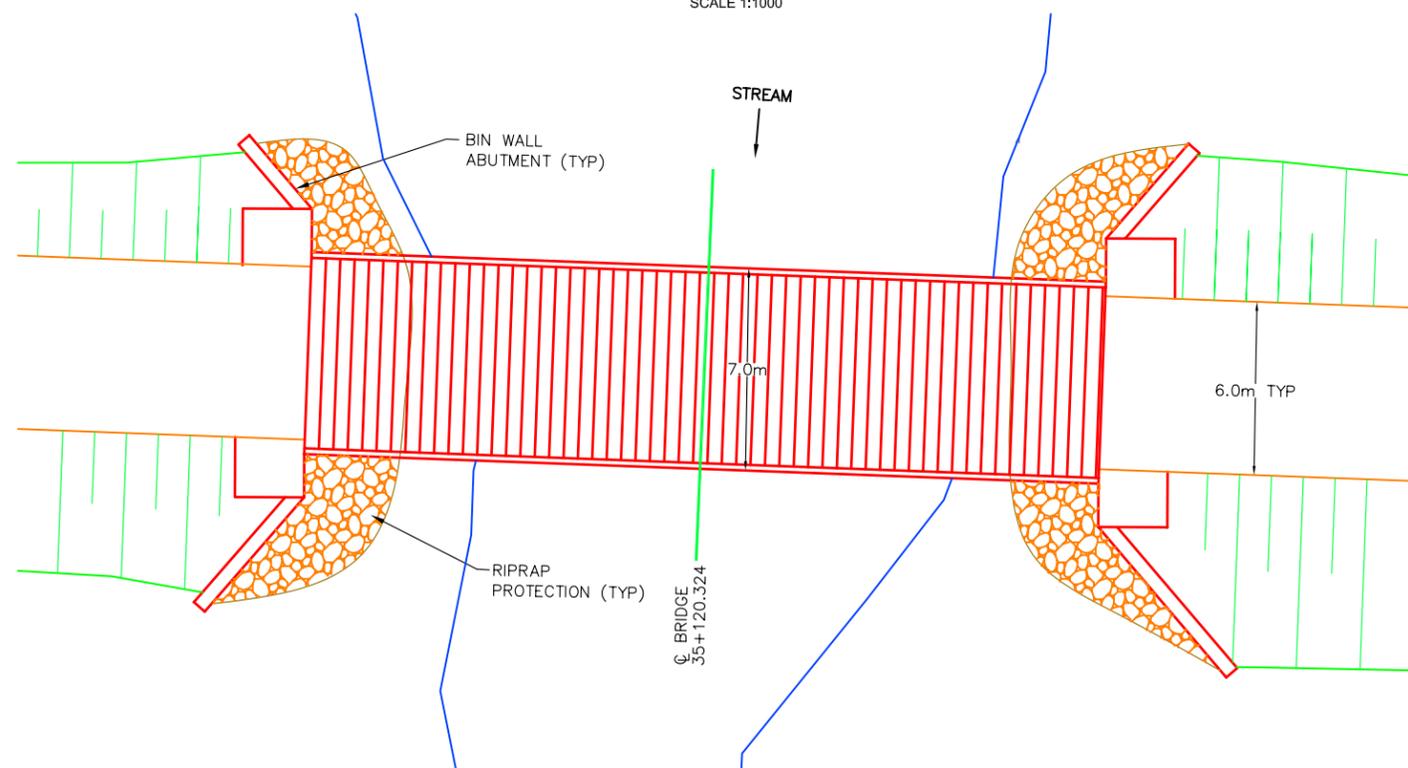
DRAWN BY:	D.Mc./T.B.	PROJECT NO.:	05-160
APPROVED BY:	R.F.	DATE:	APRIL 2007
SCALE:	AS SHOWN	ENCLOSURE	12

CAD REF. NO.: AS13 FINAL



WATER CROSSING - PLAN VIEW

SCALE 1:1000



WATER CROSSING DETAIL - PLAN VIEW

SCALE 1:250

NOTES:

1. THIS CROSSING IS CATEGORIZED AS MODERATE FISH HABITAT, AS IT HAS MIGRATION AND SEASONAL REARING HABITAT WITH ADEQUATE FLOW DURING MUCH OF THE YEAR.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. BRIDGE CONSTRUCTION TO CONFORM TO REQUIREMENTS OF THE FISHERIES ACT.
4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
6. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.
7. BRIDGE STRUCTURE WILL BE ABOVE THE ORDINARY HIGH WATER MARK AND AWAY FROM BANKS.

REFERENCE	AS#09
CROSSING	18
SUBSTRATE	BOULDER/COBBLE
FISH HABITAT (Y/N)	Y
WATERSHED AREA	16556.1 ha
AREA	165.56 km ² s
MEASURED DISCHARGE	6.33 m ³ /s
DISCHARGE - 100 YR	94.4
DISCHARGE - 10 YR	72.8
CROSSING TYPE	25m BRIDGE

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
 STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006

NOT FOR CONSTRUCTION

20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ	
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ	
DATE	REVISION	BY	

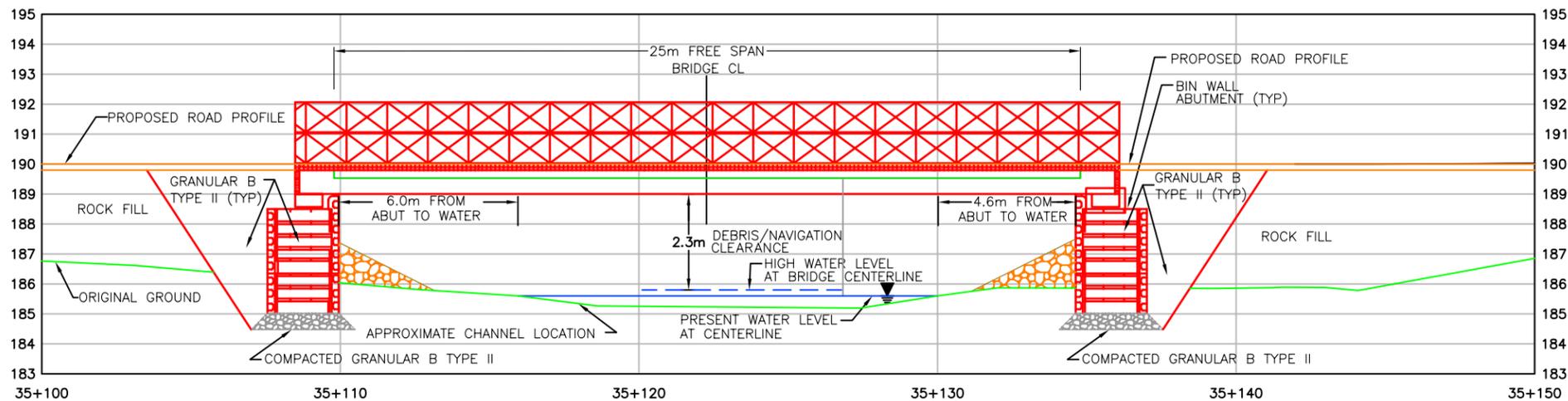
DWG. TITLE: **WATER CROSSING LOCATION PLAN AS#09**

PROJECT: **ALL-SEASON ROAD DESIGN**

HIGH LAKE, NUNAVUT

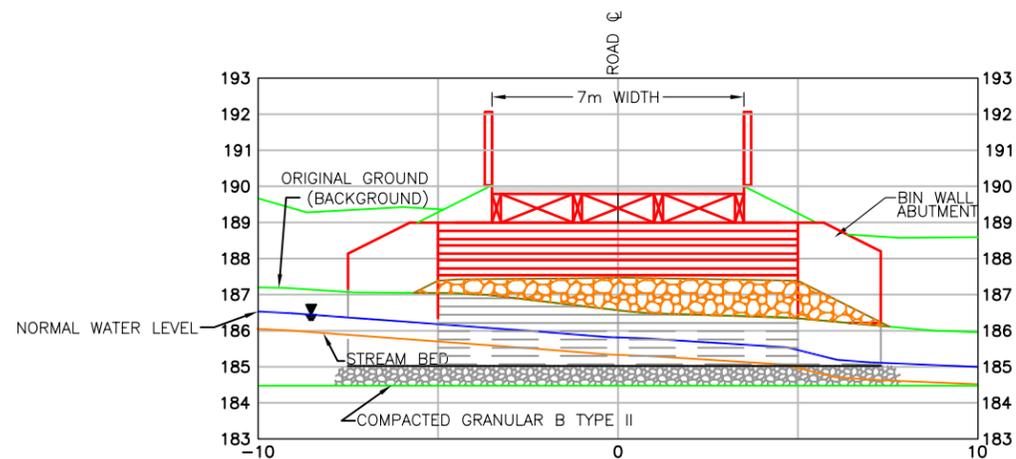
 TBT ENGINEERING	DRAWN BY:	PROJECT NO.
	D.Mc./T.B.	05-160
 CLIENT: WOLF DEN Resources Inc.	APPROVED BY:	DATE:
	R.F.	APRIL 2007
	SCALE:	ENCLOSURE
	AS SHOWN	13

CAD REF. NO.: AS09-4TB



ROAD CL PROFILE ELEVATION VIEW

SCALE 1:200



BRIDGE CL CROSS-SECTION

SCALE 1:200



PHOTO AS#09 - LOOKING UPSTREAM SOUTHWESTERLY

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
 STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006

NOT FOR CONSTRUCTION

DATE	REVISION	BY
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

DWG. TITLE: **WATER CROSSING LOCATION PLAN AS#09**

PROJECT: **ALL-SEASON ROAD DESIGN**

HIGH LAKE, NUNAVUT

TBT ENGINEERING

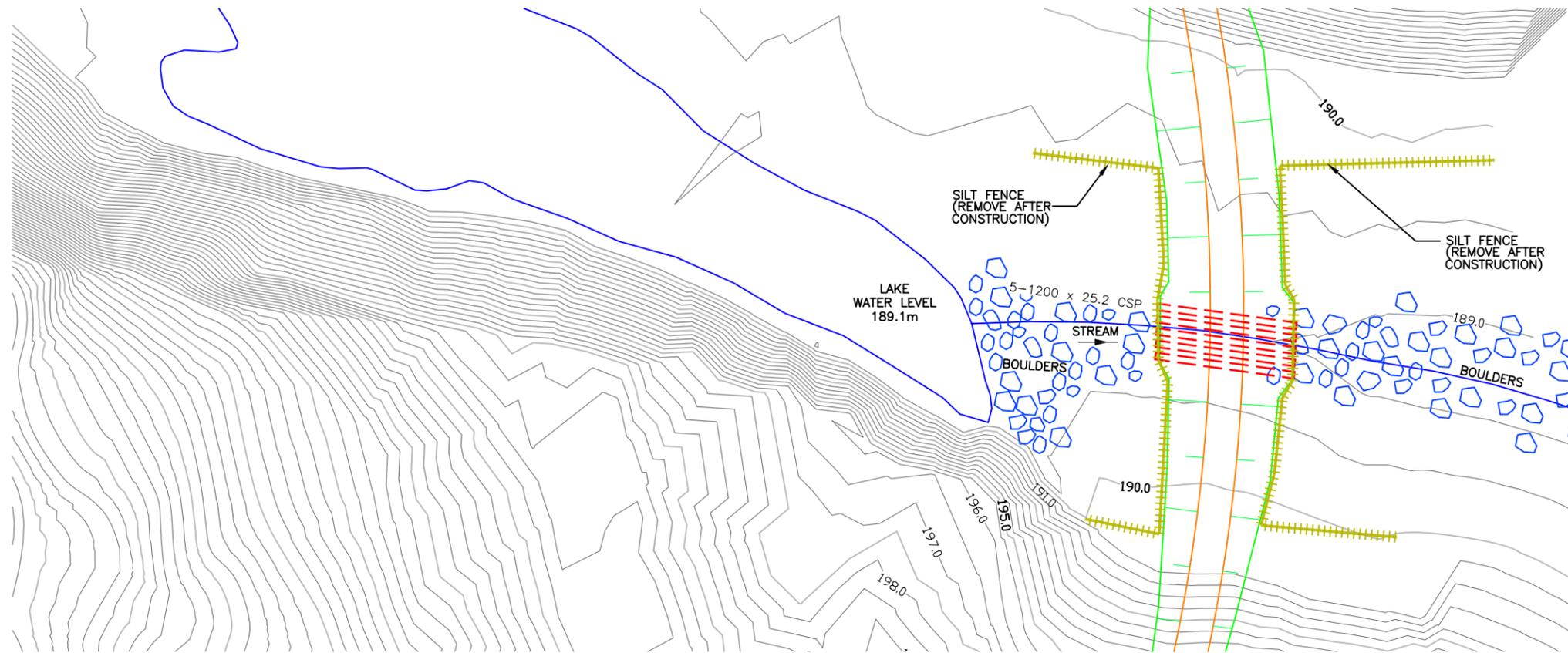
CLIENT: **WOLFDEN Resources Inc.**

DRAWN BY: **D.Mc./T.B.** PROJECT NO. **05-160**

APPROVED BY: **R.F.** DATE: **APRIL 2007**

SCALE: **AS SHOWN** ENCLOSURE **14**

CAD REF. NO.: AS09-17B



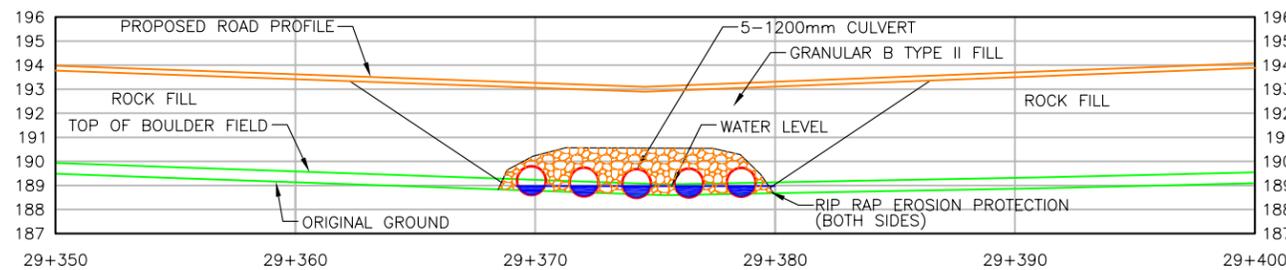
NOTES:

1. THIS CROSSING IS CATEGORIZED AS HIGH FISH HABITAT, AS IT HAS GOOD MIGRATION AND SEASONAL REARING HABITAT.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. THE BOTTOM OF THE CULVERT SHALL BE BURIED INTO THE STREAMBED NOT LESS THAN 10% OF THE CULVERT HEIGHT.
4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
6. CONSTRUCTION EQUIPMENT WILL BE OPERATED IN A MANNER TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.

REFERENCE	AS#10
CROSSING	19
SUBSTRATE	BOULDER
FISH HABITAT (Y/N)	Y
WATERSHED AREA	1027.05 ha
AREA	10.27 km ² s
MEASURED DISCHARGE	0.119 m ³ /s
DISCHARGE - 100 YR	7.0
DISCHARGE - 10 YR	5.4
CROSSING TYPE	1200 mm CULVERT

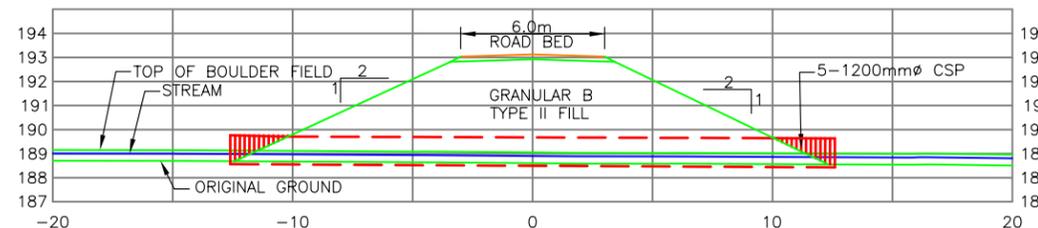
WATER CROSSING -PLAN VIEW

SCALE 1:1000



ROAD CL PROFILE - ELEVATION VIEW

SCALE 1:300



CULVERT CL CROSS-SECTION

SCALE 1:300



PHOTO AS#10 - LOOKING WESTERLY UPSTREAM TOWARDS LAKE

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
 STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ	
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ	
DATE	REVISION	BY	

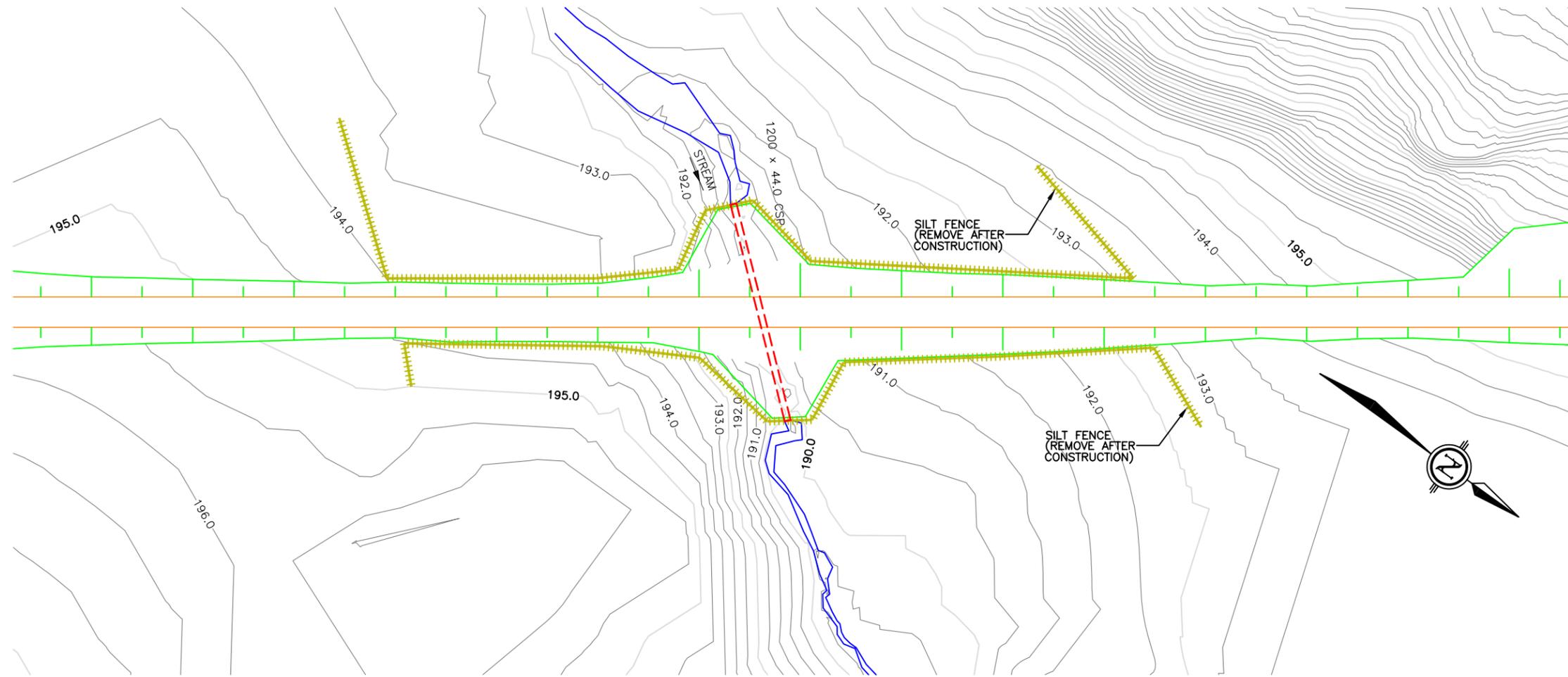
DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#10
PROJECT:	ALL-SEASON ROAD DESIGN
	HIGH LAKE, NUNAVUT

TBT ENGINEERING

CLIENT: **WOLFDEN Resources Inc.**

DRAWN BY:	D.Mc./T.B.	PROJECT NO.:	05-160
APPROVED BY:	R.F.	DATE:	APRIL 2007
SCALE:	AS SHOWN	ENCLOSURE:	15

CAD REF. NO.: AS10 FINAL



WATER CROSSING - PLAN VIEW
SCALE 1:1000

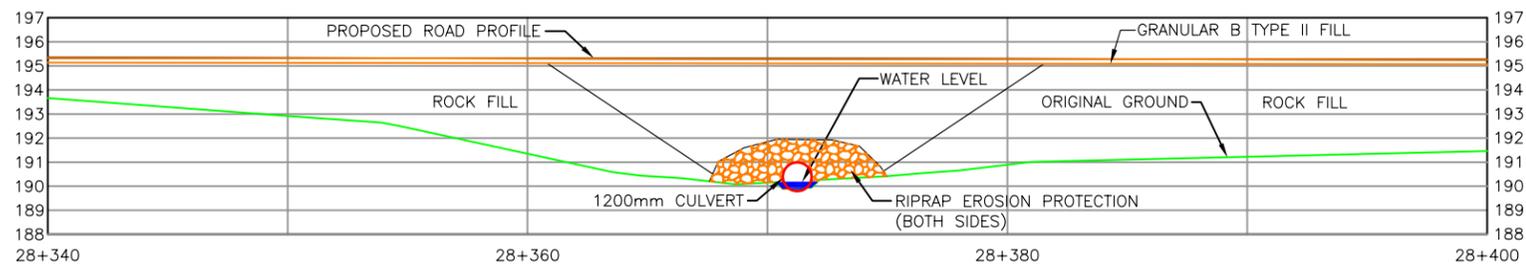
NOTES:

1. THIS CROSSING IS CATEGORIZED AS HAVING NO FISH HABITAT, DUE TO LIMITED FLOW AND NO ACCESS TO OTHER WATERBODIES.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. THE BOTTOM OF THE CULVERT SHALL BE BURIED INTO THE STREAMBED NOT LESS THAN 10% OF THE CULVERT HEIGHT.
4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
6. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.

WATER CROSSING DATA

REFERENCE	AS#11
CROSSING	20
SUBSTRATE	COBBLE/GRAVEL
FISH HABITAT (Y/N)	N
WATERSHED AREA	202.61 ha
AREA	2.03 km ² /s
MEASURED DISCHARGE	0.034 m ³ /s
DISCHARGE - 100 YR	1.2
DISCHARGE - 10 YR	0.9
CROSSING TYPE	1200 mm CULVERT

*REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.



