Hardrock Project

Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan
TC150320

Prepared for:

Greenstone Gold Mines

2381 Bristol Circle, Suite B203, Oakville, Ontario, L6H 5S9

April 2019

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April 2019

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1.0 Introduction

1.1 Purpose

Greenstone Gold Mines GP Inc. (GGM) has completed a Federal Environmental Assessment (EA) (approval received December 13, 2018) and is in the process of completing a Provincial EA for the Hardrock Project (the Project) located approximately 275 kilometres (km) northeast of Thunder Bay, Ontario, in the Ward of Geraldton, at the intersection of Highway 11 and Michael Power Boulevard (Figure 1-1). GGM proposes the Project to include the construction, operation and closure of a 30,000 tonnes per day open pit gold mine and associated infrastructure.

The Hardrock Project will include an open pit, milling and processing complex, roads and pipelines, a tailings management facility (TMF), water collection ponds and stockpiles for the storage of overburden and waste rock. A site plan showing the proposed site layout and infrastructure is provided as Figure 1-2.

To facilitate development of the Project as described above, there will be the need to overprint or otherwise impact waterbodies (creeks and man-made drainages /ponds) that contain fish and/or provide fish habitat; consequently, necessitating the provision of compensatory offsetting measures to replace the impacted fisheries values associated with the water features. The purpose of this plan is to describe the currently proposed impacts and compensatory measures associated with fish bearing waters to demonstrate that appropriate avoidance, mitigation and offsetting of fisheries values has been provided for by the Project.

Environment Canada and Climate Change (ECCC) has reviewed water features located within the footprint of the Project that were considered for amending Schedule 2 of the Metal and Diamond Mining Effluent Regulations (MDMER) based on the information submitted by GGM. Part of the process associated with adding a waterbody to Schedule 2 is the development of a fish habitat compensation plan as per Section 27.1 of the MDMER, to compensate for the loss of fish habitat resulting from the deposition of the deleterious substances into naturally occurring fish bearing waters. Additional fisheries values impacted by the Project due to works, undertakings or activities (e.g., dewatering, open pit development, creek diversion, road crossings) other than mine waste deposition, have been identified by the Department of Fisheries and Oceans DFO to likely result in Serious Harm to Fish as per Paragraph 35 of the *Fisheries Act*, and as such will also require compensatory measures through implementation of a fisheries offset plan. Discussions with ECCC and DFO have confirmed that Greenstone will work in cooperation with DFO to develop an acceptable combined fisheries offset and compensation plan that will include compensation fish habitat if required for Schedule 2 waterbody impacts, and fisheries offset measures for the Paragraph 35 impacts.

The terms “compensation and offset” both refer to the provision of replacement fish habitat values for fish bearing waters and are frequently used interchangeably; but “compensation plan” specifically refers to the Schedule 2 documentation (Sections 27.1 of the MDMER) whereas “offset plan” specifically refers to the documentation associated with the *Fisheries Act* Section 35 authorization.

This document is a revised plan, which presents the proposed impacts and offset measures consistent with the currently proposed site plan and design details. Revisions of this document may be necessary to accommodate any final site plan optimizations and detailed design modifications.

1.2 Stakeholder Consultation and Engagement

The Hardrock Project; Goldfield Creek diversion; and, proposed compensatory measures have been discussed as a Project component throughout the Federal and Provincial EA process. Consultation with DFO and ECCC to date has advanced the development of the compensation measures presented in the compensation plan and offsetting plan presented within. Likewise there has been engagement with other stakeholders such as First Nation and Métis representatives and Provincial regulators (MNRF) during the draft plan preparation. The early consultation feedback on alternatives assessment shaped the preferred alignment for the Goldfield Creek diversion. Consultation on the offsetting concept that followed helped shape additional field work carried out in 2016 to further evaluate flows and informed a revised approach with respect to flow management through the Southwest Arm Tributary. Additional consultation helped to inform the detailed design and this version of the plan with a focus on habitat design features within the Goldfield Creek diversion.

Recently, ECCC through collaboration with DFO have provided their assessment of which waterbodies will require listing to Schedule 2 of the MDMER (Dec.20, 2018 letter). The comments and discussion points received from consultation to date, as well as the segregation of impacts as either Section 35 Serious Harm or Schedule 2 amendments have been incorporated into this revision of the plan.

1.3 Background and Environmental Setting

Detailed fisheries and fish habitat studies have been undertaken at the Project site and include multiple years and multiple seasons of investigation. A brief summary of the watercourses considered to be impacted by the Project are provided below based on the listed reports below. Additional detailed fisheries investigations are available in the following Project documents:

- Environmental Baseline Data Report – Hardrock Project: Fish and Fish Habitat (Stantec 2014);
- Environmental Baseline Data Report – Hardrock Project: Fish and Fish Habitat (Stantec February 2015);
- Supplemental 2015 Fish and Fish Habitat Data Report – Hardrock Project (Stantec 2016);
- Data summaries from 2016 field studies; and
- Pre-construction Aquatic Monitoring Report. September 17, 2018.

Recognition is also given to the AFN, Biigtigong Nishnaabeg, Biinjitiwaabik Zaaging Anishinaabek, CLFN, Eabametoong First Nation (EFN), Ginoogaming First Nation (GFN), LLFN and MNO who have identified that they use various watercourses within the Project area for the exercise of their rights and way of life. A summary of "Consideration of Aboriginal Information and Traditional Knowledge" is provided in section 11.1.3 of the EIS Document.

1.3.1 Goldfield Creek

Goldfield Creek is a small creek system that discharges into the Southwest Arm of Kenogamisis Lake. It has a watershed of approximately 35 km^2 and is considered a coolwater, permanent flowing system. Typical water depth is approximately 0.6 m with bankfull widths of 4 to 5 m over most of its length, with

broader bankfull sections of 10 to 18 m in the cattail wetland present at the mouth of Goldfield Creek, where flow converges with the Goldfield Creek Tributary.

Substrate is generally detritus and sand, with few areas of gravel, cobble, and boulder. Riffle habitat is uncommon within the lower reaches of Goldfield Creek, but occur more frequently upstream closer to Goldfield Lake where the creek is controlled by bedrock resulting in a series of ponds. The channel is unconfined, and sinuous, resulting in a good mix of flats and pools. Instream cover is present in the form of aquatic vegetation, overhanging vegetation and large wood structure. The fish community consists of 13 fish species as summarized in Table 1-1. Although most of the fish community is represented by small bodied species, larger species are present in small numbers including sport fish such as Northern Pike, Walleye, Burbot and Yellow Perch.

1.3.2 Southwest Arm Tributary

The Southwest Arm Tributary originates near two wetland ponds (SWP1 and SWP2) on the west side of Lahtis Road and flows southeasterly into the northern end of the Southwest Arm of Kenogamisis Lake. The tributary has a watershed of 8.1 km^2, and is considered a permanent flowing coolwater watercourse.

The creek has a bank full width ranging from 2.5 m to 4.0 m, a mean depth of 1.0 m, and maximum pool depth of 1.5 m. The habitat is generally flats and pools interspersed with ponds, although there is one narrow section of creek with higher gradient that provides riffle and run morphology and boulder / cobble substrate. This narrow section may provide potential spawning habitat for White Sucker. Aquatic vegetation and other structures such as deep pools and boulders provide instream cover opportunities.

A total of 15 species (Table 1-1) of fish were captured in the watercourse, mainly represented by small bodied cyprinids and forage species, with less abundant species such as Northern Pike, Walleye, Burbot and Yellow Perch. A single adult brook trout was captured in the spring of 2016, and is considered an incidental migrant and not a resident species.

1.3.3 First Order, Intermittent and Ephemeral Watercourses

Twenty-eight first order, ephemeral, or intermittent watercourses were identified in the Local assessment area which have been assigned watercourse letters (A, B, C… etc.) for referencing purposes. These watercourses generally ephemeral and have poorly defined channels throughout most of their length, and flow is diffusely spread out across treed wetlands. Substrates in these poorly defined watercourses are largely comprised of organic forest soils. A number of the water courses are man-made features and include highway ditches, golf course and historical tailings drainage features (e.g., WC-C, WC-D, WC-I, WC-E and WC-J1).

Specific watercourses that are impacted by the Project include watercourses C, D, F, G, I, M, O and Z. Fish communities where present were typically represented by low species richness and low abundance, often by a single small bodied species (Brook stickleback) (Table 1-1).

1.3.4 Golf Course Pond #3

Golf course pond #3 is an artificial pond constructed for irrigation and aesthetics for the Kenogamisis Golf Club. The pond is populated by small bodied forage species but it is poorly connected to Watercourse C and ultimately to Kenogomisis Lake. The pond is 3.32 ha in size with a maximum and average depth of 1.4

m and 0.4 m, respectively. Golf Course Pond #3 is located adjacent to the historical MacLeod tailings and receives drainage inputs which affects water quality within the pond and downstream drainage.

1.3.5 Fisheries Diversity and Productivity

Fish species presence and species richness (total number of species) in local waterbodies and watercourses affected by the project are presented in Table 1-1 as a measure of species diversity. Fisheries productivity was measured using a surrogate metric, namely Catch per Unit Effort (CPUE) which is a measure of abundance and effort by fishing gear type. For comparison purposes, the baseline conditions have been summarized by pond or creek in Table 1-2. By comparing species richness and CPUE in the baseline conditions to the constructed offset measure habitats, it can be clearly demonstrated whether the offset measures have provided a comparable level of diversity and productivity.

Table 1-1: Fish Species of Local Waterbodies Affected by Project

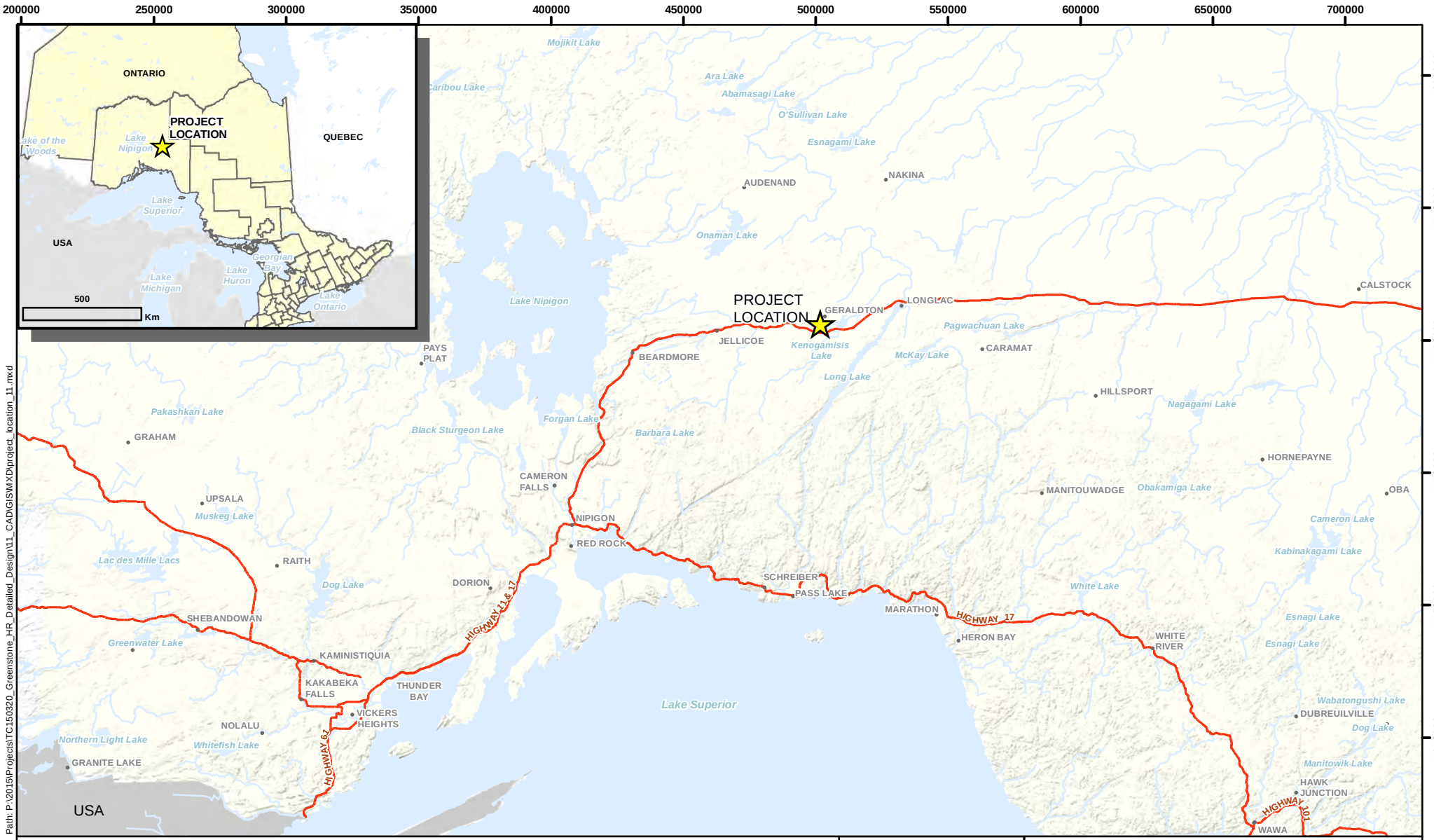
Common name	Goldfield Creek	Golf Course Pond 3	Southwest Arm Tributary	Southwest Pond 1	Southwest Pond 2	Southwest Pond 3	Southwest Pond 4	Watercourse C	Watercourse D	Watercourse F	Watercourse G	Watercourse I	Watercourse M	Watercourse O	Watercourse Z
Lake Whitefish															
Cisco															
Northern Pike	✓		✓			✓							✓		
White Sucker	✓	✓	✓					✓							✓
Brook Tout			✓												
Shorthead Redhorse															
Northern Redbelly Dace		✓		✓	✓			✓							
Finescale Dace		✓		✓	✓			✓							
Northern Redbelly Dace Finescale Dace Hybrid				✓											
Blacknose Shiner															
Spottail Shiner	✓	✓	✓												
Fathead Minnow		✓		✓	✓			✓							
Northern Pearl Dace		✓			✓			✓							
Lake Chub	✓														
Burbot	✓		✓												
Brook Stickleback	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
Trout-Perch	✓														
Yellow Perch	✓		✓			✓									
Walleye	✓		✓												
Iowa Darter	✓		✓												
Johnny Darter	✓		✓												
Logperch	✓														
Longnose Dace	✓														
Species Richness (No. of species)	**13**	**7**	**10**	**5**	**5**	**2**	**0**	**6**	**1**	**1**	**1**	**1**	**2**	**1**	**2**

Table 1-2: Fish Productivity Metrics (CPUE) for Local Waterbodies Affected by Project

Waterbody	Watershed Area (km^2)	Habitat Type	Minnow Trap	Electrofishing	Gillnets	Trap/Hoop Nets
Goldfield Creek	32.4	Small Riverine	0.003	0.003	1.798	0.084
Goldfield Creek Tributary	8.94	Small Riverine	0.003	0.018	N/A	0.031
Golf Course Pond 2	<5	Small Lacustrine	0.239	N/A	N/A	N/A
Golf Course Pond 3	<5	Small Lacustrine	0.962	0	0.113	0
Southwest Arm Tributary Channel	8.1	Small Riverine	0.003	0.026	N/A	0.134
Southwest Arm Tributary Pond 1	<5	Small Lacustrine	0.704	0.168	N/A	N/A
Southwest Arm Tributary Pond 2	<5	Small Lacustrine	3.280	0.006	N/A	N/A
Southwest Arm Tributary Pond 3	<5	Small Lacustrine	0	N/A	0.172	0.039
Southwest Arm Tributary Pond 4	~6	Small Lacustrine	0	0	N/A	N/A
Watercourse C	<5	Intermittent	0.072	0.003	0	N/A
Watercourse D	<5	Intermittent	0.023	0.0004	N/A	N/A
Watercourse F	<5	Intermittent	0.064	0.002	N/A	N/A
Watercourse G	<5	Intermittent	0.007	0	N/A	N/A
Watercourse I	<5	Intermittent	0.072	0	N/A	N/A
Watercourse M	<5	Intermittent	0.029	0.002	N/A	0
Watercourse O	<5	Intermittent	0.008	0.001	N/A	0
Watercourse Z	<5	Intermittent	0.003	0.001	N/A	0.083
Average CPUE	**<10**	**Intermittent**	**0.040**	**0.001**	**0**	**0**
	5-50	**Small Riverine**	**0.003**	**0.016**	**1.798**	**0.082**
	10-100	**Small Lacustrine**	**0.864**	**0.044**	**0.142**	**0.020**

Notes:

1. Gear-specific values represent number of individuals caught per trap/net hour or electrofishing second relative to the gear type.
2. Electrofishing values include fish capture data from backpack and boat-mounted electrofishing efforts.
3. Trap/Hoop Net values include fish capture data from hoop net, mini-fyke net and trap net efforts.
4. N/A indicates the gear type was not utilized for fish collection activities at that location.
5. Zero values indicate the respective gear was utilized, but no fish were captured.



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LEGEND

- Project Location
- Major Cities
- Major Road
- Watercourse
- Waterbody

NOTES:
- Topographic features extracted from LIO, MNRF.

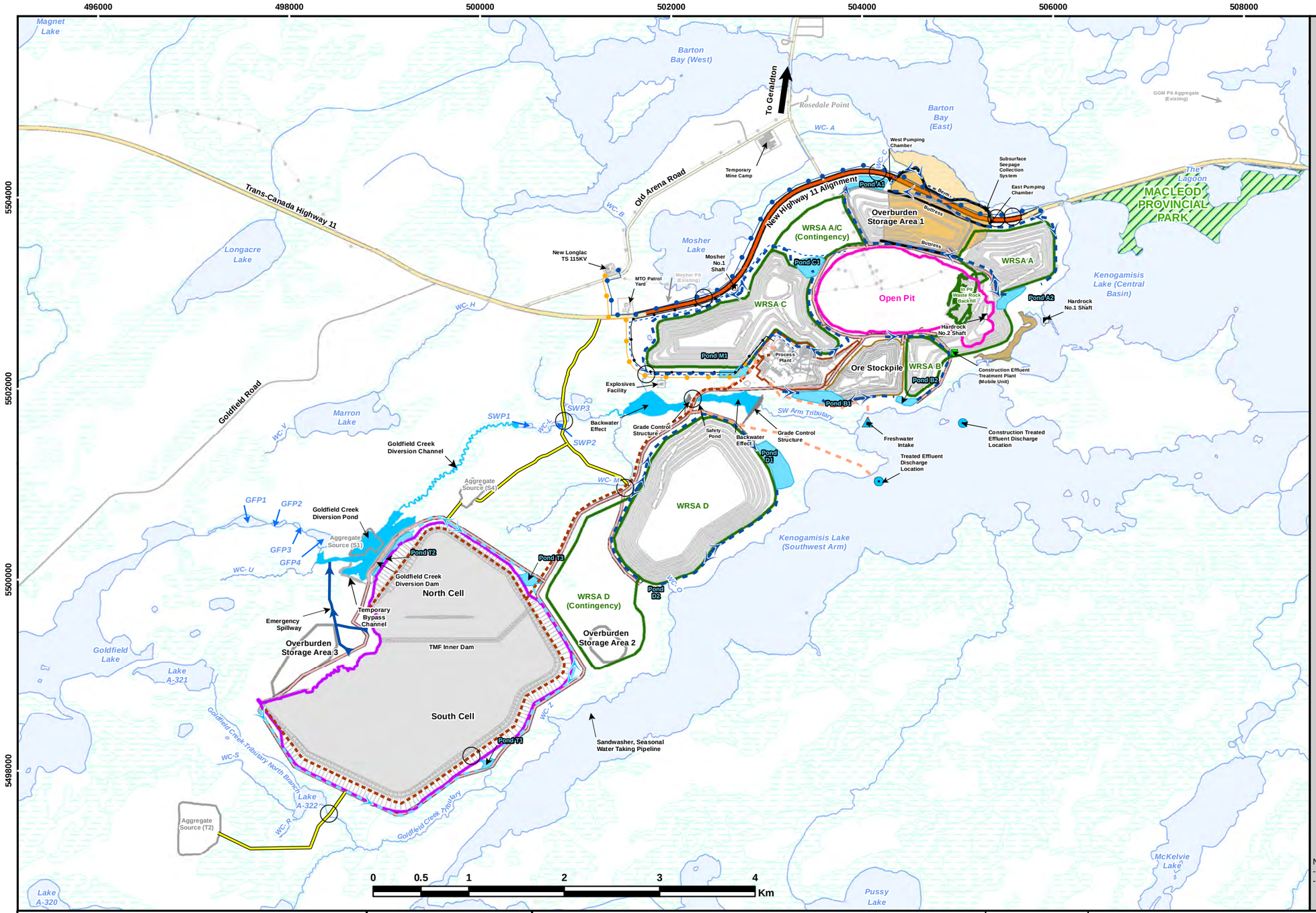
Datum & Projection:
NAD 1983 UTM Zone 16N

0 75 150 225 300 Kilometres

GREENSTONE GOLD MINES HARDROCK PROJECT

Project Location

PROJECT N^{o}: TC150320	**FIGURE: 1-1**
SCALE: 1:2,000,000	DATE: April 2019



Preliminary Site Plan

- Discharge Location
- Existing Mine Shaft
- Fresh Water Pumping Station
- Temorary Water Treatment Plant
- Watercrossing
- Diversion Channel
- Construction Access Road
- Emergency Spillways
- Potable Water Pipeline
- Conduits
- Power Line Realignment 44kV
- Power Line12.5 kV
- 115kv Transmission Line
- Seepage Collection Ditch
- Seepage Collection System
- Site Ditch
- Tailings Pipeline and Overhead Powerline
- Aggregate Source
- Collection Ponds
- Open Pit- Full Extent
- Ore Stockpile
- Process Plant Area
- Waste Rock Storage Area
- Tailing Management Area

Highway Realignment

- New Highway 11 Alignment

Existing Features*

- Highway
- Major Road
- Local Road
- Existing Power Line
- Watercourse
- Provincial Park
- Waterbody
- Wetland (Eco-Site Based)
- Wetland (Unevaluated- MNRF Data)

Historic Tailings Areas

- Hardrock Tailings
- MacLeod High Tailings
- MacLeod Low Tailings

NOTES:
- Mine site layout provided by Stantec.
- Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

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wood.

DWN BY: MD

CHK'D BY: MR

DATUM & PROJECTION: NAD 1983 UTM Zone 16N

SCALE: 1:42,000

PROJECT

GREENSTONE GOLD MINES
HARDROCK PROJECT

TITLE

SITE PLAN

DATE: April 2019

PROJECT No: TC150320

REV No: A

FIGURE No: 1-2

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2.0 Project Contact Information

Proponent:

Name and Address of Owner

Head Office
Greenstone Gold Mines
2381 Bristol Circle, Suite B203
Oakville, Ontario, L6H 5S9

Project / Mailing Address

Project Office
Greenstone Gold Mines
404 Main Street, Suite D
Geraldton, Ontario, P0T 1M0

Authorized Contact Person

Attention to:
Stephen Lines M.Sc., P.Biol.
Environmental Assessment and Permitting Manager
Greenstone Gold Mines
2381 Bristol Circle, Suite B203
Oakville, Ontario, L6H 5S9
Telephone: 514-604-4459
Steve.lines@ggmines.com

Mr. Lines is an authorized representative for the Proponent and will be the signing authority for the Application, on behalf of the Proponent.

3.0 Location of Proposed Project

The Project is located approximately 275 kilometres (km) northeast of Thunder Bay, Ontario, in the Ward of Geraldton, at the intersection of Highway 11 and Michael Power Boulevard The Universal Transverse Mercator (UTM) coordinates for the general Project are 502,000 E, 5,502,000 N (NAD 83 Zone 16T).

There are several waterbodies (small ponds and creeks) directly affected by the Project where serious harm to fish would occur or where the deposition of mine waste may require that natural water features be listed on Schedule 2 of the MDMER. These waterbody locations are summarized below in Table 3-1 and shown in Figure 3-1. Additional descriptions of the Project impacts are provided in Section 6.

Table 3-1: Coordinates of Waterbodies Affected by Project

Relevant Legislation	Name of Waterbody	Easting (Centroid)	Northing (Centroid)
Section 35	Portions of Goldfield Creek Upstream of TMF	498587	5500209
	Portions of Goldfield Creek Downstream of TMF	500050	5497861
	Golf Course Pond #2	503843	5503522
	Golf Course Pond #3 Upstream of Overburden Stockpile	504077	5503508
	Portion of Watercourse C Downstream of Overburden Stockpile	504240	5504384
	Portion of Watercourse D Upstream of Stockpile A	505409	5503786
	Portion of Watercourse D Downstream of Stockpile A	504884	5503311
	Watercourse F	502397	5502979
	Portion of Watercourse G Downstream of Stockpile C	501696	5502092
	Watercourse I	505572	5503787
	Watercourse M	501431	5501584
	Portion of Watercourse O Downstream of Stockpile D	501696	5502092
	Watercourse Z	500690	5498582
	Southwest Arm Tributary	502510	5501879
	Kenogamisis Lake (Temporary water discharge)	505019	5502006
	Kenogamisis Lake (Permanent water discharge)	504097	5501094
	Crossing on Goldfield Creek (Haul Road)	499909	5498155
	Crossing on Southwest Arm Tributary (Haul Road)	502251	5501893
	Crossing on Southwest Arm Tributary and Goldfield Creek Diversion Channel	500892	5501651
	Crossing on Watercourse C	504166	5504264
	Crossing on Watercourse D	505406	5503781
	Crossing on Watercourse G	501734	5502127
	Crossing on Watercourse I	505579	5503799
	Crossing on Watercourse F	502439	5502958
	Crossing on Goldfield Creek Tributary North Branch	4984134	5497546
Schedule 2	Portions of Goldfield Creek overprinted by TMF	499525	5499125
	Golf Course Pond #3 Within Overburden Stockpile	504151	5503652
	Portion of Watercourse C within Overburden Stockpile	504261	5503947
	Portion of Watercourse D within Stockpile A	505241	5503538
	Portion of Watercourse G Within Stockpile C	501824	5502273
	Portion of Watercourse O within Stockpile D	501821	5500019

Notes:
Coordinates are in UTM NAD 83, Zone 16T
Centroid is the approximate centermost point of the length or portion of waterbody affected by the Project

498000 500000 502000 504000 506000

5504000 5502000 5500000 5498000

INSET 2

Mosher Lake

Watercourse F

Old Arena Road

WC- B

Mosher Lake

Watercourse C

Golf Course Pond 2

Golf Course Pond 3

Watercourse I

Watercourse D

Kenogamisis Lake (Central Basin)

Trans-Canada Highway 11

WC- H

Watercourse F

Watercourse G

Haul Road Crossing

New Lahtis Rd. Culvert and Local Channel Reconstruction

Goldfield Road

Marron Lake

WC- V

SWP1

WC- L

SWP3

SWP2

NEW VALLEY AND CHANNEL CONSTRUCTION (2.7 KM)

GRADE CONTROLS POND AREA 5

SW Arm Tributary

EXISTING CHANNEL NO MODIFICATION REQUIERED

WC- M

GFP1 GFP2 GFP3 GFP4

NEW GOLDFIELD CREEK DIVERSION POND (19.1 HA)

WC- U

Watercourse O

Kenogamisis Lake (Southwest Arm)

INSET 1

Barton Bay (East)

Watercourse I

Watercourse D

Lake A-321

Goldfield Creek

Watercourse Z

Goldfield Creek-Tributary North Branch

WC-S

Lake A-322

WC- R

Goldfield Creek Tributary

0 0.5 1 2 3 4 Km

LEGEND

- Schedule 2
- Section 35
- Watercrossing
- Permanent Water Discharge Location
- Temporary Water Discharge Location
- Grade Control Structures
- Goldfield Creek Realignment and Offset Measures
- Proposed Mine Site Footprint
- Proposed Haul Road
- Proposed Potable Water Pipeline
- Proposed Power Line 12.5 kV
- Proposed Seepage Collection Ditch
- Proposed Pipeline and Overhead Powerline

Existing Features

- Proposed Highway 11 Alignment
- Highway
- Major Road
- Local Road
- Watercourse
- Waterbody
- Wetland (Eco-Site Based)
- Wetland (Unevaluated- MNRF Data)

NOTES:
- Mine site layout provided by Stantec.
- Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

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wood.

DWN BY: MD

CHK'D BY: MR

DATUM & PROJECTION: NAD 1983 UTM Zone 16N

SCALE: 1:32,000

PROJECT

GREENSTONE GOLD MINES
HARDROCK PROJECT

TITLE

FISHERIES IMPACTS AND OFFSET LOCATIONS

DATE: April 2019

PROJECT No: TC150320

REV No: A

FIGURE No: 3-1

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4.0 Description of Proposed Project

The Proponent proposes to construct, operate and eventually reclaim a new open pit gold mine at the Hardrock property. The Project will include all mine workings, process and waste disposal facilities, and related infrastructure (Figure 1-2).

Mining of the Hardrock deposit has been designed as an open pit. The process plant will operate 365 days per year with a Life of Mine (LOM) of approximately 15 years. The mill throughput range from 24,000 tonnes per day (tpd) for approximately the first two years of operation (i.e., Mill Phase 1), increasing to 30,000 tpd for the balance of operation (i.e., Mill Phase 2). The overall Project development schedule will consist of the following main phases, during which various Project activities will be completed:

- Construction: Years -3 to -1 with early ore stockpiling commencing after the first year of construction.
- Operation: Years 1 to 15, with the first year representing a partial year as the Project transitions from construction to operation.
- Closure:
  - Active Closure: Years 16 to 20, corresponding to the period when primary decommissioning and rehabilitation activities are carried out.
  - Post-Closure: Years 21 to 36, corresponding to a semi-passive period when the Project is monitored and the open pit is allowed to fill with water creating a pit lake.

The key components of the Project are as follows:

- Open pit;
- Waste rock storage areas (WRSAs) (designated as WRSA A, WRSA B, WRSA C and WRSA D);
- Topsoil and overburden storage areas;
- Ore stockpile;
- Crushing plants and mill feed storage area;
- Process plant;
- Tailings management facility (TMF);
- Water management facilities including contact water collection system (ditches and ponds);
- Power plant and associated infrastructure;
- Liquefied natural gas plant;
- Explosives facility;

- Buildings and supporting infrastructure;
- Water supply and associated infrastructure;
- Sewage treatment plant;
- Effluent treatment plant;
- Lighting and security;
- Site roads and parking areas;
- Watercourse crossings and habitat compensation/offsets;
- Goldfield Creek diversion;
- Onsite pipelines;
- Fuel and hazardous materials;
- Aggregate sources; and
- Temporary camp.

Project activities include the relocation of existing infrastructure currently located within the PDA, including a portion of Highway 11, a Ministry of Transportation (MTO) Patrol Yard, and Hydro One Networks Inc. (Hydro One) facilities.

In addition to the components listed above, the Project will include all temporary activities associated with their construction including stockpiles, laydown areas, access roads, water management, temporary flow isolation and creek crossings.

Detailed descriptions of the Project components and their interactions with the environment can be found in the Hardrock Project Environmental Impact Statement / Environmental Assessment (Stantec 2017).

5.0 Description of Proposed Works, Undertaking or Activity Likely to Result in Residual Serious Harm to fish

Project activities with potential to result in the deposition of mine waste into waters frequented by fish, or serious harm to fish include direct infilling of waterbodies, flow reductions to downstream creek sections, water intake or discharge structures and road crossings of local watercourses. The flow reductions to various creeks have been estimated and in cases where the reductions are minimal (less than 15% reduction in mean annual flow) the likelihood of serious harm occurring is considered low. Waterbodies that will experience greater flow reductions (greater than 15% reduction in mean annual flow) have been determined as likely to have some residual effect, proportional to the degree of flow loss, and have consequently been included in Section 6, Table 6-1. Road crossings will use standard mitigation measures and best management practices (structure sizing, embedment, construction methods) to mitigate impacts. Although not expected to cause serious harm to fish on an individual basis, there are approoximately 10 road crossings proposed (Figure 3-1), and as such they are included in Table 6-1 to be considered cumulatively with other inwater works for residual footprint. Likewise, water discharge structures are largely mitigatable, but there will still be a remnant residual footprint considered in the plan and summarized in Table 6-1.