ROAD CL PROFILE - ELEVATION VIEW
SCALE 1:300

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

DATE	REVISION	BY
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#11
PROJECT:	ALL-SEASON ROAD DESIGN
	HIGH LAKE, NUNAVUT

TBT ENGINEERING

CLIENT: **WOLFDEN Resources Inc.**

DRAWN BY:	D.Mc./T.B.	PROJECT NO.:	05-160
APPROVED BY:	R.F.	DATE:	APRIL 2007
SCALE:	AS SHOWN	ENCLOSURE:	16

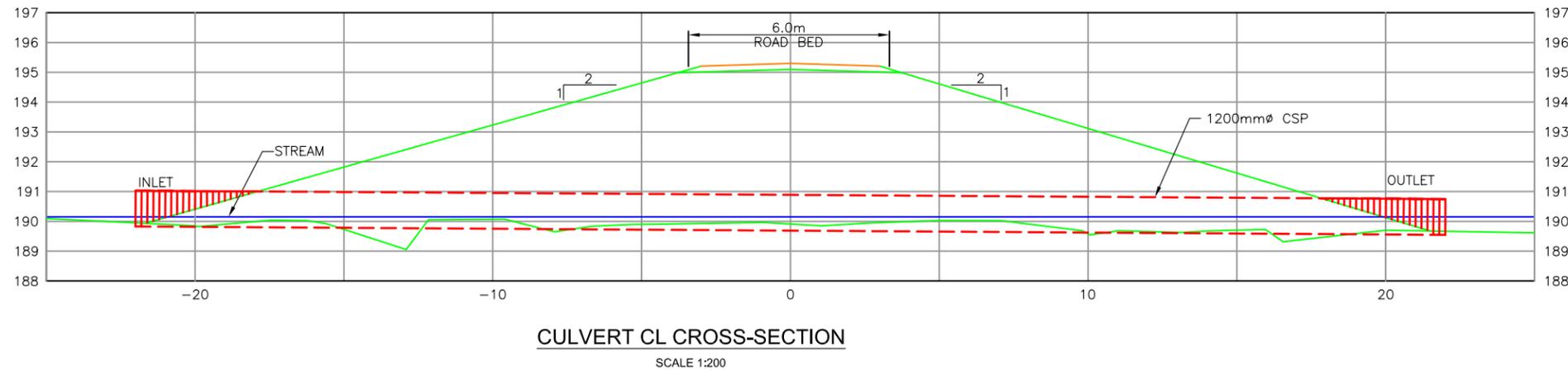
CAD REF. NO.: AS13 FINAL



PHOTO AS#11 - LOOKING UPSTREAM



PHOTO AS#11 - LOOKING DOWNSTREAM



WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

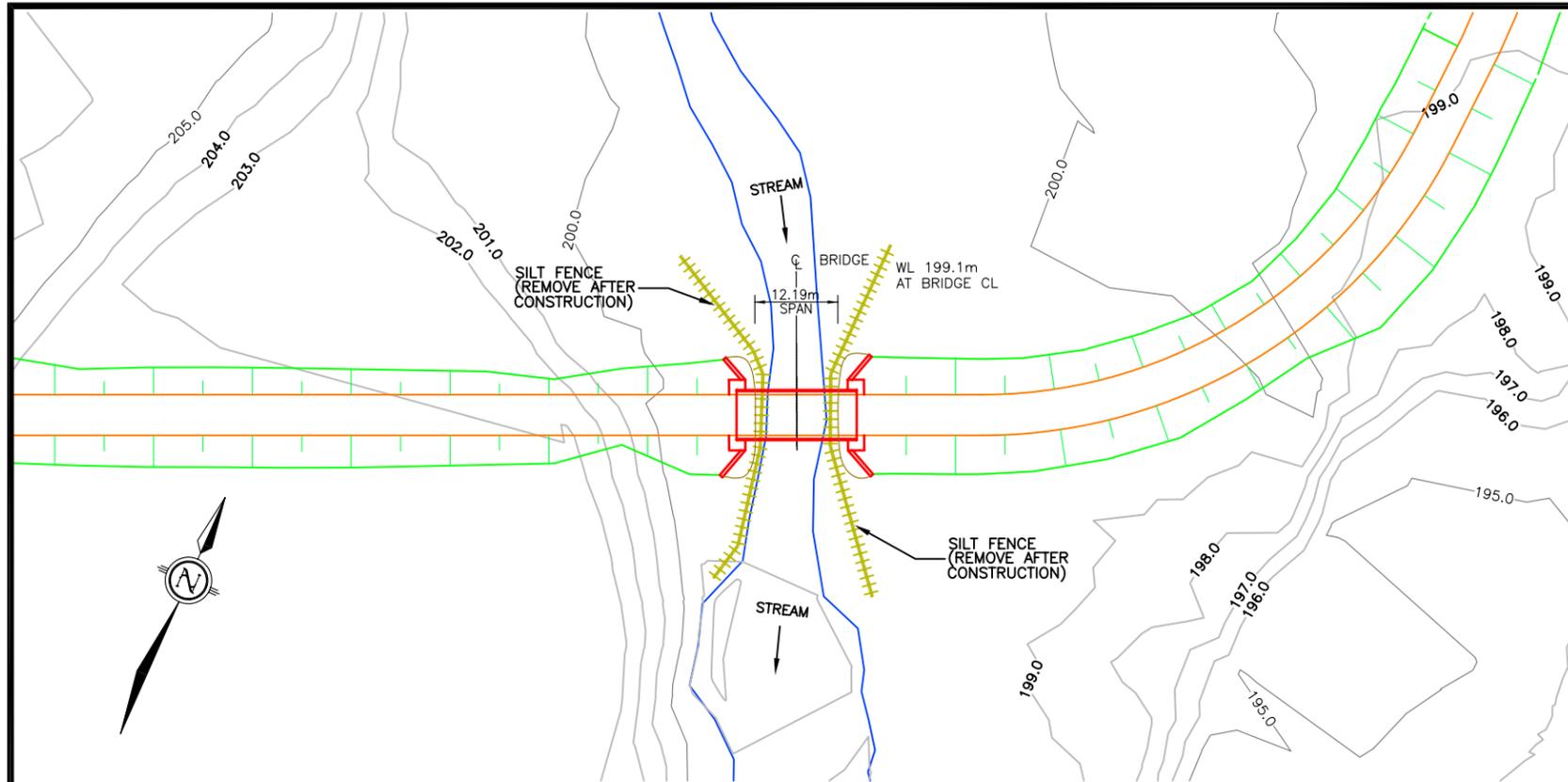
DATE	REVISION	BY
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#11
PROJECT:	ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT

 **TBT ENGINEERING**
 CLIENT:
 **WOLFDEN**
 Resources Inc.

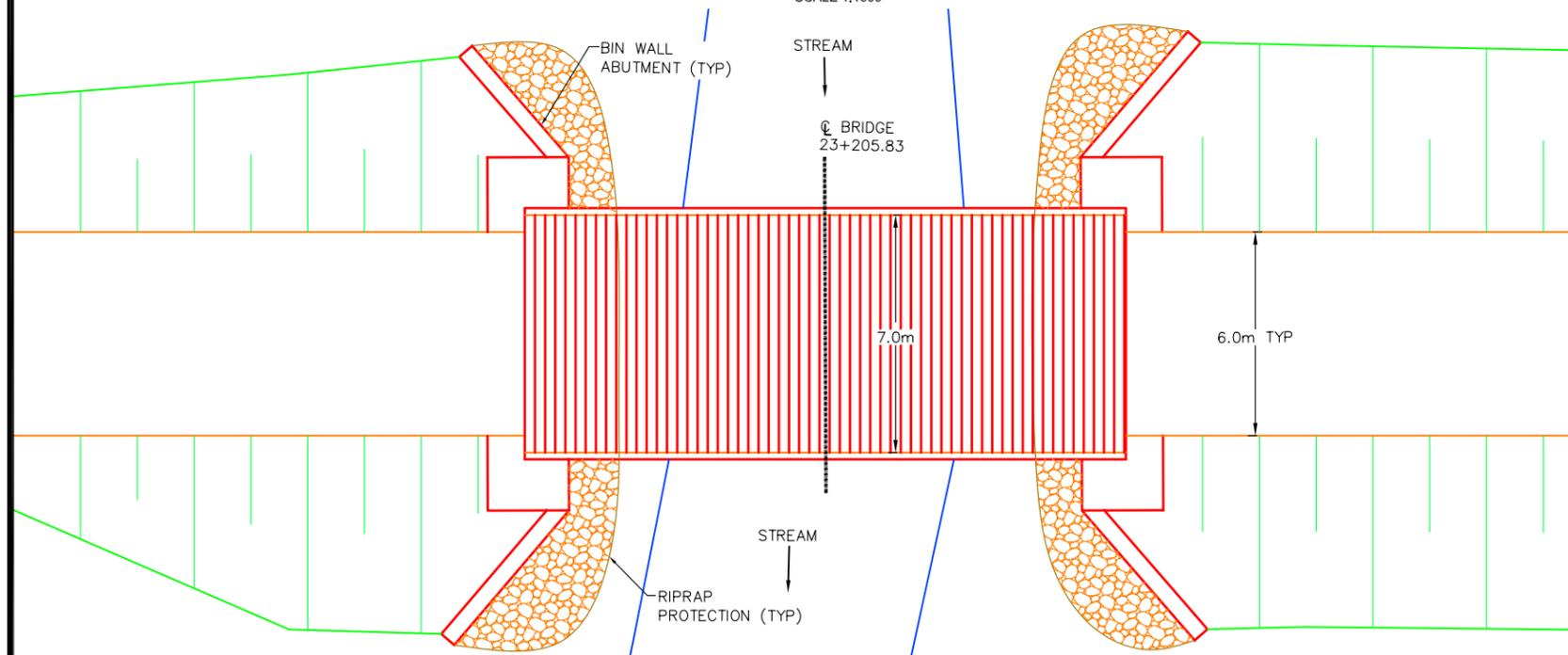
DRAWN BY:	D.Mc./T.B.	PROJECT NO.:	05-160
APPROVED BY:	R.F.	DATE:	APRIL 2007
SCALE:	AS SHOWN	ENCLOSURE	17

CAD REF. NO.: AS11



WATER CROSSING - PLAN VIEW

SCALE 1:1000



WATER CROSSING DETAIL - PLAN VIEW

SCALE 1:200

NOTES:

1. THIS CROSSING IS CATEGORIZED AS HIGH FISH HABITAT, AS IT HAS GOOD MIGRATION AND SEASONAL REARING HABITAT.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. BRIDGE CONSTRUCTION TO CONFORM TO REQUIREMENTS OF THE FISHERIES ACT.
4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
6. BRIDGE STRUCTURE WILL BE ABOVE THE ORDINARY HIGH WATER MARK AND AWAY FROM BANKS.
7. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.

REFERENCE	AS#12
CROSSING	NORTH OF 21
SUBSTRATE	GRAVEL/COBBLE
FISH HABITAT (Y/N)	Y
WATERSHED AREA	2551.51 ha
AREA	25.52 km ² /s
MEASURED DISCHARGE	1.105 m ³ /s
DISCHARGE - 100 YR	17.5
DISCHARGE - 10 YR	13.5
CROSSING TYPE	12.19m BRIDGE

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
 STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006

NOT FOR CONSTRUCTION

DATE	REVISION	BY
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

DWG. TITLE: **WATER CROSSING LOCATION PLAN AS#12**

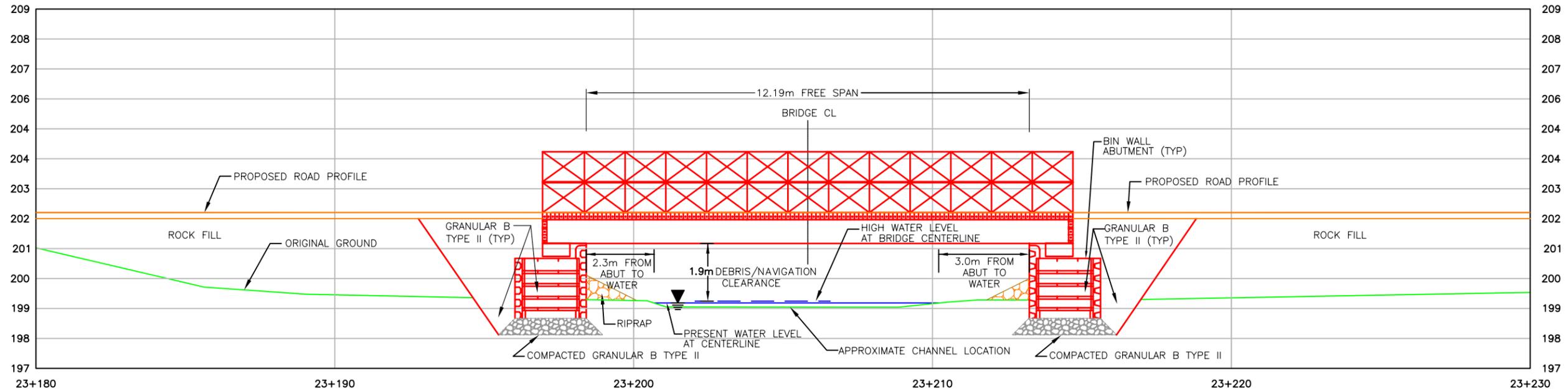
PROJECT: **ALL-SEASON ROAD DESIGN**

HIGH LAKE, NUNAVUT

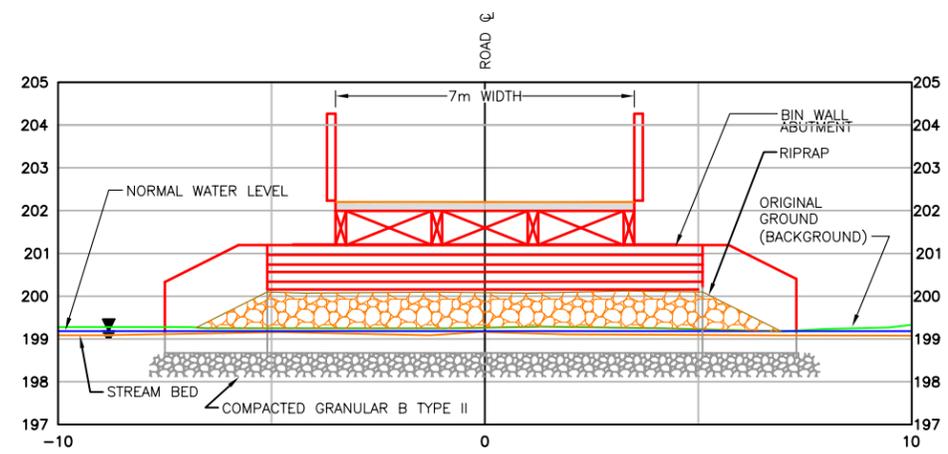
TBT ENGINEERING

CLIENT: **WOLFDEN Resources Inc.**

DRAWN BY:	D.Mc./T.B.	PROJECT NO.:	05-160
APPROVED BY:	R.F.	DATE:	APRIL 2007
SCALE:	AS SHOWN	ENCLOSURE:	18



ROAD CL PROFILE - ELEVATION VIEW
SCALE 1:150



BRIDGE CL CROSS-SECTION
SCALE 1:150



PHOTO AS#12 - LOOKING UPSTREAM

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006

NOT FOR CONSTRUCTION

20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ
DATE	REVISION	BY

DWG. TITLE: **WATER CROSSING LOCATION PLAN AS#12**

PROJECT: **ALL-SEASON ROAD DESIGN**

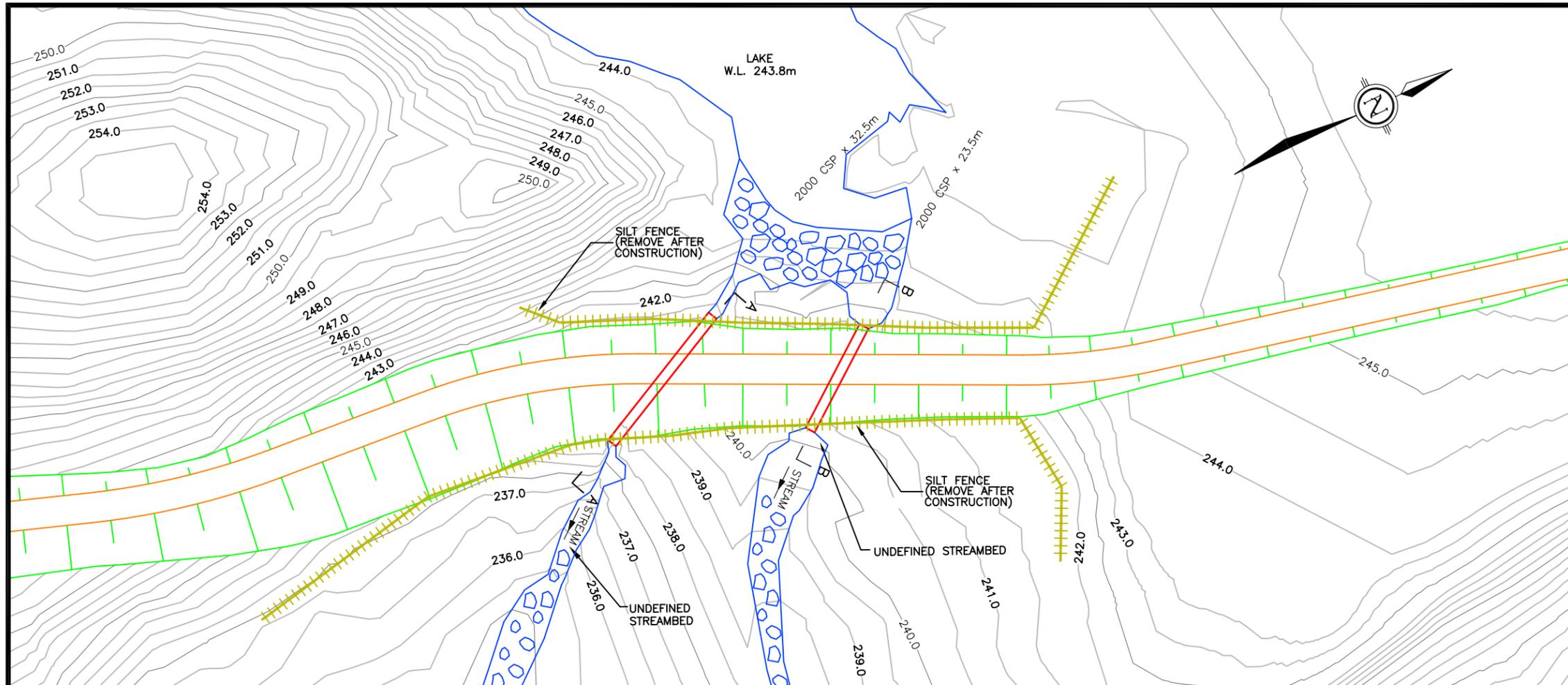
HIGH LAKE, NUNAVUT

TBT ENGINEERING

CLIENT: **WOLFDEN Resources Inc.**

DRAWN BY:	PROJECT NO.
D.Mc./T.B.	05-160
APPROVED BY:	DATE:
R.F.	APRIL 2007
SCALE:	ENCLOSURE
AS SHOWN	19

CAD REF. NO.: AS12-FB



WATER CROSSING - PLAN VIEW

SCALE 1:1000

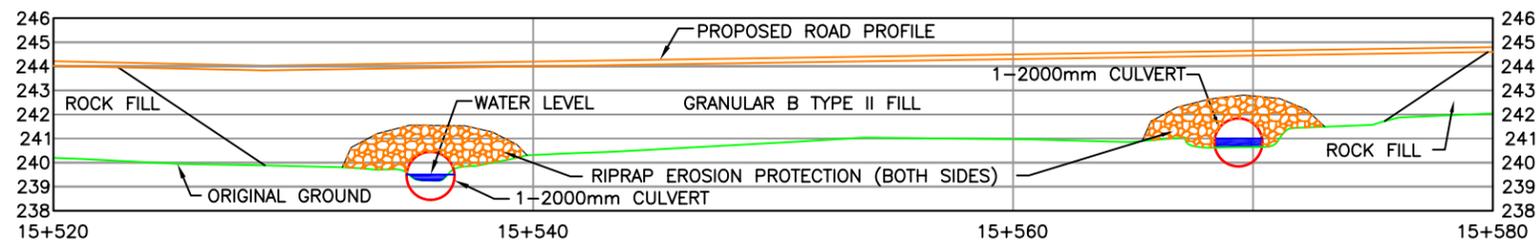
NOTES:

1. THIS CROSSING IS CATEGORIZED AS HIGH FISH HABITAT, AS IT HAS GOOD MIGRATION AND SEASONAL REARING HABITAT.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. THE BOTTOM OF THE CULVERT SHALL BE BURIED INTO THE STREAMBED NOT LESS THAN 40% OF THE CULVERT HEIGHT TO PROVIDE REDUCED FLOW VELOCITY AND ALLOW FOR ADEQUATE FISH PASSAGE.
4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
6. CONSTRUCTION EQUIPMENT WILL BE OPERATED IN A MANNER TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.

WATER CROSSING DATA

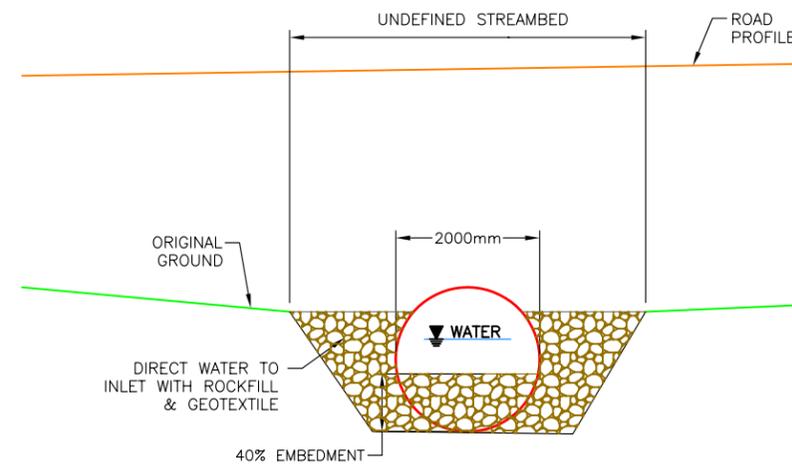
REFERENCE	AS#13
CROSSING	27
SUBSTRATE	BOULDER/COBBLE/GRAVEL
FISH HABITAT (Y/N)	Y
WATERSHED AREA	584.52 ha
AREA	5.85 km ²
MEASURED DISCHARGE	0.55 m ³ /s
DISCHARGE - 100 YR	3.9
DISCHARGE - 10 YR	3.0
CROSSING TYPE	2000 mm CULVERT

*REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.



ROAD CL PROFILE - ELEVATION VIEW

SCALE 1:300



CULVERT INVERT DETAIL (TYP)

SCALE: NTS

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005. STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

DATE	REVISION	BY
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

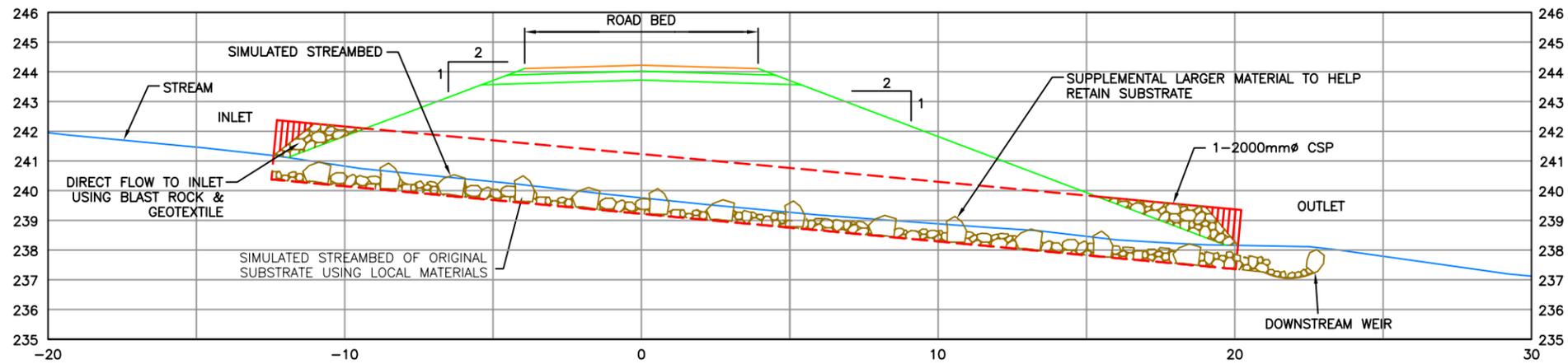
DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#13
PROJECT:	ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT

TBT ENGINEERING

CLIENT: WOLFDEN Resources Inc.

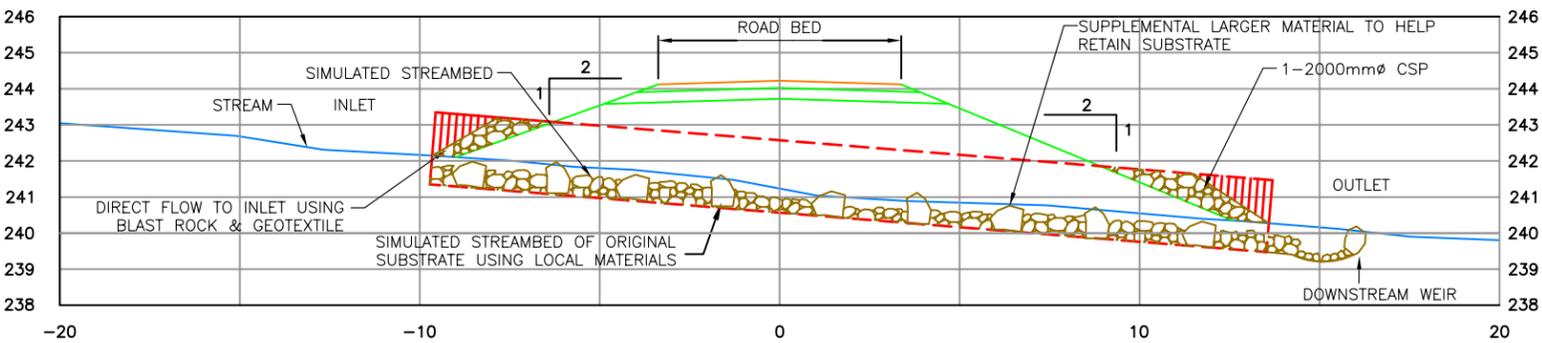
DRAWN BY:	D.Mc.J.B.	PROJECT NO.:	05-160
APPROVED BY:	R.F.	DATE:	APRIL 2007
SCALE:	AS SHOWN	ENCLOSURE:	20

CAD REF. NO. A813



CULVERT CL CROSS-SECTION A-A

SCALE 1:200



CULVERT CL CROSS-SECTION B-B

SCALE 1:200



PHOTO AS#13 - LOOKING UPSTREAM AT UNDEFINED STREAMBED.

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

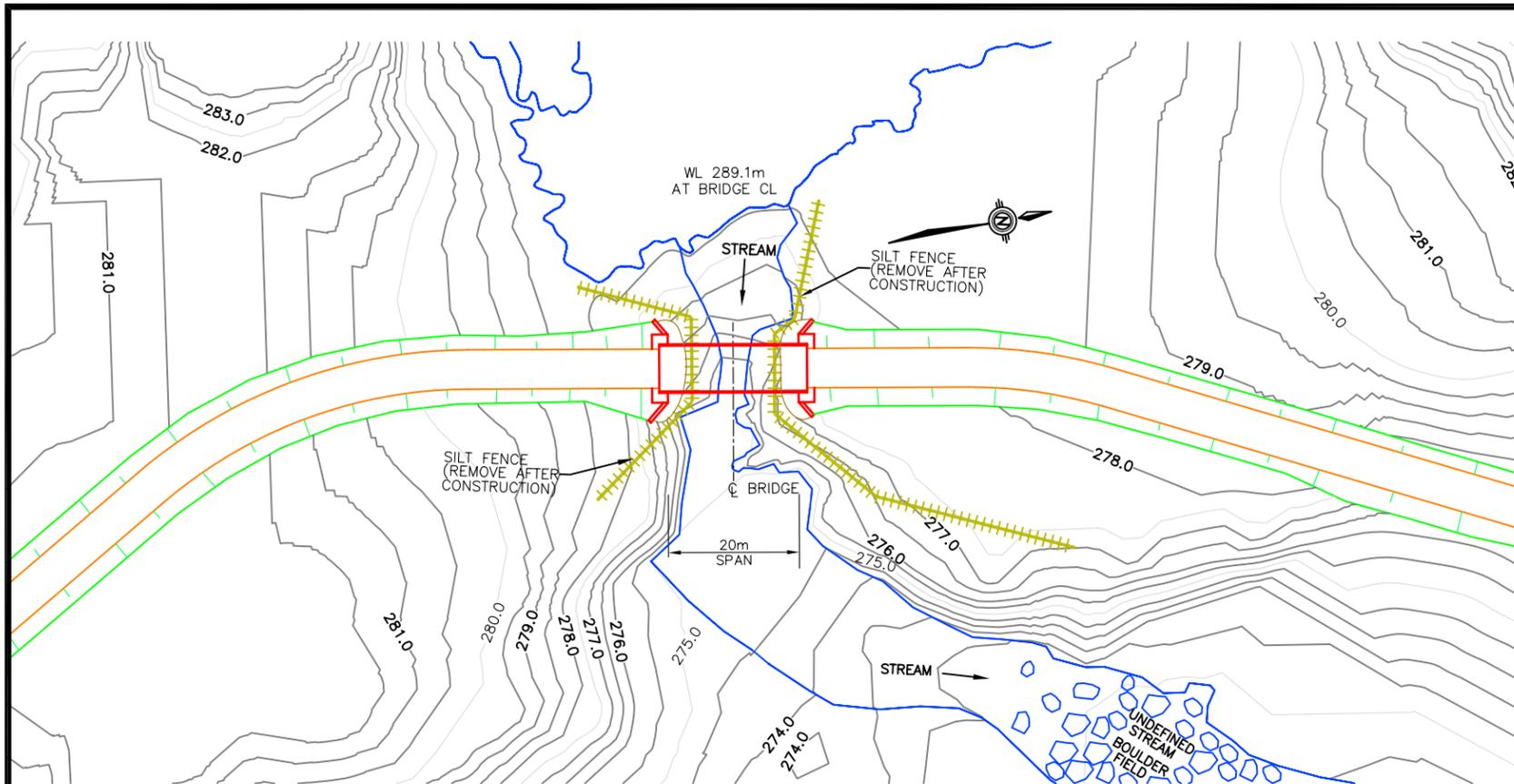
NOT FOR CONSTRUCTION

DATE	REVISION	BY
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#13
PROJECT:	ALL-SEASON ROAD DESIGN
	HIGH LAKE, NUNAVUT

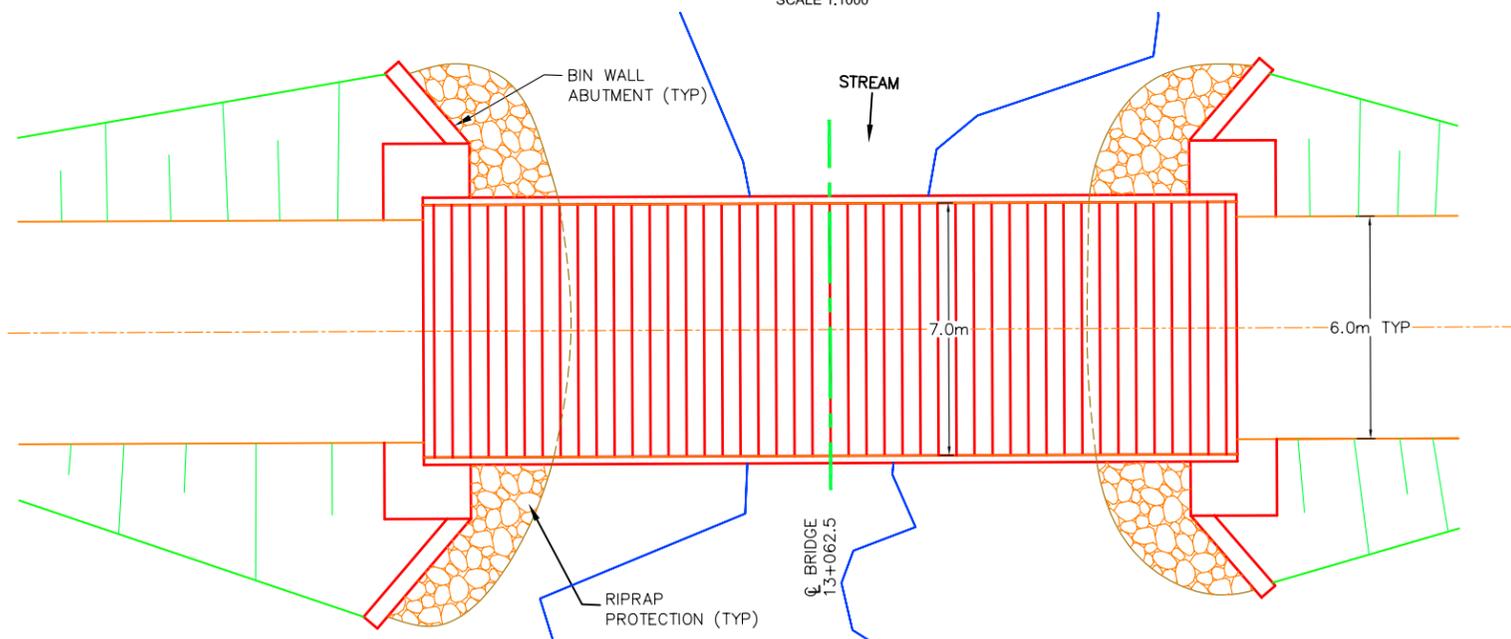
	DRAWN BY:	D.Mc./T.B.	PROJECT NO.:	05-160
	APPROVED BY:	R.F.	DATE:	APRIL 2007
	SCALE:	AS SHOWN	ENCLOSURE	21

CAD REF. NO.: A813 FINAL



WATER CROSSING - PLAN VIEW

SCALE 1:1000



WATER CROSSING DETAIL - PLAN VIEW

SCALE 1:200

NOTES:

1. THIS CROSSING IS CATEGORIZED AS HIGH FISH HABITAT, AS IT HAS GOOD MIGRATION AND SEASONAL REARING HABITAT.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. BRIDGE CONSTRUCTION TO CONFORM TO REQUIREMENTS OF THE FISHERIES ACT.
4. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
6. BRIDGE STRUCTURE WILL BE ABOVE THE ORDINARY HIGH WATER MARK AND AWAY FROM BANKS.
7. CONSTRUCTION EQUIPMENT WILL BE OPERATED IN A MANNER TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.

WATER CROSSING DATA

REFERENCE	AS#14
CROSSING	30
SUBSTRATE	BOULDER/COBBLE
FISH HABITAT (Y/N)	Y
WATERSHED AREA	4928.52 ha
AREA	49.29 km ² /s
MEASURED DISCHARGE	4.5 m ³ /s
DISCHARGE - 100 YR	33.1
DISCHARGE - 10 YR	25.5
CROSSING TYPE	20m BRIDGE

*REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006

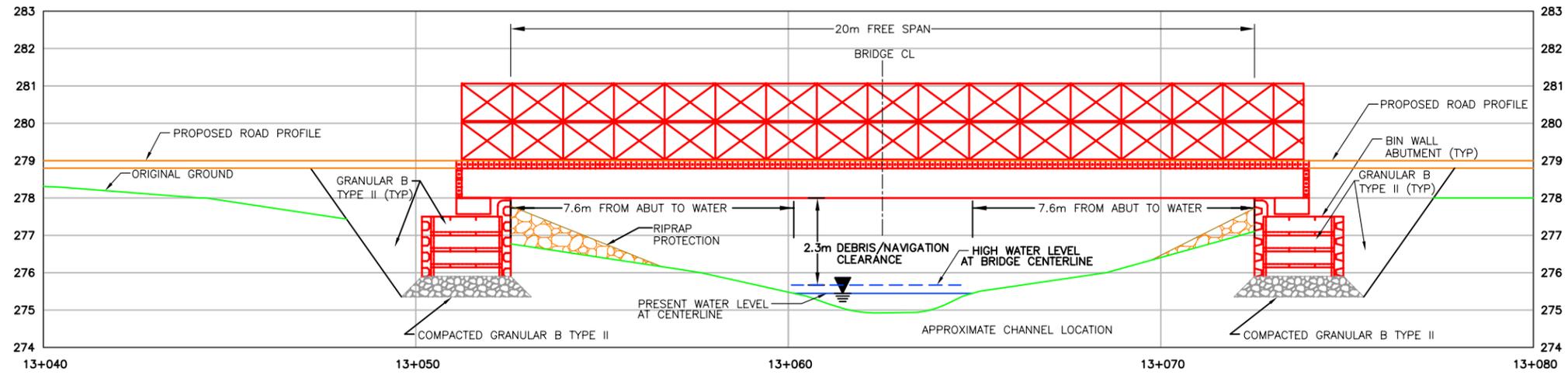
NOT FOR CONSTRUCTION

DATE	REVISION	BY
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

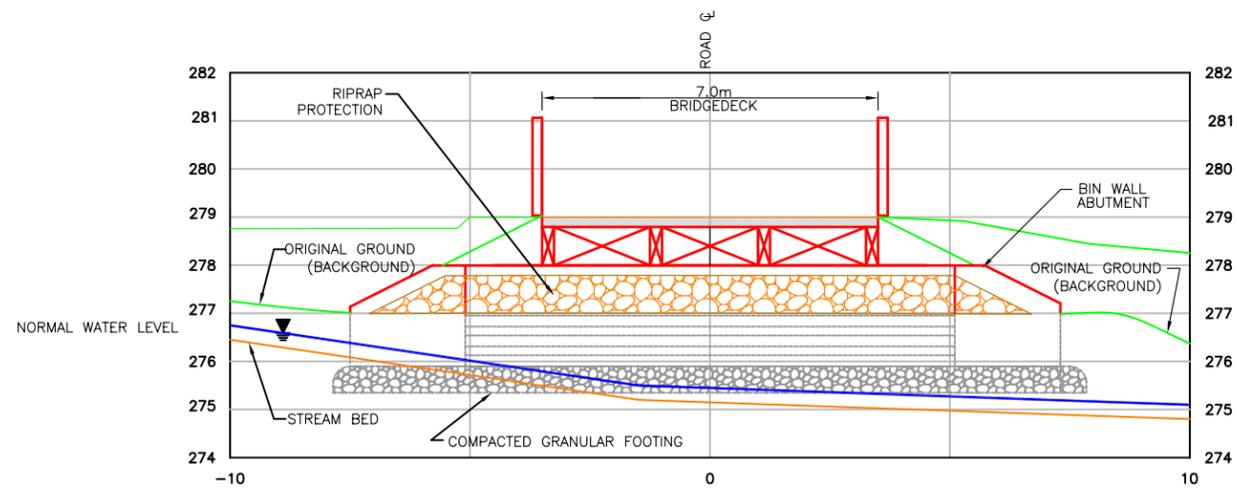
DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#14
PROJECT:	ALL-SEASON ROAD DESIGN
	HIGH LAKE, NUNAVUT

 CLIENT: 	DRAWN BY:	PROJECT NO.
	D.Mc./T.B.	05-160
	APPROVED BY:	DATE:
	R.F.	APRIL 2007
	SCALE:	ENCLOSURE
	AS SHOWN	22

CAD REF. NO.: A813 FINAL



ROAD CL PROFILE - ELEVATION VIEW
SCALE 1:150



BRIDGE CL CROSS-SECTION
SCALE 1:150



PHOTO AS#14 - LOOKING UPSTREAM AT CROSSING LOCATION.

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.
STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006

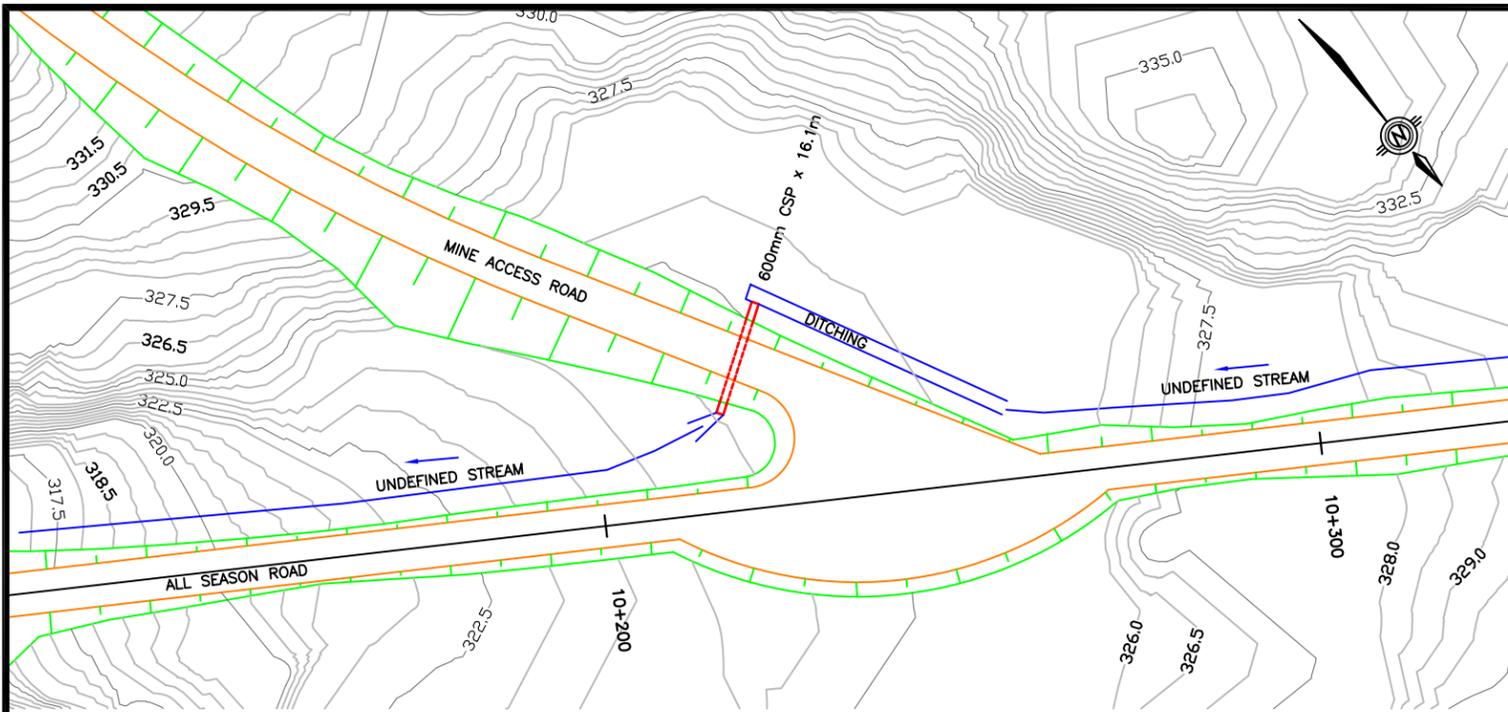
NOT FOR CONSTRUCTION

DATE	REVISION	BY
20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ

DWG. TITLE: **WATER CROSSING LOCATION PLAN AS#14**
PROJECT: **ALL-SEASON ROAD DESIGN**
HIGH LAKE, NUNAVUT

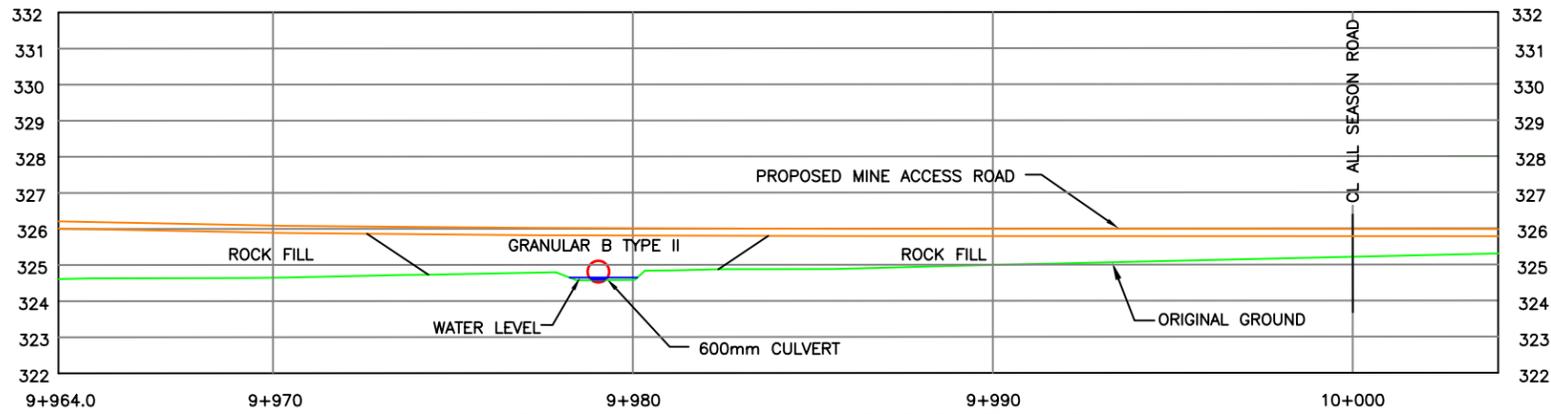
 	DRAWN BY: D.Mc./T.B.	PROJECT NO. 05-160
	APPROVED BY: R.F.	DATE: APRIL 2007
	SCALE: AS SHOWN	ENCLOSURE 23

CAD REF. NO.: AS14-1TB



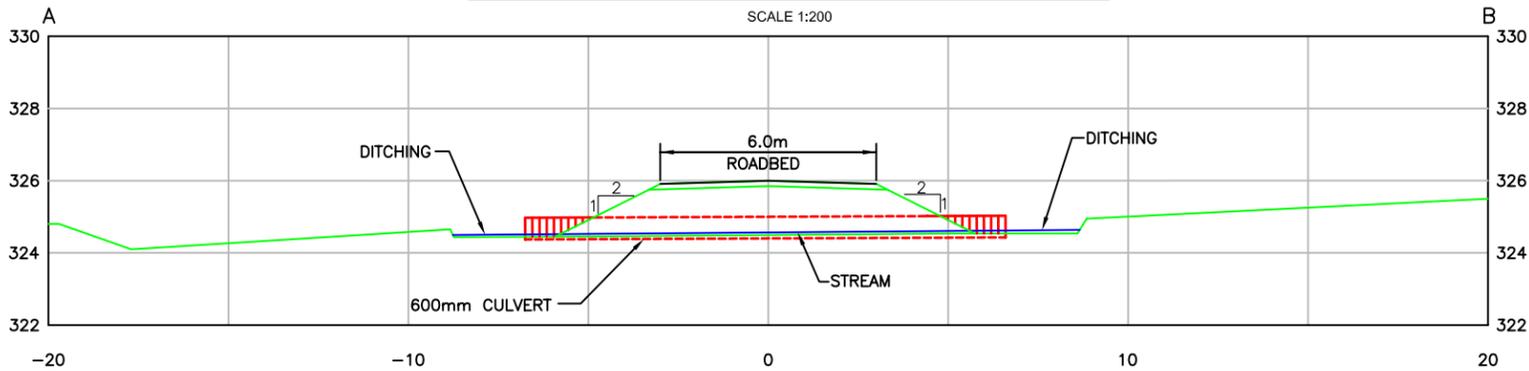
WATER CROSSING -PLAN VIEW

SCALE 1:1000



MINE ACCESS ROAD CL PROFILE - ELEVATION VIEW

SCALE 1:200



CULVERT CL CROSS-SECTION

SCALE 1:200

WATER CROSSING DATA

REFERENCE	AS#15
CROSSING	31
SUBSTRATE	BEDROCK/BOULDER
FISH HABITAT (Y/N)	N
WATERSHED AREA	65.9 ha
AREA	0.66 km ² /s
MEASURED DISCHARGE	0.0123 m ³ /s
DISCHARGE - 100 YR	0.2
DISCHARGE - 10 YR	0.1
CROSSING TYPE	600mm CULVERT

*REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005.