Project activities with potential to result in the deposition of mine waste in fish frequented waters requiring Schedule 2 Listing as per the MDMER are as follows:

1. Deposition of mine waste into natural waterbodies that are frequented by fish (Portions of Goldfield Creek: WC-O; WC-G; Golf Course Pond 3, WC-C; WC-D).

Project activities with the potential to result in serious harm requiring Fisheries Act, Section 35(2)(b) authorization are as follows:

1. Overprinting of fisheries habitats or killing of fish through infilling or excavation to construct the mine features (i.e., open pit), or loss of habitat or killing of fish during construction activities not associated with the deposition of a mine waste;

2. Watercourse diversion (Goldfield Creek);

3. Minor inwater works associated with site access or infrastructure such as road crossings and water discharge pipelines and structures.

4. Changes in flows to watercourses through watershed area changes, water taking, discharge or mine dewatering that result in changes to the mean annual discharge of more than 15% unless the changes are assessed as acceptable or mitigated (Goldfield Creek, WC-C, WC-D, WC-F, WC-G; WC-I, WC-M, WC-O; and, WC-Z).

6.0 Serious Harm to Fish Likely to Result from the Proposed Works, Undertaking or Activity

A summary of the areas of habitat destruction / alteration resulting in serious harm to fish as per Paragraph 35(2)(b) of the *Fisheries Act*, and or waterbodies to be listed to Schedule 2 within the Project area is provided in Tables 6-1 and 6-2 and shown in Figure 3-1.

6.1 *Fisheries Act*, Paragraph 35(2)(b) Authorization

All works resulting in the serious harm or impacts to fish as per Section 35 of the Fisheries Act are permanent in nature according to current DFO policy. The impacts are derived from either direct habitat loss (infilling or excavation) of water features, or in permanent alteration from a reduction in base flows (calculated as a percent watershed reduction). In the case of direct habitat loss, the lost habitat is quantified as 100% of the area overprinted. In the case of flow reductions, the criteria used to derive the quantity of permanent alteration is as follows:

- Areas with less than 15% flow reduction are negligibly affected, and not included in the areas of residual serious harm.
- Areas with more than 15% flow reduction but less than 85% flow reduction are considered partially affected and serious harm is calculated as the total habitat area multiplied by the percent flow reduction (example: habitat measuring 100 m^2 in area with a 60% flow reduction would result in 100 m^2*0.60 = 60 m^2 of permanent habitat alteration).
- Areas with greater than 85% flow reduction are considered significantly affected and are quantified as 100% of the area.

Impacts summarized in Table 6-1 reflect the serious harm to fish as per Paragraph 35(2) of the *Fisheries Act*.

Table 6-1: Summary of Residual Serious Harm as per Paragraph 35(2) of the *Fisheries Act*

Waterbody Name	Effect	Fisheries Habitat or Waterbody Affected by Project (ha)	% Change in Flow	Residual Serious Harm [1, 2] Section 35 (ha)
Goldfield Creek	**Habitat Loss**: Overprinting of Goldfield Creek within the Footprint of the Diversion Dyke	0.04	NA	0.04
	Permanent Alteration: Flow reduction downstream of the TMF to confluence with Goldfield Creek Tributary	0.34	-99.3%	0.34
	Permanent Alteration: Flow reduction from confluence with Goldfield Creek Tributary to Kenogamisis Lake	0.38	-71.0%	0.27
Golf Course Pond 3	**Habitat Loss**: Excavation and overprinting by the open pit, highway realignment	3.32	NA	0.18
WC-C	**Permanent Alteration**: Flow reduction due to reduced drainage area	0.03	-84.7%	0.03
WC-D	**Habitat Loss**: Excavation and overprinting by the open pit, highway realignment	0.16	NA	0.06
	Permanent Alteration: Flow reduction from the realigned Highway 11 to Kenogamisis Lake	0.05	-70.0%	0.03
WC-F	**Permanent Alteration**: Flow reduction due to reduced drainage area	0.02	-43.6%	0.01
WC-G	**Permanent Alteration**: Flow reduction from WRSA C to the Southwest Arm Tributary	0.03	-61.0%	0.02
WC-I	**Permanent Alteration**: Flow reduction due to reduced drainage area	0.01	-80.0%	0.01
WC-M	**Permanent Alteration**: Flow reduction due to reduced drainage area	0.27	-17.0%	0.05
WC-O	**Permanent Alteration:** Flow reduction downstream of WRSA D due to reduced drainage area	0.02	-99.0%	0.02
WC-Z	**Permanent Alteration**: Flow reduction due to reduced drainage area	0.01	-90.7%	0.01
Various	**Permanent Alteration:** Road crossings associated with site access and haul roads – assume cumulative value 10 crossings X 100 m length and 3 m channel width (average)	0.30	NA	0.30
Kenogamisis Lake	**Permanent Alteration:** Temporary water discharge line and structure	0.007	NA	0.01
Kenogamisis Lake	**Permanent Alteration:** Permanent water discharge line and structure	0.008	NA	0.01
Total Area of Serious Harm				**1.39**

Notes:
[1] Flow changes above 15% will be offset based on proportion of watershed affected (the Offset Requirement is the product of area affected and the flow reduction) and 100% of the area affected will be offset for areas with >85 % flow reduction.
[2] Residual impact is rounded up to nearest 0.01 ha.
NA not applicable

6.2 MDMER Schedule 2 Listing

A summary of the waterbodies frequented by fish that will receive mine waste deposition is provided in Table 6-2. These areas were determined by ECCC based on information supplied by GGM as requiring Schedule 2 listing as per the MDMER.

Table 6-2: Summary of Waterbodies Requiring Schedule 2 Listing as per the MDMER

Waterbody Name	Effect	Fisheries Habitat or Waterbody Affected by the Project (ha)	Schedule 2 Listing Waterbody Area [1] (ha)
Goldfield Creek	**Habitat Loss**: Overprinting of Goldfield Creek within the Footprint of the TMF	1.98	1.98
Golf Course Pond 3	**Habitat Loss**: Due to overprinting by Overburden Stockpile	3.32	3.14
WC-C	**Habitat Loss**: Due to overprinting by Overburden Stockpile	0.11	0.11
WC-D	**Habitat Loss**: Due to overprinting by Overburden Stockpile	0.16	0.10
WC-G	**Habitat Loss**: Due to overprinting by WRSA C	0.03	0.03
WC-O	**Habitat Loss**: Due to overprinting by WRSA D	0.04	0.04
Total Area of Schedule 2 Waterbody Areas			**5.40**

Notes:
[1] Residual impact is rounded up to nearest 0.01 ha.
NA not applicable

6.3 Combined Serious Harm to Fish Likely to Result from the Proposed Works, Undertaking or Activity

The combined impacts to waterbodies frequented by fish associated with the Project, as described in Sections 6.1 and 6.2 has been calculated as 6.79 ha, the majority of which is comprised of the following works:

- The realignment of Goldfield Creek and loss of creek due to the TMF will result in the relocation and flow reduction impact of approximately 2.6 ha of small creek habitat.
- The open pit encroachment and overprinting of man-made Golf Course Pond #3 will result in approximately 3.32 ha of lost pond habitat.

These two undertakings account for nearly 6 ha of the total impacts, or approximately 87% of the total area. The remaining 13% of the impacted area results from minor infringement and flow reductions to several intermittent / ephemeral watercourses, road crossings, and water discharge locations. Impacts summarized in Table 6-3 reflect both serious harm to fish as per Paragraph 35(2)(b) of the *Fisheries Act*, as well as the proposed waterbodies requiring Schedule 2 listing as per the MDMER.

Table 6-3: Combined Summary of Impacts Requiring Fisheries Act Authorization or MDMER Schedule 2 Listing

Impact	Area (ha)[1]
Total Fisheries Impact Section 35 Serious Harm	1.39
Total Waterbody Impacts Schedule 2	5.40
Combined Section 35 and Schedule 2 Areas	**6.79**

Notes:
[1] Residual impact is rounded up to nearest 0.01 ha.

7.0 Conditions that Relate to the Period during which the Work Undertaking or Activity can be Carried On

7.1 Seasonal Construction Constraints

The waterbodies associated with the works, undertaking or activity that are likely to result in serious harm to fish are considered coolwater with respect to fish communities and species sensitivities. As such, inwater works are to be avoided between April 1 and June 15 of any given year to comply with the inwater timing constraints for spring spawning species as per MNRF Inwater work timing window guidelines (OMNR 2013); and, DFO's Ontario Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (DFO 2017). Once the initial isolation of specific areas are complete and the risk of impacting downstream habitats is removed, this timing window would no longer apply. In the event that an exemption to the specified timing window is necessary, a request for alternate work periods will be made to the MNRF and copied to DFO.

7.2 Construction Schedule

The offset measures would be substantially constructed early in the Project, prior to or concurrently with the majority of the fisheries impacts. All of the fisheries offset measures are expected to be completed by Year 1 of operations.

A tentative schedule for impacts and plan implementation is provided in Table 7-1. The timeline is an estimate based on the current understanding of the Project development and approval schedule. For flexibility and contingency with respect to the actual construction start date, the schedule shown in Table 7-1 is based on the number of years prior to or after the start of the Project operation phase (Section 4.0). If the work, undertaking or activity cannot be completed during the approximate time period specified in the final plan, DFO will be notified in writing in advance of the expiration of the above time period, and provided with a revised schedule. It is understood that DFO may, where appropriate, provide written notice that the period to carry on the works, undertaking or activity has been extended.

Table 7-1: Conceptual Schedule of Project Undertaking or Activities

Offset Component / Activity	Impact or Offset	Mine Operations Commence Year 1	
		Early Start (yr)	Late Completion (yr)
Diversion of Goldfield Creek	Offset	-2	1
Abandon Goldfield Creek Channel	Impact	-1	1
Flow integration with Southwest Arm Tributary	Mitigation	-1	1
Golf Course Pond 3 (overprint)	Impact	-2	1
Watercourse C (flow reduction)	Impact	1	3
Watercourse D (flow reduction)	Impact	1	15
Watercourse G (flow reduction)	Impact	1	8
Watercourse I (flow reduction)	Impact	-1	3
Watercourse O (flow reduction)	Impact	1	15
Watercourse Z (flow reduction)	Impact	1	15
Maintenance or adjustment period to offset works if required	Offset	1	5

8.0 Conditions that Relate to Measures and Standards to Avoid or Mitigate Serious Harm to Fish

8.1 Measures or Standards

To avoid or mitigate additional serious harm during implementation of the plan, a combination of site specific mitigation measures as defined in permits, approvals or EA commitments and best management practices will be used. A list of typical measures and standards that are to be implemented during the Project to avoid or mitigate serious harm to fish are shown in Table 8-1.

8.2 Contingency Measures

A list of contingency measures to be implemented during the Project to avoid or mitigate serious harm to fish is shown in Table 8-1.

8.3 Dates that the Measures and Standards shall be Implemented

The measures and standards and contingencies listed in Table 8-1 shall be implemented and/or ready for use prior to the start of the works, and maintained in a functional or prepared state until completion of the works specified in the plan.

8.4 Conditions that Relate to Monitoring and Reporting of Measures and Standards to Avoid or Mitigate Serious Harm to Fish

8.4.1 Monitoring of Avoidance and Mitigation Measures

To ensure that the measures and standards described in this plan are implemented as proposed, construction and plan implementation will be monitored by Greenstone onsite monitors, or designates. Monitoring will be reported to DFO in an "as constructed" report provided within 12 months of the works being completed. The "as constructed" monitoring report will be as per the sections below.

8.4.2 Demonstration of Effective Implementation

To demonstrate effective implementation and function of the avoidance and mitigation measures, GGM will maintain the following documentation and provide summaries of the documents in the "as constructed" report. The documentation will include any observed mortalities of fish, their approximate numbers and location, and the suspected cause of mortality if known. If additional serious harm greater than that predicted in the plan occurs; it will be documented and reported to the DFO immediately. Records include:

- A detailed photographic record from consistent vantage points and inspection reports will be kept to document measures and standards employed and their effectiveness to limit the serious harm;
- A record of all fish removal efforts carried out with the numbers of fish removed and relocation locations; and
- A record of any contingency measures that were implemented and the effectiveness of the measures.

8.4.3 Contingency Measures

In the event that mitigation measures do not function as described, the DFO will be notified of the implementation of contingency measures when/if they occur; and detailed record will be made of any contingency measures that were followed to prevent impacts greater than those covered addressed by this offset plan. For cases such as a need to work within a restricted activity period, the modified plans should be subject to DFO's review and approval before the commencement or continuation of work. A summary of any contingency measures will be provided in the "as constructed" report.

Table 8-1: List of Measures and Standards, Success Criteria and Contingency Measures

Measure or Standard	Success Criteria	Contingency
Sediment and erosion control measures associated with the work will be in place prior to substantial ground disturbance and will be monitored and maintained through the duration of construction to ensure compliance with applicable water quality legislation.	No visible sediment entering natural waterbodies as a result of ground disturbance. Turbidity values within specified values as per provincial permit conditions or the Project Water Management Plan.	Stop the work that is resulting in sediment release until effective controls are implemented. Maintain supply of erosion and sediment control supplies on site to repair, replace or supplement control measures as needed. Notify the DFO of the implementation of contingency measures. If it is a constraint period, the modified plans are subject to DFO review and approval prior to continuation of work.
Observe timing constraints for inwater work .	No inwater work during constraint period (April 1 through June 15).	Exemption from timing period may be requested from MNRF and copied to DFO.
Minimize duration of inwater work to the extent practicable.	Work continues in continuous manner to completion.	Monitor contractor's effort and implement additional site planning as needed. Ensure materials are available to complete the construction continuously as needed.
Undertake inwater activities in isolation of open or flowing water to avoid introducing sediment into the watercourse.	Work areas are effectively isolated from flowing water.	Stop works that are not isolated from flowing water. Isolate work area, remove fish from work area before continuing works. Maintain a sufficient supply of pumps and materials on site to isolate flows.
Stabilize shoreline or banks disturbed by any activity associated with the works.	Shorelines are mostly stable and not eroding.	Grade bank to stable slope if necessary. Use temporary or permanent bank stabilization material to stabilize banks.
Remove fish from areas where waterbodies are to be abandoned or isolated from the active creek channel due to the works.	No dead or stranded fish within the work areas.	If stranded or distressed fish are observed in the work area, stop work causing distress, and continue fish removal.
Screen or use other deterrents at any pump intakes in accordance with the DFO's *Freshwater Intake End-of-Pipe Fish screen Guideline* (1995) to prevent entrainment or impingement of fish.	No fish entrained or impinged at pump intakes.	If fish are entrained or impinged, implement corrective action by, either repairing or supplementing the exclusion measure in place.
Ensure that machinery arrives on site in a clean condition and is maintained free of fluid leaks.	Machinery arrives on site in clean condition.	Have an area or location on site to clean equipment to a suitable condition on arrival or as required.
Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.	No deleterious substances entering waterbodies.	Follow site response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance and keep an emergency spill kit on site.
Remove all unused construction materials from site upon Project completion.	Site is clean with no unused construction material that may enter the waterbody.	Use designated locations for excess material and or stabilization measure to prevent excess material from entering any watercourse.

9.0 Conditions that Relate to the Offsetting of the Serious Harm to Fish likely to Result from the Authorized Work, Undertaking or Activity

9.1 Letter of Credit

As per SOR/2013-191 Paragraph 3(1)(b) and MMER Paragraph 27.1(4) the proponent will provide irrevocable letters of credit issued by a recognized Canadian financial institution to cover the costs of implementing the offsetting plan and compensation plan. DFO may draw upon funds of the letters of credit provided to cover the cost of implementing the offsetting measures including the associated monitoring and reporting measures included in this plan, for instances where the Proponent fails to implement these required measures. The values of the letters of credit will be determined with DFO and submitted under separate cover with the final application documents and fisheries offset plan, and prior to Schedule 2 listing, respectively.

9.2 Scale and Description of Offsetting Measures

The proposed compensatory measure for the estimated 6.79 ha of impacted waterbodies (Table 6-1) will be incorporated into the Goldfield Creek diversion channel from the TMF location to the upper most diversion pond of the Southwest Arm Tributary, and then integration of the increased flows into the existing Southwest Arm Tributary valley (Figure 3-1). The increased flows will be integrated through the use of valley wide grade controls to arrest flow velocity and mitigate erosional forces, in addition to localized reconstruction and enlargement of the upper creek section in the vicinity of the Lahtis Road crossing. The grade controls will create a shallow impoundment of the valley mimicking large beaver ponds.

The overall Goldfield Creek diversion and offset plan will include several compensatory measures as follows:

1. Development of approximately 19 ha of new pond habitat at the interface between the existing Goldfield Creek and the new diversion channel (referred to as the Goldfield Creek Diversion Pond or GFDP);

2. Construction of a new approximately 2.7 km (1.6 ha) Goldfield Creek diversion channel (bankfull Channel dimension) between the Goldfield Diversion Pond and the existing Southwest Arm Tributary watercourse (SWP1);

3. Reconstruct the existing Southwest Arm Tributary channel between SWP2 and SWP3 to convey larger flows and facilitate the replacement of the existing Lahtis Road crossing.

4. Construct two valley wide grade control structures within the existing Southwest Arm Tributary to attenuate flows, and dissipate water velocity to mitigate erosion due to increased flows. The grade controls will cause a shallow impoundment of the valley mimicking large beaver ponds.

Discussions with stakeholders to date have indicated a preference for maintaining the existing, primarily small bodied fish communities in the new offset habitats, rather than target the production of large gamefish species in the tributary. This approach would mimic the existing fish and fish habitat of the

impacted Goldfield Creek. The works associated with the above four offset measures will mainly contribute to local baitfish production with potential enhancements to the existing use by Walleye and Pike (particularly in the diversion pond), which are highly valued recreational and sustenance species in the region. Ongoing consultation to develop the final fisheries offset plan will confirm the objectives of the habitat features for the offset measures described below.

9.2.1 Measure 1 – Goldfield Creek Diversion Pond.

The Goldfield Creek Diversion Pond (GFDP) will be a newly constructed pond at the origin (headwater) of the new diversion channel. The pond will measure approximately 19.17 ha (191,729 m^2) in area under normal water level (NWL) conditions with water depths of up to 10 m. The GFDP will provide similar habitat attributes as those currently found in the ponds within the upstream existing Goldfield Creek (GFP1 through GFP4) but with a greater average and maximum depth which will enhance summer and winter refuge areas for fish. Current design drawings showing the proposed pond area and habitat features are provided in Attachment 1, Drawings No. 307 through No. 309.

Based on stakeholder discussion to date, the GFDP will incorporate several habitat features with the objective of providing quality fisheries values early in the development of the pond. Habitat features and plan components for the GFDP are as follows:

1. Permanent deeper water refuge pools and connector channels will be integrated into the pond to allow summer and winter refuge for both small and large bodied fish. Approximately 18% of the pond area will be greater than 5 m in depth. Incorporation of a proposed aggregate extraction pit (S1, Figure 1-2) will provide a maximum pool depth of up to 10 m which may promote habitat for larger bodied fish not currently in abundance within the existing creek system. These deeper water pools and refuge areas are situated strategically around the pond and connected with deep central channels. A summary of the proposed pond bathymetry is provided in Table 9-1.

2. Boulder piles (~78) and submerged tree piles (~31) will be spaced in both shallow and deeper zones to provide cover opportunities throughout the pond (Drawing No. 002). Typical designs for these structures are shown in Drawing No. 001. The location and numbers of these structures may be modified in the final plan based on further discussion with stakeholders (e.g., to reflect a preference for wood structure vs. rock structure), but the commitment to develop submerged and emergent habitat cover will be maintained.

3. Based on stakeholder comments and input, a functional and integrated riparian edge and productive littoral zones will be developed to benefit both aquatic species and other wildlife that inhabit the creek valley. The margins of the pond will be integrated into the existing forest cover along the west shoreline to the extent possible through careful implementation of an edge management design. The edge management design will be finalized with stakeholder input and included in the final plan. The design will include a mixture of trees intentionally felled into the littoral zone for cover, with remaining trees retained at the high water level to provide shade and riparian habitat function. Excluding the aggregate extraction area, trees within the permanently wetted area will be mostly removed, but the stump rootmass will be retained in situ or pushed over to expose the roots and create a divot and hummock in the substrate. Some trees may remain standing in shallow flooded areas to provide additional habitat for wildlife. Harvested trees will be used to construct submerged log structures, with surplus logs and slash removed from the area. The riparian area along the diversion dam and east shoreline will not be vegetated with trees or deep rooting vegetation to

protect the integrity of the diversion dam. However, meadow conditions will be promoted with seed mix or seed bank material, supplemented with log structure and boulders.

9.2.2 Measure 2 – New Goldfield Creek Diversion Valley and Channel between the GFDP and SWP1

The new constructed valley and channel between the GFDP and the uppermost Southwest Arm Tributary pond (SWP1) will have a valley length of approximately 1.6 km and a channel length of approximately 2.6 km. The planform and cross-section of the new diversion channel were determined based on a geomorphological assessment (Parish 2016) of the existing Goldfield Creek channel diagnostics, taking into account the gradient of the proposed new valley as well as channel corridor, soil composition, and cut and fill volumes required to establish a stable channel with natural characteristics.

The new channel will follow an existing valley feature which is capable of accommodating the Goldfield Creek diversion design flows. A hydraulic assessment of the diversion channel is based on the Timmins (regional) storm event to confirm hydraulic containment. A low height flood protection berm will be required at the beginning of the diversion channel (station 0+040) but otherwise the existing ground and proposed cut is sufficient to contain future flows within the new valley.

A design of the channel, plan and profile is provided in Attachment 1 Drawing No. 310 through Drawing No. 312. The planform will have a mostly unconfined channel and a valley slope of approximately 0.18% to 0.8% which is similar to but higher than the existing Goldfield Creek's valley slope of 0.15% to 0.30%. The meander belt width of the new channel will be approximately 46 m with a radius of curvature ranging from 4.0 to 11.5 m matching the existing creek conditions, giving the channel a sinuosity factor of approximately 1.63. The excavated or inundated floodplain will range from 38 m to 120 m in width.

The channel cross-section is also based on the existing Goldfield Creek channel and has a capacity of approximately 3.35 m^3/s to accommodate slightly less than bankfull flow conditions (4.7 m^3/s). At the bankfull condition flows will expand into the constructed floodplain emulating the current hydraulic conditions and ecological function of the existing creek. The bankfull channel will have a top width of 6 m and a typical depth of 1 to 1.3 m.

Channel banks will be constructed at a slope of 2 horizontal to 1 vertical (2H:1V) and valley walls will have a maximum constructed slope of 3H:1V as shown in Drawing No. 311, unless natural undisturbed slopes are steeper. Much of the valley slope will have more gradual slopes based on existing topography. It is expected that undercut banks will form over time as a result of channel adjustment and vegetation growth. Wood structure and coarse substrates will be incorporated into the design to provide immediate instream cover and localized morphological and substrate diversity. The integration of fish habitat cover structures into the channel design is based on ongoing stakeholder consultation, and will be detailed in design as appropriate.

Floodplain enhancement was a recommendation during stakeholder discussion to date, and specifically the objective to incorporate habitats that would benefit terrestrial (e.g., birds, bats and furbearing) and semi aquatic (e.g., frogs and turtles) wildlife as well as fisheries. At this time there is provision of floodplain depressions and woody species plantings into the design as shown in Drawings No. 310 and 311. The floodplain depression depths will range from vernal pools to semi-permanent ponds. Logs salvaged from the tree clearing efforts will be retained to be placed within the floodplain and the depressions. Additionally trees may be partially limbed and retained or embedded into the floodplain to emulate

senescent trees, for nesting / perching habits. Additional details regarding the proposed holistic ecosystem approach fro the realignment is provided in section 9.2.6.

The channel when completed will provide an additional habitat offset area of approximately 1.5 ha (6 m x 2,600 m) that is consistent with the Goldfield Creek habitat being lost. This value is conservative as the floodplain depression areas have not been included in the calculation of area.

9.2.3 Measure 3 – Reconstruct the existing Southwest Arm Tributary Channel between SWP2 and SWP3

The existing channel between SWP2 and SWP3 includes the existing Lahtis Road Crossing, and is considered susceptible to erosion without regrading and replacement of the existing crossing structure. As such, a new channel outlet from SWP2 will be constructed and extend to the inflow of SWP3 (Drawing No. 318). The channel will extend approximately 218 m and accommodate the increased flow consistent with the channel sections shown in Drawing No. 318. The existing floodplain has capacity to receive the increased flows and does not require regrading. The existing Lahtis Road culverts will be replaced with new structures capable of passing the bankfull flow unrestricted, and designed to pass as a minimum the 1 in 10 year storm event without overtopping (Drawing 341-C-202-0002). The crossing structures will be installed using best management practices to ensure effective fish passage including appropriate embeddedness (~300 mm) and will match the channel slope with natural substrates placed within the crossing structure.

9.2.4 Measure 4 – Valley Wide Grade Control Structures within the Existing Southwest Arm Tributary Downstream of SWP3

The proposed flow integration of Goldfield Creek watershed into the existing Southwest Arm Tributary will include permanent valley wide grade controls that will cause inundation of the existing Southwest Arm Tributary floodplain (See Attachment 1, Drawings No. 313 through No. 317 for the current design). The permanent grade control structures will develop a shallow zone of standing water similar to a beaver pond condition that will dissipate flow velocity across the wide wetted cross section, effectively mitigating the risk of significant erosion. The grade controls will be constructed as broad features with riffle habitat channels that provide for fish passage and increase habitat diversity. The overall effect will be that the habitat conditions in the Southwest Arm Tributary will be modified, but the resulting conditions are expected to prevent erosion, maintain the resident fish species and provide additional permanently wetted areas with fisheries values comparable to other beaver ponds and impounded habitats in the existing system. The open water / wetted area of the tributary will be increased by approximately 14.5 ha due to the intentional ponding associated with the grade controls. This ponded area will increase the existing water depth through this reach by up to 1 m, converting the small defined channel into a broad valley wide open water area that will promote wetland features as the ponded areas mature.

The grade controls are designed to be approximately 1 m above the current ambient floodplain elevation, with a low flow channel having a typical depth of 0.5 m. As such the floodplain immediately upstream of the features will be backwatered to a depth of 0.5 to 0.75 m with the water depth decreasing with upstream distance. The lower grade control (Grade Control #1) will be constructed to an elevation of 331.0 masl which will extend the back water condition at elevation 330.5 masl (Pond #1) upstream to the downstream workings of Grade Control #2. A constructed transition channel will be developed between the grade control and the existing channel. Grade Control #2 will have a constructed elevation of 331.5 masl and extend the backwater condition at 331 masl (Pond #2) upstream to approximately 200 m

downstream of SWP3. The existing channel between SWP3 and the impounded area of Pond #2 may experience temporary erosion, but the mobilized material will settle within the pond #2 area.

The two resulting impounded areas (Ponds #1 and #2) will have wetted areas of approximately 6.9 ha and 9.6 ha, respectively. The existing channel within the inundated area has a channel and SWP4 area of approximately 2 ha.

The grade control designs (Drawings No. 313 to No. 317) currently assume a permanent structure design to resist long term change. Although there will be a net increase in permanent wetted area of approximately 14.5 ha resulting from the ponds, we have not carried this value into the final offset calculation in this version of the plan pending further discussion with DFO and MNRF on the potential that these ponds may naturalize over the long term and the corresponding wetted area may adjust naturally as well.

Development of the Project will require a haul road to be constructed between the open pit and facilities on the north side and WRSA and TMF on the south side of the Southwest Arm Tributary. The haul road crossing has been integrated into grade control structure #2 to minimize the number of cross valley structure built. Details of the haul road crossing are provided in Drawing No. 341-C-202-0001, and includes the ability to pass the 100 yr storm event without overtopping. The culvert configuration includes larger (2.4 m diameter) culverts to convey low low and provide fish passage, with additional 1.2 m diameter culverts to provide flood flow conveyance.

9.2.5 Hydrology Considerations

The hydrology of the existing and proposed Goldfield Creek diversion and Southwest Arm Tributary has been assessed using the Hydrologic Modelling System (HEC-HMS) developed by the U.S. Army Corps of Engineers Hydrologic Engineering Centre, Version 3.5. This model was used for the simulation of catchment runoff, and for reservoir routing which was carried out at Goldfield Lake (through the existing natural outlet), at the TMF, and at the Goldfield Creek Diversion Pond directly upstream of the Diversion Channel leading to the Southwest Arm Tributary. This modelling was carried out to determine the design storm flow conditions within the Goldfield Creek diversion with contributions from Goldfield Lake and upper reaches of Goldfield Creek, the Southwest Arm Tributary, and discharge from the TMF via the emergency spillway.

To account for extreme flood flow conditions, the diversion channel floodplain has been sized sufficiently to accommodate the flows from the TMF spillway and Goldfield Creek in events greater than the 100 year storm and has the capacity to pass flows up to and including the PMF event.

Runoff coefficients of 49%, 95%, and 100% were assigned for natural ground, tailings surfaces, and water surfaces, respectively, for the 100 year 24 hour rainfall event. Lag time through Goldfield Lake is based on the wave velocity equation shown in the SCS manual, Chapter 15 (NRCS, 2010).

The high flow mapping derived from this analysis is shown for the Southwest Arm Tributary for both the existing conditions and future conditions. The analysis includes the low flow, 2, 10 and 100 year high flow events (Figure 9-1). The analysis shows that the Southwest Arm Tributary has enough capacity to contain and pass the diverted Goldfield Creek flows without significant interactions with existing or proposed infrastructure.

9.2.6 Holistic Ecosystem Approach

This section of the Plan is included in response to Indigenous community consultation and a request that a holistic ecosystem approach that extends beyond fish and fish habitat be integrated into the Goldfield Creek diversion approach. The ecosystem approach is described here, and formal implementation and monitoring of the features will be specified through the Project's Biodiversity Management and Monitoring Plan.

The proposed Goldfield Creek diversion has been designed using an ecosystem-based approach to maintain the ecosystem function of the area once the diversion has been constructed. The ecosystem approach involves the replication of ecosystem function (consistent channel, and floodplain size) within the area being altered to ensure that the diverted creek system has a reasonable potential for supporting species of wildlife and vegetation that is present in the existing Goldfield Creek valley.

In the case of the Goldfield Creek diversion the original habitat is an organic thicket swamp that is managed, in part, by beavers in the system. The existing ecosystem supports minnows, amphibians, birds as well as the many other species found in a healthy boreal forest. Additionally, the existing ecosystem supports the insects and plants that form the lower levels of the food chain, on which all these species depend. Efforts are being made to recreate the natural environments of Goldfield Creek within the new diversion channel corridor, including salvaging organic soils which contain existing seed bank and re-using these soils within the diversion to re-establish the plant species which naturally occur in the area.

Over time the diversion channel and overbank areas are expected to develop vegetation communities that are increasingly similar to the upstream creek conditions as native plants continue to colonize the new area from upstream creek flows. It is expected that the new creek habitat will be able to support the species present in the area relatively early in its development and will continue to improve the ecosystem services provided over time as the habitat matures.

The new creek and floodplain will incorporate features which will enhance the habitat for use by the wildlife species known to be present in the surrounding area. Specific habitat enhancements planned include the following:

1. Bat Boxes;

2. Snags;

3. Woody Debris;

4. Turtle Nesting Areas; and

5. Rock Piles

Further information regarding the proposed habitat features planned to be incorporated into the proposed Goldfield Creek diversion follows:

Bat Boxes

Bat boxes are planned near newly created habitat by the Goldfield Creek Pond, new creek and/or grade control structures.