NOTES:

1. THIS CROSSING IS CATEGORIZED AS HAVING NO FISH HABITAT, DUE TO LIMITED FLOW AND NO ACCESS TO OTHER WATERBODIES.
2. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
3. THE BOTTOM OF THE CULVERT SHALL BE BURIED INTO THE STREAMBED NOT LESS THAN 10% OF THE CULVERT HEIGHT.



PHOTO AS#15 - LOOKING SOUTHWEST ABOVE CROSSING LOCATION.

WATER CROSSING DATA REFERENCED FROM CROSSING METHOD RECOMMENDATIONS, A-S ROAD, GARTNER LEE, DEC 2005. STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

20/04/07	UPDATED WITH REVISED ALIGNMENT/SURVEY DATA	CVZ
15/05/06	FINAL - CONCEPTUAL DESIGN REPORT	CVZ
DATE	REVISION	BY

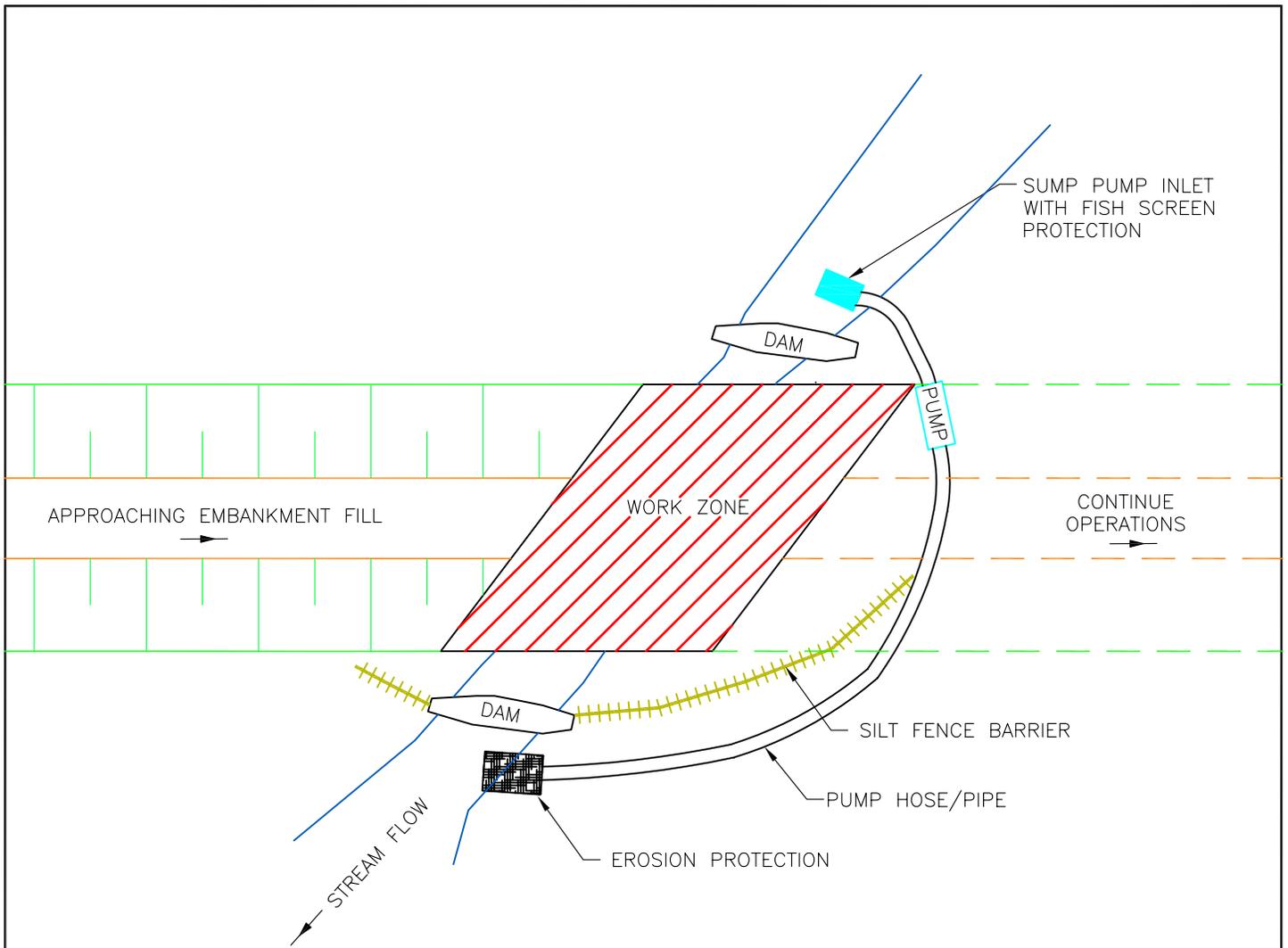
DWG. TITLE:	WATER CROSSING LOCATION PLAN AS#15	
PROJECT:	ALL-SEASON ROAD DESIGN	
	HIGH LAKE, NUNAVUT	

CLIENT: WOLFDEN Resources Inc.	DRAWN BY:	PROJECT NO.
	D.Mc./T.B.	05-160
SCALE: AS SHOWN	APPROVED BY:	DATE:
	R.F.	APRIL 2007
	ENCLOSURE	
	24	

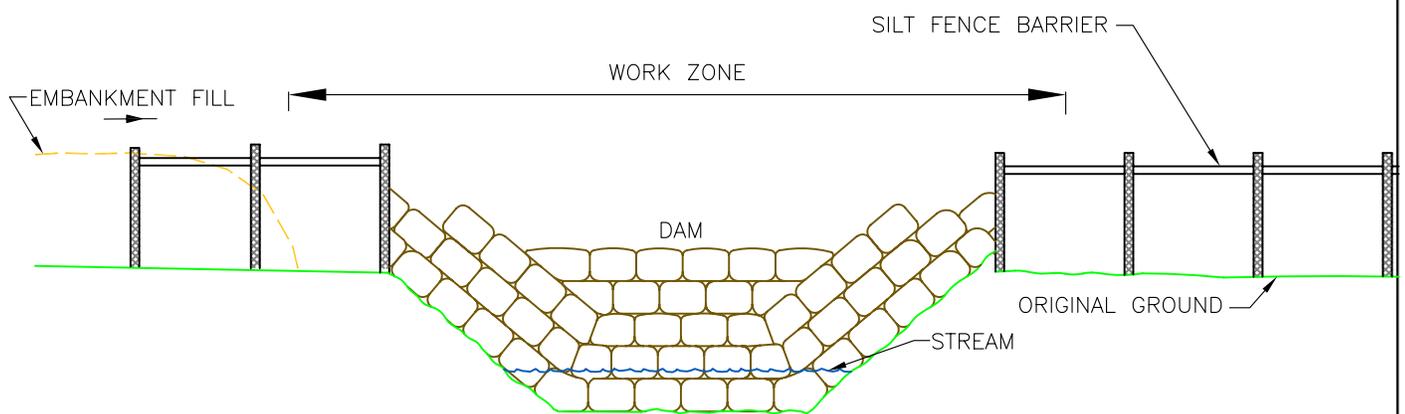
CAD REF. NO.: AS15-4TB

APPENDIX C

Water Crossing Diversion and Dewatering Technique Typical drawings

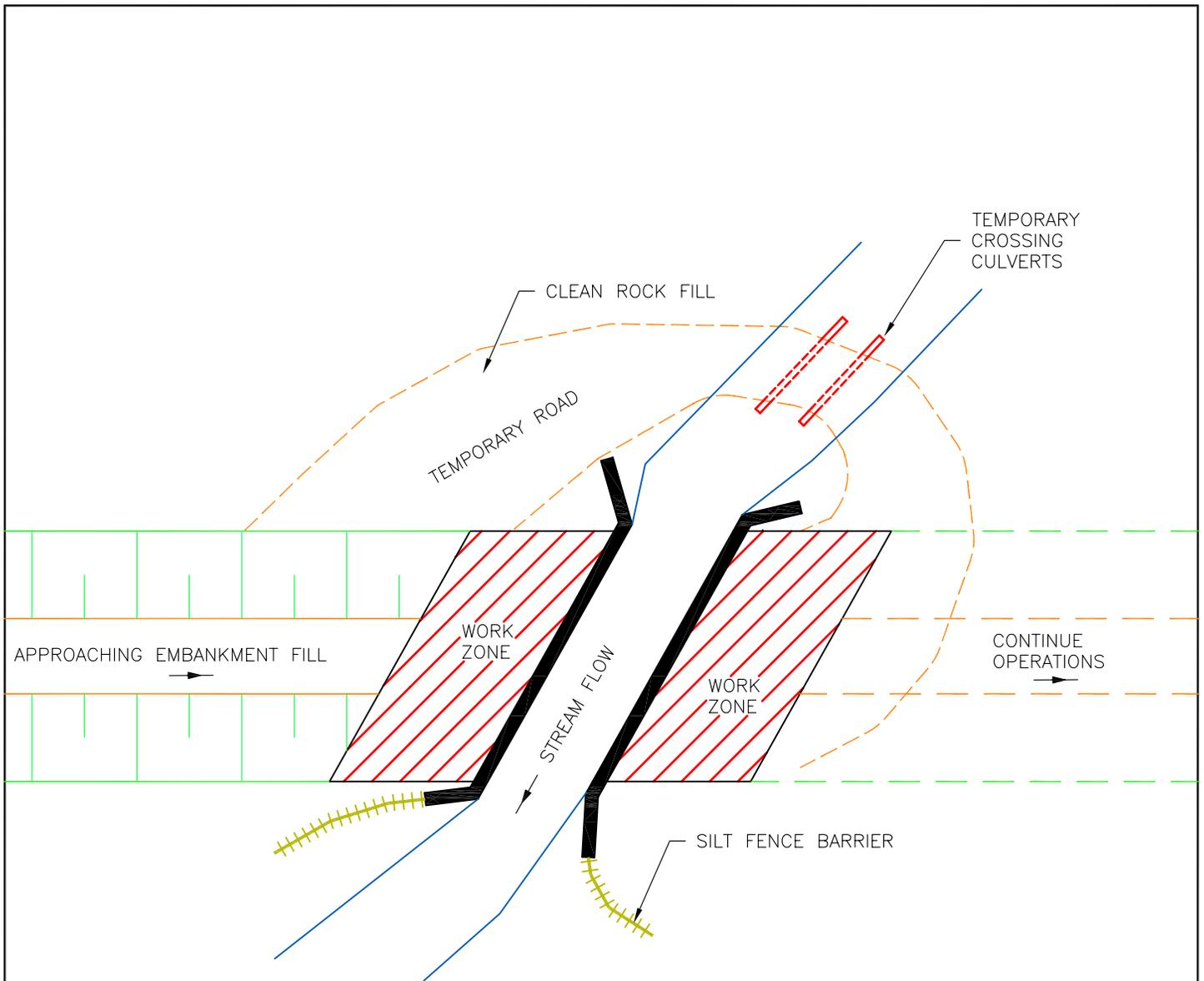


PLAN VIEW

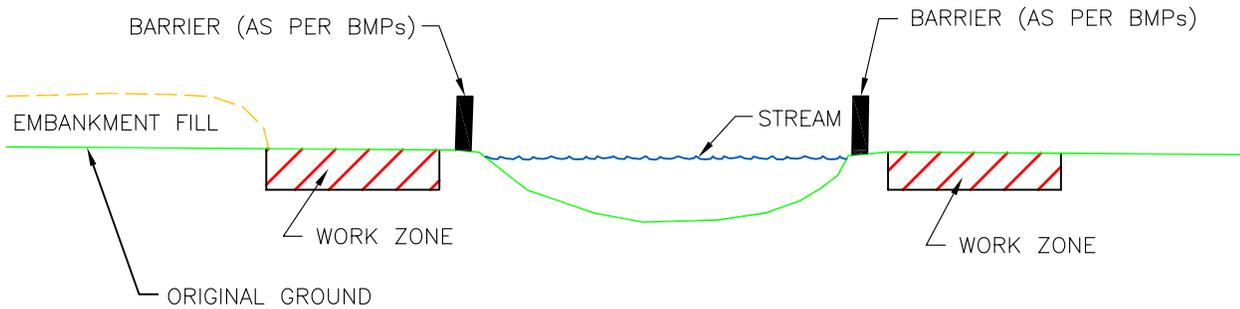


CROSS-SECTION

DWG. TITLE: TECHNIQUE No. 1 - DAM & PUMP METHOD	 TBT ENGINEERING	DRAWN BY: D.Mc./T.B.	PROJECT NO. 05-160
PROJECT: STREAM FLOW DIVERSION DETAILS ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT		CLIENT:  WOLFDEN Resources Inc.	APPROVED BY: R.F.
	SCALE: N.T.S.		ENCLOSURE C-1

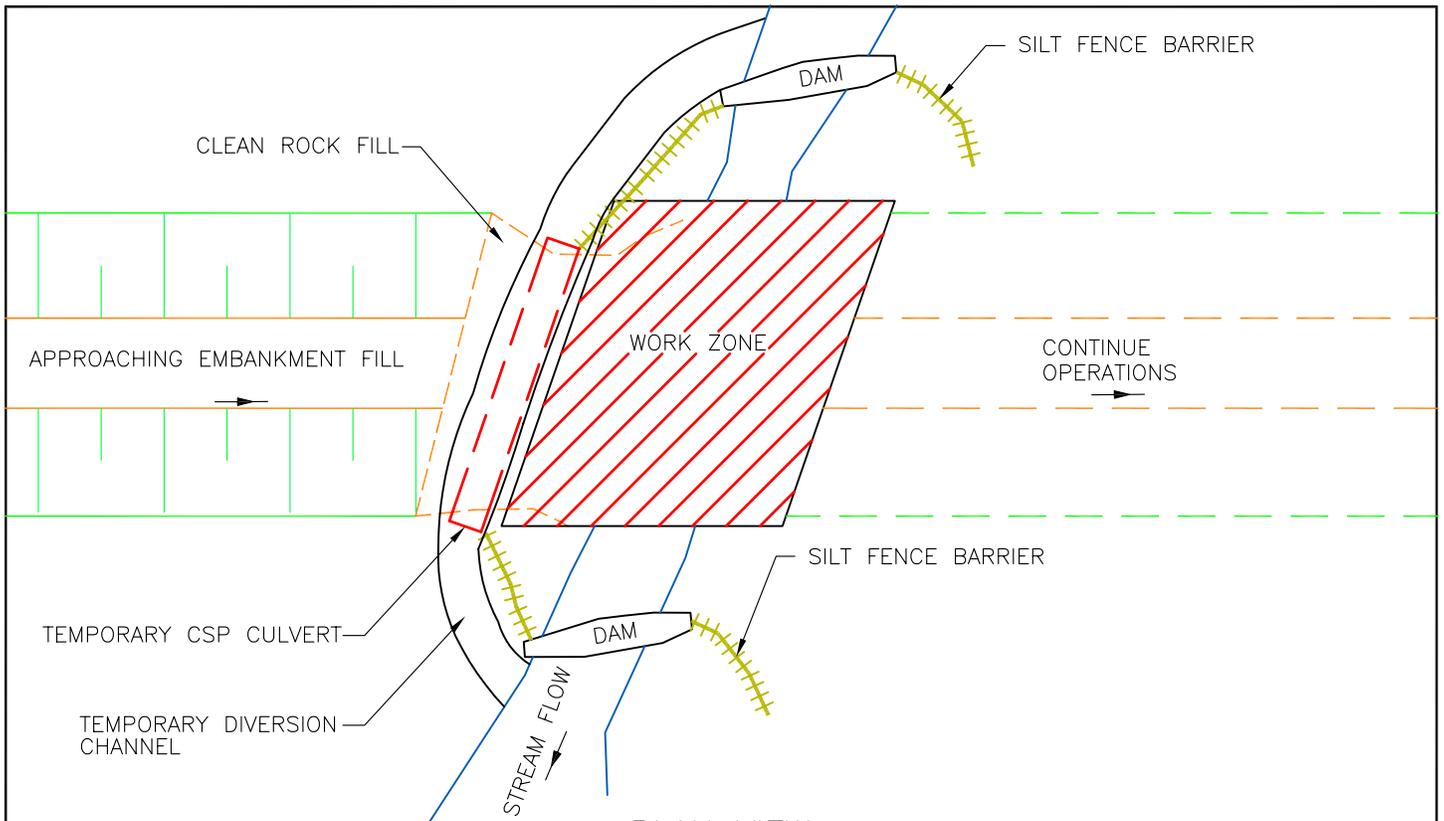


PLAN VIEW

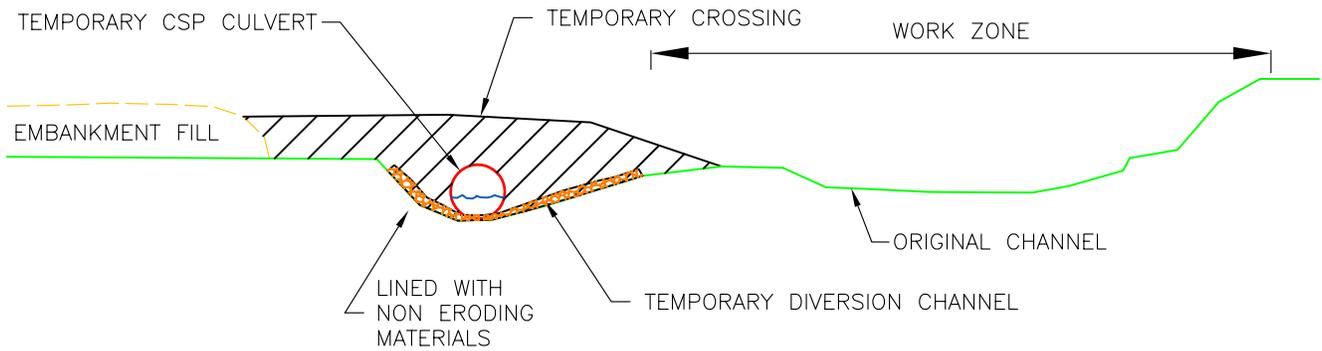


CROSS-SECTION

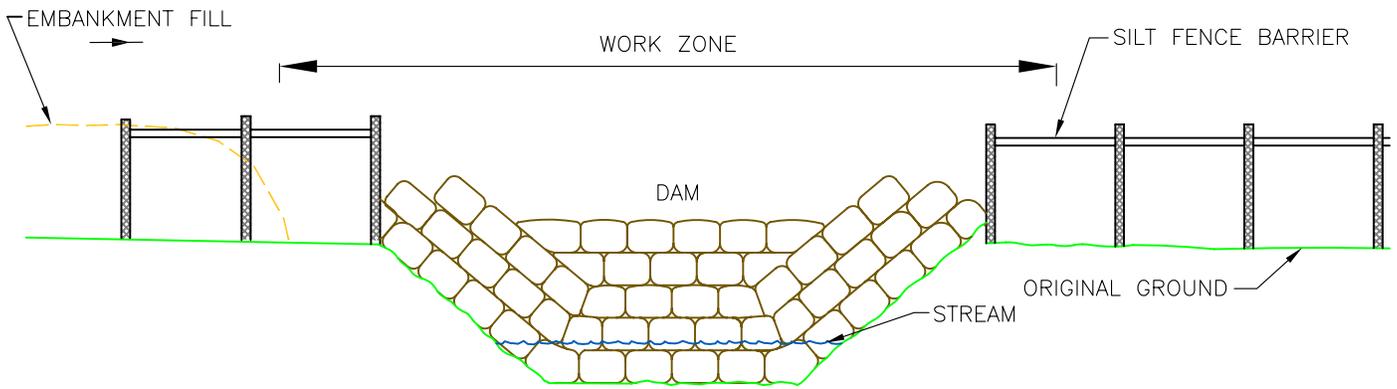
DWG. TITLE: TECHNIQUE No. 2 - INTERIOR DIVERSION CHANNEL	 TBT ENGINEERING	DRAWN BY: D.Mc./T.B.	PROJECT NO. 05-160
		APPROVED BY: R.F.	DATE: APRIL 2007
PROJECT: STREAM FLOW DIVERSION DETAILS ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT	CLIENT:  WOLFDEN Resources Inc.	SCALE: N.T.S.	ENCLOSURE C-2