Snags

During tree removals, select trees will be retained along access routes and the felled trees which are not merchantable will be stockpiled for reuse as snags or tree piles. Snags provide perching opportunities for birds and provide a home for insects which are a food source for birds such as Northern Flickers. Snags will be installed within the floodplain of the new creek by creating a hole of a depth at least ¼ of the height of the tree, standing the tree in the hole, and then backfilling around the tree. Trees used for snags will be a minimum of 4m long and have a minimum diameter at breast height of 150mm. Roughly one snag will be installed per 1,800 m^2 of graded floodplain with a minimum of 40 snags installed throughout the 2 km long floodplain of the new channel.

Woody Debris

Tree stumps / logs will be installed within the floodprone depressions located along the realignment. A minimum of one tree stump/ log will be installed per 125 m^2 of floodprone depression. In addition to this brush/tree piles shall be placed within the floodplain throughout the entire length of the channel.

A minimum of one brush pile will be placed every 100 m along the floodplain of the realignment, on each side of the low flow channel, in an alternating pattern. This equals a minimum of 40 brush piles installed throughout the 2 km alignment.

Tree Piles

Tree piles will be installed within the Goldfield Diversion Pond. Although some of these tree piles will be completely submerged to provide submerged fish habitat, however a number of them will be installed shallow enough that a portion of the pile will be above the normal water level. These piles installed in shallow water will provide an opportunity for bird perching and turtle basking within the ponds. Based on the comments from the Indigenous community consultation, focus will be made to position the tree piles in a shallow water partially submerged arrangement with the rock piles preferentially located in the deeper water.

Turtle Nesting Areas

Turtle nesting sites will be created within the floodplain or valley slopes along the new creek. One turtle nesting site will be created by each of the floodprone depressions (total of six sites). An additional four turtle nesting sites will be created adjacent to ponded water bodies such as the diversion pond.

Turtle nesting sites will be roughly 4 m to 6 m in diameter and will consist of a gravel/sand mixture of nesting substrate placed in a mound at least 40 cm thick atop a weed barrier.

Rock Piles

Rock piles will be scattered throughout the floodplain of the new channel. Rock piles will be 1 m to 3 m in diameter and will consist of cobble and boulder sized rock. These rock piles will diversify habitat and add

areas for reptiles to bask. Rock piles will be placed roughly every 50 m along the floodplain of the new channel, with a total of roughly 40 rock piles installed along the length of the realignment.

9.3 Criteria to Assess the Implementation and Effectiveness of the Offset Measures

Implementation and effectiveness of the offset measures will be determined by confirming that measures have been constructed as per the approved plans and are functioning as intended using the criteria outlined in Table 9-2.

9.4 Contingency Measures

If the results of the monitoring required in Section 9.4.2 indicate that the offsetting measures are not completed by the date specified and/or are not functioning according to the criteria in Table 9-2, the Proponent will give written notice to DFO and shall implement the contingency measures and associated monitoring specified in Table 9-2.

9.4.1 Scale and Description of Contingency Measures

The scale and description of proposed contingencies that will be implemented in the event that offset measures are not functioning, as specified, are listed in Table 9-3.

9.4.2 Monitoring of Contingency Measures

Monitoring of the implemented contingency measures prelisted in Table 9-3 will follow the criteria specified in Table 10-1. The period of monitoring in Table 10-1 will be extended until the success criteria are achieved or as otherwise agreed to in writing by DFO. In the event that the overall Project schedule and timelines for offset plan implementation are changed, the monitoring timelines will be adjusted accordingly and provided in writing to DFO for approval.

Table 9-1: Goldfield Diversion Pond Bathymetry

Minimum Elevation (masl)	Maximum Elevation (masl)	Area(m^2)	Area (%)	Water Depth
330.0	335.0	34,258	17.9	5.0 - 10.0
335.0	337.0	21,475	11.2	3.0 - 5.0
337.0	338.0	52,335	27.3	2.0 - 3.0
338.0	339.0	54,565	28.4	1.0 - 2.0
339.0	339.5	13,985	7.3	0.5 - 1.0
339.5	340.0	15,111	7.9	0.0 - 0.5
Total		**191,729**	**100**	**n/a**

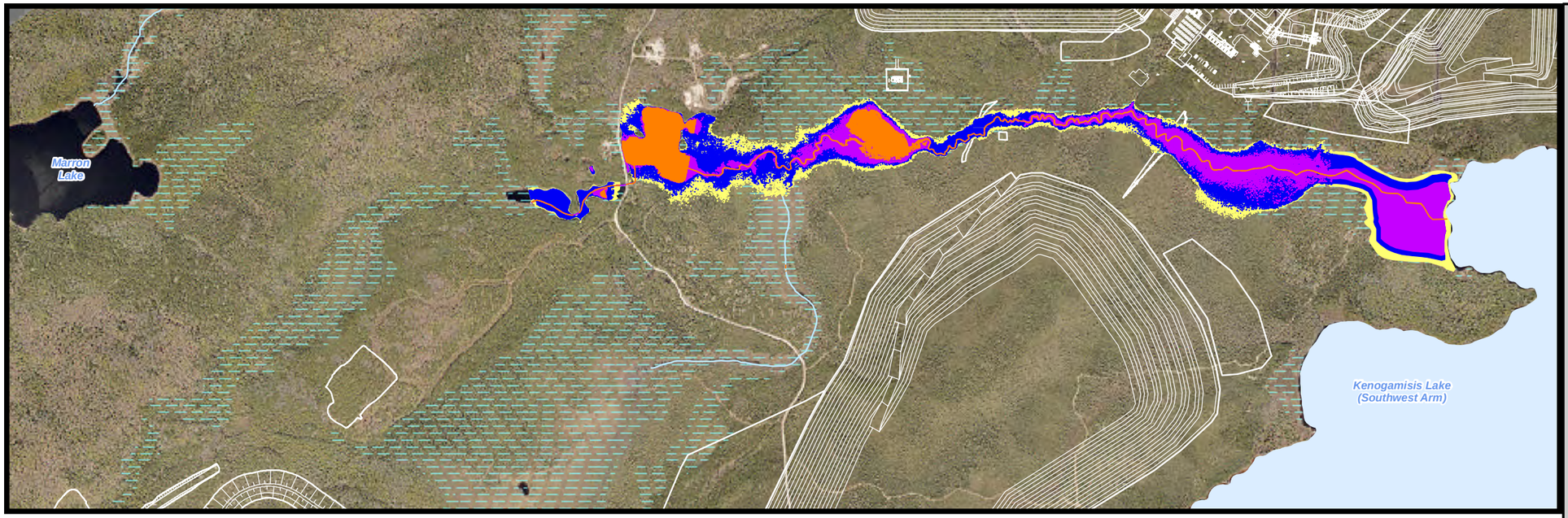
Table 9-2: Criteria and Timing to Assess Offsetting Measures Implementation and Effectiveness Success

Attribute	Success Criteria	Date
Physical construction of offset measures	• As-built survey demonstrates that measures are constructed as per the approved plans	Within 12 months following construction
Physical function of offset measures	• Water levels, channel gradients and water depth are consistent with those specified in the design and facilitate conditions for fish passage. • Aerial extent of works as per the plans (habitat quantity consistent with design)	Within 12 months following construction
Stability of structures	• Constructed habitat features remain in place (wood structure, rock and vegetation structures in place. • Channel banks and offset features are stable and not eroding (greater than 80% of features are considered stable) • Riparian vegetation cover and plantings achieve 80% coverage of area, and or survival of planted stock	Stability assessment in years 1, 3 and 5 post construction.
Species presence	• Fish community and abundance is consistent with baseline studies of comparable habitats.	Fish assessment in years 1, 3 and 5 post construction.
Full life cycle usage	• Multiple year classes including young of the year fish are present in the offset feature. This will be demonstrated through assessment of size classes and length frequency comparison. Fish capture techniques will be dependent on specific habitat and include electrofishing, minnow traps, seine nets, gill nets and trap/hoop nets. • Suitable habitat is available for all fish life stages and functions, including reproduction, nursery, rearing, foraging and overwintering.	Fish and fish habitat assessment in years 1, 3 and 5 post construction
Fish abundance	• Overall Catch per Unit Effort (CPUE) for all species combined, for at least two of following capture methods (electrofishing, Minnow Traps, Seine Nets, gill nets and trap/hoop nets). Success criteria will be the consistent CPUE catch rates as those summarized in Table 1-2 for respective habitat types.	Fish assessment in years 1, 3 and 5 post construction

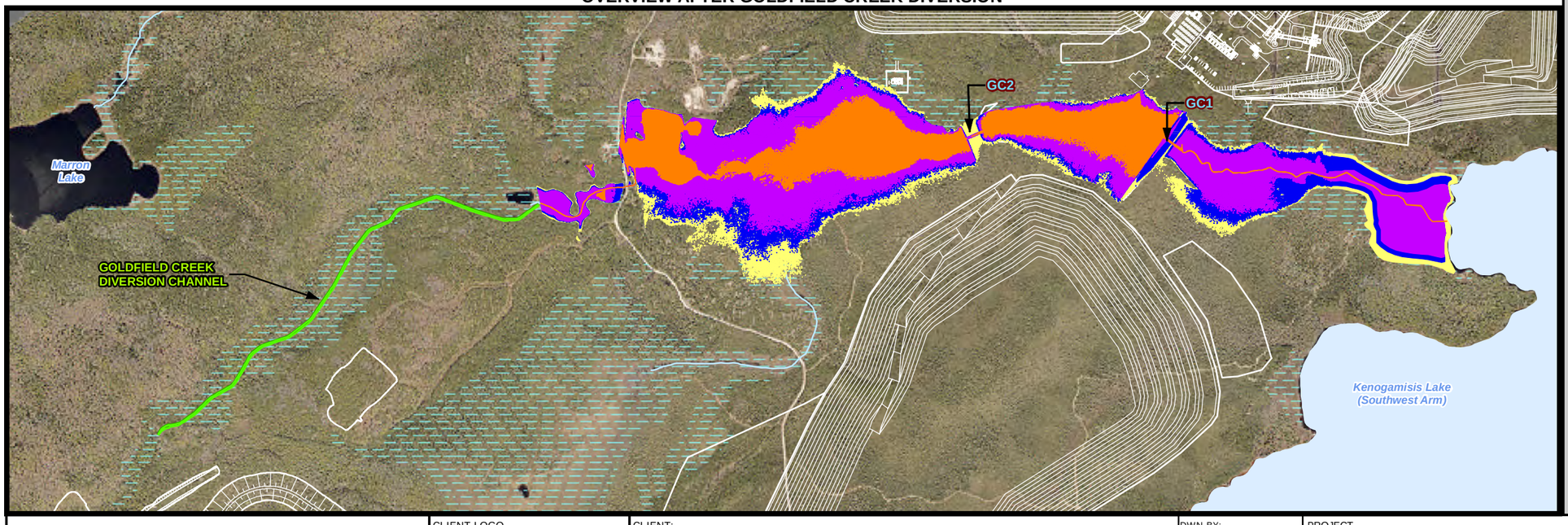
Table 9-3: Contingency Measures for Implementation Success

Attribute	Mode of Failure	Contingency
Physical construction of offset measures	• Channel not constructed as per plan. • Water area, depths and or habitat structures not in place or present as per the plans.	• Engineer / biologist to assess failure and recommend corrective actions. • Proponent to take required corrective action.
Physical function of offset measures	• Conditions do not provide for fish passage or targeted life stage purpose (spawning).	• Engineer / biologist to assess cause of failure and recommend corrective actions. • Proponent to take required corrective action.
	• Water level not consistent with those specified in plans.	• Adjust grades of structures to alter water levels • Excavate pools to specified depths. • Add more substrate or regrade substrates
Stability of structures	• Constructed habitat features (wood, rock and vegetation structures) missing or not functional	• Repair or replace structures
	• Channel not stable (less than 80% of channel is considered stable)	• Assess cause and areas of instability • Add permanent erosion control (rock, vegetation) in areas of erosion • Grade channel to decrease velocity
	• Riparian vegetation cover and plantings are less than 80% coverage of area, and or survival of planted stock	• Apply seed and replacement plantings where required • Substitute species, and/or use soil amendments if conditions require.
Species presence	• Less than 70% of baseline species of fish are present in the baitfish offset measure.	• Use monitoring data to assess limiting factors for other species • Supplement limiting factors through additional works or assess habitat use by other species.
Life cycle usage	• Absence of expected year classes.	• Use monitoring data to assess limiting factors for spawning, nursery, rearing or overwintering • Supplement limiting factors through additional planting, structure placement or excavation
Fish abundance	• Overall Catch per Unit Effort (CPUE) does not meet targets.	• Use monitoring data to assess limiting factors for abundance • Supplement limiting factors through additional planting, structure or excavation. • Consider longer term monitoring program if trend shows increasing abundance.

OVERVIEW BEFORE GOLDFIELD CREEK DIVERSION



OVERVIEW AFTER GOLDFIELD CREEK DIVERSION



LEGEND

- Floodplain for Low Flow Conditions
- Floodplain for 2 Year Flood Event
- Floodplain for 10 Year Flood Event
- Floodplain for 100 Year Flood Event
- GC1 Grade Control Structures (labelled with ID)
- Goldfield Creek Diversion Channel
- Mine Infrastructure
- Watercourse
- Waterbody
- Low Lying Area

NOTES:
- Aerial imagery provided by Premier Gold, 2014.
- Waterline derived from Lidar.
- Floodplain modelling for "After Goldfield Creek Diversion" scenario does not include designed haul roads.

N

CLIENT LOGO

GREENSTONE GOLD MINES

CLIENT:

GREENSTONE GOLD MINES

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wood.

DWN BY: MD

CHK'D BY: MR

DATUM & PROJECTION: NAD 1983 UTM Zone 16N

SCALE: 1:18,000

PROJECT

GREENSTONE GOLD MINES
HARDROCK PROJECT

TITLE

SOUTHWEST ARM TRIB. WATER LEVEL MODEL OF BEFORE AND AFTER GOLDFIELD CREEK DIVERSION

DATE: April 2019

PROJECT No: TC150320

REV No: A

FIGURE No: 9-1

P:\2015\Projects\TC150320_Greenstone_HR_Detailed_Design\11_CAD\GIS\MXD\SW_arm_water_level_model_before_after_3.mxd

10.0 Conditions that Relate to Monitoring and Reporting of Implementation of Offsetting Measures

10.1 Schedule and Criteria

The Proponent shall conduct monitoring of the implementation of the offsetting measures according to the timeline and criteria listed in Table 10-1.

10.2 Report Schedule

The Proponent shall report to DFO on whether the offsetting measures were conducted according to the conditions of the authorization by providing the reports listed in Table 10-1. An as constructed report will be due within 12 months of completing construction of the works. Performance monitoring reports will be due on or before December 31 of years 1, 3 and 5 following construction of the works. Modifications to the proposed monitoring schedule may be requested by the Proponent in writing to DFO.

Table 10-1: Monitoring Criteria and Reporting Schedule of Offsetting Measures

Attribute	Monitoring Criteria	Report Schedule
Physical construction of offset measures	• As-built survey will be conducted within 6 months of completion of the offset measures. • Photo documentation will be taken during construction to document that mitigation and avoidance measures were implemented, and that all structures were constructed as per the approved plans. • A comparison of the constructed habitat to the approved plan will be made to confirm that the area of replacement habitat is equal to or greater than that specified in the plan	As-constructed Report due to DFO within 6 months of construction
Physical function of offset measures	• Channel / Pond conditions and water levels / depths remain consistent with the design • Assess hydraulic connection through grade controls and channel transitions to confirm conditions for fish passage. • Fish presence within the offset areas will be monitored once per summer in years 1, 3 and 5 post construction to demonstrate fish usage and abundance. • Spawning survey or juvenile fish survey conducted in years 1, 3 and 5 post construction to assess use of the potential riffle spawning areas	Performance Monitoring Reports due to DFO on or before December 31 each year for years 1, 3 and 5 post construction
Stability of structures	• Observations will be made once per year in years 1, 3 and 5 post construction, to confirm that constructed features are in place and functional. • Stability of the features and general condition will be assessed by mapping and photo documenting the habitats. Consistent vantage points will be used to provide between year comparisons. • Riparian vegetation cover and plantings success will be monitored by estimating the percent cover of herbaceous ground cover, and the percent survival of planted stock (shrubs).	
Species presence *Full Life cycle usage* *Fish abundance*	Fish sampling /observation will be conducted in years 1, 3 and 5 post construction to demonstrate: • Comparable abundance and diversity in offset areas to the comparable natural habitats. • Complete age class representation by resident fish species to demonstrate reproduction and overwintering survival;	

11.0 Fisheries Offset and Compensation Accounting and Balancing

The total area of impacts to fisheries and fish habitat requiring authorization under Section 35 of the Fisheries Act or listing under Schedule 2 of the MDMER is 1.39 ha and 5.40 ha respectively as per section 6 and Tables 6-1, 6-2 and 6-3. A net calculated area of 6.79 ha will be residually impacted by the development of the Project.

An additional 2 ha of the Southwest Arm tributary channel will be altered from its current conditions, but not seriously harmed (Section 9.2.4) as it is still expected to retain the resident species of fish in comparable abundance. Consequently, the Southwest Arm Tributary is not included in the impact calculation.

The offset plan as described in Section 9 will result in the development of approximately 19.17 ha of new pond habitat (GFDP) and 1.5 ha of new channel habitat for a total of 20.67 ha of newly constructed Goldfield Creek habitat. The additional 14.5 ha of increased pond habitat in the Southwest Arm Tributary has not been added into the offset calculation at this time.

Excluding the ponded Southwest Arm Tributary areas, the total offset area proposed is 20.77 ha (Table 11-1) resulting in a net habitat gain of 13.88 ha and representing a ratio of approximately 3:1.

Table 11-1: Offset and Compensation Areas Accounting and Balance Summary

Segment Description	Initial impact Area (ha)	Calculated Offset Area (ha)
Schedule 2 Impacts as per Table 6-1	-5.40	
Section 35 Impacts as per Table 6-2	-1.39	
Goldfield Diversion Pond		19.17
Goldfield Diversion Channel		1.5
Southwest Arm Tributary Existing area	n/a	
Southwest Arm Tributary with Grade Controls		Not included at this time
Summary	-6.79	20.67
Net Difference		13.88
Net Ratio		3:1

12.0 References

DFO 2015; Freshwater Intake End-of-Pipe Fish Screen Guideline; Retrieved from http://www.dfo-mpo.gc.ca/Library/223669.pdf

DFO 2017; Timing windows to conduct projects in or around water; Retrieved from http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/index-eng.html.

Stantec 2017; Hardrock Project Environmental Impact Statement / Environmental Assessment.

OMNR 2013; In-Water Work Timing Window Guidelines, 2pp.

Parish 2016 - Hardrock Mine goldfield Creek Realignment - Draft July 2016.

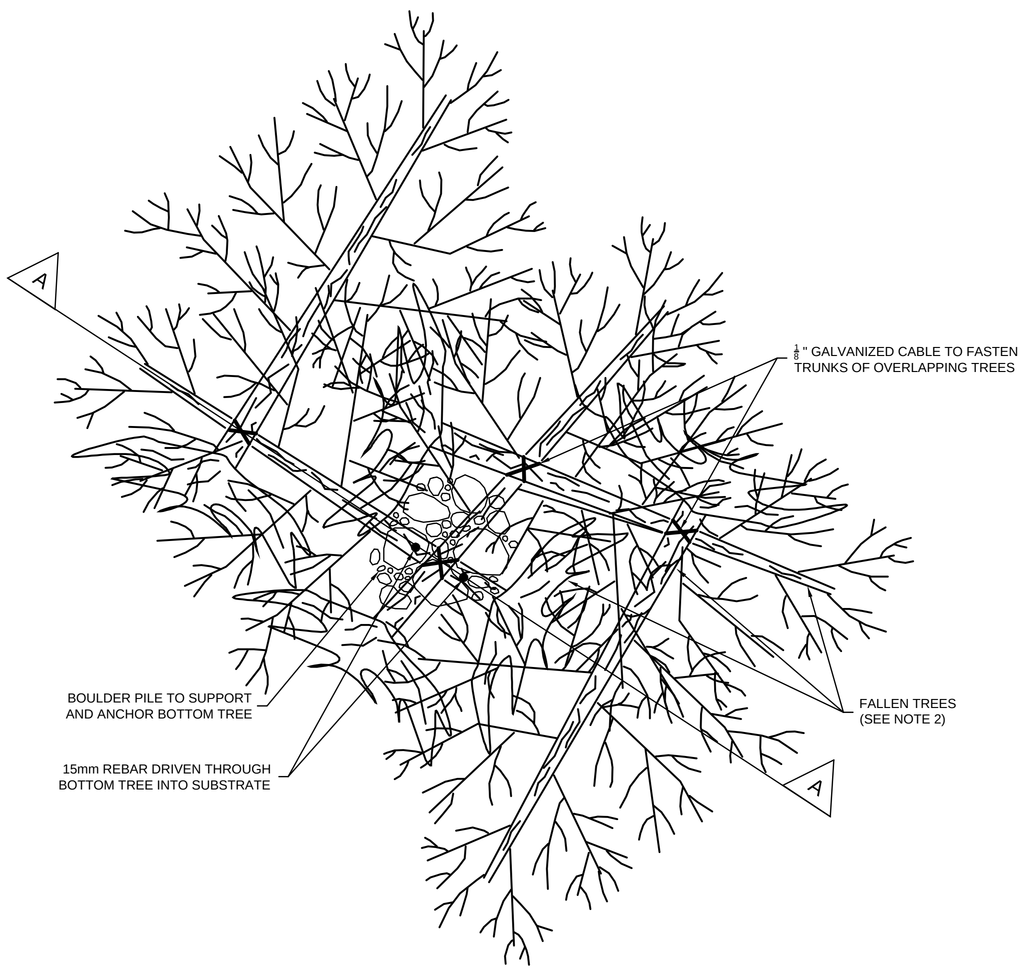
Attachment 1

Design Drawings

1A Goldfield Diversion Pond
1B Goldfield Creek Diversion Channel
1C Southwest Arm Tributary Grade Controls

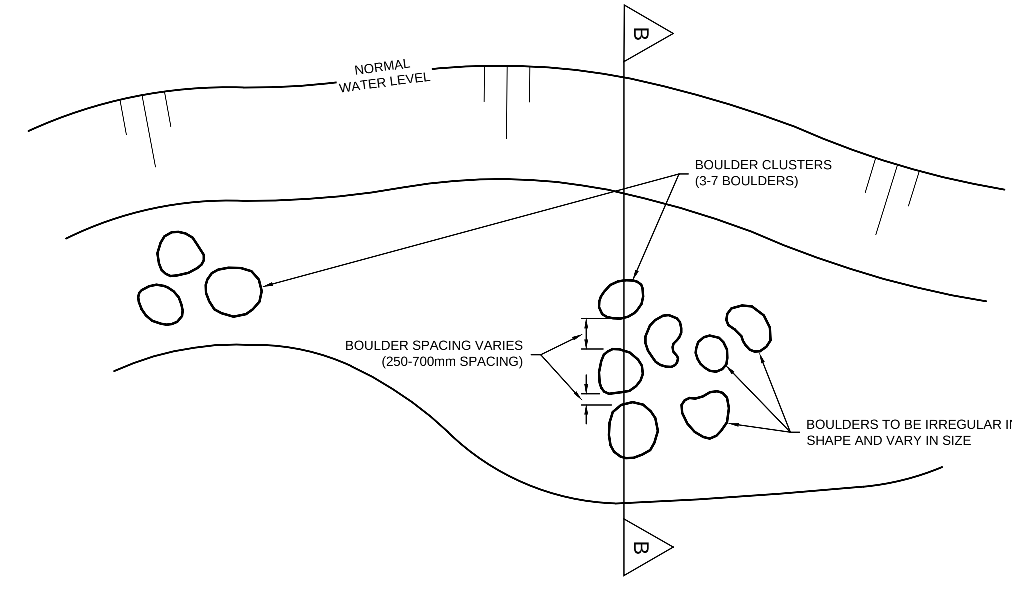
Attachment 1A

Goldfield Diversion Pond



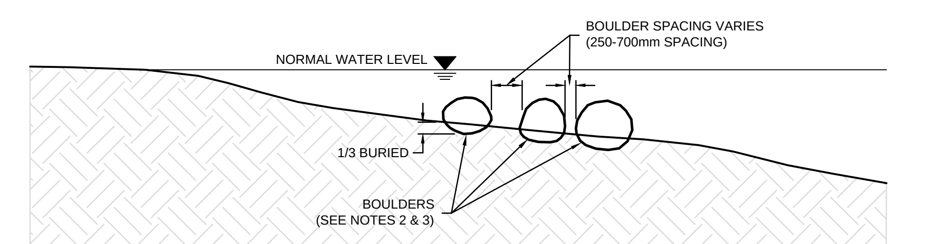
TYPICAL TREE PILE: PLAN VIEW

SCALE : N.T.S.



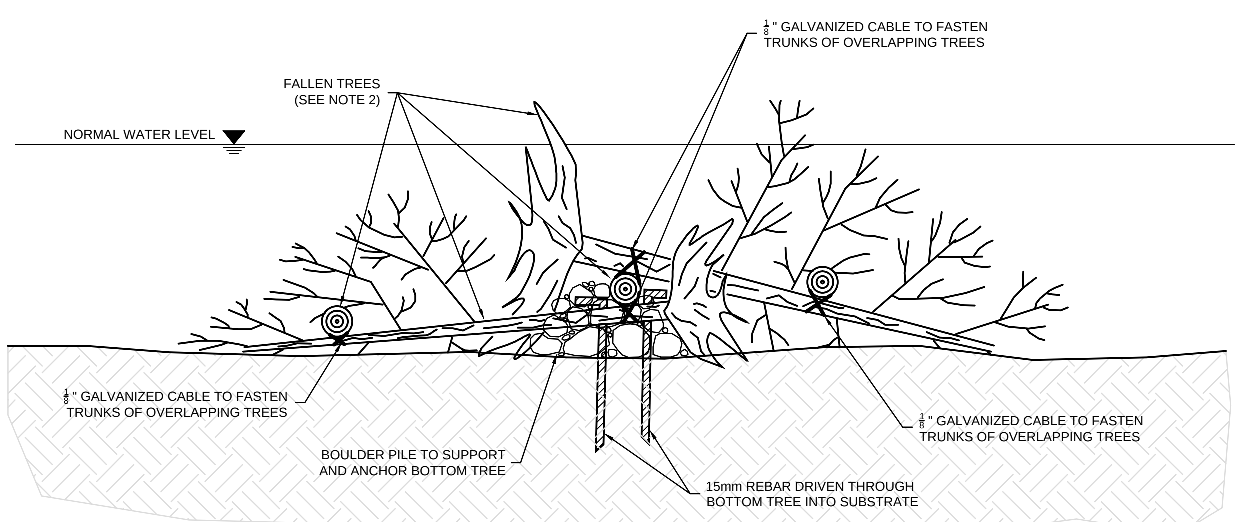
TYPICAL BOULDER CLUSTER: PLAN VIEW

SCALE : N.T.S.



TYPICAL BOULDER CULSTER: SECTION B-B

SCALE : N.T.S.



TYPICAL TREE PILE: SECTION A-A

SCALE : N.T.S.

BOULDER CLUSTER NOTES:

1. BOULDER CLUSTERS SHALL BE PLACED IN LOCATIONS OUTLINED IN THE APPROVED PLANS.
2. BOULDERS SHALL BE APPROXIMATELY 700mm TO 1300mm IN DIAMETER.
3. USE OF IRREGULARLY SHAPED BOULDERS WITH A VARIETY OF DIAMETERS IS PREFERRED.
4. BOULDERS SHALL NOT CONTAIN POTENTIALLY ACID GENERATING ROCK.
5. BOULDER CLUSTERS SHALL CONSIST OF 3 TO 7 BOULDERS.
6. BOULDERS SHALL BE BURIED TO ONE THIRD OF THEIR TOTAL HEIGHT.
7. BOULDERS MAY BE PLACED SUCH THAT THE TOPS OF SOME BOULDERS ARE ABOVE THE NORMAL WATER LEVEL.
8. SPACING BETWEEN BOULDERS WITHIN THE CLUSTER SHALL RANGE FROM 250mm TO 700mm.

TREE PILE MATERIALS NOTES:

1. TREE PILES SHALL CONSIST OF A MINIMUM OF 5 TREES.
2. TREES SHALL HAVE A MINIMUM DIAMETER OF 150mm AND A MINIMUM LENGTH OF 3m.
3. IT IS PREFERRED THAT TREES WITH ROOTS AND BRANCHES INTACT BE UTILIZED FOR CONSTRUCTION OF TREE PILES.
4. TREES SHALL BE SOUND AND FREE OF CENTER ROT.
5. TREES UTILIZED SHALL BE A MIXTURE OF CONIFEROUS AND DECIDUOUS TREES
6. BOULDERS UTILIZED FOR CRADLE/SADDLE AND WEIGHTING OF BOTTOM TREE SHALL BE A UNIFORM MIXTURE OF 150mm TO 400mm ROCK WHICH IS NOT POTENTIALLY ACID GENERATING.
7. TREES SHALL BE FASTENED TOGETHER UTILIZING $\frac{1}{8}$" GALVANIZED CABLE (OR EQUIVALENT).

TREE PILE GENERAL NOTES:

1. IT IS PREFERRED THAT WITHIN EACH POND APPROXIMATELY $\frac{1}{3}$ OF TREE PILES CONTAIN SOLELY CONIFEROUS TREES, $\frac{1}{3}$ OF TREE PILES CONTAIN SOLELY DECIDUOUS TREES, AND THE REMAINING $\frac{1}{3}$ OF TREE PILES CONTAIN BOTH CONIFEROUS AND DECIDUOUS TREES.
2. DRYING OUT OF TREES PRIOR TO INSTALLATION SHALL BE MINIMIZED IN ORDER TO REDUCE THE NUMBER OF BRANCHES WHICH ARE BROKEN OFF DURING INSTALLATION.

TREE PILE INSTALLATION NOTES:

1. TREE PILES SHALL BE PLACED IN LOCATIONS OUTLINED IN THE APPROVED PLANS.
2. ALL TREE PILES SHALL BE INSTALLED IN THE DRY.
3. TREE PILES SHALL CONSIST OF A MINIMUM OF 5 TREES.
4. TREE PILES SHALL BE CONSTRUCTED BY STACKING TREES ATOP ONE ANOTHER TO PROVIDE HEIGHT TO THE STRUCTURE.
5. THE BOTTOM TREE IN THE PILE SHALL BE PLACED IN A BOULDER CRADLE/SADDLE AND FURTHER WEIGHTED WITH BOULDERS IN ADDITION TO BEING ANCHORED TO THE GROUND WITH REBAR.
6. REBAR ANCHORING SHALL CONSIST OF A MINIMUM OF TWO 15mm REBAR STAKES.
7. TWO PILOT HOLES SHALL BE DRILLED VERTICAL IN THE TREE TRUNK OF THE BOTTOM TREE ONCE IT HAS BEEN PLACED SECURELY IN THE BOULDER CRADLE. THE HOLES SHALL BE A MINIMUM OF 300mm APART FROM EACH OTHER.
8. EACH REBAR STAKE SHALL BE DRIVEN INTO THE NATIVE GROUND THROUGH THE PILOT HOLE LEAVING 150mm OF REBAR EXPOSED OUT OF THE TRUNK.
9. EACH EXPOSED REBAR SECTION SHALL BE BENT OVER THE SIDES OF THE TREE IN OPPOSITE DIRECTIONS, THUS LOCKING THE TREE IN PLACE.
10. BOULDERS SHALL BE ADDED TO THE CRADLE TO CREATE A BOULDER PILE WHICH COVERS THE REBAR STAKES.
11. TREES SHALL THEN BE ADDED TO THE PILE BY OVERLAPPING TREE TRUNKS AND BINDING THE TREES TOGETHER AT THE POINT OF OVERLAP UTILIZING $\frac{1}{8}$" GALVANIZED CABLE (OR EQUIVALENT).
12. TREE TRUNKS MAY BE CLEARED OF BRANCHES AT THEIR POINT OF OVERLAP TO FACILITATE FASTENING WITH OVERLAPPING TREES.

DOCUMENT NO.: HP-EG003-346-C-202-0004

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
A	19	07	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo:

Client: GREENSTONE GOLD MINES

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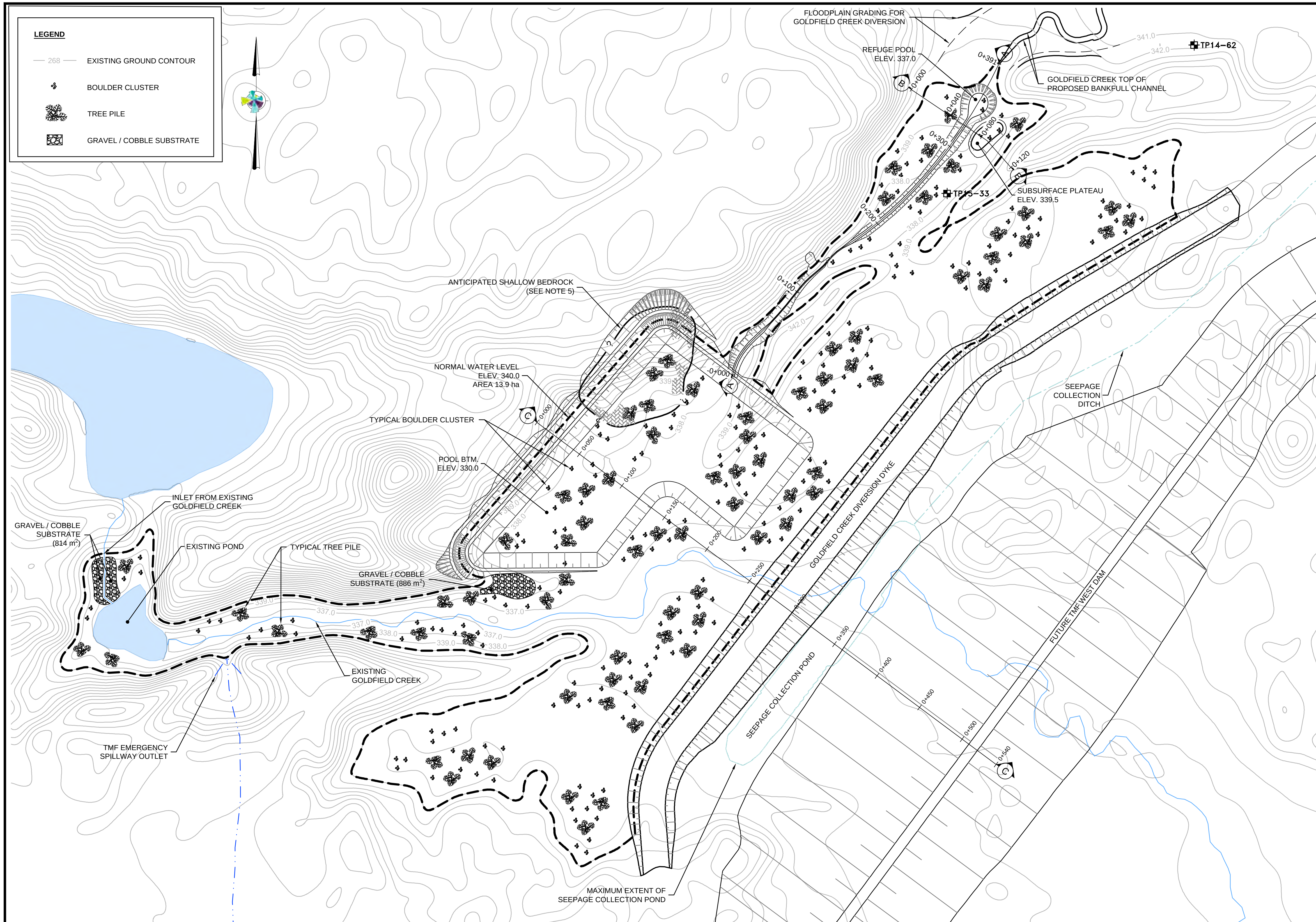
DRAWN BY: NSH
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: HARDROCK MINE DETAIL DESIGN

TITLE: TREE PILE AND BOULDER CLUSTER TYPICAL DETAILS

PROJECT NO.: TC150320
REVISION NO.: A
DATE: JULY 2018
SCALE: AS SHOWN
DRAWING NO.: 307



PLAN VIEW: GOLDFIELD DIVERSION POND

SCALE = 1:2000

0m 20 40 60 80

1 : 2000

NOTES:

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. 1.0m EXISTING CONDITION CONTOURS HAVE BEEN AUTOMATICALLY GENERATED AND SMOOTHED BY AUTOCAD.
3. AN AMOUNT OF TOPSOIL SUFFICIENT TO COMPLETE THE WORKS SHALL BE STRIPPED FROM AREAS REQUIRING GRADING AND STOCKPILED FOR RE-USE.
4. FLOWS SHALL BE MANAGED DURING CONSTRUCTION TO MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENT TRANSPORT OFF-SITE.
5. THE ACTUAL ELEVATIONS WITHIN THE AREA OF ANTICIPATED SHALLOW BEDROCK SHALL MATCH THE BEDROCK SURFACE, THIS BEDROCK WILL NOT BE BLASTED OR REMOVED.

VEGETATION RESTORATION NOTES:

1. ALL AREAS EXCAVATED TO THE DEPTH OF MINERAL SOIL AND LOCATED AT AN ELEVATION OF 3.5m BELOW THE NORMAL WATER LEVEL, OR HIGHER, SHALL BE TREATED WITH A MINIMUM OF 100mm OF TOPSOIL / ORGANIC SOIL SALVAGED FROM SITE.
2. THE FLOOR OF THE FORMER S1 PIT EXCAVATION SHALL NOT BE TREATED WITH TOPSOIL / ORGANIC SOIL.
3. PLACED TOPSOIL SHALL BE COMPACTED UTILIZING THE TRACK WEIGHT OF A CRAWLER TRACTOR OR DOZER. FURTHER MACHINERY TRAFFIC ATOP PLACED TOPSOIL SHALL BE MINIMIZED TO PREVENT OVER-COMPACTION.
4. ANY SOIL COMPACTED DUE TO REPEATED MACHINERY ACCESS SHALL BE LOOSENED PRIOR TO SEED APPLICATION.
5. ALL DISTURBED SOILS SHALL BE STABILIZED WITH A NURSE CROP OUTLINED IN TABLE 2.
6. EFFORTS SHALL BE MADE TO UTILIZE LOCALLY SOURCED NATIVE WETLAND SEED BANK MATERIAL IN AS MANY AREAS AS POSSIBLE. IF SUFFICIENT WETLAND SEED BANK IS NOT AVAILABLE THEN AN APPROVED WETLAND SEED MIX SHALL BE UTILIZED.
7. SUBSTITUTIONS OF PLANT MATERIAL MUST BE APPROVED BY GREENSTONE GOLD MINE'S ENVIRONMENTAL SPECIALIST.

SUMMARY POND AREA AND WATER DEPTH:

Elevations Table

Minimum Elevation	Maximum Elevation	Area (m^2)	% Area	Water Depth
339.5	340.0	15,111	7.9%	0.0 - 0.5
339.0	339.5	13,985	7.3%	0.5 - 1.0
338.0	339.0	54,565	28.4%	1.0 - 2.0
337.0	338.0	52,335	27.3%	2.0 - 3.0
335.0	337.0	21,475	11.2%	3.0 - 5.0
330.0	335.0	34,258	17.9%	5.0 - 10.0
TOTAL		191,729		

TABLE 1. MATERIAL SUMMARY

LOCATION	MATERIAL	QUANTITY
DISTURBED AREAS	NURSE CROP SEED MIX	VARIES
DISTURBED AREAS	SALVAGED TOPSOIL / ORGANIC SOIL CONTAINING SEEDBANK	1,628 m^3
BELOW NWL	BOULDER CLUSTER	202
BELOW NWL	TREE PILE	79

TABLE 2. NURSE CROP SEEDING

TIMING OF SEEDING	SELECTED SEED TYPE		
	LATIN NAME	COMMON NAME	APPLICATION RATE
POST-SPRING FRESHET TO AUG. 14	*Avena sativa*	Oats	15 kg/ha
AUG. 15 TO OCT. 15	*Triticum aestivum*	Winter Wheat	15 kg/ha

DOCUMENT NO.: HP-EG003-346-C-202-0005

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
B	07	11	2018	ISSUED FOR REVIEW	NSH	MCR
A	19	07	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD

Client: GREENSTONE GOLD MINES

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wood.

DRAWN BY: NSH
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: HARDROCK MINE DETAIL DESIGN

TITLE: GOLDFIELD DIVERSION POND PLAN VIEW

PROJECT NO.: TC150320
REVISION NO.: B
DATE: JULY 2018
SCALE: AS SHOWN
DRAWING NO.: 308

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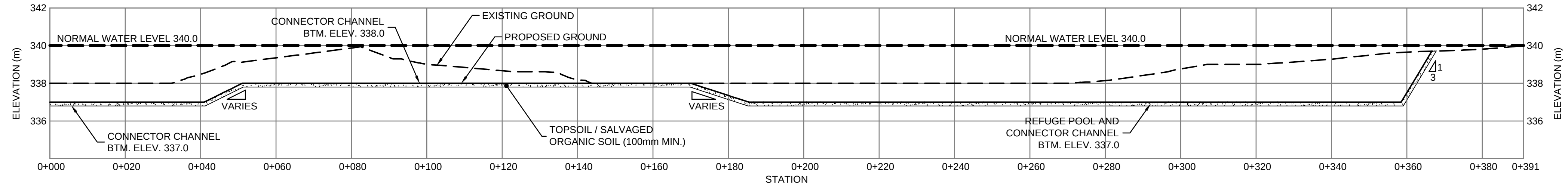
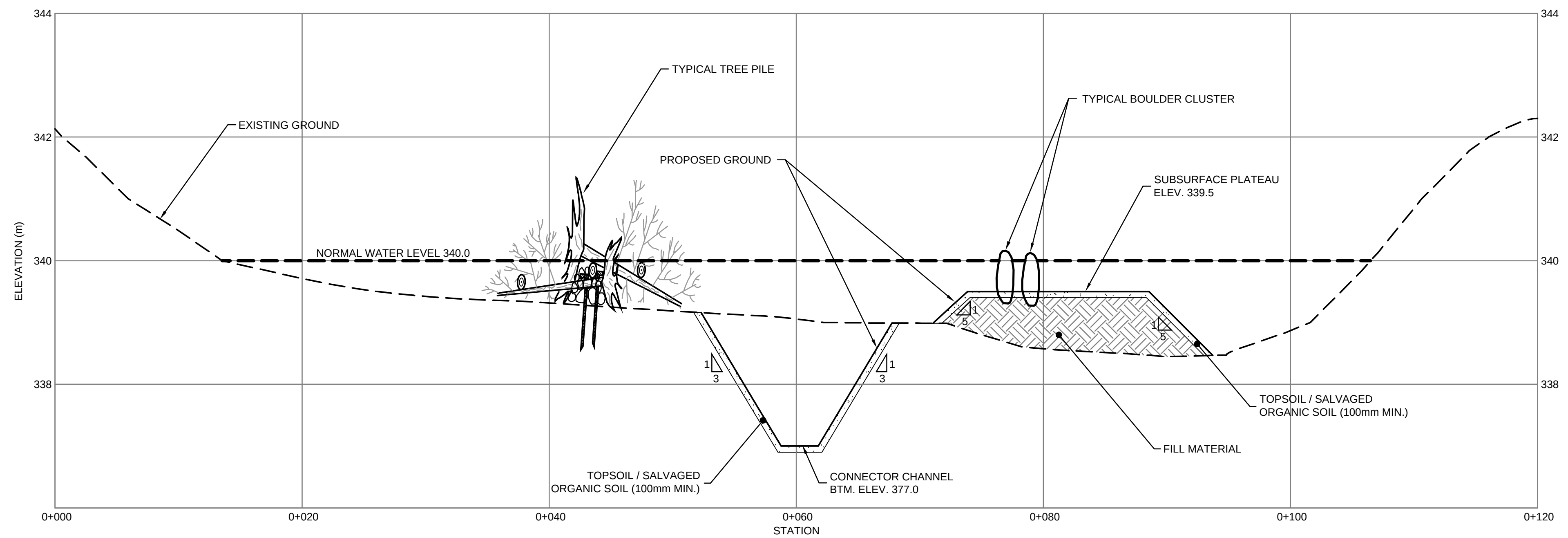


SECTION A-A: GOLDFIELD DIVERSION POND

SCALE: H=1:750 V=1:150

HORIZONTAL SCALE: 1 : 750 VERTICAL SCALE: 1 : 150

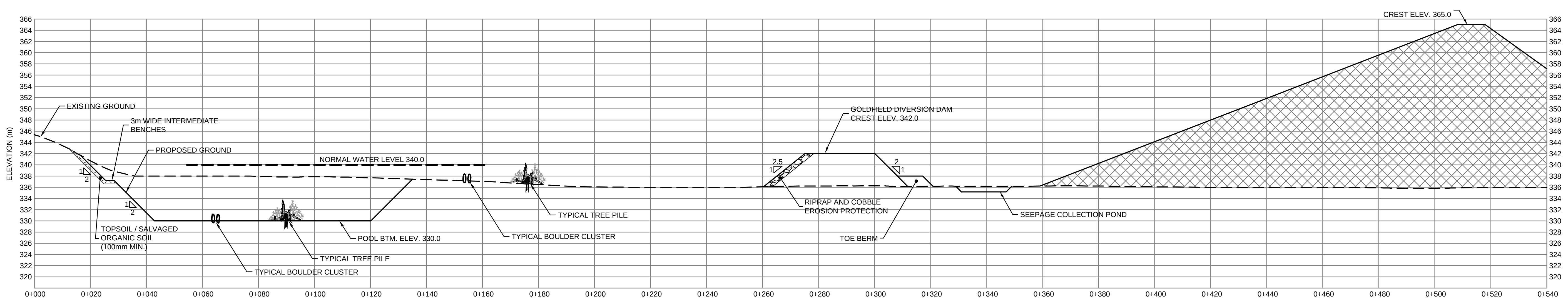
NOTES:
1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. 1.0m EXISTING CONDITION CONTOURS HAVE BEEN AUTOMATICALLY GENERATED AND SMOOTHED BY AUTOCAD.
3. TO BE READ IN CONJUNCTION WITH SHEET 002



SECTION B-B: GOLDFIELD DIVERSION POND

SCALE: H=1:250 V=1:50

HORIZONTAL SCALE: 1 : 250 VERTICAL SCALE: 1 : 50



SECTION C-C: GOLDFIELD DIVERSION POND

SCALE: H=1:750 V=1:150

HORIZONTAL SCALE: 1 : 750 VERTICAL SCALE: 1 : 150

DOCUMENT NO.: HP-EG003-346-C-202-0006

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
-						
-						
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B	07	11	2018	ISSUED FOR REVIEW	MCR	NSH
A	18	07	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD MINES

Client: GREENSTONE GOLD MINES

Wood Environment & Infrastructure Solutions
160 Traders Boulevard East
Mississauga, Ontario, Canada L4Z 3K7

wood.

DRAWN BY: NSH
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: HARDROCK MINE DETAIL DESIGN

TITLE: GOLDFIELD DIVERSION POND SECTION VIEW

PROJECT NO.: TC150320
REVISION NO.: B
DATE: JULY 2018
SCALE: AS SHOWN
DRAWING NO.: 309

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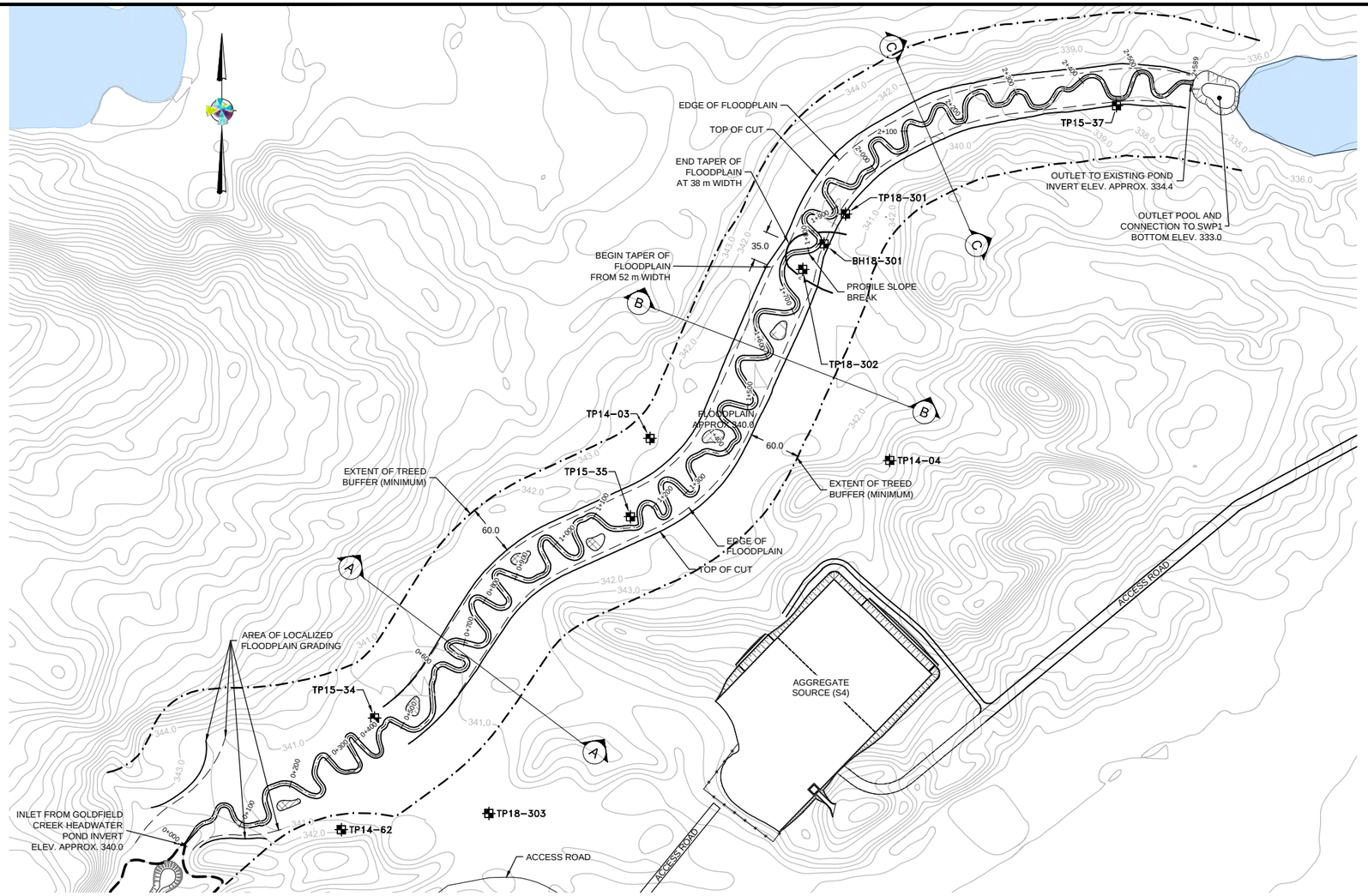
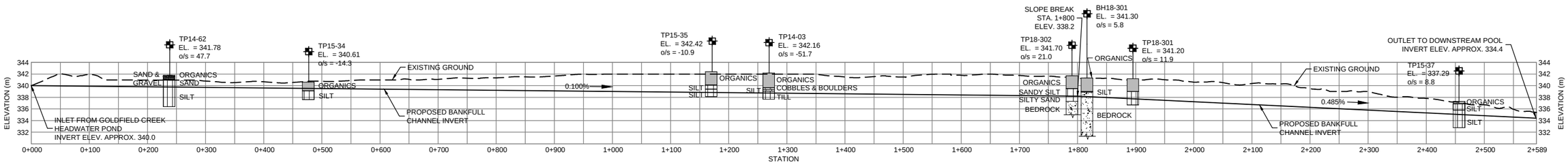
Attachment 1B

Goldfield Diversion Channel



PLAN VIEW: GOLDFIELD CREEK REALIGNMENT

SCALE = 1:3000



PROFILE VIEW: GOLDFIELD CREEK REALIGNMENT

SCALE: H = 1:3500 V = 1:350

LEGEND

- 338.0 — EXISTING GROUND CONTOUR
- BANKFULL CHANNEL CENTERLINE
- TOP OF BANKFULL CHANNEL
- EDGE OF FLOODPLAIN
- FLOODPLAIN TOP OF CUT
- EXTENT OF TREED BUFFER (MIN.)
- FLOODPRONE DEPRESSION

NOTES:

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. AN AMOUNT OF TOPSOIL SUFFICIENT TO COMPLETE THE WORKS SHALL BE STRIPPED FROM AREAS REQUIRING GRADING AND STOCKPILED FOR RE-USE.
3. FLOWS SHALL BE MANAGED DURING CONSTRUCTION TO MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENT TRANSPORT OFF-SITE.
4. BASED ON BOREHOLE LOGS THERE IS A POTENTIAL FOR SHALLOW BEDROCK TO BE ENCOUNTERED BETWEEN STATION 1+750 AND 1+850. BLASTING OF THIS BEDROCK MAY BE REQUIRED TO FACILITATE CHANNEL CONSTRUCTION.
5. THE DOWNSTREAM END OF THE OUTLET POOL SHALL BE TIED INTO THE UPSTREAM END OF SWP1 A MINIMUM OF 1m BELOW THE WATER LEVEL OF SWP1.

VEGETATION RESTORATION NOTES:

1. ALL AREAS EXCAVATED TO THE DEPTH OF MINERAL SOIL SHALL BE TREATED WITH A MINIMUM OF 100mm OF TOPSOIL / ORGANIC SOIL SALVAGED FROM SITE.
2. PLACED TOPSOIL SHALL BE COMPACTED UTILIZING THE TRACK WEIGHT OF A CRAWLER TRACTOR OR DOZER. FURTHER MACHINERY TRAFFIC ATOP PLACED TOPSOIL SHALL BE MINIMIZED TO PREVENT OVER-COMPACTION.
3. ANY SOIL COMPACTED DUE TO REPEATED MACHINERY ACCESS SHALL BE LOOSENED PRIOR TO SEED APPLICATION.
4. ALL DISTURBED SOILS SHALL BE STABILIZED WITH A NURSE CROP OUTLINED IN TABLE 1.
5. EFFORTS SHALL BE MADE TO UTILIZE LOCALLY SOURCED NATIVE WETLAND SEED BANK MATERIAL IN AS MANY AREAS AS POSSIBLE. IF SUFFICIENT WETLAND SEED BANK IS NOT AVAILABLE THEN AN APPROVED WETLAND SEED MIX SHALL BE UTILIZED.

TABLE 1. NURSE CROP SEEDING

TIMING OF SEEDING	SELECTED SEED TYPE		
	LATIN NAME	COMMON NAME	APPLICATION RATE
POST-SPRING FRESHET TO AUG. 14	*Avena sativa*	Oats	15 kg/ha
AUG. 15 TO OCT. 15	*Triticum aestivum*	Winter Wheat	15 kg/ha

DOCUMENT NO.: HP-EG003-346-C-202-0007

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR
C	08	11	2018	ISSUED FOR REVIEW	NSH	MCR
B	14	08	2018	ISSUED FOR REVIEW	NSH	MCR
A	19	07	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD MINES

Client: GREENSTONE GOLD MINES

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160 Traders Boulevard East
Mississauga, Ontario, Canada L4Z 3K7
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DRAWN BY: NSH
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: HARDROCK MINE DETAIL DESIGN

TITLE: GOLDFIELD CREEK REALIGNMENT PLAN AND PROFILE VIEW

PROJECT NO.: TC150320
REVISION NO.: C
DATE: JULY 2018
SCALE: AS SHOWN
DRAWING NO.: 310

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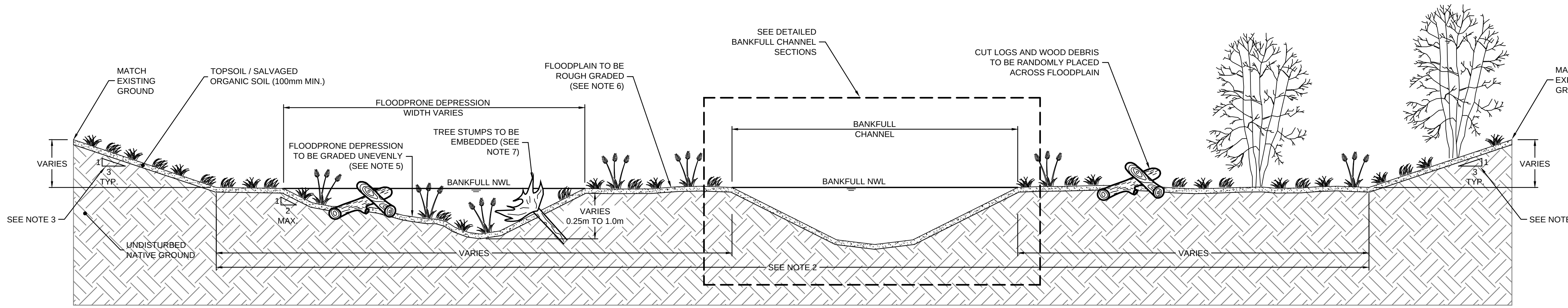
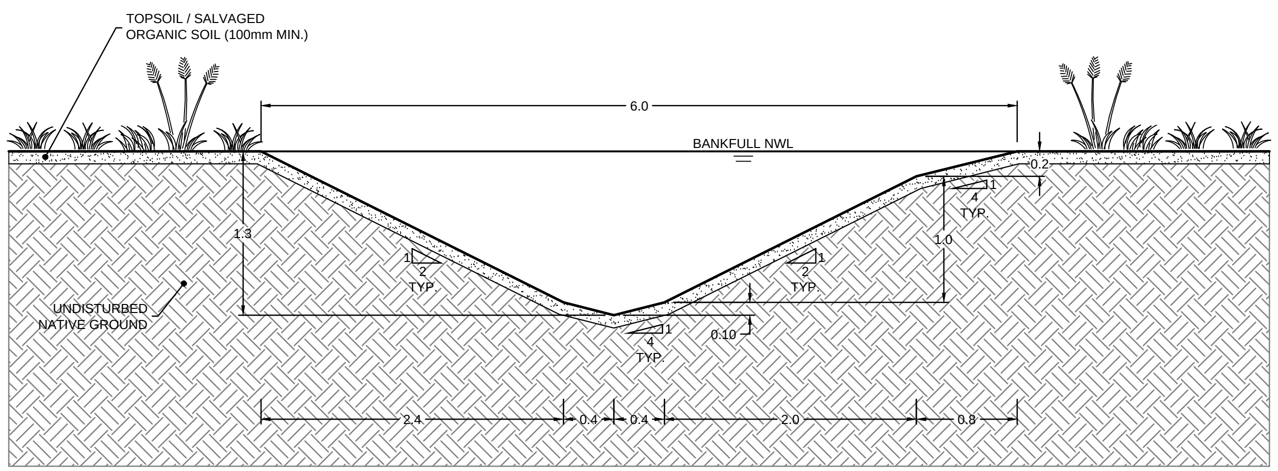


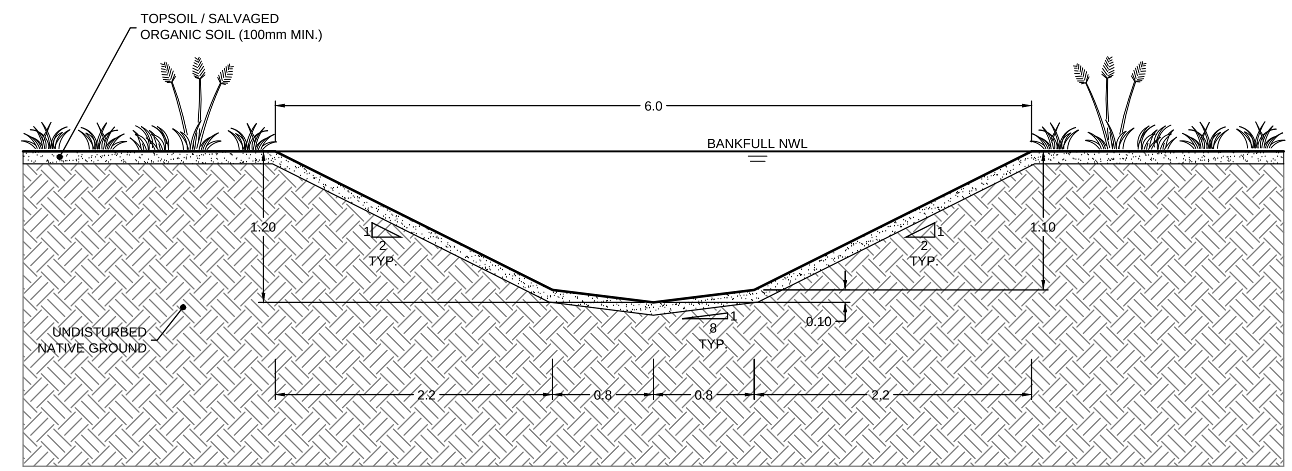
SECTION VIEW: GOLDFIELD CREEK REALIGNMENT AND FLOODPLAIN TYPICAL

SCALE : N.T.S.



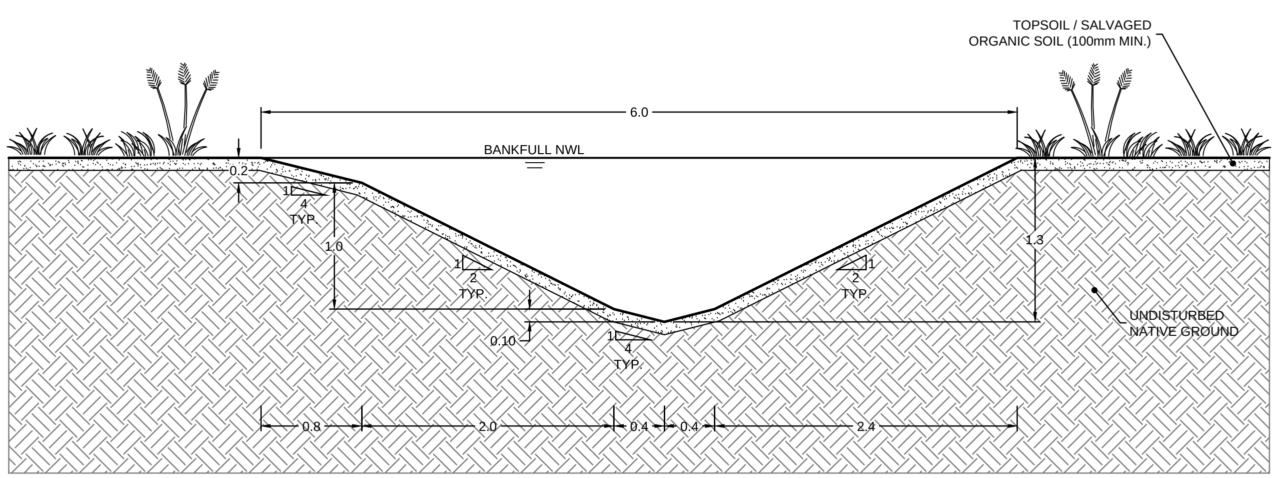
SECTION VIEW: GOLDFIELD CREEK POOL LEFT TYPICAL

SCALE : N.T.S.