PLAN VIEW

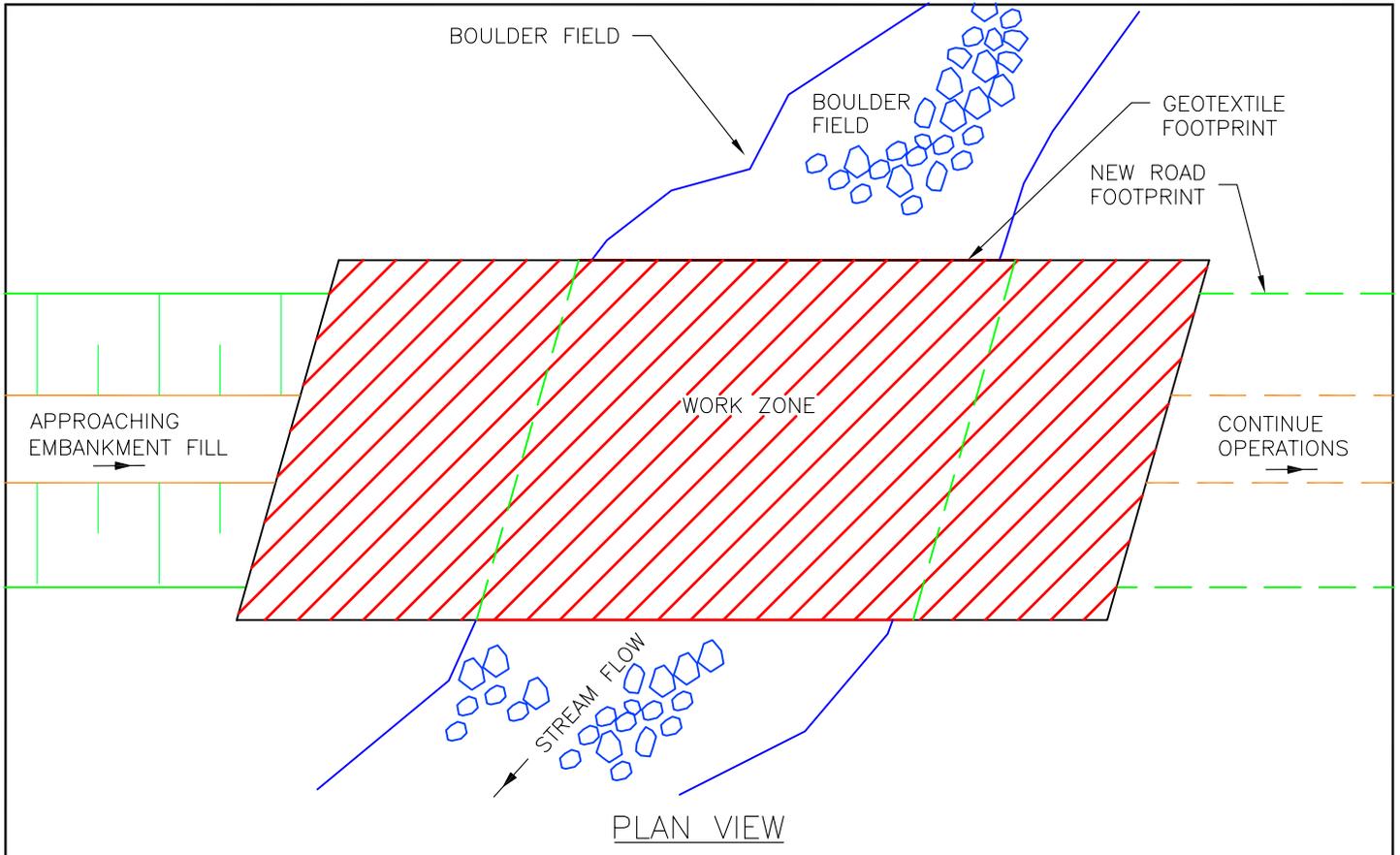


WATER CROSSING DETAIL - CROSS-SECTION

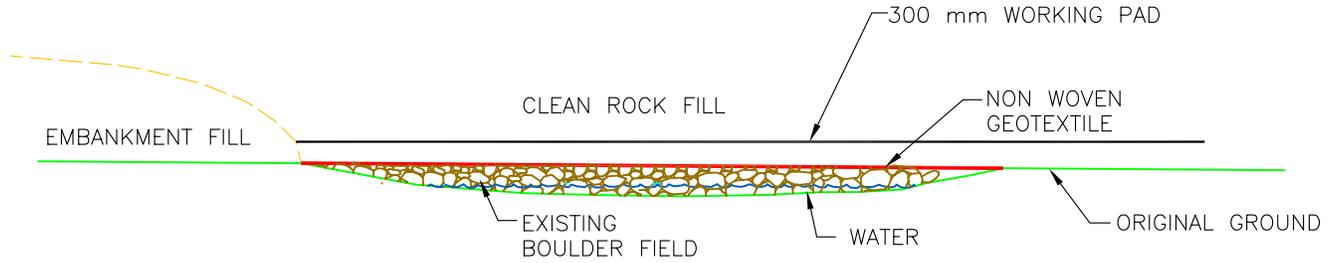


DAM DETAIL - CROSS-SECTION

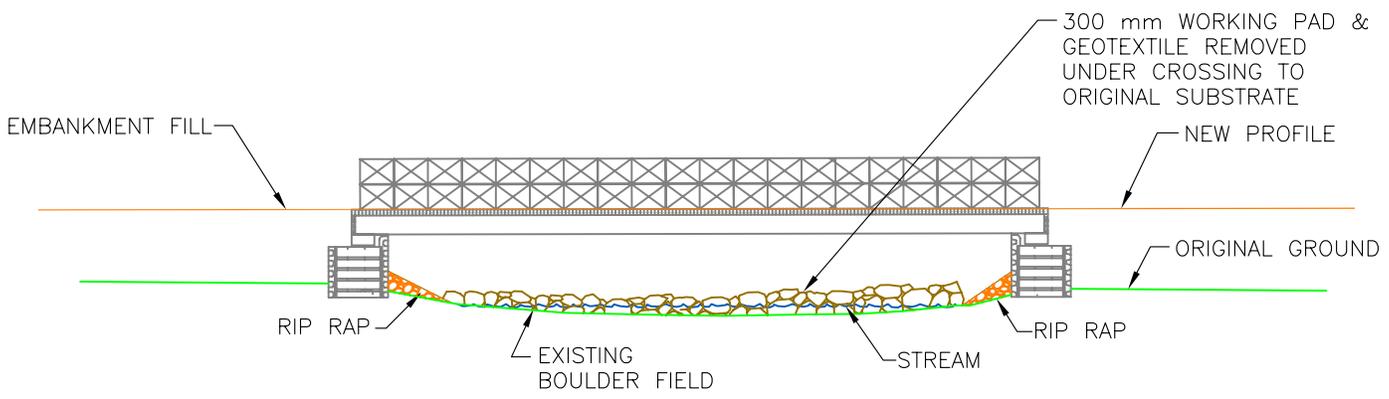
DWG. TITLE: TECHNIQUE No. 3 - EXTERIOR DIVERSION CHANNEL	 TBT ENGINEERING	DRAWN BY: D.Mc./T.B.	PROJECT NO. 05-160
		APPROVED BY: R.F.	DATE: APRIL 2007
PROJECT: STREAM FLOW DIVERSION DETAILS ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT	CLIENT:  WOLFDEN Resources Inc.	SCALE: N.T.S.	ENCLOSURE C-3



PLAN VIEW



CONSTRUCTION CROSSING DETAIL - ELEVATION VIEW

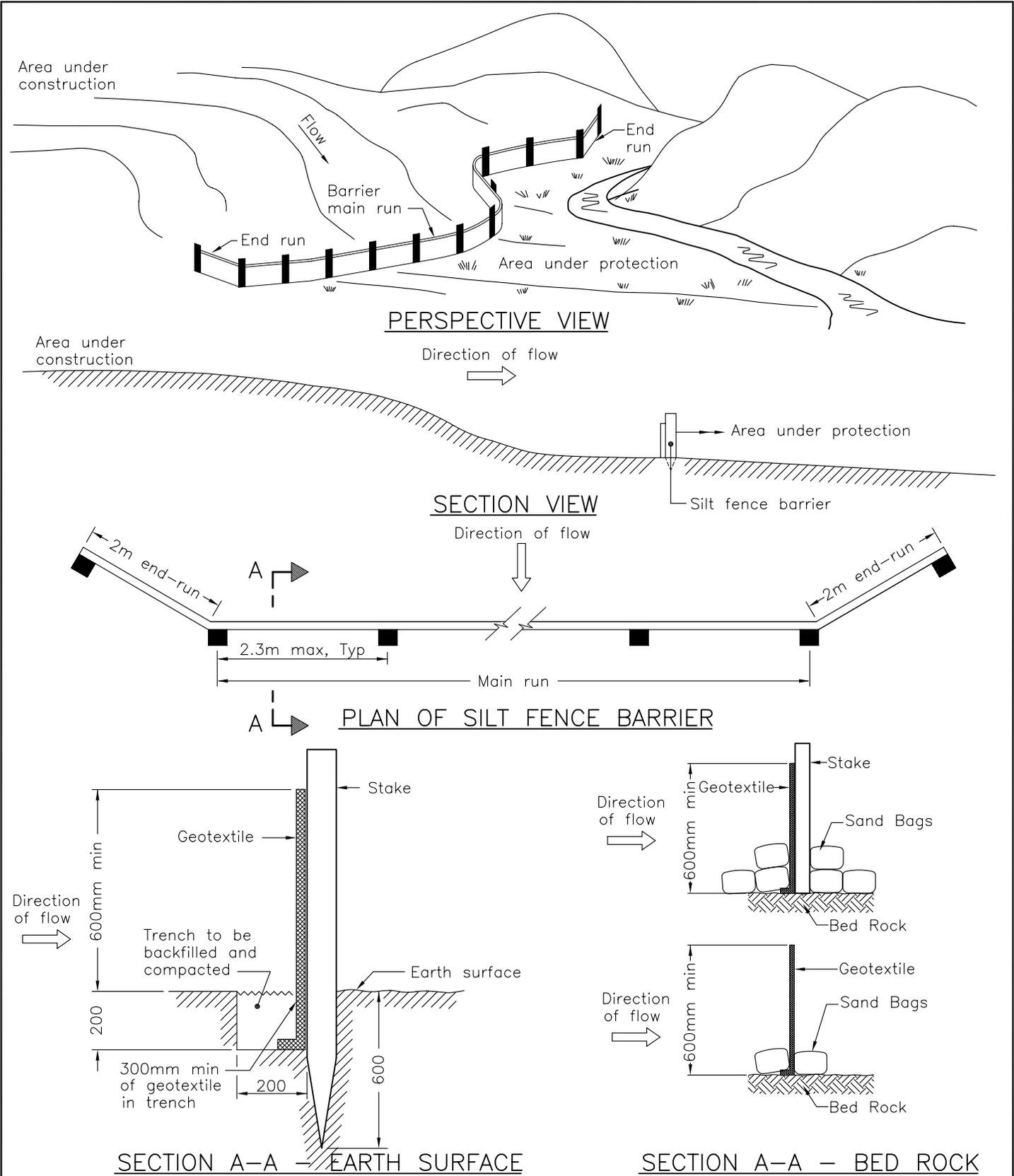


FINISHED CROSSING DETAIL - ELEVATION VIEW

DWG. TITLE: TECHNIQUE No. 4 - PROTECT & COVER METHOD	 TBT ENGINEERING	DRAWN BY: D.Mc./T.B.	PROJECT NO. 05-160
		APPROVED BY: R.F.	DATE: APRIL 2007
PROJECT: STREAM FLOW DIVERSION DETAILS ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT	CLIENT:  WOLFDEN Resources Inc.	SCALE: N.T.S.	ENCLOSURE C-4

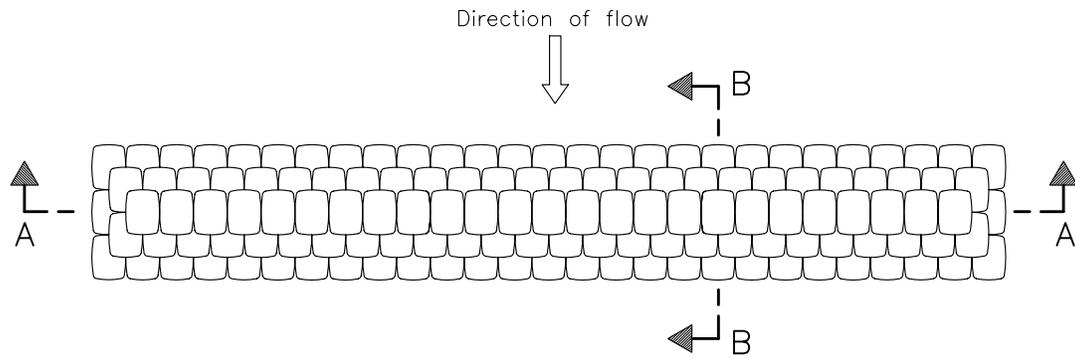
APPENDIX D

Erosion and Sediment Control Detail Drawings

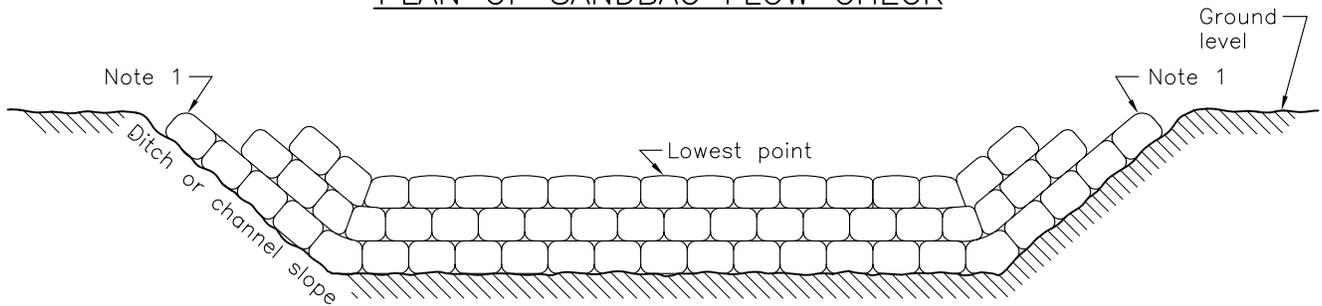


NOTE:
 All dimensions are in millimetres or metres unless otherwise shown.

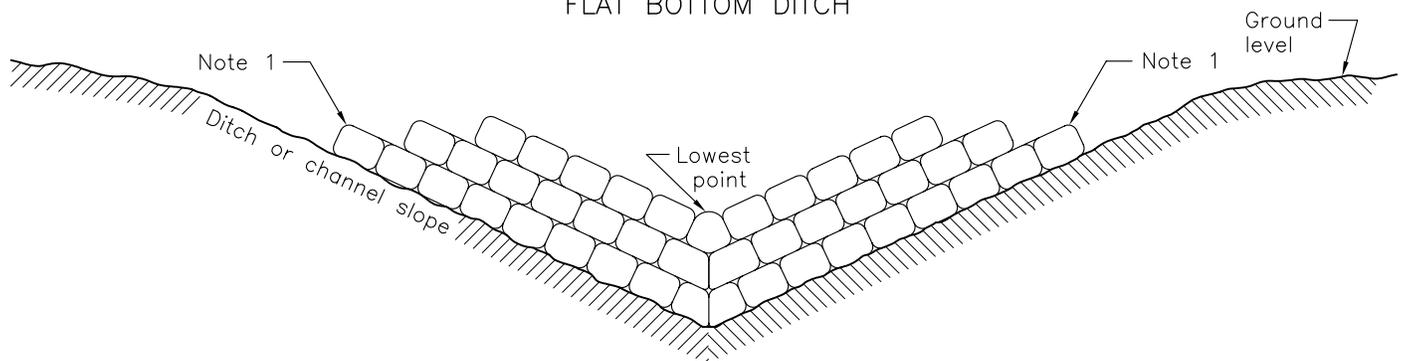
DWG. TITLE: LIGHT DUTY SILT FENCE BARRIER	TBT ENGINEERING CLIENT: WOLFDEN Resources Inc.	DRAWN BY: T.B.	PROJECT NO. 05-160
		APPROVED BY: R.F.	DATE: APRIL 2007
PROJECT: EROSION AND SEDIMENT CONTROL DETAILS ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT		SCALE: N.T.S.	ENCLOSURE D-1



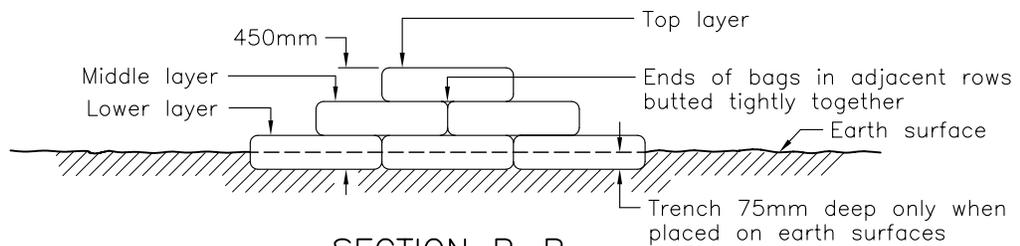
PLAN OF SANDBAG FLOW CHECK



SECTION A-A
FLAT BOTTOM DITCH



SECTION A-A
V-DITCH



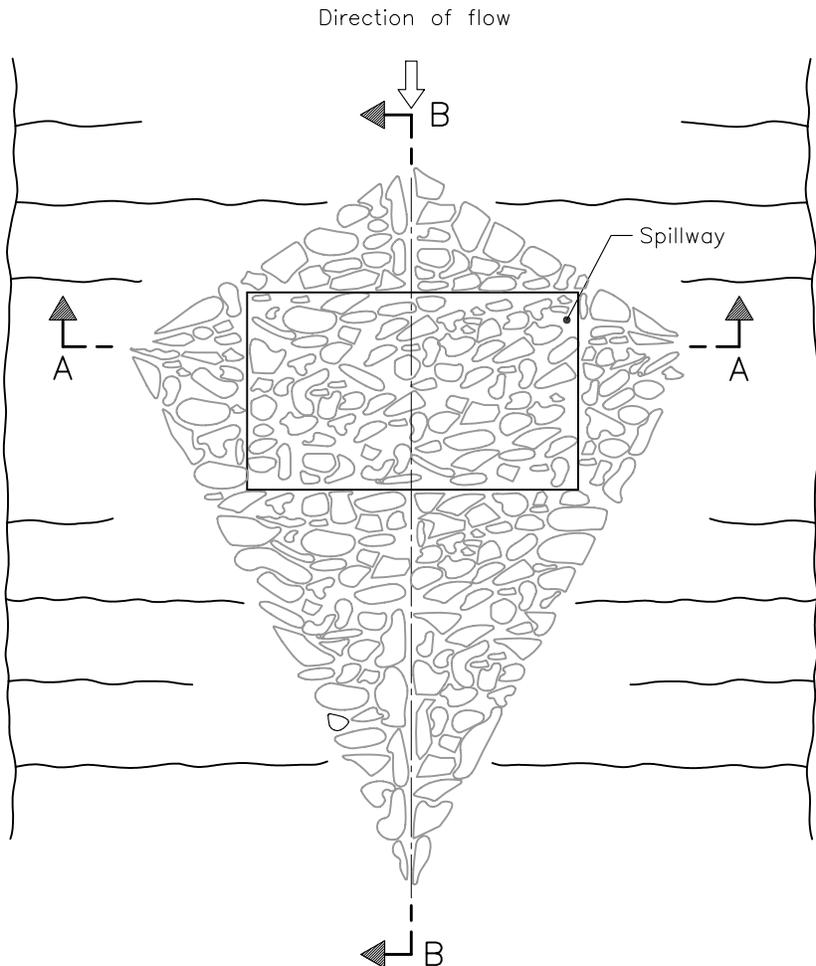
SECTION B-B

NOTES:

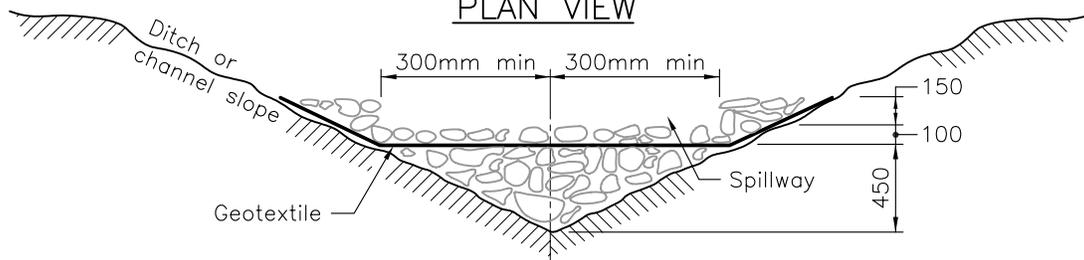
1 End of flow check at ground level to be higher than the lowest point of flow check. Sufficient sandbags are to be placed to prevent end scouring.

All dimensions are in millimetres or metres unless otherwise shown.