SECTION VIEW: GOLDFIELD CREEK RUN TYPICAL

SCALE : N.T.S.



SECTION VIEW: GOLDFIELD CREEK POOL RIGHT TYPICAL

SCALE : N.T.S.

NOTES:

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. FLOODPLAIN WIDTH SHALL VARY AS OUTLINED WITHIN TABLE 1.
3. FLOODPLAIN SIDE SLOPES VARY AS REQUIRED BASED ON THE PROPOSED LOCALIZED GRADING FROM 0+000 TO 0+150. FLOODPLAIN SIDE SLOPES WILL BASED ON EXISTING TOPOGRAPHY FROM 0+150 TO 0+487 AND 2+588 TO 2+666.
4. FLOODPRONE DEPRESSIONS SHALL BE LOCATED IN AREAS SPECIFIED IN THE GOLDFIELD CREEK REALIGNMENT PLAN VIEW.
5. FLOODPRONE DEPRESSION TO BE GRADED UNEVENLY TO PROMOTE MICROTOPOGRAPHY AND VARIABLE WATER DEPTHS WHEN FLOODED.
6. FLOODPLAIN SHALL BE ROUGH GRADED ONLY SO AS NOT TO CREATE A UNIFORM FLOODPLAIN.
7. TREE STUMPS SHALL BE EMBEDDED WITHIN THE FLOODPRONE DEPRESSIONS. APPROXIMATELY ONE TREE STUMP SHALL BE INSTALLED PER 125 m^2 OF FLOODPRONE DEPRESSION.
8. ANY COMPACTED SOIL DUE TO MACHINERY ACCESS SHALL BE LOOSENED PRIOR TO TOPSOIL PLACEMENT AND SEED APPLICATION.
9. ALL AREAS SHALL HAVE 100mm OF TOPSOIL PLACED ON SUBGRADE TO BRING AREAS TO FINAL GRADE.

TABLE 1. FLOODPLAIN WIDTH SUMMARY

BANKFULL CHANNEL CENTERLINE STATION	FLOODPLAIN WIDTH
0+000 TO 0+150	56m TO 120m BASED ON PROPOSED LOCALIZED GRADING
0+150 TO 0+487	VARIES BASED ON EXISTING TOPOGRAPHY (NO FLOODPLAIN GRADING)
0+487 TO 1+754	EXCAVATED TO 52m
1+754 TO 1+800	EXCAVATED TO TAPER FROM 52m TO 38m
1+800 TO 2+588	EXCAVATED TO 38m
2+588 TO 2+666	VARIES BASED ON EXISTING TOPOGRAPHY (NO FLOODPLAIN GRADING)

DOCUMENT NO.: HP-EG003-346-C-202-0008

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
-						
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A	19	07	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD MINES

Client: GREENSTONE GOLD MINES

Wood Environment & Infrastructure Solutions
160 Traders Boulevard East
Mississauga, Ontario, Canada L4Z 3K7

wood.

DRAWN BY: NSH
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: HARDROCK MINE DETAIL DESIGN

TITLE: GOLDFIELD CREEK REALIGNMENT TYPICAL SECTIONS

PROJECT NO.: TC150320
REVISION NO.: A
DATE: JULY 2018
SCALE: AS SHOWN
DRAWING NO.: 311

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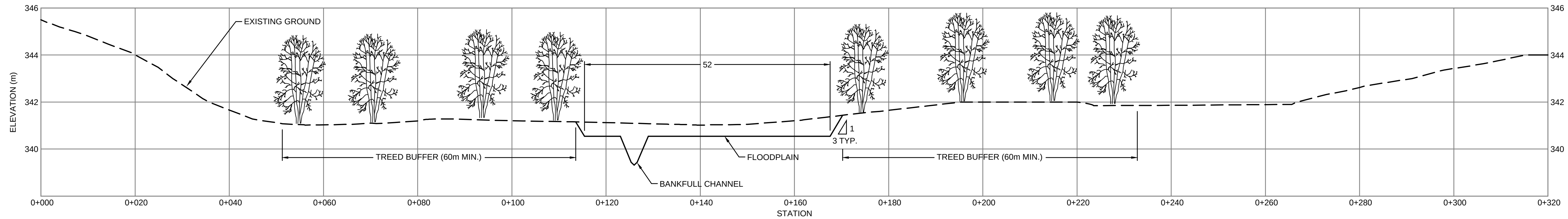
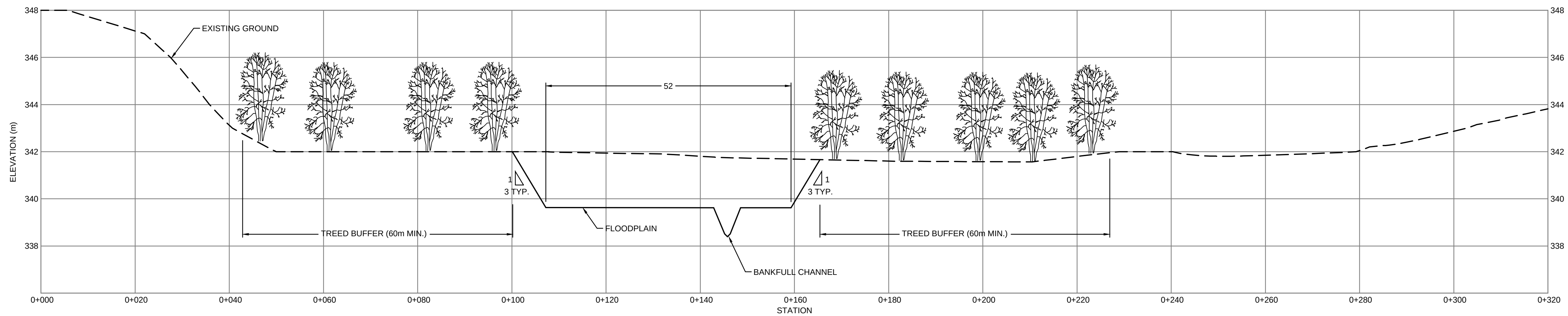


SECTION A-A: GOLDFIELD CREEK REALIGNMENT AND FLOODPLAIN

SCALE : H=1:500 V=1:100

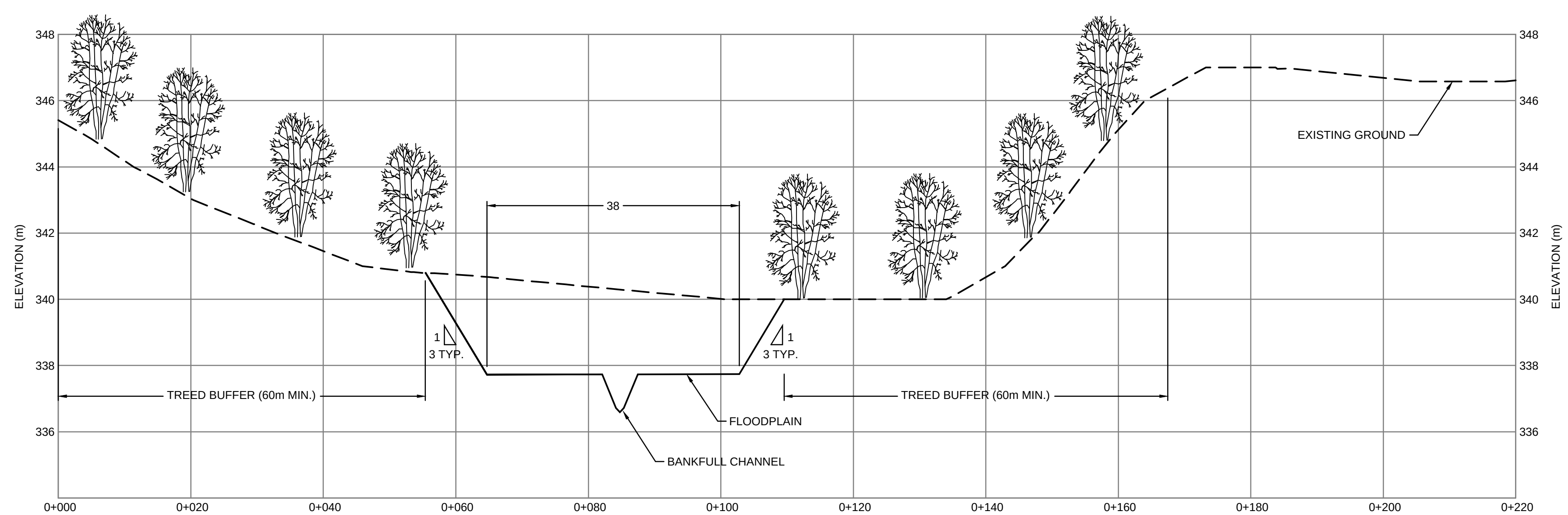
HORIZONTAL SCALE: 1 : 500 VERTICAL SCALE: 1 : 100



SECTION B-B: GOLDFIELD CREEK REALIGNMENT AND FLOODPLAIN

SCALE : H=1:500 V=1:100

HORIZONTAL SCALE: 1 : 500 VERTICAL SCALE: 1 : 100



NOTES:

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. FLOODPLAIN SHALL BE ROUGH GRADED ONLY SO AS NOT TO CREATE A UNIFORM FLOODPLAIN.
3. ANY COMPACTED SOIL DUE TO MACHINERY ACCESS SHALL BE LOOSENED PRIOR TO TOPSOIL PLACEMENT AND SEED APPLICATION.
4. ALL AREAS IN WHICH MINERAL SOIL IS EXPOSED SHALL HAVE 100mm OF TOPSOIL PLACED ON SUBGRADE TO BRING AREAS TO FINAL GRADE.

HORIZONTAL SCALE: 1 : 500 VERTICAL SCALE: 1 : 100

SECTION C-C: GOLDFIELD CREEK REALIGNMENT AND FLOODPLAIN

SCALE : H=1:500 V=1:100

DOCUMENT NO.: HP-EG003-346-C-202-0015

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
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-						
B	20	08	2018	ISSUED FOR REVIEW	NSH	MCR
A	13	08	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD MINES

Client: GREENSTONE GOLD MINES

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www.amecfw.com

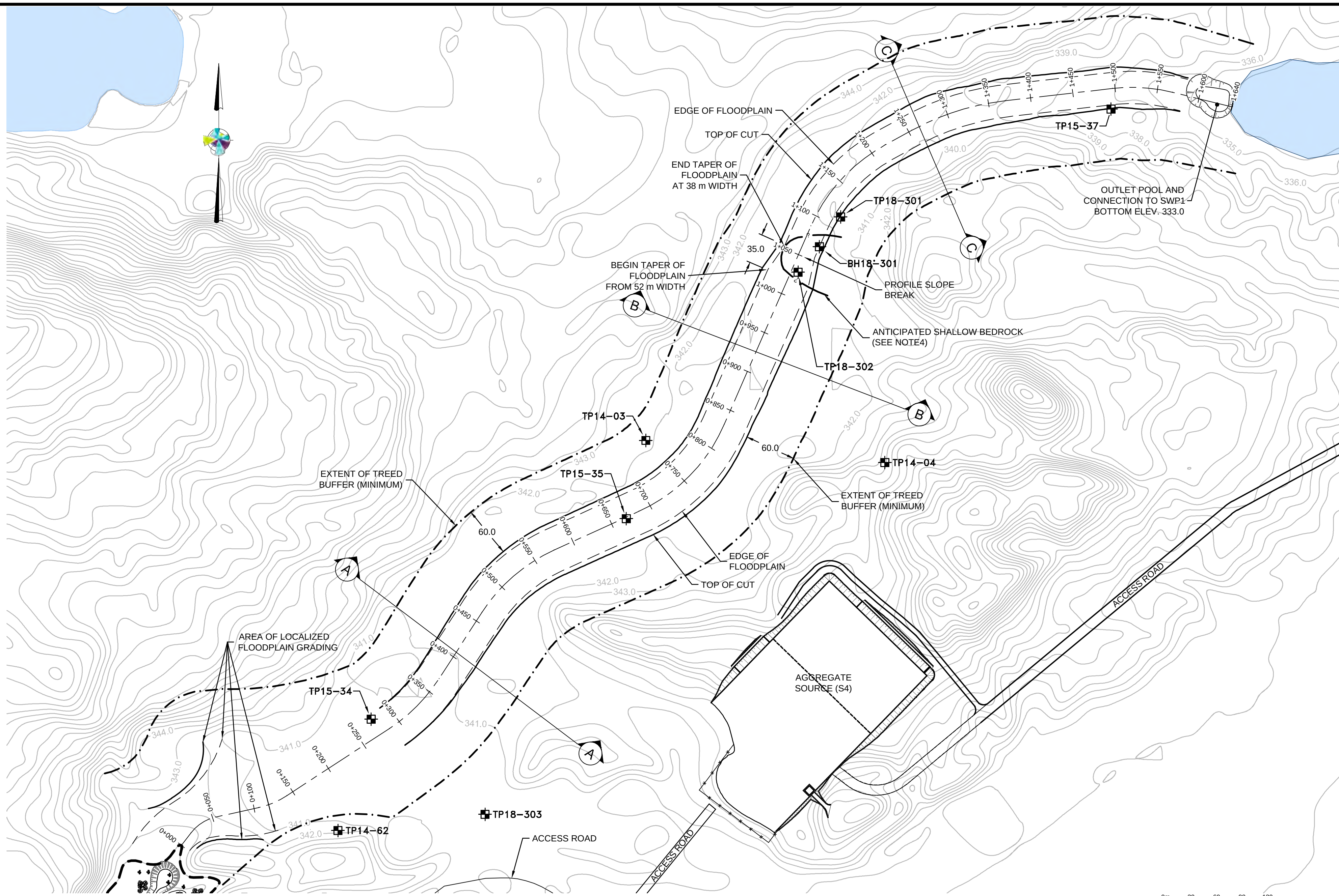
wood.

DRAWN BY: NSH
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: HARDROCK MINE DETAIL DESIGN

TITLE: GOLDFIELD CREEK REALIGNMENT SECTION VIEWS

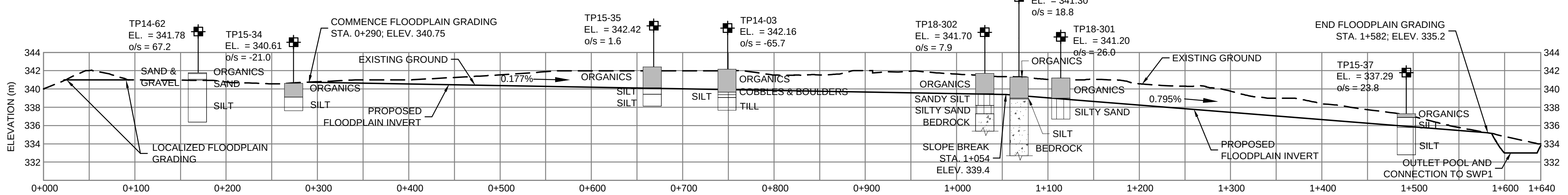
PROJECT NO.: TC150320
REVISION NO.: B
DATE: JULY 2018
SCALE: AS SHOWN
DRAWING NO.: 319



PLAN VIEW: GOLDFIELD CREEK REALIGNMENT FLOODPLAIN GRADING

SCALE = 1:3000

SCALE: 0m 30 60 90 120 — 1 : 3000



PROFILE VIEW: GOLDFIELD CREEK REALIGNMENT FLOODPLAIN GRADING

SCALE: H = 1:3000 V = 1:300

HORIZONTAL SCALE: 0m 30 60 90 120 — 1 : 3000

VERTICAL SCALE: 0m 3 6 9 12 — 1:300

LEGEND

- 338.0 — EXISTING GROUND CONTOUR
- EDGE OF FLOODPLAIN
- FLOODPLAIN TOP OF CUT
- FLOODPLAIN CENTERLINE
- EXTENT OF TREED BUFFER (MIN.)

NOTES:

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
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3. FLOWS SHALL BE MANAGED DURING CONSTRUCTION TO MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENT TRANSPORT OFF-SITE.
4. BASED ON BOREHOLE LOGS THERE IS A POTENTIAL FOR SHALLOW BEDROCK TO BE ENCOUNTERED BETWEEN STATION 1+000 AND 1+100. BLASTING OF THIS BEDROCK MAY BE REQUIRED TO FACILITATE CHANNEL CONSTRUCTION.
5. THE DOWNSTREAM END OF THE OUTLET POOL SHALL BE TIED INTO THE UPSTREAM END OF SWP1 A MINIMUM OF 1m BELOW THE WATER LEVEL OF SWP1.

VEGETATION RESTORATION NOTES:

1. ALL AREAS EXCAVATED TO THE DEPTH OF MINERAL SOIL SHALL BE TREATED WITH A MINIMUM OF 100mm OF TOPSOIL / ORGANIC SOIL SALVAGED FROM SITE.
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TABLE 1. NURSE CROP SEEDING

TIMING OF SEEDING	SELECTED SEED TYPE		
	LATIN NAME	COMMON NAME	APPLICATION RATE
POST-SPRING FRESHET TO AUG. 14	*Avena sativa*	Oats	15 kg/ha
AUG. 15 TO OCT. 15	*Triticum aestivum*	Winter Wheat	15 kg/ha

DOCUMENT NO.: HP-EG003-346-C-202-0009

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
C	08	11	2018	ISSUED FOR REVIEW	NSH	MCR
B	20	08	2018	ISSUED FOR REVIEW	NSH	MCR
A	19	07	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD

Client: GREENSTONE GOLD MINES

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wood.

DRAWN BY: NSH
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: HARDROCK MINE DETAIL DESIGN

TITLE: GOLDFIELD CREEK REALIGNMENT FLOODPLAIN PLAN AND PROFILE VIEW

PROJECT NO.: TC150320
REVISION NO.: C
DATE: JULY 2018
SCALE: AS SHOWN
DRAWING NO.: 312

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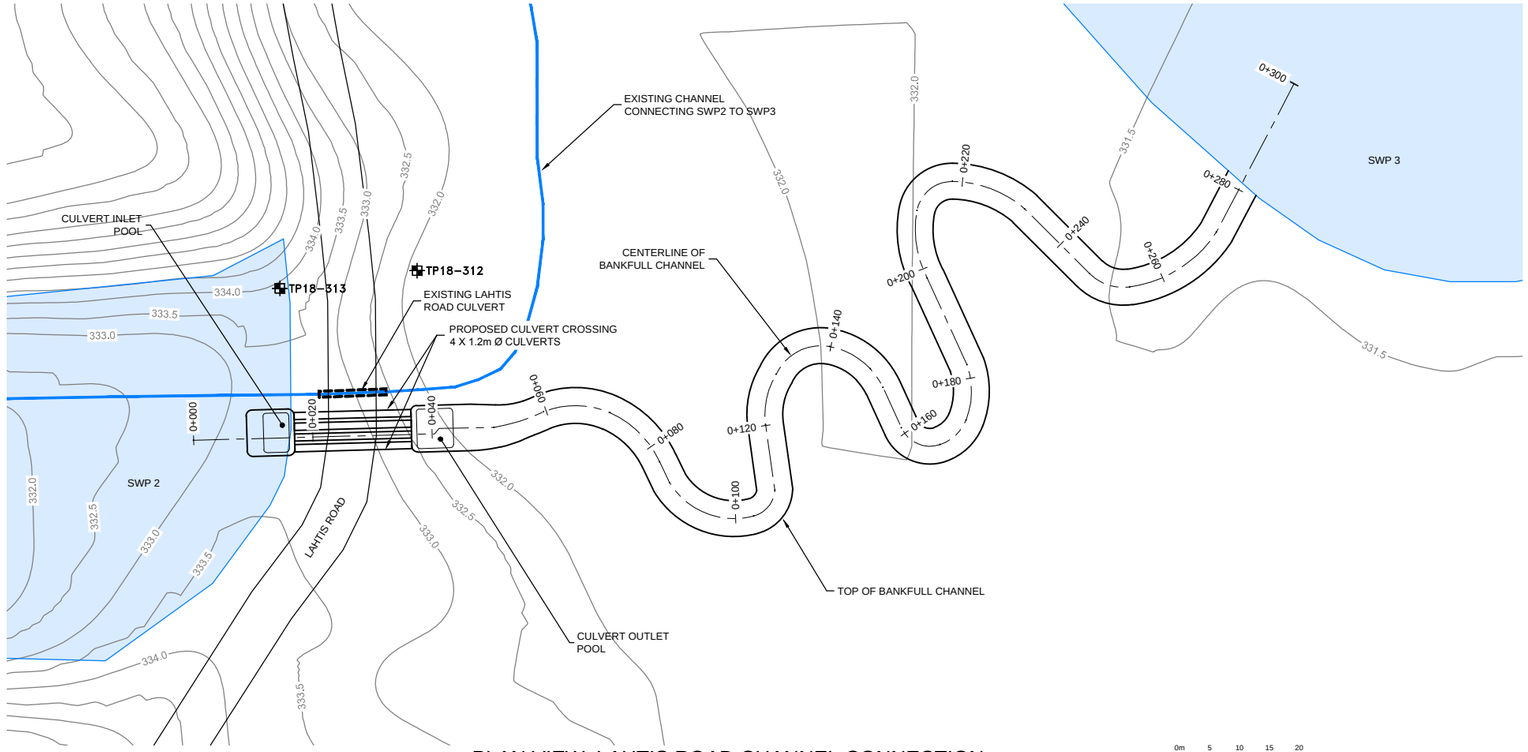
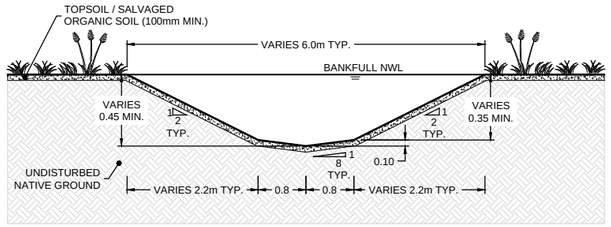


PLAN VIEW: LAHTIS ROAD CHANNEL CONNECTION

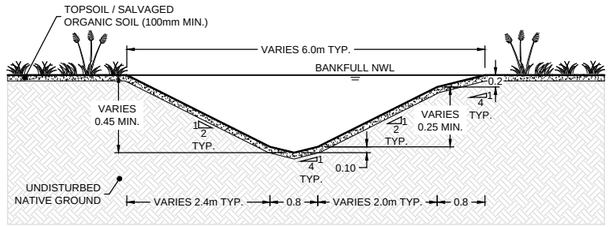
SCALE = 1:500

SCALE: 0m 5 10 15 20 — 1 : 500



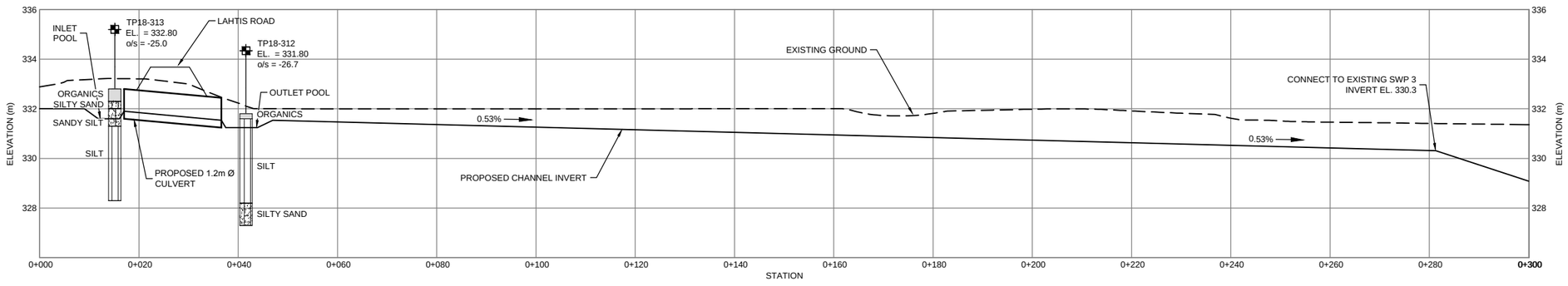
SECTION VIEW: LAHTIS ROAD CHANNEL RUN TYPICAL

SCALE : N.T.S.



SECTION VIEW: LAHTIS ROAD CHANNEL POOL LEFT TYPICAL

SCALE : N.T.S.



PROFILE VIEW: LAHTIS ROAD CHANNEL CONNECTION

SCALE : H=1:500 V=1:100

HORIZONTAL SCALE: 0m 5 10 15 20 — 1 : 500

VERTICAL SCALE: 0m 1 2 3 4 — 1 : 100

NOTES:

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. ANY COMPACTED SOIL DUE TO MACHINERY ACCESS SHALL BE LOOSENED PRIOR TO TOPSOIL PLACEMENT AND SEED APPLICATION.

VEGETATION RESTORATION NOTES:

1. ALL AREAS EXCAVATED TO THE DEPTH OF MINERAL SOIL SHALL BE TREATED WITH A MINIMUM OF 100mm OF TOPSOIL / ORGANIC SOIL SALVAGED FROM SITE.
2. PLACED TOPSOIL SHALL BE COMPACTED UTILIZING THE TRACK WEIGHT OF A CRAWLER TRACTOR OR DOZER. FURTHER MACHINERY TRAFFIC ATOP PLACED TOPSOIL SHALL BE MINIMIZED TO PREVENT OVER-COMPACTION.
3. ANY SOIL COMPACTED DUE TO REPEATED MACHINERY ACCESS SHALL BE LOOSENED PRIOR TO SEED APPLICATION.
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5. EFFORTS SHALL BE MADE TO UTILIZE LOCALLY SOURCED NATIVE WETLAND SEED BANK MATERIAL IN AS MANY AREAS AS POSSIBLE. IF SUFFICIENT WETLAND SEED BANK IS NOT AVAILABLE THEN AN APPROVED WETLAND SEED MIX SHALL BE UTILIZED.
6. SUBSTITUTIONS OF PLANT MATERIAL MUST BE APPROVED BY GREENSTONE GOLD MINE'S ENVIRONMENTAL SPECIALIST.

TABLE 1. NURSE CROP SEEDING

TIMING OF SEEDING	SELECTED SEED TYPE		
	LATIN NAME	COMMON NAME	APPLICATION RATE
POST-SPRING FRESHET TO AUG. 14	*Avena sativa*	Oats	15 kg/ha
AUG. 15 TO OCT. 15	*Triticum aestivum*	Winter Wheat	15 kg/ha

DOCUMENT NO.: HP-EG003-346-C-202-0016

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
A	18	10	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD MINES

Client: GREENSTONE GOLD MINES

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Mississauga, Ontario, Canada L4Z 3K7

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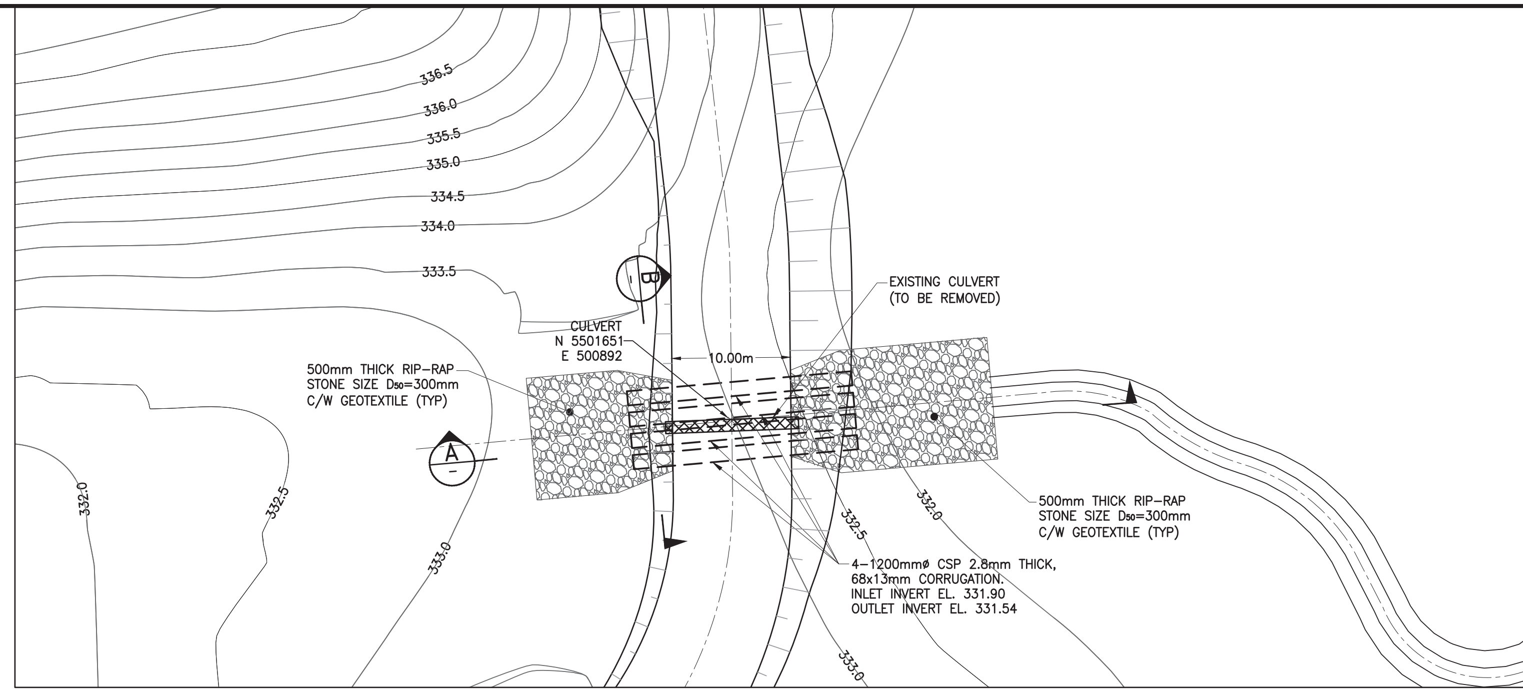
DRAWN BY:	NSH
DESIGNED BY:	NSH
CHECKED BY:	MCR
REVIEWED BY:	MCR
APPROVED BY:	MCR

PROJECT: HARDROCK MINE DETAIL DESIGN

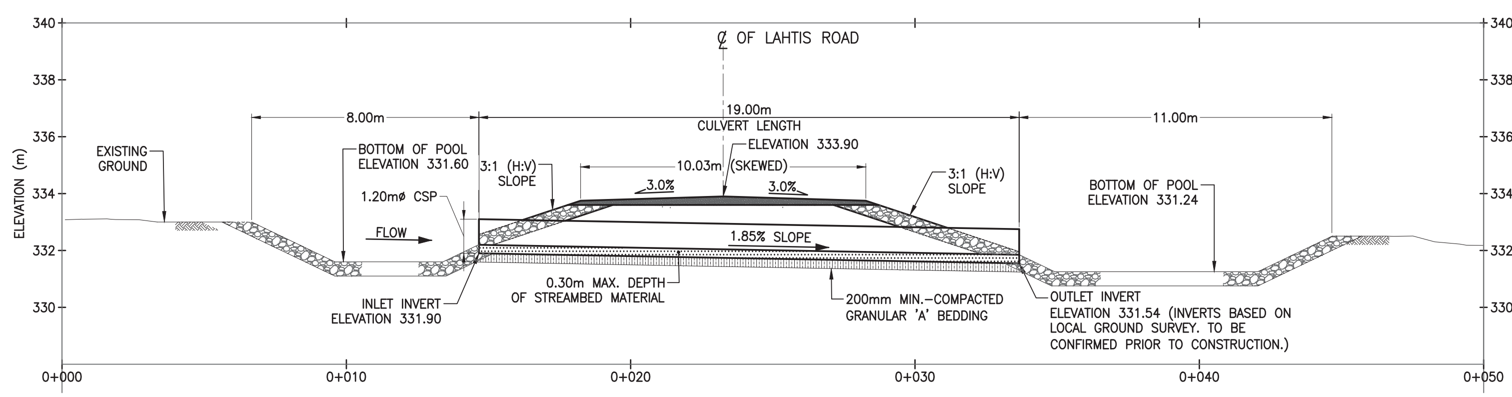
TITLE: LAHTIS ROAD CHANNEL CONNECTION PLAN, PROFILE AND TYPICAL SECTIONS

PROJECT NO.:	TC150320
REVISION NO.	A
DATE:	OCTOBER 2018
SCALE:	AS SHOWN
DRAWING NO.:	318



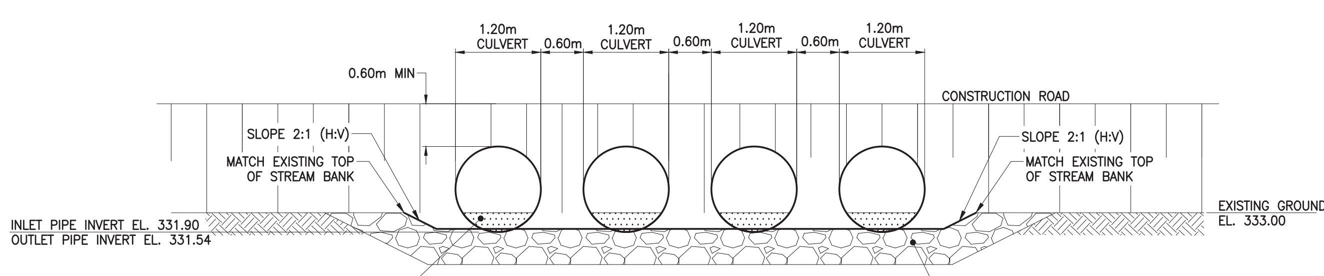
PLAN

SCALE: 1:300



CULVERT PROFILE (A)

SCALE: 1:125



SECTION (B)

SCALE: 1:50

GENERAL NOTES:

1. ALL ELEVATIONS, GRID COORDINATES AND DIMENSIONS ARE IN METRES. GRID COORDINATES ARE REFERENCED TO UTM NAD 83 ZONE 16N. CONTOUR INTERVAL AT 1.0m.
2. EXISTING GROUND CONTOURS PRODUCED FROM LIDAR FLOWN MAY 27 2014, COMPILED BY KBM RESOURCES GROUP.
3. EXISTING GROUND CONTOURS OUTSIDE OF LIDAR MAPPING WERE RETRIEVED FROM LAND INFORMATION OF ONTARIO PROVINCIAL DEM 20M GRID SIZE, BY THE MNR (ONTARIO MINISTRY OF NATURAL RESOURCES)
4. ALL WORK AND MATERIALS SHALL CONFORM TO CURRENT ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND STANDARDS.
5. ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE 'OCCUPATIONAL HEALTH AND SAFETY ACT' AND REGULATIONS FOR CONSTRUCTION PROJECTS.
6. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND ABOVEGROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL CONFIRM THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
7. ALL DIMENSIONS AND ELEVATIONS SHALL BE CHECKED AND VERIFIED PRIOR TO ANY CONSTRUCTION. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER BEFORE PROCEEDING.