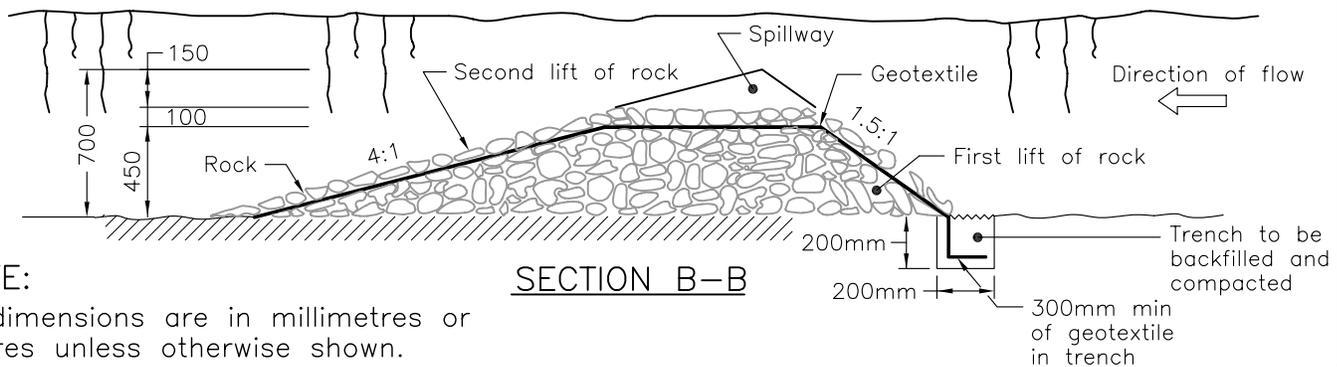
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PROJECT: <p style="text-align: center;">EROSION AND SEDIMENT CONTROL DETAILS ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT</p>			CLIENT:  WOLFDEN Resources Inc.	APPROVED BY: <p style="text-align: center;">R.F.</p>
			SCALE: <p style="text-align: center;">N.T.S.</p>	ENCLOSURE <p style="text-align: center;">D-2</p>



PLAN VIEW



SECTION A-A



SECTION B-B

NOTE:

All dimensions are in millimetres or metres unless otherwise shown.

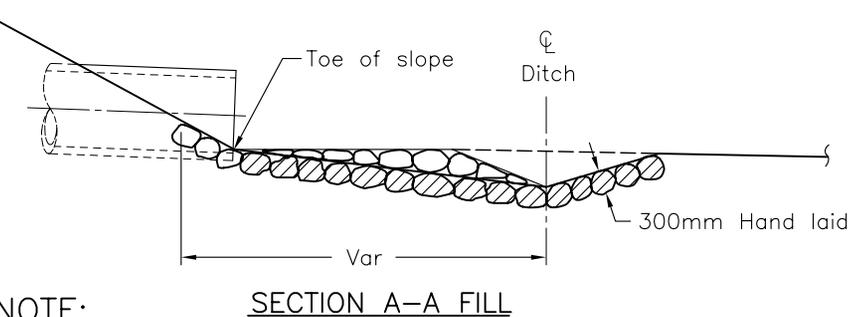
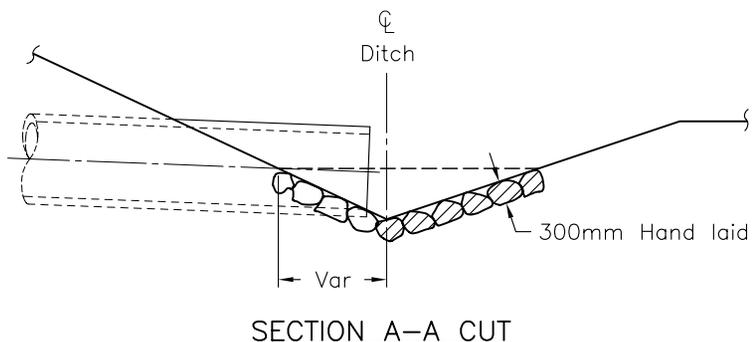
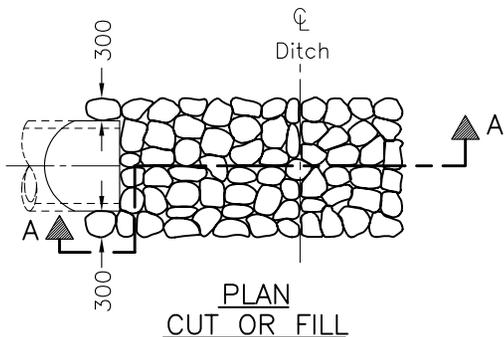
DWG. TITLE:	ROCK FLOW CHECK DAM - V-DITCH
PROJECT:	EROSION AND SEDIMENT CONTROL DETAILS ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT

TBT ENGINEERING

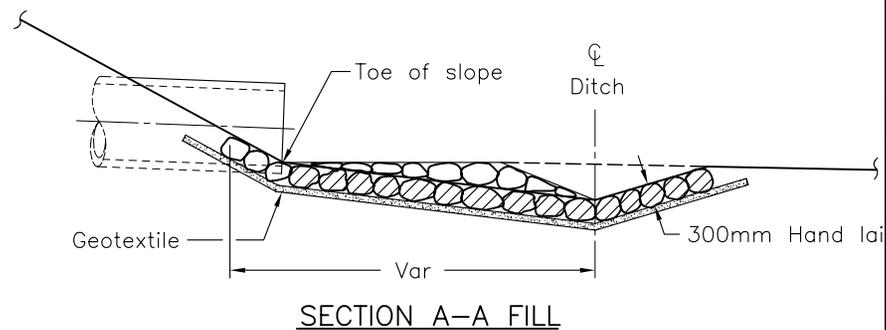
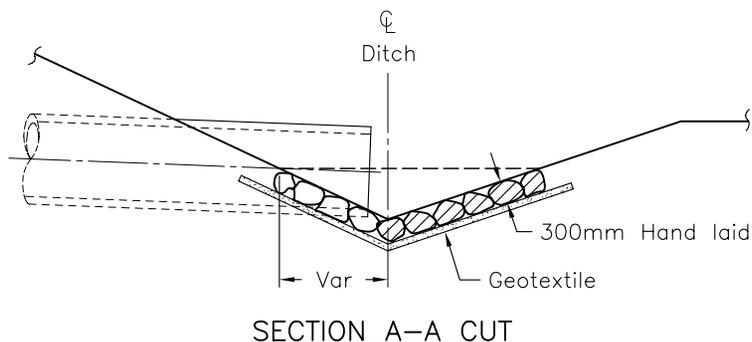
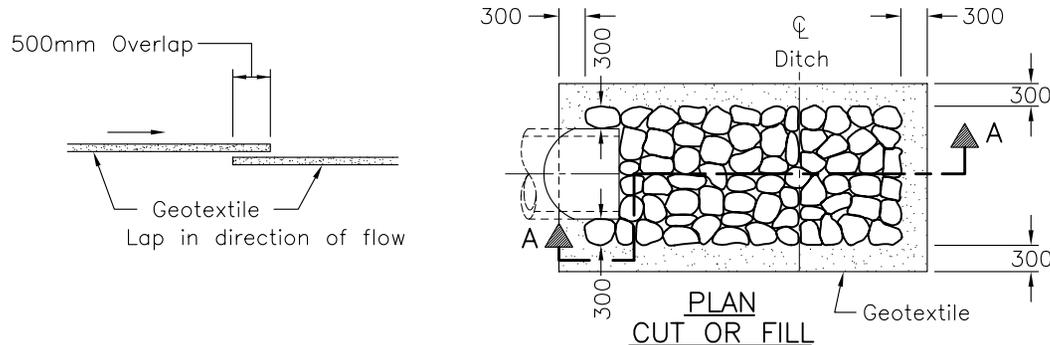
CLIENT: **WOLFDEN Resources Inc.**

DRAWN BY:	T.B.	PROJECT NO.	05-160
APPROVED BY:	R.F.	DATE:	APRIL 2007
SCALE:	N.T.S.	ENCLOSURE	D-3

TYPE 'A'
WITHOUT GEOTEXTILE



TYPE 'B'
WITH GEOTEXTILE



NOTE:

All dimensions are in millimetres unless otherwise shown.

DWG. TITLE:

RIP-RAP TREATMENT

PROJECT:

EROSION AND SEDIMENT CONTROL DETAILS
ALL-SEASON ROAD DESIGN
HIGH LAKE, NUNAVUT



CLIENT:



DRAWN BY:

T.B.

APPROVED BY:

R.F.

SCALE:

N.T.S.

PROJECT NO.

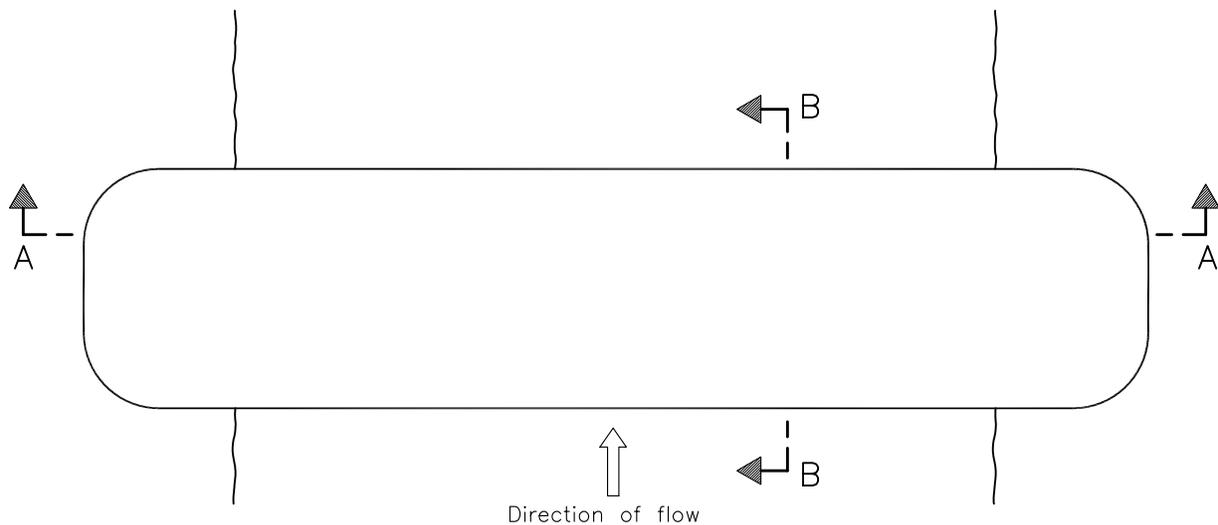
05-160

DATE:

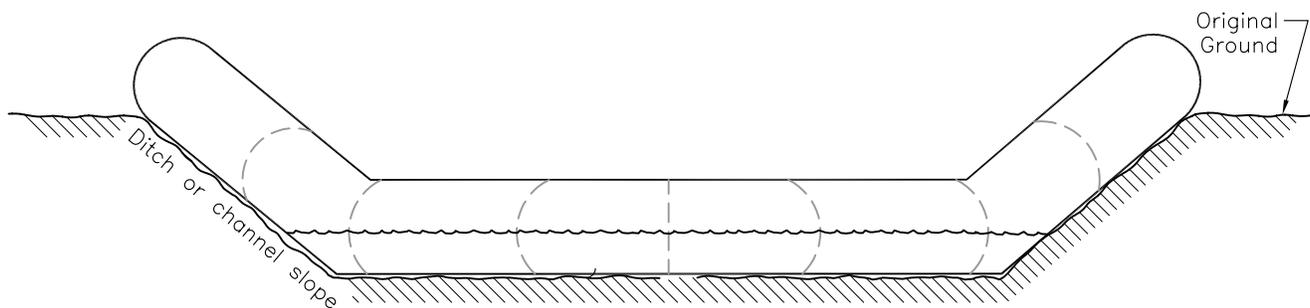
APRIL 2007

ENCLOSURE

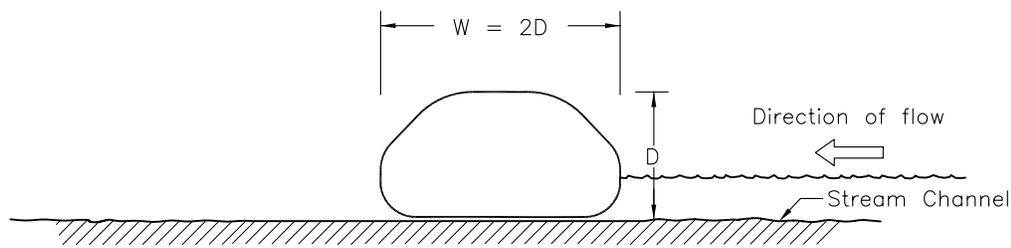
D-4



AQUA DAM OR EQUIVALENT – PLAN VIEW



FLAT BOTTOM – SECTION A-A

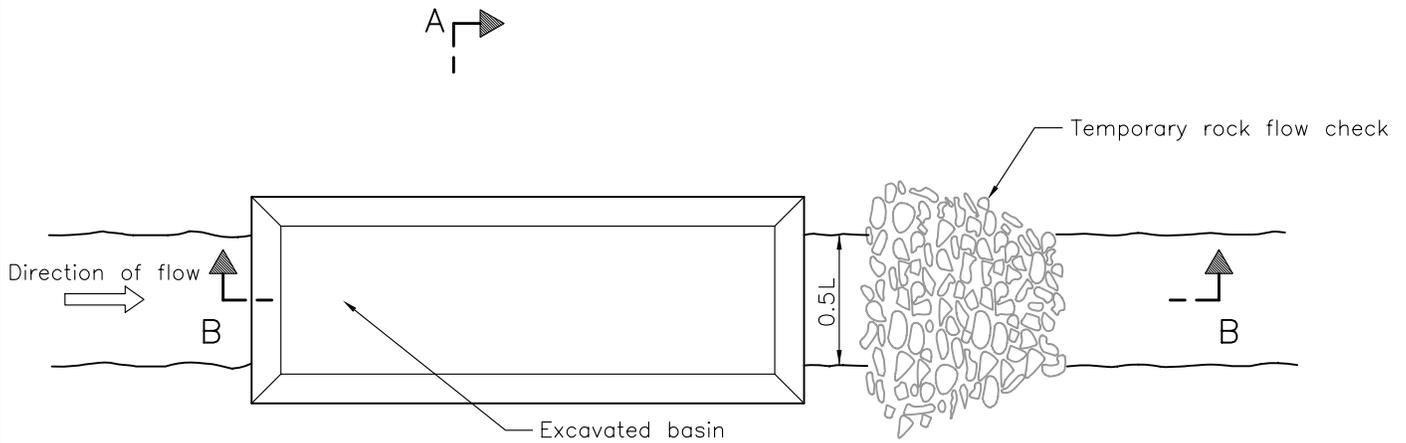


SECTION B-B

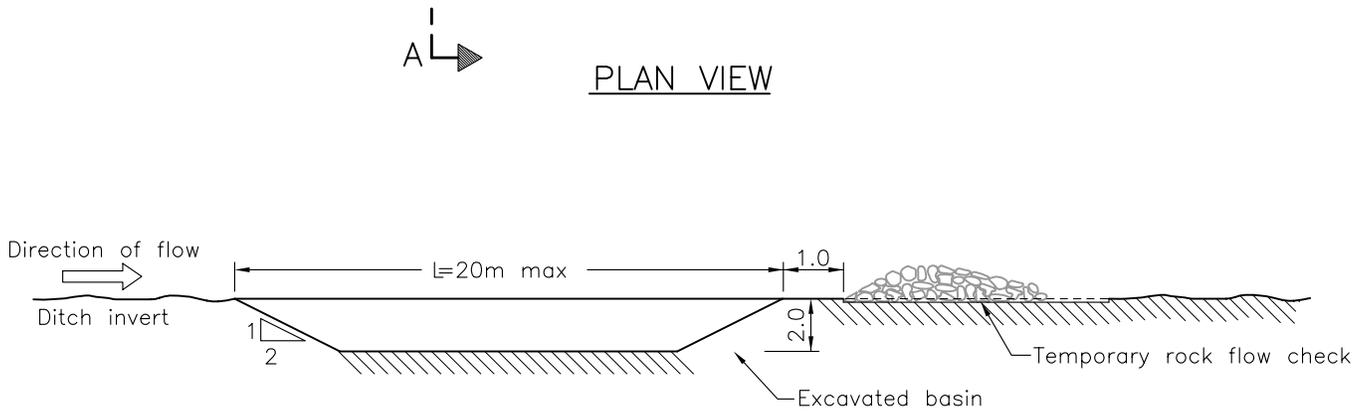
NOTES:

1 Water-inflated Dams are environmentally safe, stable water barriers used to contain, divert and control the flow of water. The design consists of two polyethylene liners contained by a single woven geotextile outer tube. When the two inner tubes are filled with water, the resulting pressure and mass create a stable, non-rolling wall of water.

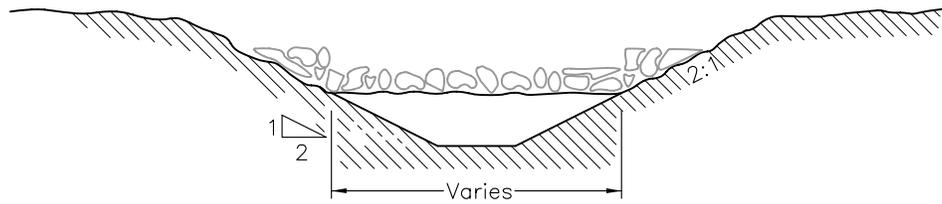
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PROJECT: <p style="text-align: center;">EROSION AND SEDIMENT CONTROL DETAILS ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT</p>		CLIENT:  <p>WOLFDEN Resources Inc.</p>	APPROVED BY: <p style="text-align: center;">R.F.</p>
			SCALE: <p style="text-align: center;">N.T.S.</p>



PLAN VIEW



SECTION B-B



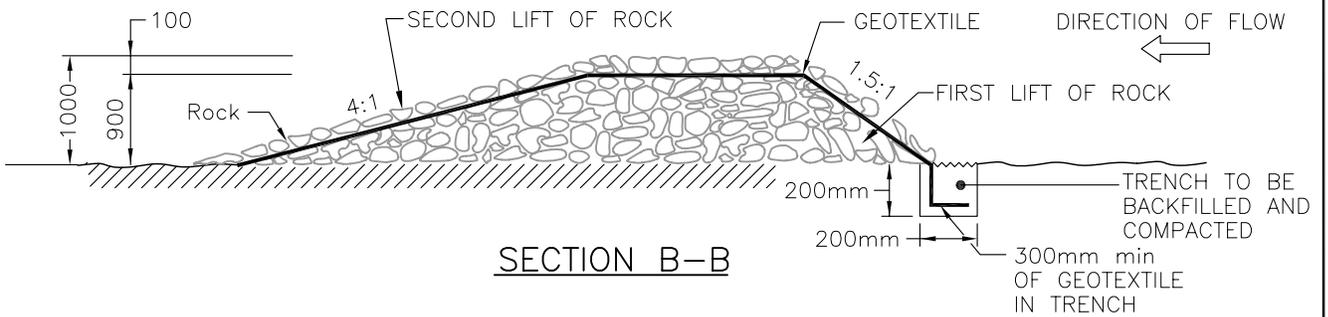
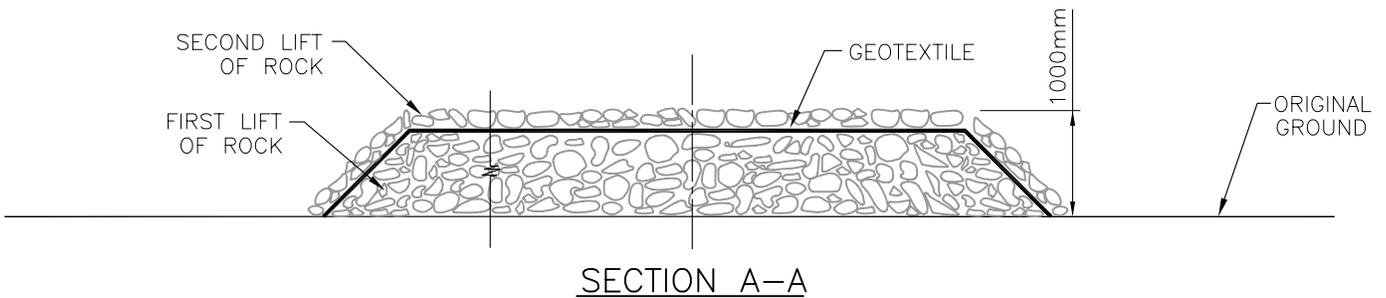
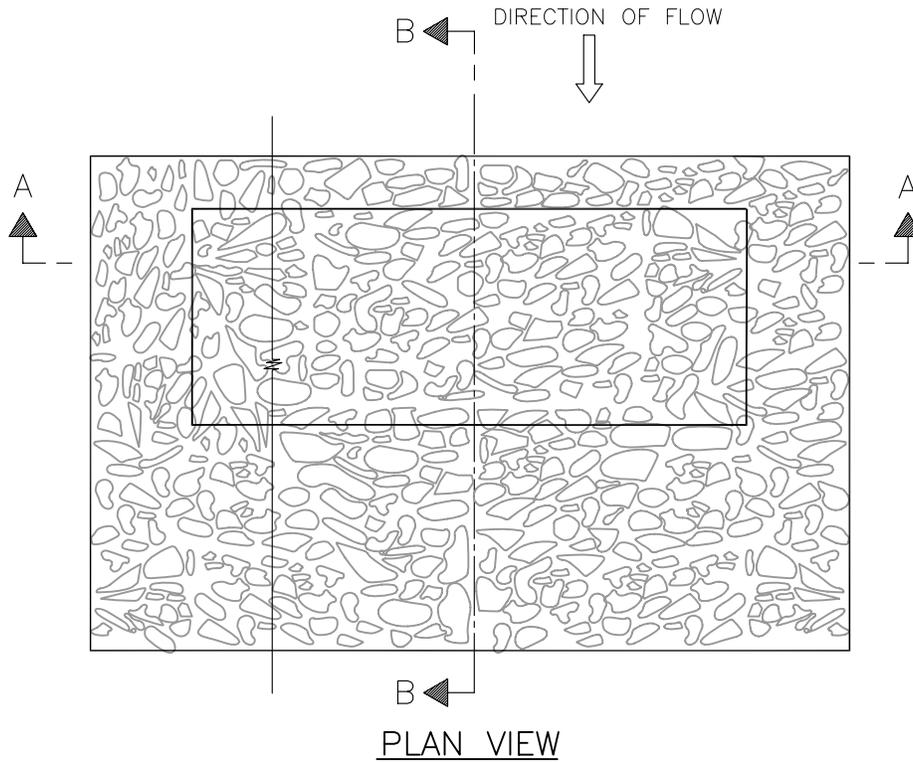
SECTION A-A

NOTES:

Ditch cross section upstream or downstream of sediment trap may be flat bottom or 'V' shaped.

All dimensions are in millimetres or metres unless otherwise shown.

<p>DWG. TITLE:</p> <p style="text-align: center;">RETENTION POND</p>	 <p>TBT ENGINEERING</p>	<p>DRAWN BY:</p> <p style="text-align: center;">T.B.</p>	<p>PROJECT NO.</p> <p style="text-align: center;">05-160</p>
<p>PROJECT:</p> <p style="text-align: center;">EROSION AND SEDIMENT CONTROL DETAILS ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT</p>		<p>CLIENT:</p>  <p>WOLFDEN Resources Inc.</p>	<p>APPROVED BY:</p> <p style="text-align: center;">R.F.</p>
			<p>SCALE:</p> <p style="text-align: center;">N.T.S.</p>

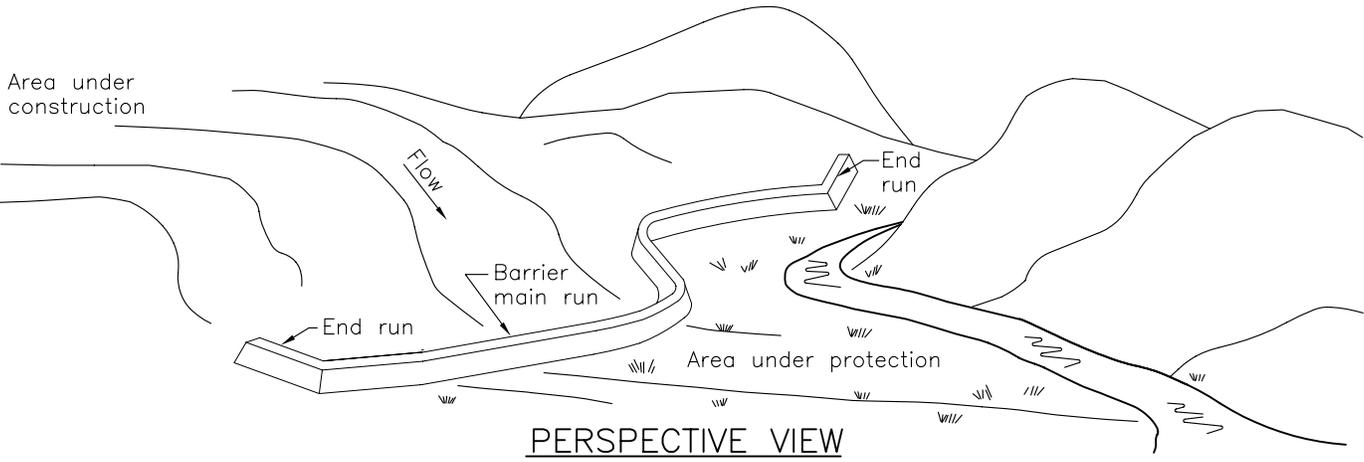


NOTE:

All dimensions are in millimetres or metres unless otherwise shown.

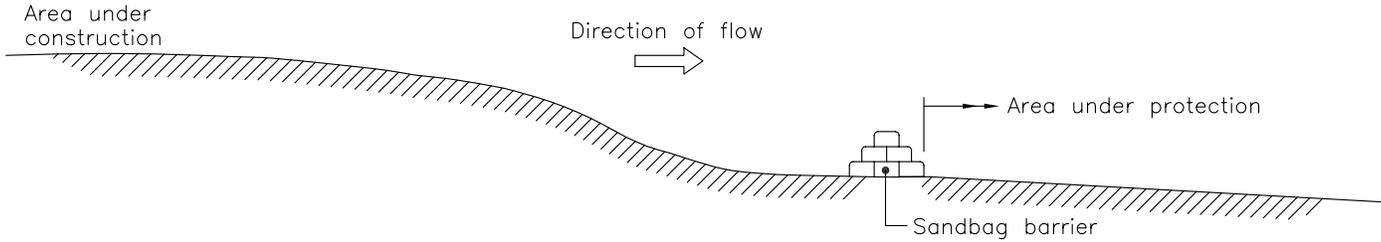
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PROJECT:	EROSION AND SEDIMENT CONTROL DETAILS ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT	CLIENT:  WOLFDEN Resources Inc.	T.B.	05-160
			APPROVED BY:	DATE:
			R.F.	APRIL 2007
			SCALE:	ENCLOSURE
			N.T.S.	D-7

Area under construction



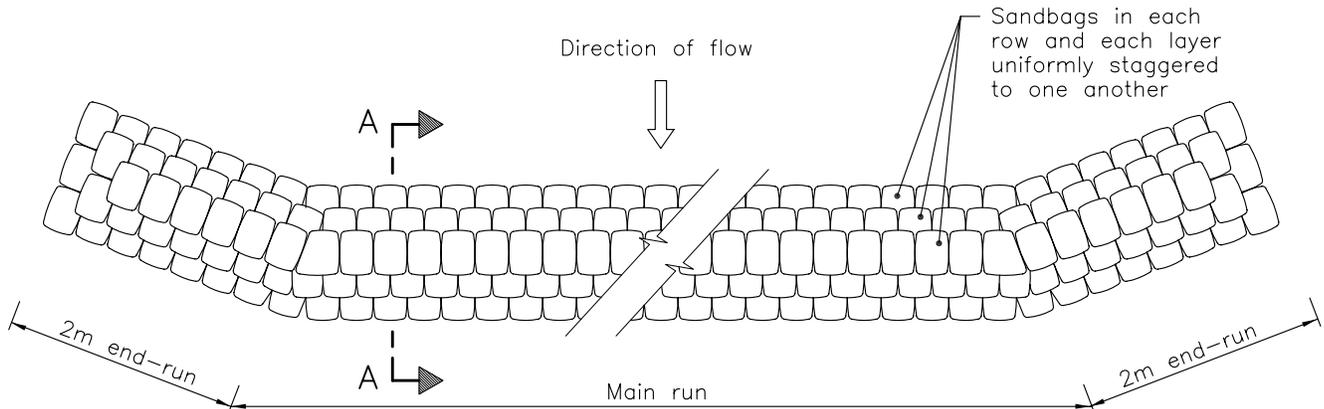
PERSPECTIVE VIEW

Area under construction



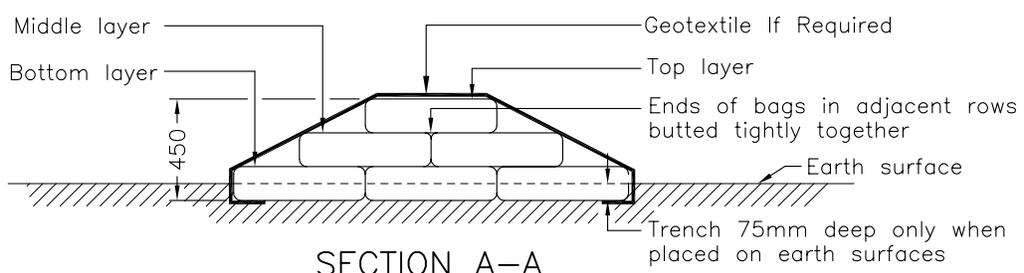
SECTION VIEW

Direction of flow



PLAN OF SANDBAG BARRIER

Direction of flow



SECTION A-A

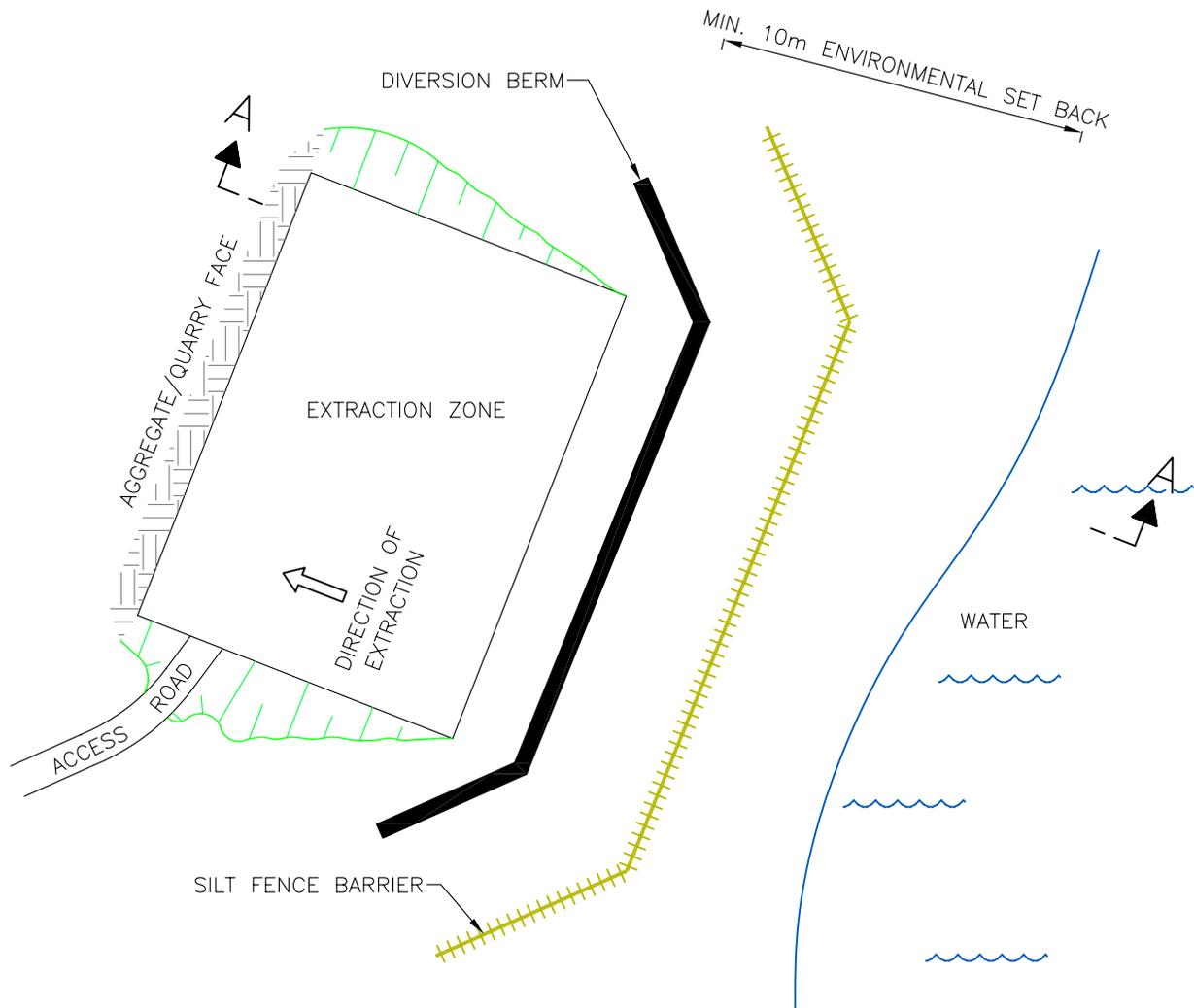
NOTE:

All dimensions are in millimetres or metres unless otherwise shown.

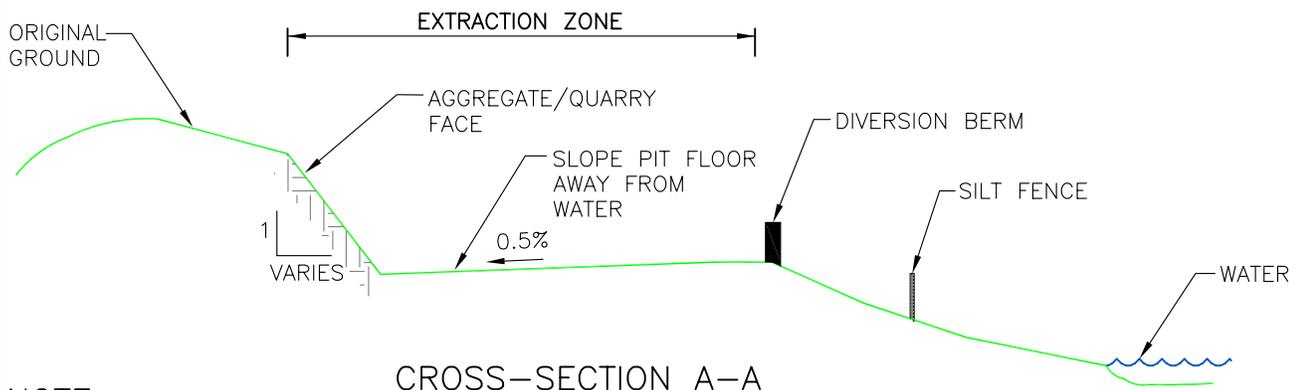
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PROJECT: <p style="text-align: center;">EROSION AND SEDIMENT CONTROL DETAILS ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT</p>			CLIENT:  WOLFDEN Resources Inc.	APPROVED BY: <p style="text-align: center;">R.F.</p>
			SCALE: <p style="text-align: center;">N.T.S.</p>	ENCLOSURE <p style="text-align: center;">D-8</p>

APPENDIX E

Borrow Source Erosion and Sediment Control Drawings



BORROW SOURCE EXTRACTION DETAIL NEAR WATER – PLAN VIEW



CROSS-SECTION A-A

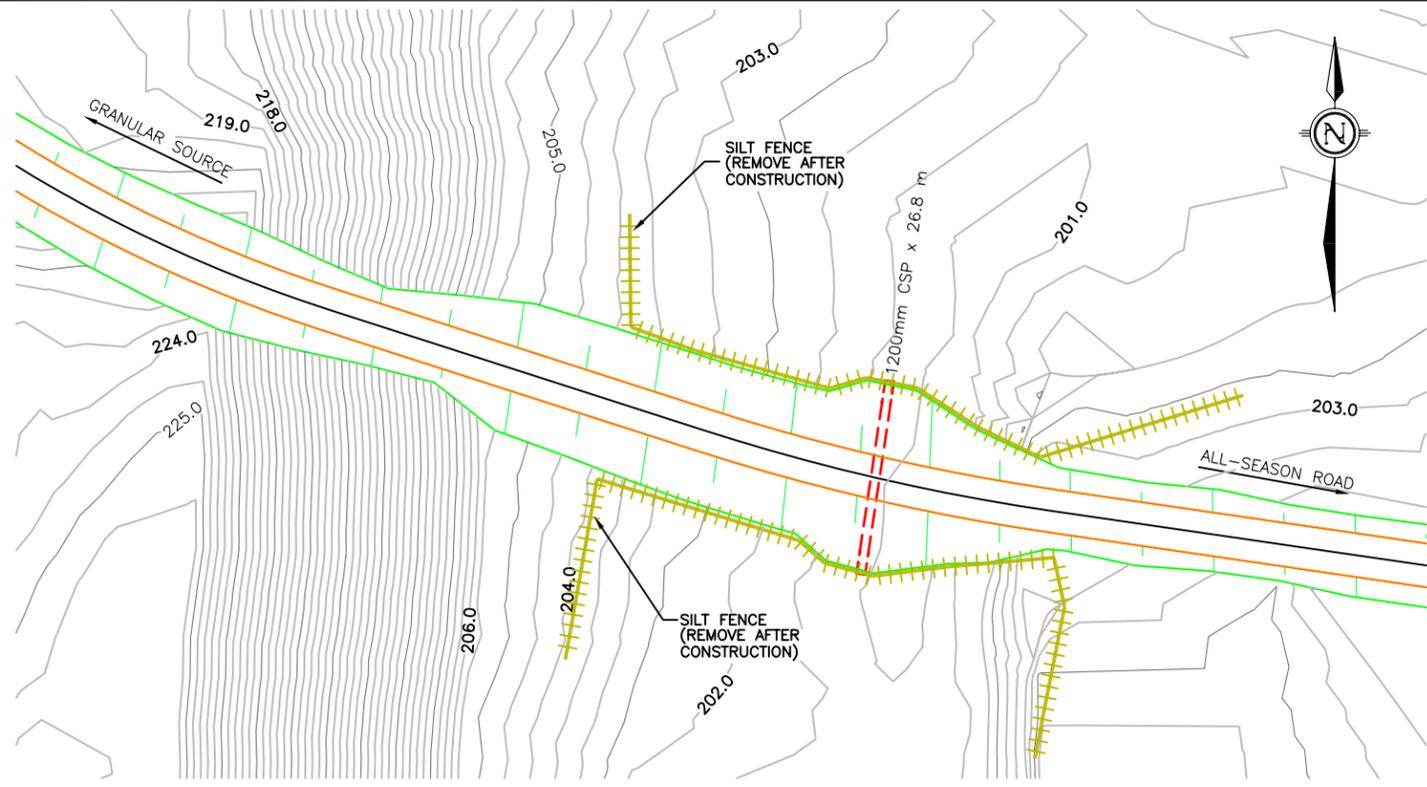
NOTE:

Storm drainage to be diverted to a retention pond as required.

<p>DWG. TITLE: EROSION AND SEDIMENT CONTROL DETAILS</p>	 TBT ENGINEERING <small>CLIENT:</small>  WOLFDEN <small>Resources Inc.</small>	<p>DRAWN BY: D.Mc./T.B.</p>	<p>PROJECT NO. 05-160</p>
<p>PROJECT: BORROW SOURCE EROSION AND SEDIMENT CONTROL ALL-SEASON ROAD DESIGN HIGH LAKE, NUNAVUT</p>		<p>APPROVED BY: R.F.</p>	<p>DATE: APRIL 2007</p>
		<p>SCALE: N.T.S.</p>	<p>ENCLOSURE E-1</p>

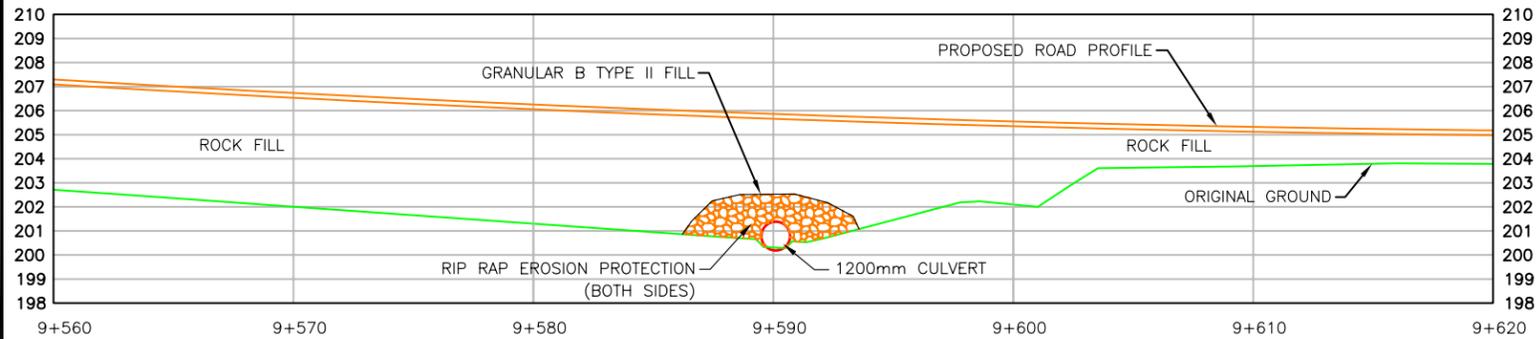
APPENDIX F

Detailed Conceptual Plans (Access Road Water Crossings)



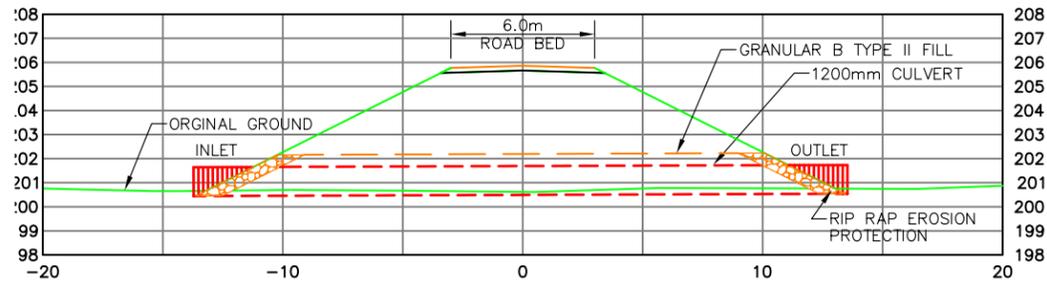
WATER CROSSING - PLAN VIEW

SCALE 1:1000



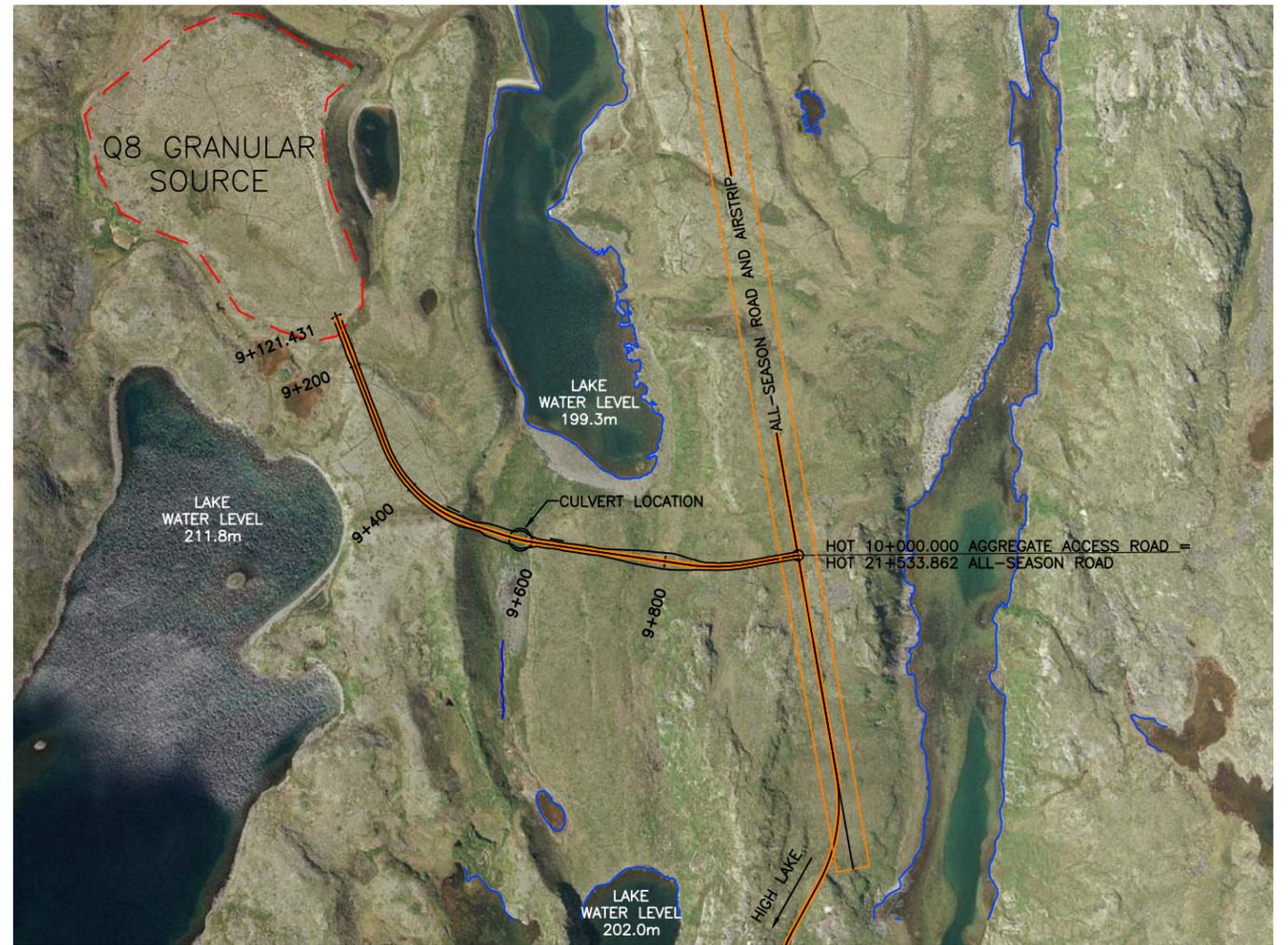
ROAD CL PROFILE - ELEVATION VIEW

SCALE 1:300



CULVERT CL CROSS-SECTION

SCALE 1:300



AERIAL PHOTO - OVERVIEW

SCALE 1:10,000

NOTES:

1. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
2. THE BOTTOM OF THE CULVERT SHALL BE BURIED INTO THE STREAMBED NOT LESS THAN 10% OF THE CULVERT HEIGHT.
3. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
4. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
5. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.

STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

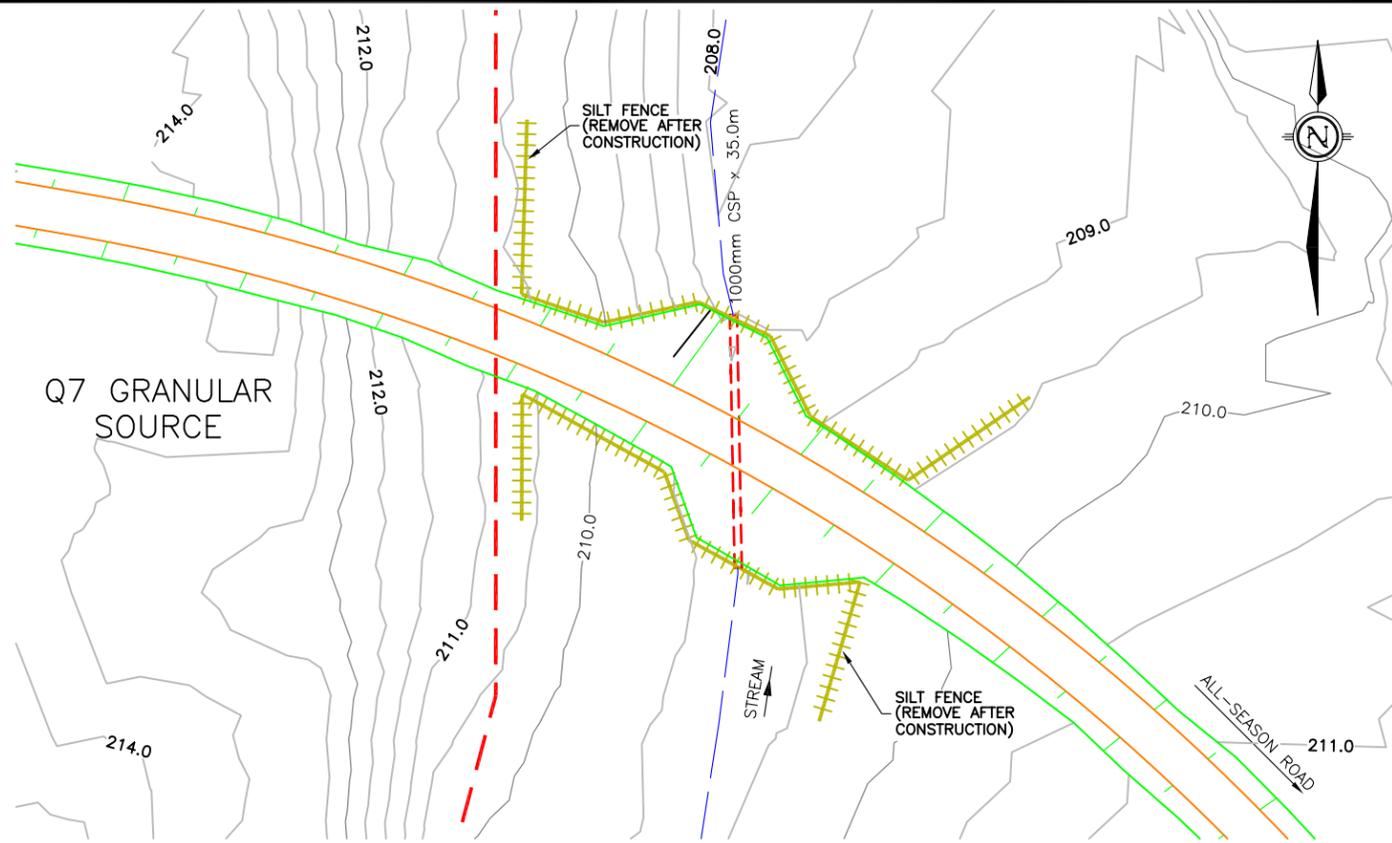
NOT FOR CONSTRUCTION

30/04/07	FOR REVIEW	CVZ
DATE	REVISION	BY

DWG. TITLE:	WATER CROSSING LOCATION PLAN
PROJECT:	BORROW SOURCE ROAD ACCESS Q8 GRANULAR SOURCE HIGH LAKE, NUNAVUT

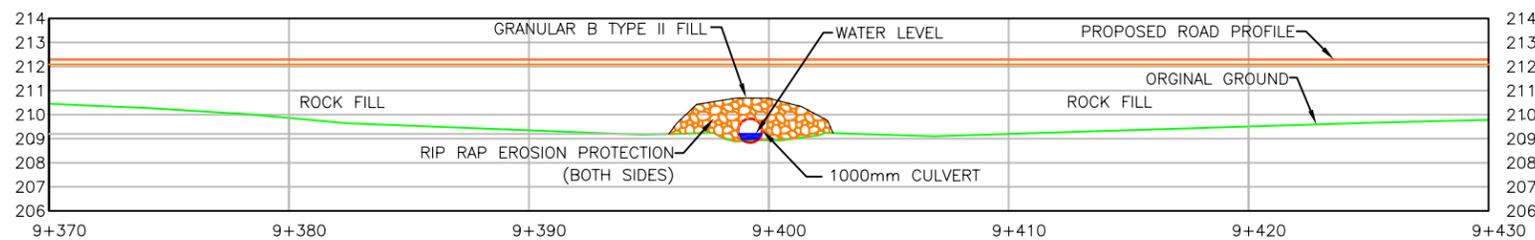
TBT ENGINEERING WOLFDEN Resources Inc.	DRAWN BY:	D.Mc./T.B.	PROJECT NO.:	05-160
	APPROVED BY:	R.F.	DATE:	APRIL 2007
	SCALE:	AS SHOWN	ENCLOSURE:	F-1

CAD REF. NO.: A81-247B



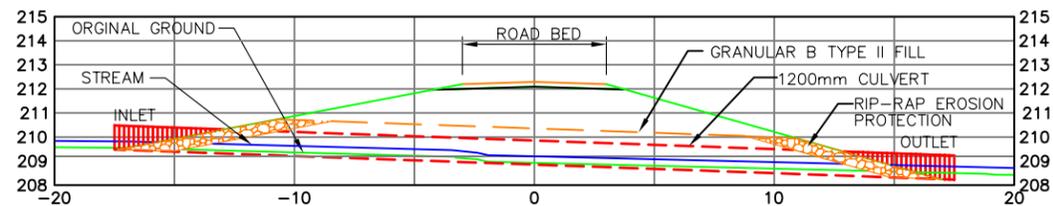
WATER CROSSING - PLAN VIEW

SCALE 1:1000



ROAD CL PROFILE - ELEVATION VIEW

SCALE 1:300



CULVERT CL CROSS-SECTION

SCALE 1:300



AERIAL PHOTO - OVERVIEW

SCALE 1:10,000

NOTES:

1. RIVER BANK LOCATIONS AND WATER LEVELS ARE REFERENCED TO FIELD SURVEY/REVIEW CONDUCTED BY TBT ENGINEERING ON JULY 2006.
2. THE BOTTOM OF THE CULVERT SHALL BE BURIED INTO THE STREAMBED NOT LESS THAN 10% OF THE CULVERT HEIGHT.
3. DISTURBANCE TO VEGETATION IS TO BE MINIMIZED.
4. SEDIMENT AND EROSION CONTROL MEASURES WILL BE UTILIZED TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATERCOURSE.
5. CONSTRUCTION EQUIPMENT WILL BE OPERATED TO PREVENT DELETERIOUS SUBSTANCES FROM ENTERING THE WATER.

STREAM CROSSING SURVEY AND FIELD REVIEW CONDUCTED BY TBT ENGINEERING JULY 2006.

NOT FOR CONSTRUCTION

30/04/07	FOR REVIEW	CVZ
DATE	REVISION	BY

DWG. TITLE:	WATER CROSSING LOCATION PLAN
PROJECT:	BORROW SOURCE ROAD ACCESS Q7 GRANULAR SOURCE HIGH LAKE, NUNAVUT

TBT ENGINEERING CLIENT: WOLFDEN Resources Inc.	DRAWN BY:	PROJECT NO.
	D.Mc./T.B.	05-160
	APPROVED BY:	DATE:
	R.F.	APRIL 2007
	SCALE:	ENCLOSURE
	AS SHOWN	F-2

CAD REF. NO.: A81-2478

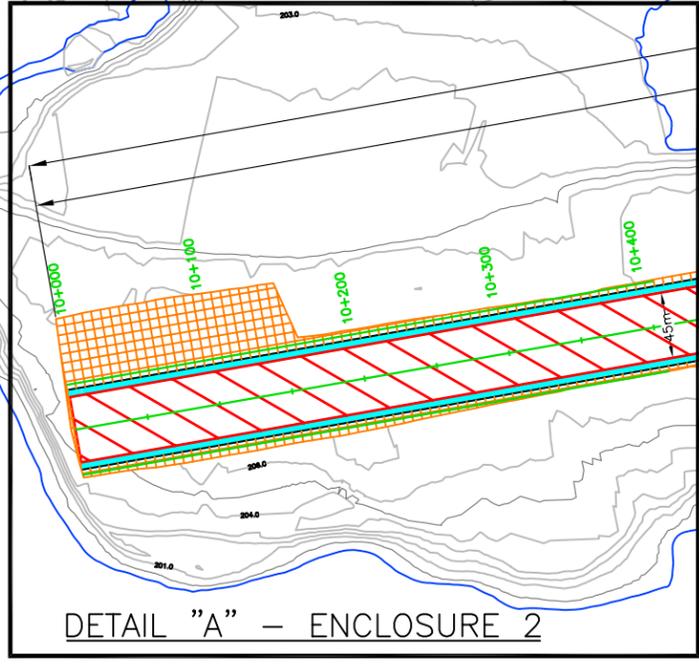
APPENDIX G

Airstrip Drainage Plans

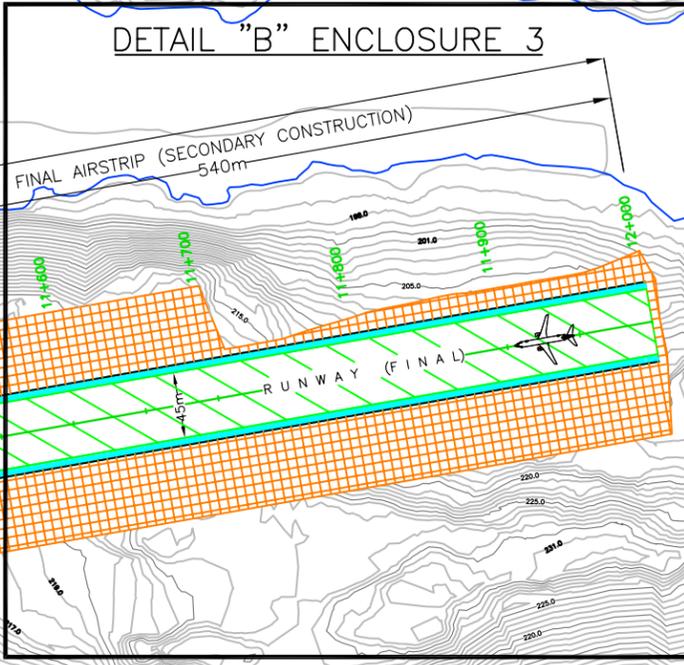


KENARCTIC RIVER

DETAIL "B" ENCLOSURE 3



DETAIL "A" - ENCLOSURE 2



LEGEND

	45m TEMPORARY RUNWAY AIRSTRIP (INITIAL CONSTRUCTION)
	45m FINAL RUNWAY AIRSTRIP (SECONDARY CONSTRUCTION)
	5m RUNWAY STRIP GRADED
	CUT/FILL AREA FOR AIRSTRIP

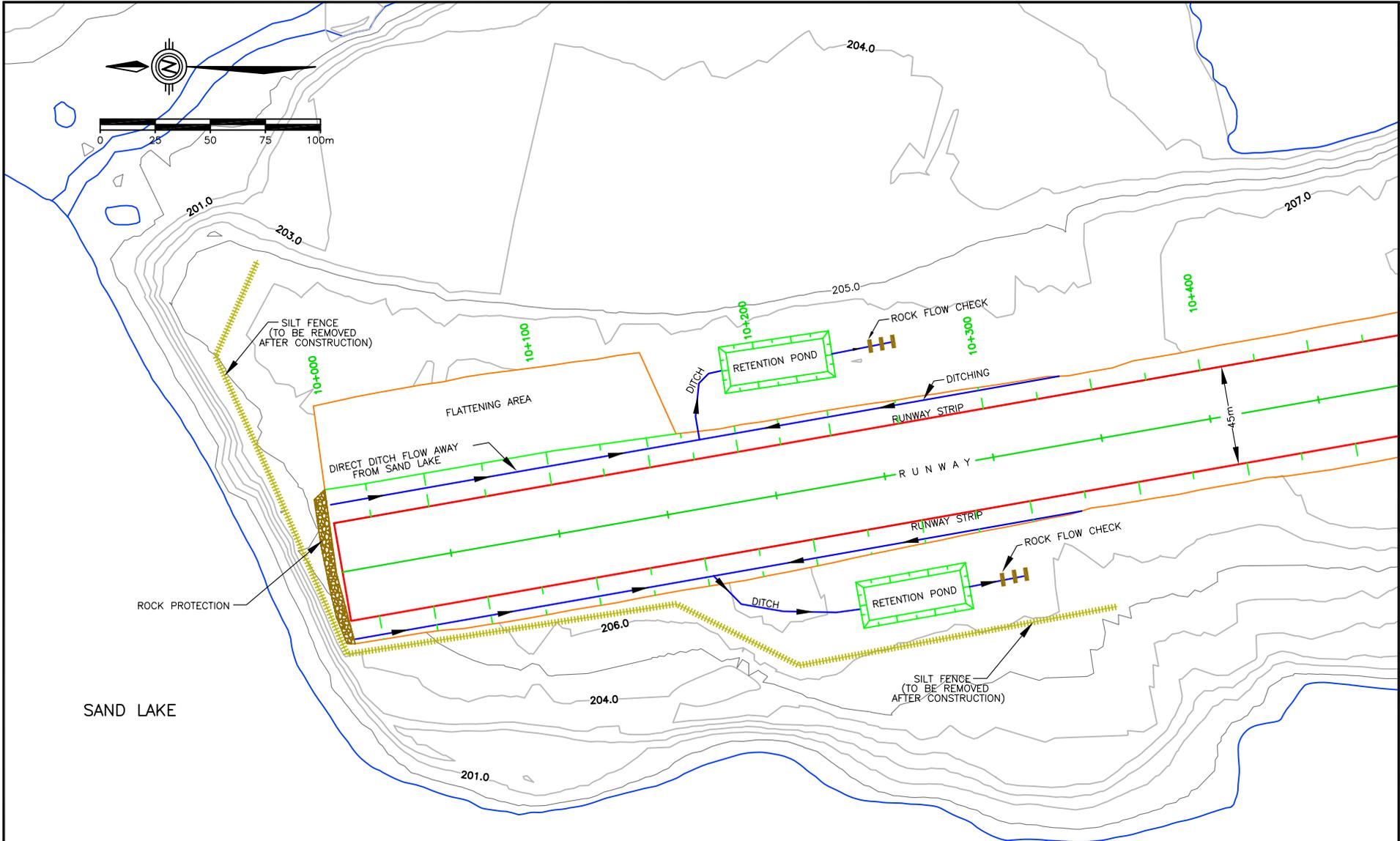
SAND LAKE

FINAL AIRSTRIP 2000m

TEMPORARY AIRSTRIP (INITIAL CONSTRUCTION) 1460m

FINAL AIRSTRIP (SECONDARY CONSTRUCTION) 540m

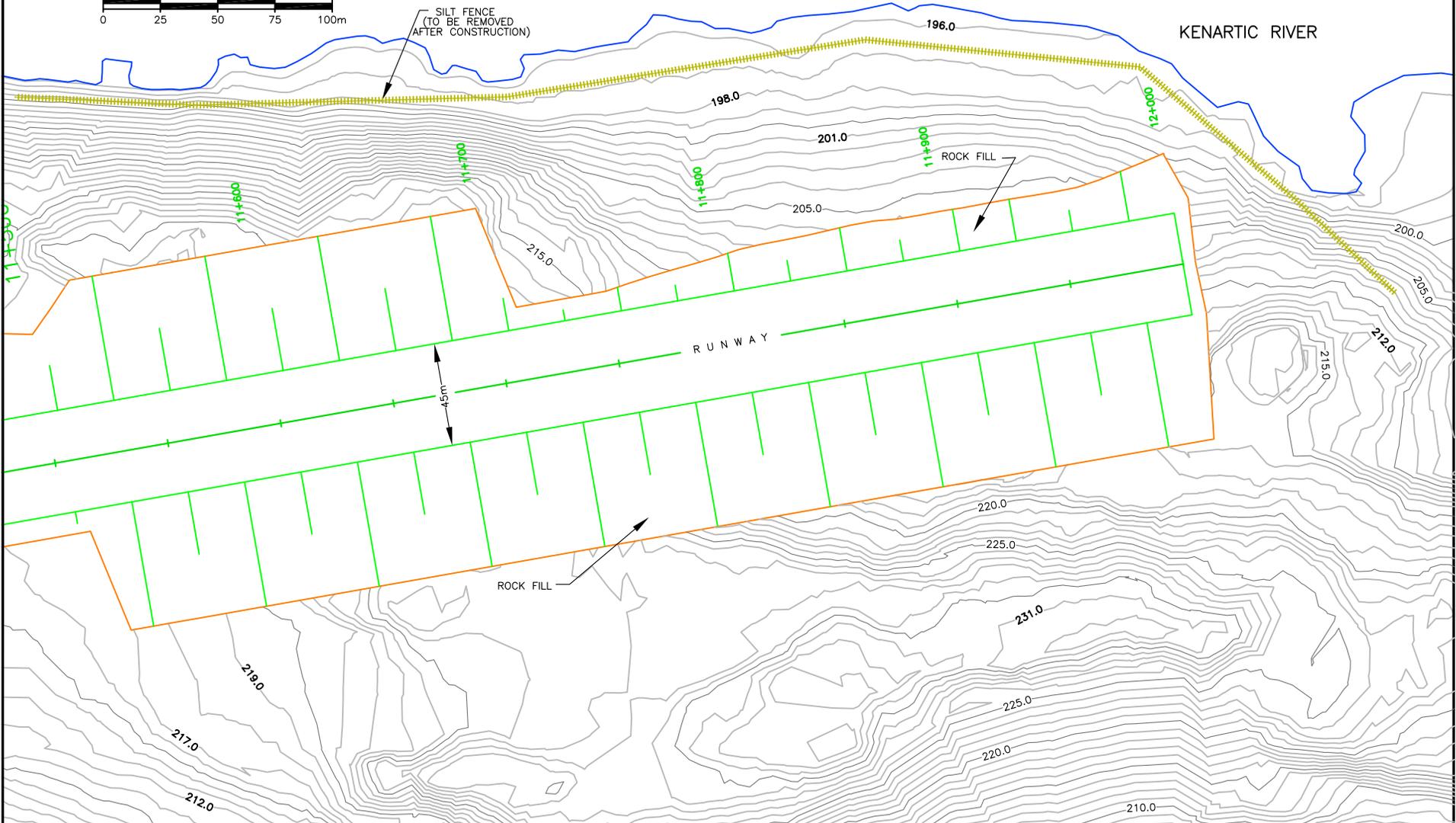
DWG. TITLE: PROPOSED AIRSTRIP DRAINAGE PLAN			 TBT ENGINEERING CLIENT:  WOLF DEN Resources Inc.	DRAWN BY: C.V.Z.	PROJECT NO. 05-160
PROJECT: PROPOSED SAND LAKE AIRSTRIP EROSION & SEDIMENT CONTROL DETAILS HIGH LAKE, NUNAVUT				APPROVED BY: R.F.	DATE: APRIL 2007
30/04/07	FOR REVIEW	CVZ	SCALE: 1:5000	ENCLOSURE G-1	
DATE	REVISION	BY			



NORTHWEST CORNER – PLAN VIEW

DWG. TITLE:	PROPOSED AIRSTRIP DRAINAGE PLAN - DETAIL "A"	 TBT ENGINEERING	DRAWN BY: T.B.	PROJECT NO. 05-160
PROJECT:	PROPOSED SANDLAKE AIRSTRIP EROSION & SEDIMENT CONTROL DETAILS HIGH LAKE, NUNAVUT		CLIENT:  WOLFDEN Resources Inc.	APPROVED BY: R.F.
				SCALE: 1:2500

SOUTHEAST CORNER – PLAN VIEW



DWG. TITLE: **PROPOSED AIRSTRIP DRAINAGE PLAN - DETAIL "B"**

PROJECT: **PROPOSED SANDLAKE AIRSTRIP
EROSION & SEDIMENT CONTROL DETAILS
HIGH LAKE, NUNAVUT**

 **TBT ENGINEERING**

CLIENT:  **WOLFDEN**
Resources Inc.

DRAWN BY: **T.B.** PROJECT NO. **05-160**

APPROVED BY: **R.F.** DATE: **APRIL 2007**

SCALE: **1:2500** ENCLOSURE **G-3**