CULVERTS:

1. CULVERT DIAMETER, LENGTHS AND MATERIAL SHALL BE AS NOTED ON THE DRAWINGS. CULVERTS SHALL CONFORM TO OPSS 1801.
2. CULVERT BEDDING AND COVER SHALL BE AS PER OPSD 802.010 AND/OR OPSD 802.013. BEDDING AND COVER MATERIAL SHALL BE GRANULAR 'A' AS PER OPSS.PROV.1010, COMPACTED TO 100% SPMDD.
3. TRENCH BACKFILL SHALL BE SELECT NATIVE MATERIAL COMPACTED TO 95% SPMDD MINIMUM.

RIP-RAP:

1. RIP-RAP SHALL BE AS PER OPSS.PROV.1004.
2. GEOTEXTILE SHALL BE NON-WOVEN, CLASS II CONFORMING TO OPSS 1860, WITH AN FOS OF 75 – 150 μm.

ABBREVIATIONS:

m	– METER	N	– NORTHING
TYP.	– TYPICAL	E	– EASTING
EL.	– ELEVATION	℄	– CENTRELINE
INV.	– INVERT	ø	– DIAMETER
MIN	– MINIMUM	μm	– MICRO METER
C/W	– COMPLETE WITH		
H:V	– HORIZONTAL : VERTICAL		
D_{50}	– MEDIUM VALUE OF PARTICLE SIZE DISTRIBUTION		
CSP	– CORRUGATED STEEL PIPE		
OPSD	– ONTARIO PROVINCIAL STANDARD DRAWING		
OPSS	– ONTARIO PROVINCIAL STANDARD SPEC.		
SPMDD	– STANDARD PROCTOR MAXIMUM DRY DENSITY		

SCALE:

0m 0.5 1 1.5 2 2.5 — 1:50

0m 1 2 3 4 5 6 — 1:125

0m 3 6 9 12 15 — 1:300

LEGEND:

- 460 — EXISTING CONTOUR
- DIRECTION OF FLOW
- + 460.00 — PROPOSED GROUND ELEVATION
- 3:1 (H:V) SLOPE
- RIP-RAP
- CULVERT EMBEDMENT
- COMPACTED GRANULAR 'A' BEDDING

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
B	29	OCT	2018	ISSUED FOR REVIEW		
A	02	AUG	2018	ISSUED FOR REVIEW		

Client Logo: GREENSTONE GOLD

Client: GREENSTONE GOLD MINES

Wood Environment & Infrastructure Solutions
160 Traders Boulevard East
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wood.

DRAWN BY:	W. ZHANG
DESIGNED BY:	J. JACKSON
CHECKED BY:	
REVIEWED BY:	
APPROVED BY:	

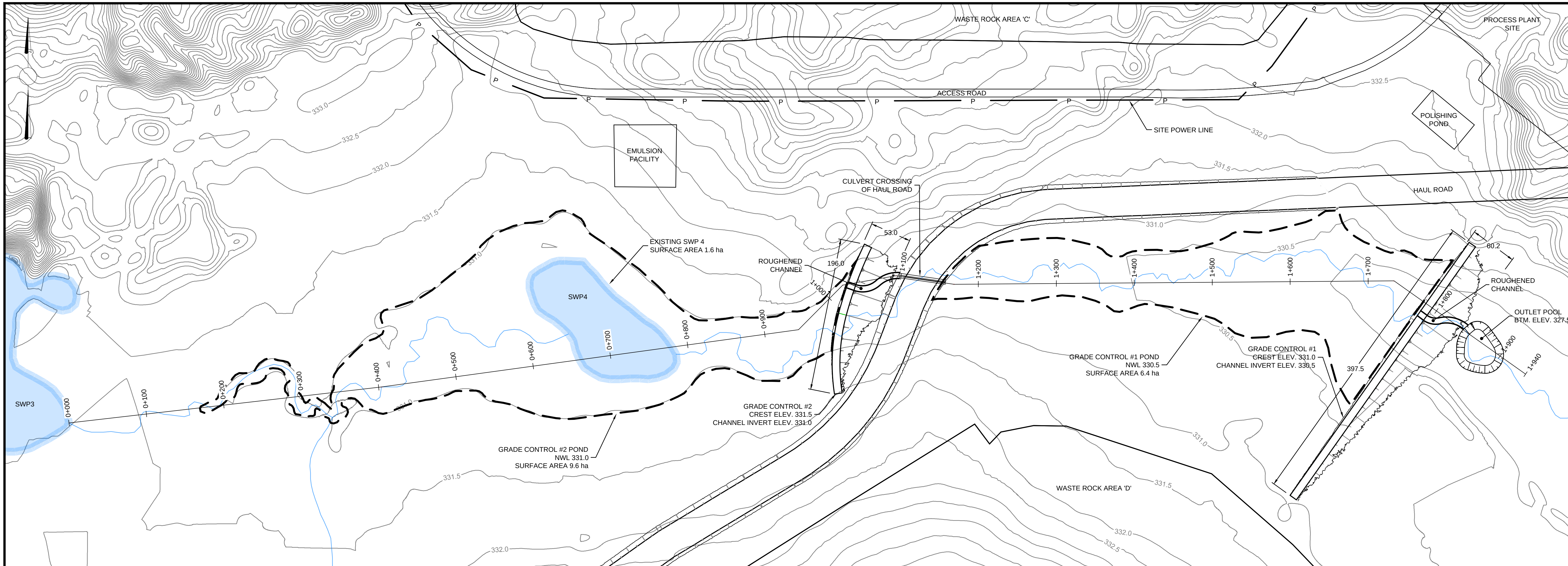
PROJECT: HARDROCK

TITLE: TAILINGS MANAGEMENT FACILITY HAUL ROAD CULVERT A2

PROJECT NO.:	150320
REVISION NO.	B
DATE:	JULY 26 2018
SCALE:	AS SHOWN
DOC NO.:	HP-EG003-341-C-202-0002

Attachment 1C

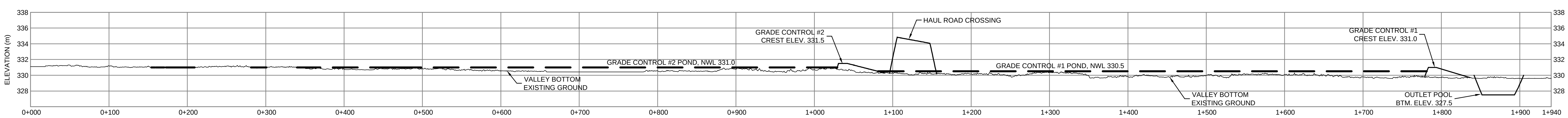
Southwest Arm Tributary Grade Controls



PLAN VIEW: SW ARM TRIBUTARY GRADE CONTROL STRUCTURES

SCALE = 1:2500

SCALE: 1 : 2500



PROFILE VIEW: SW ARM TRIBUTARY GRADE CONTROL STRUCTURES

SCALE: H=1:2500 V=1:250

HORIZONTAL SCALE: 1 : 2500

VERTICAL SCALE: 1 : 250

NOTES:

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. 1.0m EXISTING CONDITION CONTOURS HAVE BEEN AUTOMATICALLY GENERATED AND SMOOTHED BY AUTOCAD.
3. FLOWS SHALL BE MANAGED DURING CONSTRUCTION TO MINIMIZE THE POTENTIAL FOR EROSION AND SEDIMENT TRANSPORT OFF-SITE.
4. DOWNSTREAM END OF OUTLET POOL TO BE TIED IN TO EXISTING SW ARM TRIBUTARY.

DOCUMENT NO.: HP-EG003-346-C-202-0010

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
A	19	07	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD MINES

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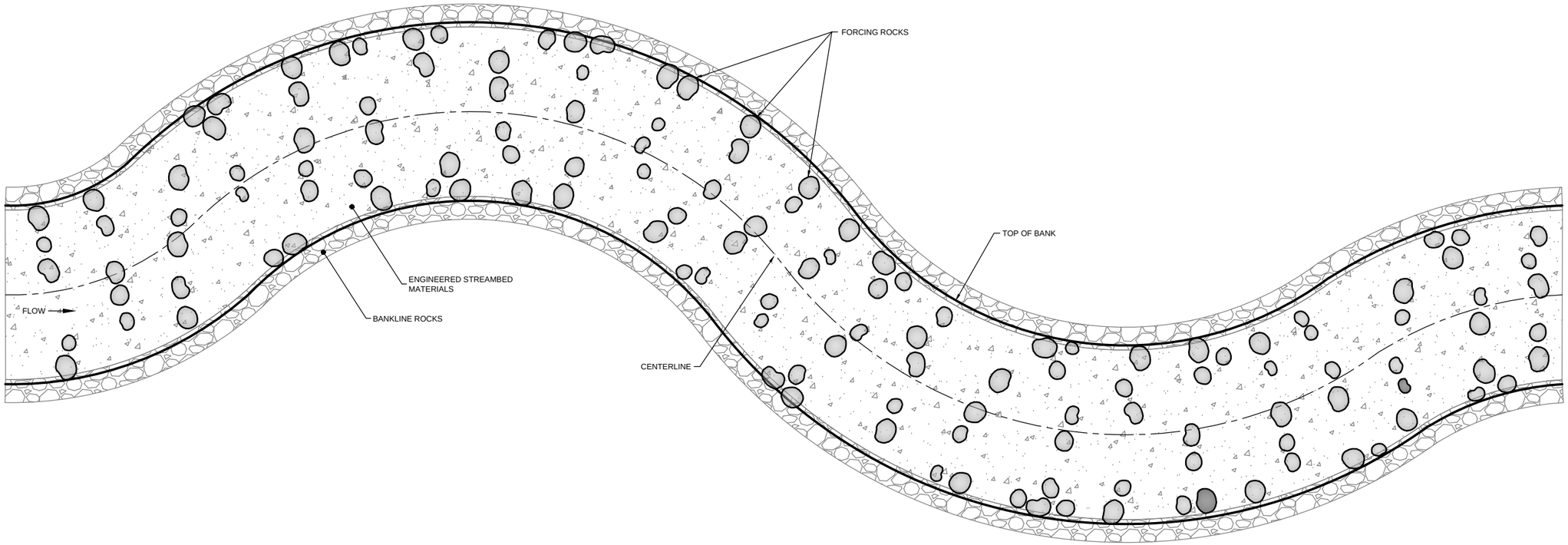
wood.

DRAWN BY: NSH
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: HARDROCK MINE DETAIL DESIGN

TITLE: SW ARM TRIBUTARY GRADE CONTROL STRUCTURES OVERVIEW PLAN AND PROFILE

PROJECT NO.: TC150320
REVISION NO.: A
DATE: JULY 2018
SCALE: AS SHOWN
DRAWING NO.: 313



TYPICAL ROUGHENED CHANNEL: PLAN VIEW

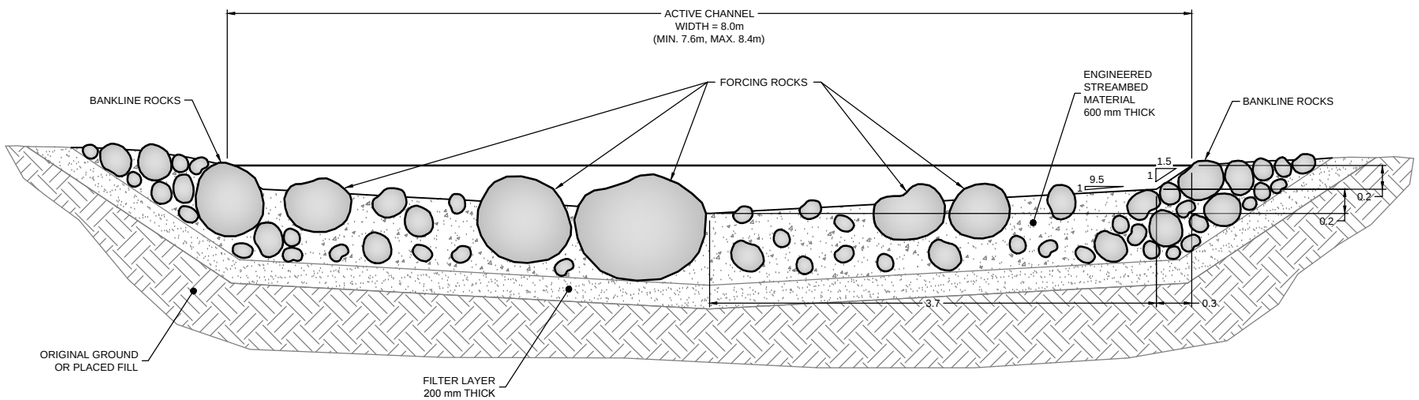
SCALE : N.T.S.

NOTES:

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. IT IS RECOMMENDED THAT WORK BE PERFORMED IN SECTIONS STARTING UPSTREAM AND PROGRESSING DOWNSTREAM SO THAT COMPLETED WORK DOES NOT BACKWATER THE CURRENT WORK AREA.
3. THE SEQUENCE OF CONSTRUCTION SHOULD BE PLANNED BY THE CONTRACTOR TO ENSURE LARGE EQUIPMENT DOES NOT HAVE TO CROSS OVER COMPLETED STRUCTURES OR BANKLINE ROCK.

RECOMMENDED CONSTRUCTION SEQUENCING:

1. EXCAVATE NATIVE MATERIAL AND/OR BACKFILL AND COMPACTED MATERIAL TO THE SUBGRADE ELEVATIONS FOR INSTALLATION OF THE FILTER LAYER, BANKLINES AND ENGINEERED STREAMBED MATERIAL.
2. INSTALL BANKLINE ROCK, INCLUDING ANY KEYSTONE ROCKS THAT PROTRUDE FROM THE BANK. INDIVIDUALLY PLACE THE LARGER ROCK IN THE BANKLINE GRADATION. USE SMALLER MATERIAL TO FILL IN THE VOIDS BETWEEN THE LARGE ROCK. TO COMPACT THE BANKLINES TAMP IN PLACE. FOLLOWING TAMPING IT IS RECOMMENDED TO SPRAY THE BANKLINES WITH SEDIMENT LADEN WATER TO WASH THE FINER MATERIAL INTO THE VOIDS (THIS PROCESS IS REFERRED TO AS JETTING)
3. INSTALL THE ENGINEERED STREAMBED MATERIAL IN TWO LIFTS EACH OF APPROXIMATELY 200mm THICK.
   - 3.1. BEGIN EACH LIFT BY INDIVIDUALLY PLACING THE LARGEST ROCKS IN THE LIFT (THOSE WITH A SIZE GREATER THAN THE THICKNESS OF THE LIFT) THROUGHOUT THE CHANNEL BED IN THE PROPORTIONS SPECIFIED IN THE ENGINEERED STREAMBED MATERIAL GRADATION. THIS WILL ALLOW THE LARGE ROCKS TO PROTRUDE ABOVE THE FINISHED GRADE TO CREATE HYDRAULIC ROUGHNESS AND DIVERSITY. ROCK SHOULD NOT BE INSTALLED TO PROTRUDE MORE THAN ON-THIRD OF THE ROCKS HEIGHT ABOVE THE FINISHED GRADE OF THE CHANNEL BED.
   - 3.2. PLACE REMAINING MATERIAL INTO THE CHANNEL AT THE THICKNESS EQUAL TO ONE LIFT. MIX IN-SITU AS NECESSARY UNTIL THE MIXTURE IS WELL GRADED.
   - 3.3. COMPACT EACH LIFT BY TAMPING FOLLOWED BY JETTING SO THAT FINE MATERIAL IS WORKED INTO THE LIFT. IF WATER CONTINUES TO RAPIDLY INFILTRATE INTO THE TOP OF THE LIFT THEN ADD ADDITIONAL FINE MATERIAL AND CONTINUE TO JET THE MATERIAL INTO THE BED. REPEAT AS NECESSARY UNTIL THE BED IS ADEQUATELY SEALED.
   - 3.4. DURING THE FINAL FLOODING OF THE TOP LIFT A PROPERLY SEALED BED WILL MAINTAIN WATER FLOWING DOWN-SLOPE ACROSS THE SURFACE OF THE ROUGHENED CHANNEL.



TYPICAL ROUGHENED CHANNEL: SECTION VIEW

SCALE : N.T.S.

TABLE 1: ENGINEERED STREAMBED MATERIAL GRADATION

PERCENT FINER (BY SIZE)	PARTICLE SIZE (mm)
100	935
84	375
65	280
50	150
32	50
16	10
8	2

TABLE 2: BANKLINE ROCK GRADATION*

PERCENT FINER (BY SIZE)	PARTICLE SIZE (mm)
100	650
84	505
65	350
50	240
32	130
16	50
8	18

* BANKLINE ROCK TO BE MIXED WITH SILT OR SANDY SILT AT A RATIO OF 10 PARTS ROCK TO 1 PART SILT OR SANDY SILT

DOCUMENT NO.: HP-EG003-346-C-202-0011

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A	19	07	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD MINES

Client: GREENSTONE GOLD MINES

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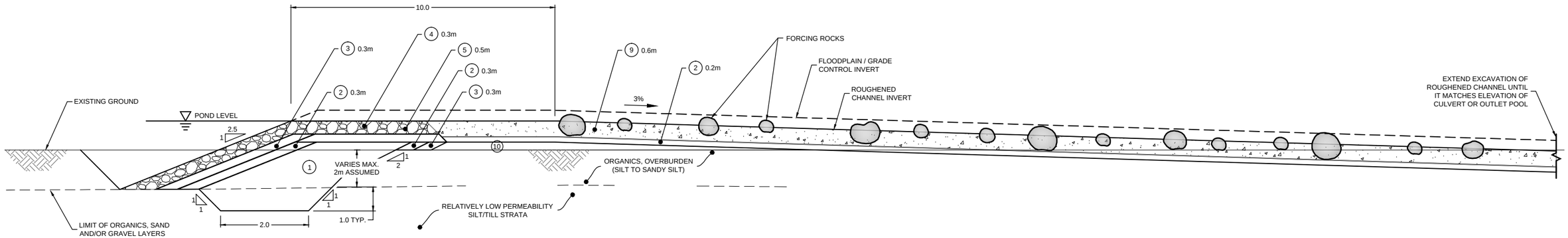
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: HARDROCK MINE DETAIL DESIGN

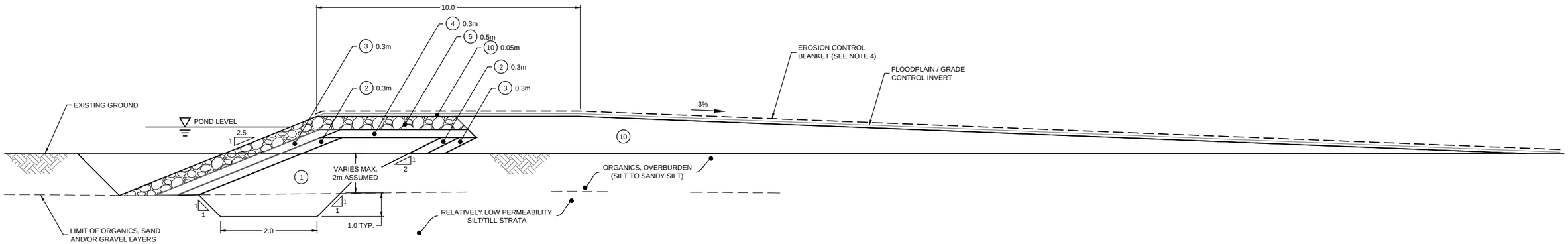
TITLE: SW ARM TRIBUTARY
GRADE CONTROL AND ROUGHENED CHANNEL
TYPICAL PLAN AND SECTION VIEWS

PROJECT NO.: TC150320
REVISION NO.: A
DATE: JULY 2018
SCALE: AS SHOWN
DRAWING NO.: 314



TYPICAL SECTION VIEW: GRADE CONTROL STRUCTURE AT ROUGHENED CHANNEL OUTLET (SECTION B-B)

SCALE : N.T.S.



TYPICAL SECTION VIEW: GRADE CONTROL STRUCTURE (SECTION A-A)

SCALE : N.T.S.

FILL ZONES	
1 TILL CORE	-
2 FILTER	SAND AND GRAVEL MINUS 25 mm
3 TRANSITION	SAND, GRAVEL AND COBBLE MINUS 200mm
4 FROST PROTECTION	SAND, GRAVEL AND COBBLE MINUS 100 mm
5 EROSION PROTECTION	COBBLES 100 - 300 mm (SEE NOTE 2)
9 ENGINEERED STREAMBED MATERIAL	SEE SHEET 314
10 RANDOM FILL	-
11 TOPSOIL	-

NOTES:

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. FILL ZONE 5 EROSION PROTECTION SHALL BE MIXED WITH TOPSOIL AT A RATIO OF 10 PARTS 100-300mm COBBLES TO 1 PART TOPSOIL.
3. THE FILL ZONE 5 EROSION PROTECTION / TOPSOIL MIXTURE SHALL BE SPRAYED WITH SEDIMENT LADEN WATER TO WASH THE FINER MATERIAL INTO THE VOIDS (A PROCESS REFERRED TO AS JETTING). IF WATER CONTINUES TO INFILTRATE THE TOP OF THE COBBLE/TOPSOIL MIX THEN ADDITIONAL TOPSOIL SHALL BE SPREAD ACROSS THE SURFACE AND JETTING REPEATED, THIS SHALL BE REPEATED AS NECESSARY UNTIL THE COBBLE/TOPSOIL MIX IS ADEQUATELY SEALED.
4. TOPSOIL PLACED ATOP THE GRADE CONTROL SHALL BE PROTECTED WITH ANTIWASH GEOJUTE OR APPROVED EQUIVALENT OR BETTER EROSION PROTECTION BLANKET UNTIL VEGETATION HAS BECOME SATISFACTORILY ESTABLISHED.
5. KEY TRENCH TO EXTEND THROUGH PERMEABLE SOIL (MINIMUM 1.5m) AND TERMINATE IN LOW PERMEABLE FOUNDATION (SILT, TILL OR BEDROCK).

DOCUMENT NO.: HP-EG003-346-C-202-0012

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
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A	19	07	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD MINES

Client: GREENSTONE GOLD MINES

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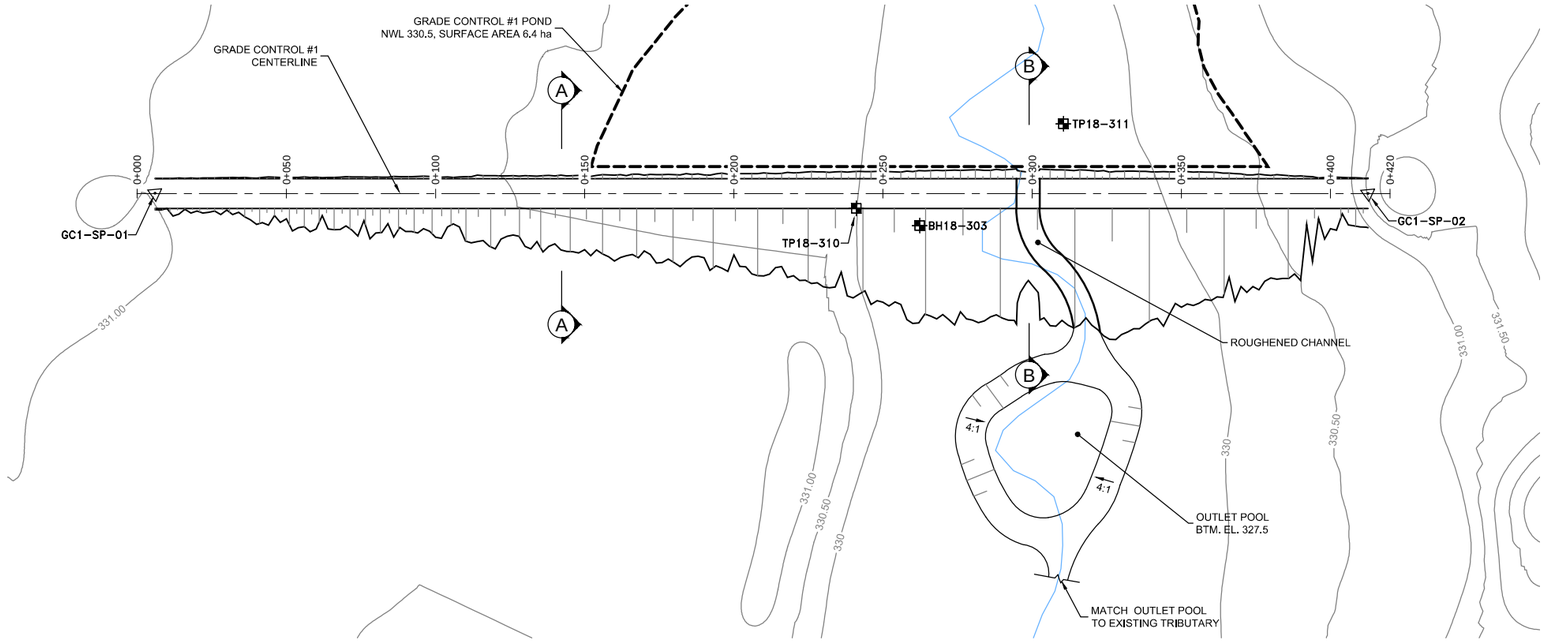
REVIEWED BY: MCR
APPROVED BY:

PROJECT: HARDROCK MINE DETAIL DESIGN

TITLE: SW ARM TRIBUTARY GRADE CONTROL TYPICAL PROFILE AND SECTION VIEWS

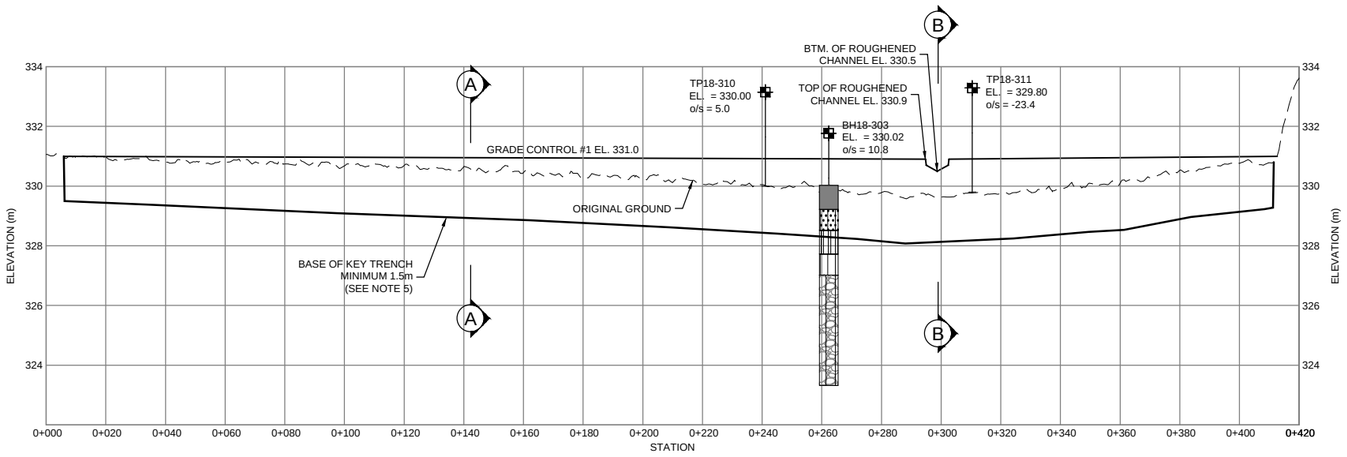
PROJECT NO.: TC150320
REVISION NO.: A
DATE: JULY 2018
SCALE: AS SHOWN
DRAWING NO.: 315



PLAN VIEW: GRADE CONTROL #1

SCALE=1:1000

SCALE: 0m 10 20 30 40 — 1 : 1000



PROFILE VIEW: GRADE CONTROL #1

SCALE : H=1:1000 V=1:100

HORIZONTAL SCALE: 0m 10 20 30 40 — 1 : 1000

VERTICAL SCALE: 0m 1 2 3 4 — 1 : 100

NOTES:

1. ALL ELEVATIONS, GRID COORDINATES AND DIMENSIONS ARE IN METRES. GRID COORDINATES ARE REFERENCED TO UTM NAD 83 ZONE 16 DATUM. CONTOUR INTERVAL AT 0.5m. ELEVATIONS ARE GEODETIC.
2. EXISTING GROUND CONTOURS PRODUCED FROM LIDAR FLOWN MAY 27 2014, COMPILED BY KBM RESOURCES GROUP.
3. SURVEYED LOCATIONS AND ELEVATIONS FOR WOOD 2018 GEOTECHNICAL INVESTIGATION LOCATIONS PROVIDED BY GREENSTONE GOLD MINES.
4. SUBSURFACE CONDITIONS ARE KNOWN ONLY AT THE INVESTIGATION LOCATIONS. ALL DATA BETWEEN AND BEYOND THESE LOCATIONS IS INFERRED AND MAY VARY FROM WHAT IS SHOWN.
5. KEY TRENCH TO EXTEND THROUGH PERMEABLE SOIL (MINIMUM 1.5m) AND TERMINATE IN LOW PERMEABLE FOUNDATION (SILT, TILL OR BEDROCK).
6. DOWNSTREAM END OF OUTLET POOL TO BE TIED IN TO EXISTING SW ARM TRIBUTARY.
7. SEE DRAWING NO. 315, DOCUMENT NO. HP-EG003-346-C-202-0014 FOR TYPICAL SECTIONS A-A AND B-B.

LEGEND:

- ORGANICS
- SAND / SILTY SAND
- SILT
- TILL
- SILT WITH INTERBEDDED CLAY LAYERS
- SAND AND GRAVEL
- SILTY SAND / SANDY SILT
- BEDROCK

GRADE CONTROL #1 SET-OUT POINTS		
ID	NORTHING (M)	EASTING (m)
GC1-SP-01	5,501,605	502,723
GC1-SP-02	5,501,937	502,958

DOCUMENT NO.: HP-EG003-346-C-202-0013

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
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A	20	07	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD MINES

Client: GREENSTONE GOLD MINES

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160 Traders Boulevard East
Mississauga, Ontario, Canada L4Z 3K7

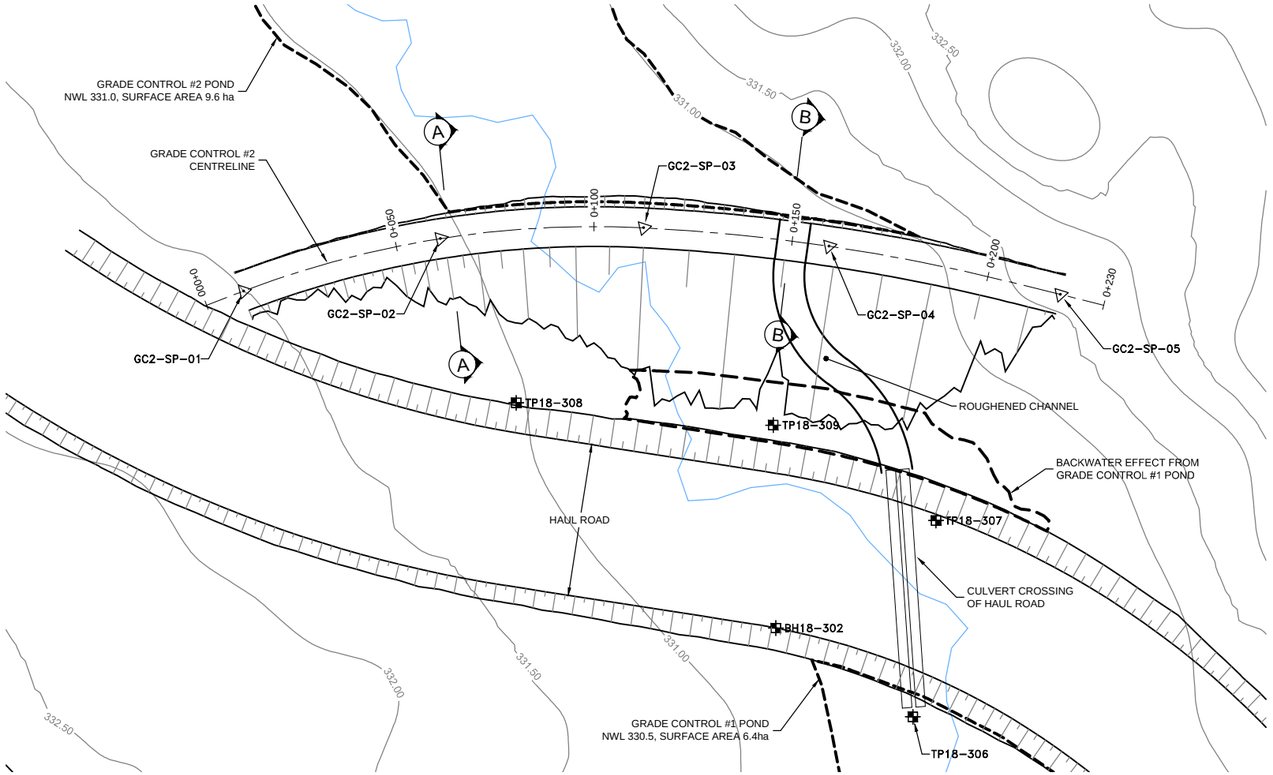
wood.

DRAWN BY:	NSH
DESIGNED BY:	NSH
CHECKED BY:	MCR
REVIEWED BY:	MCR
APPROVED BY:	

PROJECT: HARDROCK MINE DETAIL DESIGN

TITLE: SW ARM TRIBUTARY GRADE CONTROL #1 PLAN AND PROFILE VIEWS

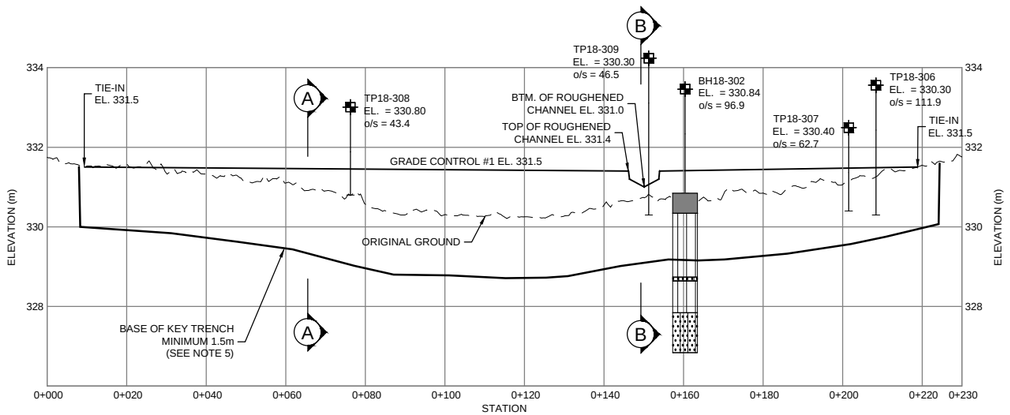
PROJECT NO.:	TC150320
REVISION NO.	A
DATE:	JULY 2018
SCALE:	AS SHOWN
DRAWING NO.:	316



PLAN VIEW: GRADE CONTROL #2

SCALE=1:750

SCALE: 0m 5 10 15 20 25 30 — 1 : 750



PROFILE VIEW: GRADE CONTROL #2

SCALE : H=1:750 V=1:75

HORIZONTAL SCALE: 0m 5 10 15 20 25 30 — 1 : 750

VERTICAL SCALE: 0m 0.5 1.0 1.5 2.0 2.5 3.0 — 1 : 75

NOTES:

1. ALL ELEVATIONS, GRID COORDINATES AND DIMENSIONS ARE IN METRES. GRID COORDINATES ARE REFERENCED TO UTM NAD 83 ZONE 16 DATUM. CONTOUR INTERVAL AT 0.5m. ELEVATIONS ARE GEODETIC.
2. EXISTING GROUND CONTOURS PRODUCED FROM LIDAR FLOWN MAY 27 2014, COMPILED BY KBM RESOURCES GROUP.
3. SURVEYED LOCATIONS AND ELEVATIONS FOR WOOD 2018 GEOTECHNICAL INVESTIGATION LOCATIONS PROVIDED BY GREENSTONE GOLD MINES.
4. SUBSURFACE CONDITIONS ARE KNOWN ONLY AT THE INVESTIGATION LOCATIONS. ALL DATA BETWEEN AND BEYOND THESE LOCATIONS IS INFERRED AND MAY VARY FROM WHAT IS SHOWN.
5. KEY TRENCH TO EXTEND THROUGH PERMEABLE SOIL (MINIMUM 1.5m) AND TERMINATE IN LOW PERMEABLE FOUNDATION (SILT, TILL OR BEDROCK).
6. SEE DRAWING NO. 315, DOCUMENT NO. HP-EG003-346-C-202-0014 FOR TYPICAL SECTIONS A-A AND B-B.

LEGEND:

- ORGANICS
- SAND / SILTY SAND
- SILT
- TILL
- SILT WITH INTERBEDDED CLAY LAYERS
- SAND AND GRAVEL
- SILTY SAND / SANDY SILT
- BEDROCK

GRADE CONTROL #2 SET-OUT POINTS

ID	NORTHING (M)	EASTING (m)
GC2-SP-01	5,501,744	502,143
GC2-SP-02	5,501,795	502,141
GC2-SP-03	5,501,846	502,149
GC2-SP-04	5,501,890	502,163
GC2-SP-05	5,501,944	502,187

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-						
A	20	07	2018	ISSUED FOR REVIEW	NSH	MCR

Client Logo: GREENSTONE GOLD MINES

Client: GREENSTONE GOLD MINES

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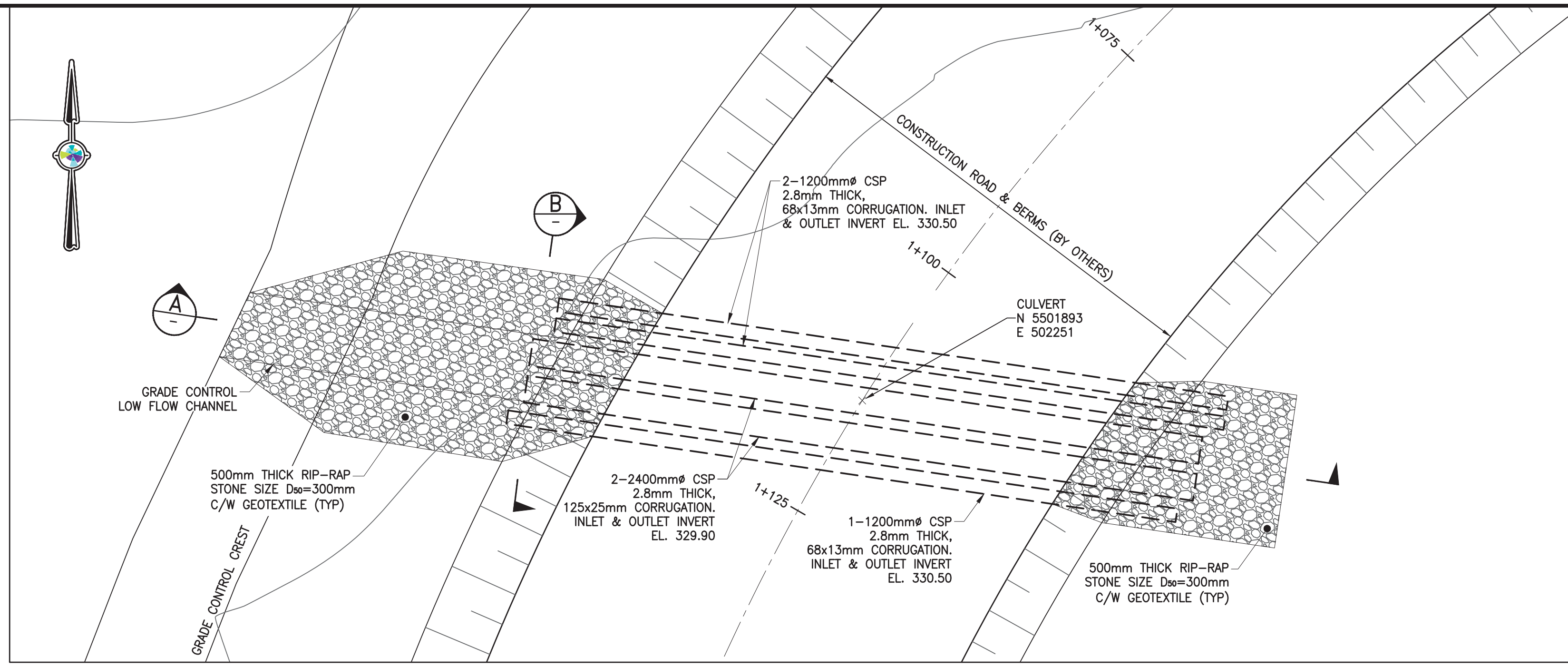
DOCUMENT NO.: HP-EG003-346-C-202-0014

DRAWN BY:	NSH
DESIGNED BY:	NSH
CHECKED BY:	MCR
REVIEWED BY:	MCR
APPROVED BY:	

PROJECT: HARDROCK MINE DETAIL DESIGN

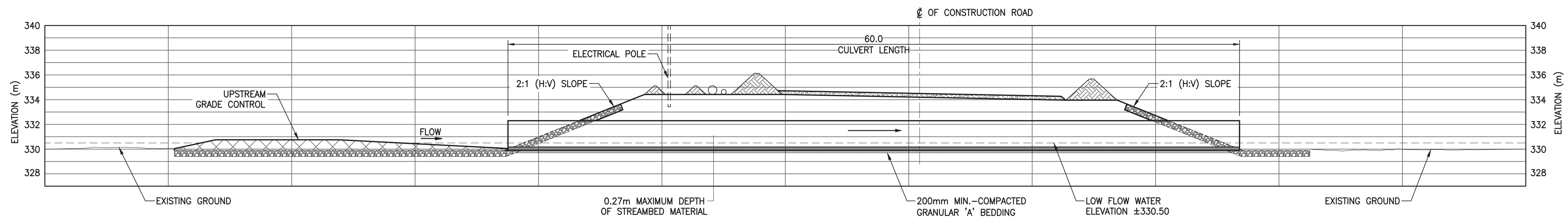
TITLE: SW ARM TRIBUTARY GRADE CONTROL #2 PLAN AND PROFILE VIEWS

PROJECT NO.:	TC150320
REVISION NO.	A
DATE:	JULY 2018
SCALE:	AS SHOWN
DRAWING NO.:	317



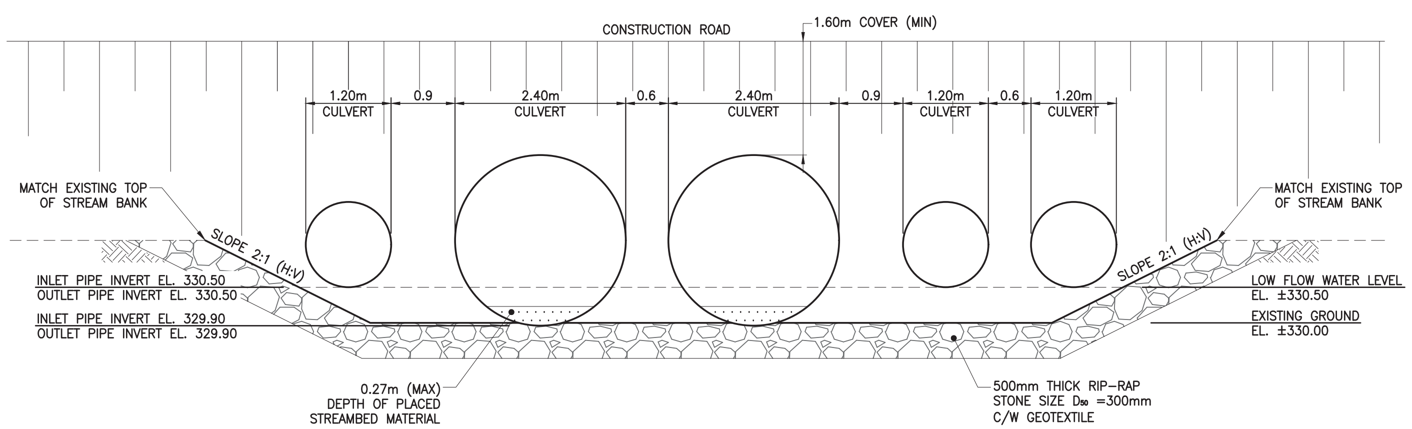
PLAN

SCALE: 1:300



CULVERT PROFILE (A)

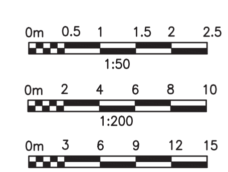
SCALE: 1:300



SECTION (B)

SCALE: 1:50

SCALE:



LEGEND:

- 460 — EXISTING CONTOUR
- DIRECTION OF FLOW
- + 460.00 — PROPOSED GROUND ELEVATION
- 2:1 (H:V) SLOPE
- RIP-RAP
- CULVERT EMBEDMENT
- COMPACTED GRANULAR 'A' BEDDING

GENERAL NOTES:

1. ALL ELEVATIONS, GRID COORDINATES AND DIMENSIONS ARE IN METRES. GRID COORDINATES ARE REFERENCED TO UTM NAD 83 ZONE 16N. CONTOUR INTERVAL AT 1.0m.
2. EXISTING GROUND CONTOURS PRODUCED FROM LIDAR FLOWN MAY 27 2014, COMPILED BY KBM RESOURCES GROUP.
3. EXISTING GROUND CONTOURS OUTSIDE OF LIDAR MAPPING WERE RETRIEVED FROM LAND INFORMATION OF ONTARIO PROVINCIAL DEM 20M GRID SIZE, BY THE MNR (ONTARIO MINISTRY OF NATURAL RESOURCES)
4. ALL WORK AND MATERIALS SHALL CONFORM TO CURRENT ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND STANDARDS.
5. ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE 'OCCUPATIONAL HEALTH AND SAFETY ACT' AND REGULATIONS FOR CONSTRUCTION PROJECTS.
6. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND ABOVEGROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL CONFIRM THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
7. ALL DIMENSIONS AND ELEVATIONS SHALL BE CHECKED AND VERIFIED PRIOR TO ANY CONSTRUCTION. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER BEFORE PROCEEDING.

CULVERTS:

1. CULVERT DIAMETER, LENGTHS AND MATERIAL SHALL BE AS NOTED ON THE DRAWINGS. CULVERTS SHALL CONFORM TO OPSS 1801.
2. CULVERT BEDDING AND COVER SHALL BE AS PER OPSD 802.010 AND/OR OPSD 802.013. BEDDING AND COVER MATERIAL SHALL BE GRANULAR 'A' AS PER OPSS.PROV.1010, COMPACTED TO 100% SPMDD.
3. TRENCH BACKFILL SHALL BE SELECT NATIVE MATERIAL COMPACTED TO 95% SPMDD MINIMUM.

RIP-RAP:

1. RIP-RAP SHALL BE AS PER OPSS.PROV.1004.
2. GEOTEXTILE SHALL BE NON-WOVEN, CLASS II CONFORMING TO OPSS 1860, WITH AN FOS OF 75 – 150 µm.

ABBREVIATIONS:

m	– METER		N	– NORTHING
TYP.	– TYPICAL		E	– EASTING
EL.	– ELEVATION		℄	– CENTRELINE
INV.	– INVERT		ø	– DIAMETER
MIN	– MINIMUM		µm	– MICRO METER
C/W	– COMPLETE WITH			
H:V	– HORIZONTAL : VERTICAL			
D50	– MEDIUM VALUE OF PARTICLE SIZE DISTRIBUTION			
CSP	– CORRUGATED STEEL PIPE			
OPSD	– ONTARIO PROVINCIAL STANDARD DRAWING			
OPSS	– ONTARIO PROVINCIAL STANDARD SPEC.			
SPMDD	– STANDARD PROCTOR MAXIMUM DRY DENSITY			

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Client Logo: GREENSTONE GOLD

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DESIGNED BY:	J.JACKSON
CHECKED BY:	N.AZAD
REVIEWED BY:	
APPROVED BY:	

PROJECT: HARDROCK

TITLE: TAILINGS MANAGEMENT FACILITY
HAUL ROAD
CULVERT A1

PROJECT NO.:	150320
REVISION NO.	B
DATE:	JULY 13 2018
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Attachment 3

Public and Aboriginal Engagement Record

GGM Hardrock Project
Summary of Consultation Related to the Goldfield Creek Realignment

FINAL REPORT

June 7, 2019

Prepared for:

Greenstone Gold Mines GP Inc.

Prepared by:

Stantec Consulting Ltd.

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1.0 INTRODUCTION

Consultation on the Hardrock Project (Project) has been ongoing prior to the permitting process, throughout the planning and environmental assessment phase, and will continue with government agencies, local Aboriginal communities, and stakeholders through the life of the Project.

The Final Environmental Impact Statement/ Environmental Assessment (EIS/EA) was submitted in July 2017 with supplemental information provided in June 2018 to meet the requirements of the federal and provincial EA processes. Federal approval was received on December 13, 2018 and provincial approval was received on March 26, 2019.

To facilitate development of the Project, Greenstone Gold Mines GP Inc. (GGM) is proposing to realign Goldfield Creek, including the construction of a Goldfield Creek Diversion Pond, Goldfield Creek Diversion Dike, realigned channel and grade controls within the existing Southwest Arm Tributary. Impacts and offsets to fish habitat and fisheries are detailed in the *Fisheries Act*, Paragraph 35(2)(b) Authorization, Offset Plan and Metal and Diamond Mining Effluent Regulations (MDMER) Schedule 2 Fish Habitat Compensation Plan. Consultation feedback related to the Goldfield Creek Realignment (also referred to as the Goldfield Creek Diversion) has been addressed through direct responses (in writing and follow-up meetings), in updated reports in the Final Environmental Impact Statement/ Environmental Assessment (EIS/EA) as appropriate, and in revised Fisheries Offset Plan reports. An overview of the key consultation that has occurred related to the Goldfield Creek Realignment is provided below.

2.0 MEETINGS

A summary of meetings and information centres held with regulatory agencies, Aboriginal communities, and other stakeholders related to the Goldfield Creek Realignment is included in Table 2-1.

Table 2-1: Key Meetings Related to the Goldfield Creek Realignment

Stakeholder	Date	Summary of Meeting
Key Meetings During the EA process		
Public Information Centres (PICs)	July 20 and 24, 2015	Provided a consultation opportunity focused primarily on the baseline studies and alternatives assessment methodology The purpose of these PICs was to present the alternatives assessment methodology for the EA and results of the baseline studies. The Alternatives Assessment for the Goldfield Creek Diversion routes was presented and questions from the public regarding the diversion were answered.
Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC)	January 16, 2015	Preliminary discussion on federal fisheries requirements including authorizations under the Fisheries Act. GGM provided an overview of the Project and the options for the Goldfield Creek Realignment that were evaluated.
DFO, ECCC, Ministry of the Environment, Conservation and Parks (MECP)	March 23, 2015	Meeting to discuss the Federal permitting approach for fish bearing water bodies. GGM presented an update on the proposed Goldfield Creek Realignment

Table 2-1: Key Meetings Related to the Goldfield Creek Realignment

Stakeholder	Date	Summary of Meeting
DFO, ECCC	September 25, 2015	Presentation of the fisheries environmental baseline data results including a discussion of requirements for Fisheries Offset Plan.
DFO	March 15, 2016	Discussion of fish and fish habitat in the Project area as well as options for the Goldfield Creek Realignment.
DFO, Ministry of Natural Resources and Forestry (MNRF)	June 14, 2016	GGM hosted DFO and MNRF on a site tour of the Project area to discuss fish and fish habitat.
Canadian Environmental Assessment Agency (CEA Agency), DFO, ECCC, MECP, MNRF	June 15, 2016	GGM met with various agencies to discuss fish and fish habitat, including the Goldfield Creek Realignment and the fisheries offsets.
LLFN	August 9, 2016	Technical review team meeting to provide an update on responses to LLFN's comments, work around Goldfield Creek, the Final EIS/EA submission, and upcoming meetings.
DFO, ECCC	October 19, 2016	Provided an update on 2016 field work and discussed feedback related to fisheries compensation and offsets.
LLFN	October 25, 2016	GGM held a meeting with LLFN to discuss closure and the Goldfield Creek diversion.
DFO, MNRF	November 10, 2016	Meeting to discuss offsetting proposed to re-create lost habitat. GGM presented updates on the Goldfield Creek Realignment with regards to flow management and fish offsetting.
PICs	November 22, 23 and 24, 2016	Provided a consultation opportunity focused primarily on the preferred undertaking (assessment, evaluation and conclusions), and included a review of comments and responses on the Draft EIS/EA including related to the Goldfield Creek Realignment. The purpose of these PICs was to summarize what GGM heard as a result of comments received on the Draft EIS/EA and provide an overview of how consultation input shaped the assessment. An updated visual simulation was presented as well as an overview of key project components.
MNRF	November 30, 2016	Meeting to discuss fisheries and terrestrial components. Included discussion on the Goldfield Creek Realignment and vegetated buffers, and fisheries offsetting.
LLFN	December 14, 2016	Workshop to discuss offsetting related to Goldfield Creek and the diversion channel.
PICs	September 13 and 16, 2017	GGM presented a summary of the Final EIS/EA submission including anticipated next steps.
Key Meetings Post-EA related to the Goldfield Creek Realignment Permitting		
GFN	May 7, 2018	GGM held a community meeting to discuss the current Project status, an overview of the environmental permitting process, timelines for mine development and anticipated next steps.

Table 2-1: Key Meetings Related to the Goldfield Creek Realignment

Stakeholder	Date	Summary of Meeting
AZA (Animibiigoo Zaagi'igan Anishinaabek)	May 8, 2018	GGM held a community meeting to discuss the current Project status, an overview of the environmental permitting process, timelines for mine development and anticipated next steps.
AFN	May 10, 2018	GGM held a community meeting to discuss the current Project status, an overview of the environmental permitting process, timelines for mine development and anticipated next steps.
LLFN	May 24, 2018	Environment Advisory Committee meeting regarding LLFN involvement in reviewing permit applications, as well as the Closure Plan, Goldfield Creek Diversion and EMMPs.
MNRF	September 25, 2018	Discussion the overall permitting schedule and requirements for MRNF permits relating to aggregate pits, *Public Lands Act*, culvert crossings, and the diversion of Goldfield Creek.
DFO, ECCC, MNRF	November 28, 2018	Technical workshop to review the Goldfield Creek Realignment plan including design considerations and permitting.
AZA	January 22, 2019	GGM held a community meeting to provide a Project updated
MNO	February 5, 2019	GGM met with MNO to provide a detailed Project update.
MNO	March 5, 2019	GGM met with MNO to review comments on draft permit applications including the Offset Plan.
AZA, Aroland First Nation (AFN), and Ginoogaming First Nation (GFN)	April 2, 2019	Meeting to review comments and responses on the draft Fisheries Offset Plan.
Red Sky Métis Independent Nation (RSMIN)	April 16, 2019	ECCC hosted meeting for Proposed amendment to Schedule 2 of the Metal and Diamond Mining Effluent Regulations (MDMER) for the Hardrock Mine project
Long Lake #58 First Nation (LLFN)	May 8, 2019	ECCC hosted meeting for Proposed amendment to Schedule 2 of the Metal and Diamond Mining Effluent Regulations (MDMER) for the Hardrock Mine project
Métis Nation of Ontario (MNO)	May 9, 2019	ECCC hosted meeting for Proposed amendment to Schedule 2 of the Metal and Diamond Mining Effluent Regulations (MDMER) for the Hardrock Mine project

3.0 KEY COMMENTS RELATED TO THE GOLDFIELD CREEK REALIGNMENT

The draft Fisheries Offset Plan was circulated to DFO, AFN, AZA, GFN, LLFN and MNO in January 2019 for review and comment. Comments and responses were provided as outlined in Table 3-1.

Table 3-1: Circulation of Comments and Responses on the draft Fisheries Offset Plan

Stakeholder	Comments Received	Responses Provided
AFN, AZA and GFN	Comments received on March 11, 2019	Responses to comments provided on April 1, 2019
DFO	Comments received on February 6, 2019	Responses to comments provided on April 9, 2019
LLFN	Comments received on March 1, 2019	Responses to comments provided on May 16, 2019
MNO	Comments received on February 25, 2019	Responses to comments provided on April 1, 2019

Table 3-2 provides a summary of key comments received from stakeholders regarding the goldfield creek diversion and how GGM considered these comments. The purpose of this summary is to highlight the key comments, rather than to itemize in detail specific comments received. A copy of comment response tables developed in response to comments from Aboriginal Communities is provided as Appendix A.

Table 3-2: Summary of Key Comments and Responses Related to the Goldfield Creek Diversion

Stakeholder	Summary of Comment	Summary of Response
Key Comments Received During the EA Process		
AFN	Noted a concern that following the realignment of Goldfield Creek, fish from Kenogamisis Lake will be able to access Goldfield Lake, and that there is a perception that Goldfield Lake, and fish in Goldfield Lake, are cleaner than the fish and water in Kenogamisis Lake.	The Baseline Report – Fish and Fish Habitat and Supplemental Baseline - Fish and Fish Habitat (Appendix E7 of the Final EIS/EA) studies determined that the ability of fish to move from Kenogamisis Lake to Goldfield Lake may be inhibited by natural conditions (steep gradients). GGM has confirmed that this steeper gradient section of Goldfield Creek will remain as it exists during baseline and fish passage from Kenogamisis Lake to Goldfield Lake will be neither enhanced or inhibited by the Project.
AZA, AFN, Biinjitiwaabik Zaaging Anishinaabek, LLFN, RSMIN, ECCC, MNRF, MOECC and DFO.	Requested further details on the channel design in the fisheries offsetting plan LLFN noted the potential to form a focus group on Offsetting for work around Goldfield Creek. The MNRF noted the importance of considering provincial	In response, a workshop was carried out in December 2016. GGM conducted a fluvial geomorphological study to predict potential effects on the Southwest Arm Tributary and to evaluate options for

Table 3-2: Summary of Key Comments and Responses Related to the Goldfield Creek Diversion

Stakeholder	Summary of Comment	Summary of Response
	management objectives in developing offsetting. DFO noted the need to consider losses and gains in the offset plan and requested additional information on effects of bioaccumulation, determining fish use and habitat function of Goldfield Creek.	managing flow and preventing erosion. The work optimized the design approach to reduce potential effects and provide opportunities for offsetting. GGM made presentations to agencies and Aboriginal groups to provide updated information, answered questions and considered additional input into the Draft Fisheries Offset Plan (Appendix F10 of the Final EIS/EA).
LLFN	Community members expressed a desire that the Goldfield Creek diversion be designed so that it supports species that are currently present in Goldfield Creek and in the Southwest Arm Tributary. There was a common interest in using natural materials and implementing techniques that allow 'nature to take over'.	GGM has used this information in developing the offsetting plan design, including the potential use of existing woody debris and seed banks.
MECP, MNRF	Noted concerns with location of the diversion in relation to Project infrastructure presented in the Draft EIS/EA, in particular related to potential effects on water quality and fish habitat offsetting due to seepage into the Southwest Arm Tributary.	GGM increased the setbacks from the Southwest Arm Tributary to waste rock storage areas B and D. GGM also completed additional field work and follow-up consultation, as a result, the Goldfield Creek diversion and the design was refined accordingly in the Final EIS/EA. GGM also incorporated the Goldfield Creek diversion in the "Technical Data Report: Hardrock Project – Assimilative Capacity Study of Southwest Arm of Kenogamisis Lake" (Appendix F6 of the Final EIS/EA), to better predict the anticipated changes to water quality in the new channel and completed flood line analysis used to refine the designs.
Key Comments Received During the Fisheries Act Permitting Process		
AZA, AFN, and GFN	Revise the Southwest Arm compensation plan to account for the presence of resident adult brook trout.	The intent of the Plan is to promote conditions to support a fish community in kind to the resident fish community of Goldfield Creek and the Southwest Arm Tributary. However, the currently proposed channel realignment would be expected to support the incidental usage of the channel by Brook Trout in the same capacity as the former channel.
AZA, AFN, and GFN	Recommended that the approach to assessing impacts to fish during construction of watercourse crossings be completed on an individual crossing basis.	Sections 5 and 6 of the Fisheries Offset Plan were updated to provide more information regarding the location of road crossings and potential areas of impact.

Table 3-2: Summary of Key Comments and Responses Related to the Goldfield Creek Diversion

Stakeholder	Summary of Comment	Summary of Response
	Recommended that GGM develop a site specific Water Quality Monitoring Plan as part of their mitigation measures associated with the compensation plan.	Table 8-1 of the Plan was updated to specify that sufficient erosion and sediment control measures will be in place, monitored, and maintained to ensure compliance with applicable water quality legislation.
AZA, AFN, and GFN	Recommended that the reporting and recording process must document and report any instances where fish mortalities occur, or any impacts of disturbance or destruction of fish habitat occurs. Further, these reports must be circulated to the First Nations communities for review.	Additional text regarding documentation and reporting was added to Section 8.4.2 of the Fisheries Offset Plan. GGM will communicate with the First Nation communities as per specific agreements (environmental monitors and committees) externally to this Plan.
AZA, AFN, and GFN	Noted that the contingency plan for assessing effectiveness of compensation measures must include an assessment on the limitations of offsetting habitat to providing adequate nursery and rearing habitat.	Table 9-3 of the Fisheries Offset Plan was updated to incorporate the reviewer's recommendation.
DFO	Request to receive a copy of the *Pre-construction Aquatic Monitoring Report.*	GGM committed to provide DFO with a copy of the report.
DFO	Request to include complete breakdown of all costs associated with the construction and monitoring of the offsetting and compensation.	The detailed cost breakdown will be provided as a separate submission
LLFN	Request for additional details regarding fish and wildlife habitat structures which will be employed.	Additional descriptions of the holistic ecosystem approach that GGM will integrate into the channel realignment has been provided in Section 9.2.6 of the final Fisheries Offset Plan. GGM and LLFN have agreed to install and monitor the broader ecosystem features within the Biodiversity Management and Monitoring Plan.
LLFN	Request for focus to be on boulder piles and creating underwater shoal features, instead of tree piles in the deeper water zones.	The final Fisheries Offset Plan includes reallocation of the distribution of boulder piles to focus them in the deeper submerged potions of the pond, and place tree piles in the shallow areas
MNO	Request for MNO to be involved n the assessment of offsetting measures implementation and effectiveness.	GGM will continue to engage with the MNO to meet the agreed upon environmental monitoring commitments.
MNO	Recommendation for MNO input to be sought during further development of: monitoring implementation; monitoring reports; objectives of fisheries management, restoration priorities and	GGM and the MNO will continue to develop opportunities for the inclusion of MNO environmental monitoring and traditional knowledge participation within the implementation of the Project.

Table 3-2: Summary of Key Comments and Responses Related to the Goldfield Creek Diversion

Stakeholder	Summary of Comment	Summary of Response
	the fish habitat features; and the riparian edge management design.	

4.0 ONGOING CONSULTATION

GGM remains committed to continuing its outreach activities, to keep stakeholders, government agencies and local Aboriginal communities informed of the Project. Key objectives of the ongoing consultation and community relations program are:

- To provide transparency about GGM's environmental management and monitoring performance.
- To continue to provide opportunities to discuss interests and comments, and resolve issues, related to the Project.

In fulfilling these objectives, GGM will continue with many of the initiatives carried out to date, including the Project website, newsletters, presentations and meetings.

APPENDIX A
COMMENTS RECEIVED FROM ABORIGINAL COMMUNITIES ON DRAFT FISHERIES OFFSET PLAN AND RESPONSES

Wood Environment & Infrastructure Solutions
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April 1, 2019

TC150320

Attn: Stephen Lines, M.Sc., P.Biol
Environmental Assessment and Permitting Manager
Greenstone Gold Mines

Via E-mail:

Dear Mr. Lines,

RE: Animbiigoo Zaagi'igan Anishinaabek (AZA), Aroland First Nation (AFN) and Ginoogaming First Nation (GFN) Review of the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood), is pleased to provide Greenstone Gold Mines (GGM) with technical responses and clarification to the Animbiigoo Zaagi'igan Anishinaabek (AZA), Aroland First Nation (AFN) and Ginoogaming First Nation (GFN), Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project. The responses are provided in the attached table, complete with the comment and recommendations as provided by Shared Value Solutions in their February 28, 2019 letter.

Should you have any questions regarding this scope please do not hesitate to contact the undersigned.

Yours truly,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Prepared by:

<original signed by>

Per: Mark Ruthven, C.E.T., CAN-CISEC
Head, Environmental Assessment
Senior Associate

Reviewed by:

<original signed by>

Per: Dan Russell, P.Geo.
Associate Geoscientist

Attachment

Animbiigoo Zaagi'igan Anishinaabek (AZA), Aroland First Nation (AFN) and Ginoogaming First Nation (GFN) Review of the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project			
No.	**Comment**	**Recommendation**	**GGM Response**
1	Section 1.3.2 Southwest Arm Tributary: In Table 1-1 of this section, it is indicated that a total of 15 species of fish were captured in the watercourse, which were primarily represented by small bodied cyprinids and forage species, with less abundant species such as northern pike, walleye, burbot and yellow perch. However, a single adult brook trout was captured in the spring of 2016, which was deemed to be considered an incidental migrant and not a resident species. No rationale is provided as to why the Southwest Arm Tributary could not host resident brook trout, despite adult brook trout being captured in the watercourse. Due to this categorization in the plan, GGM has not fully accounted for the measures needed to restore or compensate impacts to this section of watercourse.	It is acknowledged that Section 9.2.3 Measure 3 indicates that a new channel outlet from SWP2 will be constructed which extends to the inflow of SWP3 to accommodate the increased flow requirements. However, it is recommended that GGM revise the Southwest Arm compensation plan to account for the presence of resident adult brook trout. The new channel should be designed with a goal of improving or increasing the available habitat for brook trout, for all life stages.	As described in the EIS document (Section 11.1.3) this single Brook Trout captured in the SWAT was "believed to be transient and not indicative of a resident population in the Southwest Arm Tributary because it was present during the spring, when water temperatures and dissolved oxygen conditions were favorable for Brook Trout. Despite considerable sampling effort, including multiyear and multi season programs, no additional adult, juvenile or young of the year brook trout were observed. The absence of juvenile and young of the year fish in previous and subsequent fish community sampling events also indicates that there is not a resident population of Brook Trout in the Southwest Arm Tributary." Brook Trout have not been captured in Goldfield Creek. The intent of the Plan was to promote conditions to support a fish community in kind to the resident fish community of Goldfield Creek and the SWAT. However, the currently proposed channel realignment would be expected to support the incidental usage of the channel by Brook Trout in the same capacity as the former channel.
2	Section 5.0 Description of Proposed Works, Undertaking or Activity Likely to Result in Residual Serious Harm to Fish: The plan states that GGM proposes activities which have the potential to result in the deposition of mine waste into waters frequented by fish, and will result in serious harm to fish including the direct infilling of waterbodies, flow reductions to downstream creek sections, water intake or discharge structures and road crossings of local watercourses.	Although, the proposed Fisheries Act amendments under Bill C-68 have yet to be fully enacted, in the interest of assessing the impacts to fish with the highest level of scrutiny and precaution, it is recommended that the Proponent approach the plan with an analysis that goes beyond the provision of Serious Harm to a shift in focus of avoiding harmful alteration, disruption or destruction (HADD) of fish and fish habitat, which is what is contemplated under Bill	We appreciate the value in being proactive to the potential for changes in Federal requirements for offsetting and compensation but given that Bill C-68 has yet to receive Royal Assent, we are obligated to follow the current Fisheries Act as written. GGM is committed to working with DFO to ensure the offset / compensation plan is compliant with the current legislation and policies that are in force. Irrespective of the current and proposed legislation, GGM conducted a thorough assessment of potential impacts and avoidance / mitigation

Animbiigoo Zaagi'igan Anishinaabek (AZA), Aroland First Nation (AFN) and Ginoogaming First Nation (GFN) Review of the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project			
No.	**Comment**	**Recommendation**	**GGM Response**
		C-68. GGM should assess the proposed activities and design of the Project in the context of HADD avoidance and review how this new context would change or enhance the measures described within the compensation plan.	opportunities during the EA process to arrive at the current Plan. This current Plan provides a robust assessment of all Project works and undertakings that could be result in impacts to fish habitat.
3	Section 5.0 Description of Proposed Works, Undertaking or Activity Likely to Result in Residual Serious Harm to fish: GGM identifies that road crossings will use standard mitigation measures and best management practices to mitigate impacts to fish and fish habitat. These measures would include structure sizing and standardized construction methods. Once implemented, GGM posits that the standard approach will mitigate serious harm to fish on an individual crossing basis. Further, many crossings would be considered cumulatively from a mitigation perspective, as opposed to on an individual crossing basis.	Considering that waterbodies for which the crossings are being discussed are all fish-bearing watercourses, it is recommended that the approach to assessing impacts to fish during construction of watercourse crossings be completed on an individual crossing basis as opposed to on a general standard mitigation cumulative basis. In order to properly implement mitigation measures appropriate to the available fish habitat of a particular crossing, each site must be assessed and mitigated on an individual crossing basis. Furthermore, the standard mitigation measures outlined make no mention of implementing water quality monitoring during construction. The compensation plan should include site-specific water quality monitoring in order to protect against deleterious substances or erosional impacts on fish habitat during construction. It is therefore recommended that GGM develop a site-specific Water Quality Monitoring Plan as part of their mitigation measures associated with the compensation plan.	We agree that as much site-specific detail regarding impacts to fish habitat should be included in the plan. We will update Sections 5 and 6 accordingly to provide more information regarding the location of road crossings and potential areas of impact. Water quality monitoring is not specified in the fisheries offset /compensation plan as it will be appropriately addressed in the pending environmental permits associated with construction and operation of the mine. Detailed erosion and sediment control; and water quality monitoring conditions are typically included in Provincial approvals such as Lakes and Rivers Improvement Act, Permit to Take Water and Environmental Compliance Approvals. However, Table 8-1 of the Plan will be amended to specify that sufficient erosion and sediment control measures will be in place, monitored, and maintained to ensure compliance with applicable water quality legislation.
4	Section 7.1 Seasonal Construction Constraints: The waterbodies associated with the works, undertaking or activity that are likely to result in	Due to the presence of brook trout found in the Southwest Arm Tributary, it is recommended that in addition to the spring timing window, the fall	The current specified inwater timing constraints in the Plan (April 1 to June 15 of any given year) were carefully derived to using the Provincial (MNRF) "Inwater work

Animbiigoo Zaagi'igan Anishinaabek (AZA), Aroland First Nation (AFN) and Ginoogaming First Nation (GFN) Review of the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project			
No.	**Comment**	**Recommendation**	**GGM Response**
	serious harm to fish are considered coolwater with respect to fish communities and species sensitivities. As such, the offset plan stipulates that in-water works are to be avoided only between April 1 and June 15 of any given year to comply with the in-water timing constraints for spring spawning species as per MNRF in-water work timing window guidelines (OMNR 2013) and DFO's Ontario Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (DFO 2017).	timing window of Sept 1 to June 15 (OMNR 2013) be applied to the work-restriction measures on this watercourse.	timing window guidelines" (OMNR 2013); and, Federal (DFO's) "Ontario Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat" (DFO 2017). Both guidelines base the timing windows on the individual species that reside in the waterbody, as well as on the geographic region of the work. As per our response to Comment 1, the individual Brook Trout captured in the SWAT is considered a transient occurrence, and not representative of the resident fish community. Notwithstanding the above rationale for not implementing a fall timing window, all in-water works will still be carefully planned and implemented to ensure appropriate isolation from adjacent active creek flows at all times, including fall and winter.
5	Section 7.2 Construction Schedule: The plan states that if the work, undertaking or activity cannot be completed during the approximate time period specified in the final plan, only DFO will be notified in writing in advance of the expiration of the above time period, and provided with a revised schedule. Further, GGM states that it is understood that DFO may, where appropriate, provide written notice that the period to carry on the works, undertaking or activity has been extended. There is no mention of a commitment to notify the First Nations of whether any major project schedules are anticipated.	It is recommended that in addition to notification to DFO, GGM must notify all First Nation communities in advance of any deviation to the project construction schedule and must consult the communities on the appropriate path forward if significant delays are anticipated. This can be conducted through the Environmental Advisory Committee (EAC) for ease of implementation, unless the Committee is not active during a period when a notification should be given, in which case the First Nations should be notified individually.	We agree that GGM should and will communicate with the First Nation communities as per specific agreements (environmental monitors and committees) externally to this Plan. The Section 7.2 text is specifically referring the requirement for GGM to communicate and receive clarification with DFO as the Federal agency responsible for administering the fisheries Act and the conditions of the Plan.
6	Section 8.4.2 Demonstration of Effective Implementation: To demonstrate effective implementation and function of the avoidance and mitigation measures, GGM describes that they will maintain documentation and provide	This list of construction reporting does not include anywhere where GGM is committed to reporting when and where any mortalities or serious harm occurs as a result of construction-related activities, only to report on	Additional Text will be added to Section 8.4.2 of the Plan as follows: " the documentation will include any observed mortalities of fish, their approximate numbers and location, and the suspected cause of mortality if known" and "if additional serious harm greater than that predicted

Animbiigoo Zaagi'igan Anishinaabek (AZA), Aroland First Nation (AFN) and Ginoogaming First Nation (GFN) Review of the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project			
No.	**Comment**	**Recommendation**	**GGM Response**
	summaries of documents in the "as constructed" report. These records include the following: • A detailed photographic record from consistent vantage points and inspection reports will be kept to document measures and standards employed and their effectiveness to limit the serious harm • A record of all fish removal efforts carried out with the numbers of fish removed and relocation locations • A record of any contingency measures that were implemented and the effectiveness of the measures	the "effectiveness" of the proposed measures. The reporting and recording process must document and report any instances where fish mortalities occur, or any impacts of disturbance or destruction of fish habitat occurs. Further, these reports must be circulated to the First Nations communities for review (through the EAC as long as it is active, or otherwise to the individual First Nations).	in the plan occurs; it will be documented and reported to DFO immediately. " Consistent with our response to Comment 5, the reference to reporting is specifically referring the requirement for GGM to communicate to and with DFO as the Federal agency responsible for administering the fisheries Act and the conditions of the Plan. We agree that GGM should and will communicate with the First Nation communities as per specific agreements (environmental monitors and committees) externally to this Plan.
7	Table 8-1: List of Measures and Standards, Success Criteria and Contingency Measures: Sediment and erosion control measures associated with the work will be in place prior to substantial ground disturbance and through the duration of construction. If sediment does reach the watercourse, the contingency plan is to stop the work that is resulting in sediment release until effective controls are implemented. Supplies of erosion and sediment control supplies will be maintained on-site to repair, replace or supplement control measures as needed.	Although the commitment to implementing sediment and erosion control measures is described within the plan, there remains no commitment to employ any site-specific water quality monitoring for any of the in-water work locations being proposed. It is recommended that GGM develop a site-specific Water Quality Monitoring Plan as part of their mitigation measures associated with the compensation plan.	As per our Response to Comment 3, Water quality monitoring is not specified in the fisheries offset /compensation plan as it will be appropriately addressed in the pending environmental permits associated with construction and operation of the mine. Detailed erosion and sediment control; and water quality monitoring conditions are typically included in Provincial approvals such as Lakes and Rivers Improvement Act, Permit to Take Water and Environmental Compliance Approvals. However, Table 8-1 of the Plan will be amended to specify that suitable erosion and sediment controls will be in place, monitored, and maintained to ensure compliance with applicable water quality legislation.
8	Section 9.4 Contingency Measures and Section 9.4.2 Monitoring of Contingency Measures: If the results of the effectiveness monitoring of the compensation measures indicate that the offsetting	The proponent must make a commitment to consult with the First Nations in instances where delays of construction are anticipated. Further, in particular instances where the measures are not	Consistent to our response to Comments 5 and 6, the reference to reporting is specifically referring the requirement for GGM to communicate to and with DFO as the Federal agency responsible for administering the

Animbiigoo Zaagi'igan Anishinaabek (AZA), Aroland First Nation (AFN) and Ginoogaming First Nation (GFN) Review of the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project			
No.	**Comment**	**Recommendation**	**GGM Response**
	is not completed by the date specified and/or are not functioning according to the intended criteria, GGM states they will give written notice to DFO and shall implement the contingency measures and associated monitoring. Again, there is no mention of a commitment to notify or consult with First Nation communities.	performing or functioning to the intended state, the proponent has an obligation to inform the First Nations on the causes of the poor performance of the compensation works, and to consult on what appropriate next-steps will be to achieve the intended goals. These recommendations can be implemented through the Environmental Advisory Committee (EAC), unless the Committee is not active during a period when a notification should be given and/or consultation conducted, in which case the First Nations should be notified/consulted individually.	fisheries Act and the conditions of the Plan. We agree that GGM should and will communicate with the First Nation communities as per specific agreements (environmental monitors and committees) externally to this Plan.
9	Table 9-3: Contingency Measures for Implementation Success: In the table for Criteria and Timing to Assess Offsetting Measures Implementation and Effectiveness Success (Table 9-2) it states that one of the assessment criteria will be full life-cycle usage by fish in the offsetting habitat. The successful criteria will be if multiple year classes, including young of the year (YOY) fish, are present in the offset feature. This would imply that the target outcome would be to observe fish using these areas for rearing and nursery purposes as well as for other uses such as spawning and overwintering. However, in Table 9-3, the contingency plan in the absence of the expected year classes is to use monitoring data to assess limiting factors for only spawning or overwintering, which does not include assessing the limiting factors for nursery or rearing habitat for YOY of target species, and baitfish species.	The contingency plan for assessing effectiveness of compensation measures must include an assessment on the limitations of offsetting habitat to providing adequate nursery and rearing habitat. Otherwise, if nursery and rearing habitat is not considered, the assessment criteria of ensuring "full life-cycle" usage by fish in the compensatory habitat cannot be adequately evaluated.	We agree with the reviewer's comment that adequate nursery and rearing habitat should be part of the contingency assessment criteria. Table 9-3 of the Plan will be amended to incorporate the reviewer's recommendation.

Animbiigoo Zaagi'igan Anishinaabek (AZA), Aroland First Nation (AFN) and Ginoogaming First Nation (GFN) Review of the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project			
No.	**Comment**	**Recommendation**	**GGM Response**
10	Section 10.2 Report Schedule: The plan states that GGM will report to DFO on whether the offsetting measures were conducted according to the conditions of the authorization. An as-constructed report will be due within 12 months of completing construction of the works. Performance monitoring reports will be due on or before December 31 of years 1, 3 and 5 following construction of the works. Modifications to the proposed monitoring schedule may be requested by the Proponent in writing to DFO.	Again, Section 10 makes no commitment to reporting to First Nation communities. Similar to Comments 5 and 8, all the reporting described in Comment 10 must be given to the First Nations for review and comment in addition to DFO. This can be conducted through the Environmental Advisory Committee (EAC) for ease of implementation, unless the Committee is not active during a period when a report should be issued, in which case the First Nations should be reported to individually.	Consistent with previous responses, the reference to reporting is specifically referring the requirement for GGM to communicate to and with DFO as the Federal agency responsible for administering the fisheries Act and the conditions of the Plan. We agree that GGM should and will communicate with the First Nation communities as per specific agreements (environmental monitors and committees) externally to this Plan.
11	Attachment 1A: Goldfield Creek Diversion Channel: The design drawings provided in the Attachment associated with the Goldfield Creek Diversion Channel appear to lack any design features that incorporates natural channel contours or replacement of natural fish cover structures to the compensatory habitat. The drawings appear to depict a flat bottom, uniformed-sloped channel that lacks any natural restoration measures or improvements to fish habitat. While we acknowledge that the primary diversion channel function is to move water, a habitat-improvement focus should also be incorporated into the design of this channel.	It is recommended that the Proponent revisit the instream habitat design of the Goldfield Creek diversion channel in order to provide for more complex and diverse fish habitat cover structures based on natural templates, that would benefit and improve the habitat for the resident fish species in the area. This would also contribute additional habitat offsetting to the overall offsetting balance of the compensation plan. These improvements could include the addition of more mixed coarse substrates of cobble and boulders as well as the addition of instream woody debris.	Although aggregate substrate and wood structure is incorporated into other areas of the design (Goldfield Creek Diversion Pond and the realigned channel floodplain) GGM appreciates this recommendation and will add clarification into the plan that similar measures are to be included in the channel. These features will be reflected in the detailed plans for the LRIA application process.

EA = Environmental Assessment
DFO = Fisheries and Oceans Canada
ECCC = Environment and Climate Change Canada
MECP = [Ontario] Ministry of Environment Conservation and Parks
MDMER = Metal and Diamond Mining Effluent Regulations
MNRF = Ministry of Natural Resources and Forestry
EEM = Environmental Effects Monitoring

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April 9, 2019

TC150320

Attn: Stephen Lines, M.Sc., P.Biol
Environmental Assessment and Permitting Manager
Greenstone Gold Mines

Via E-mail:

Dear Mr. Lines,

RE: DFO Review of the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood), is pleased to provide Greenstone Gold Mines (GGM) with technical responses and clarification to the DFO Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project. The responses are provided in the attached table, complete with the comment and recommendations as by DFO in their February 14, 2019 Email.

Should you have any questions regarding this scope please do not hesitate to contact the undersigned.

Yours truly,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Prepared by:

<original signed by>

Per: Mark Ruthven, C.E.T., CAN-CISEC
Head, Environmental Assessment
Senior Associate

Reviewed by:

<original signed by>

Per: Dan Russell, P.Geo.
Associate Geoscientist

Attachment

DFO Review of the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project			
No.	**Section**	**Comment / Recommendation**	**GGM Response**
1	1.1- Paragraph 4	Not all waterbodies within the entire project "footprint" were considered for a Schedule 2 listing. The first line of this paragraph should also note that the determinations were "based on the information submitted by GGM".	Agreed. The plan text will be updated accordingly.
2	1.3	Has DFO seen the "Pre-construction Aquatic Monitoring Report, September 17, 2018"?	The report will be provided to DFO for information.
3	1.3.1 - Paragraph 2	"A single riffle habitat in the lower reaches is uncommon" – Unknown what exactly is being referred to here. Please change descriptive wording.	Agreed. The plan text will be updated accordingly.
4	1.3.3	"single minnow species (Brook Stickleback)" – Brook Stickleback are not a minnow species. Please change descriptive wording.	Agreed. The plan text will be updated accordingly.
5	1.3.4	Golf Course Pond #2 – Does this need to be included if it is not to be listed as a Schedule 2 and does not support a CRA fishery?	We had originally included the Pond 2 for completeness, but it can be removed from the habitat impact and compensation summaries to remove any confusion.
6	1.3.5	Fisheries productivity by CPUE only? This is fine as the primary metric however there should also be some mention of species composition/assurance of retained biodiversity.	Correct, we also propose to use species richness as a performance metric to demonstrate that species diversity has been retained. Also, metrics will demonstrate that full life cycle (based on length frequency distribution) is being accommodated within the constructed habitats.
7	Table 3-1	The coordinates and watercourse sections should be delineated in accordance to their designated legislation. If sections of the same watercourse fall under separate legislative pieces then this should be clearly identified, described and plotted. There should be no generality here with watercourses being categorized as being subject to both Paragraph 35 and MDMER. This is also mentioned in the footnotes. Again, there will be no circumstances where a s.s.35(2)(b) would be issued for a specific watercourse section only to be followed by a Schedule 2 amendment and this should be corrected.	Our intention in showing the two overlapping legislations in some of the waterbodies was to reflect the need to partially affect these waterbodies through non-schedule 2 related activities, prior to the Schedule 2 approved waste deposition. Through subsequent discussion with DFO we understand the need for a clear and definable differentiation between these two legislative approvals and will modify the table and the corresponding figure (see comment 8) to specify only one governing legislation for each location.

DFO Review of the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project			
No.	**Section**	**Comment / Recommendation**	**GGM Response**
8	Figure 3-1	Watercourses or sections of watercourses should be clearly identified (color coded) as per their designated legislation.	Consistent with our response to Comment 7, the figure will be modified to show only one governing legislation for each location
9	5.0 (First paragraph)	"water discharge structures are considered to be fully mitigatable" No, they will have a residual footprint to consider. Please change wording	The plan text will be updated to state that although the impacts are largely mitigatable, there will still be a remnant residual footprint considered in the plan.
10	6.0	While it is appropriate for the single proposed plan to encompass both offsetting required in accordance to Section 35 of the Fisheries Act and compensation for waterbodies listed under Schedule 2 of the MDMER, Section 6 should make an absolutely clear distinction between the two. This should include the separation of impact types (detailed descriptions and reasoning for designations) and the allocation of impacted habitat quantity to each legislative component. I would recommend that Section 6 (including 6-1 table) be broken into two sections designated solely to each legislative piece. This will have the benefit of keeping the terminology used specific to its use in the Fisheries Act and MDMER and ensure there is no question as to how the accounting totals have been derived.	Agreed. The plan text will be updated accordingly.
11	Table 6-1 Notes	As in Table 3-1, there is a note referencing instances where a s.s.35(2)(b) would be issued for a specific watercourse section only to be followed by a Schedule 2 amendment. This will not be the case and this should be corrected or removed.	Consistent with our response to Comments 7 and 8, the notes will be modified to show only one governing legislation for each location
12	8.4.3	DFO should be notified of the implementation of contingency measures for mitigation procedures when/if they occur. For cases such as a need to work within a restricted activity period, the modified plans should be subject to DFO's review and approval before the commencement or continuation of work.	Agreed. The plan text will be updated to reflect communication with DFO.
13	Table 8-1 First entry	See comment above "*DFO should be notified of the implementation of contingency measures for mitigation procedures when/if they occur. For cases such as a need to work within a restricted activity period, the modified plans should be subject to DFO's review and approval before the commencement or continuation of work*."	Agreed. Table 8-1 will be updated accordingly.
14	Table 8-1 –Seventh entry	Pumps should be screened in accordance to DFO's "Freshwater Intake End-of-Pipe Fish Screen Guideline" (1995). Please make specific reference.	Agreed. Table 8-1 will be updated accordingly.
15	9.1	The final application for authorization must include a complete breakdown of all costs associated with the construction and monitoring of the offsetting and	Through subsequent discussion with DFO we have proposed to provide the detailed cost breakdown of the

DFO Review of the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project			
No.	**Section**	**Comment / Recommendation**	**GGM Response**
		compensation. This budget will be subject to DFO approval and determine the final Letter of Credit amount(s).	offsetting and compensation measures under a separate cover for review and approval by DFO. DFO will review this request and determine if the proposed separate submission is acceptable or if it needs to be included in this plan.
16	Table 9-2 – Fifth entry	The collection methods used to verify full life cycle usage should be identified.	Table 9-2 will be amended to specify that the capture techniques will include electrofishing, Minnow Traps, Seine Nets), gill nets and trap / hoop nets (dependent on the specific habitats). Life cycle will be demonstrated through assessment of size classes and length frequency comparison to show multiple year classes by species reflective of young of the year through adult life stages.
17	11.0	"Fisheries Offset Accounting and Balancing" – This should remain identified as "offset and compensation", displaying the amounts for each and then combining them for a final total.	Section 11 will be amended to discuss the impacts and compensatory measures by legislation, consistent with previous comments.

DFO = Fisheries and Oceans Canada
ECCC = Environment and Climate Change Canada
MDMER = Metal and Diamond Mining Effluent Regulations
MNRF = Ministry of Natural Resources and Forestry

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May 14, 2019

Wood Project No. TC150320

Attn: Stephen Lines, M.Sc., P.Biol
Environmental Assessment and Permitting Manager
Greenstone Gold Mines

Dear Mr. Lines,

RE: Long Lake #58 First Nation Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood), is pleased to provide Greenstone Gold Mines (GGM) with technical responses and clarification to the Long Lake #58 First Nation Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project; as provided by GeoProcess in their February 27, 2019 memorandum.

The review conducted by GeoProcess on behalf of Long Lake #58 First Nation included two parts. Section 1 is a review of the "Plan" document, while Section 2 is a technical review of the Drawings in Appendix 1 of the Plan.

From a preliminary discussion with GeoProcess, the Comments in Section 1 of the review reflect the key concerns of Long Lake #58 First Nation with respect to the plan in general; while the Section 2 comments are directed at providing additional discussion and consideration during the detailed design drawing preparation.

Accordingly, we have attempted to provide complete and thorough responses to Section 1 comments and commit to further consideration of the Section 2 comments in future revisions to the design drawings.

Should you have any questions regarding this scope please do not hesitate to contact the undersigned.

Sincerely,
Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

<original signed by>

Mark Ruthven, C.E.T., CAN-CISEC
Head, Environmental Assessment; Senior Associate

<original signed by>

Dan Russell, P.Geo.
Associate Geoscientist

Attachment

Long Lake #58 Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project – Comments and Responses Section 1		
Plan Section	**Comment**	**Response**
1.1. Section 1.0 Introduction	Pg. 1. Document states, Discussions with ECCC and DFO have confirmed that Greenstone will work in cooperation with DFO to develop an acceptable combined fisheries offset plan that will include compensation fish habitat if required for Schedule 2 waterbody impacts, and fisheries offset measures for the Paragraph 35 impacts. The MECP EA review document and recommended conditions do not reflect that DFO has agreed to be the lead agency in determining the applicability of the Offset Plan.	Although it is our experience that the Federal and Provincial agencies make good efforts to work cooperatively, both the Section 35(2)(b) Authorization and the Schedule 2 waterbody amendment fall solely within Federal government jurisdiction. This may be why it was not specified in the Provincial document.
	Pg. 1 Document is a draft plan. LLFN reserves the right to review additional changes or versions of this plan based on any necessary site plan changes, detailed design modifications and any further impact analysis pertaining to Paragraph 35 Authorization or Schedule 2 amendments.	Agreed.
	Pg. 2. Document states, Additional consultation helped to inform the detailed design and final fisheries offset plan with a focus on habitat design features within the Goldfield Creek diversion. The current design and information provided by GGM to date do not fully address the request of LLFN that the design demonstrates how a holistic ecosystem approach is being implemented into the design. Additional details regarding fish and wildlife habitat structures which will be employed need to be provided to LLFN.	Additional descriptions of the holistic ecosystem approach that GGM will integrate into the channel realignment has been provided in Section 9.2.6 of the Plan. However, specific commitments for the abundance and the monitoring of such measures will need to be specified externally to this Plan as the Federal government (DFO) is unlikely to accept the monitoring of terrestrial wildlife features as a component of the Plan which is intended to specifically address impacts and offsets for fish habitat. GGM and LLFN have agreed to install and monitor the broader ecosystem features within the Biodiversity Management and Monitoring Plan.
	Pg. 3. Document states, A single adult brook trout was captured in the spring of 2016, and is considered an incidental migrant and not a resident species. More clarification is requested on this brook trout, because if SW Arm Tributary supports a migratory run of Brook Trout from Kenogamisis	The use and consideration of Aboriginal knowledge of the local fisheries was presented in Section 11.1.3 of the EIS "Consideration of Aboriginal Information and Traditional Knowledge" It is our

Long Lake #58 Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project – Comments and Responses Section 1		
Plan Section	**Comment**	**Response**
	Lake, this should be considered an important and uncommon fishery. The design of the SW Arm Tributary would have to take migratory Brook Trout into account. Has LLFN be consulted for their knowledge of the historical and present day fish species composition of the SW Arm Tributary? If so, please provide documentation.	understanding that the information gathered to date supports the statement made regarding the Brook Trout observation. As described in the EIS document (Section 11.1.3) this single Brook Trout captured in the SWAT was "believed to be transient and not indicative of a resident population in the Southwest Arm Tributary because it was present during the spring, when water temperatures and dissolved oxygen conditions were favourable for Brook Trout. The absence of juvenile and young of the year fish in previous and subsequent fish community sampling events also indicates that there is not a resident population of Brook Trout in the Southwest Arm Tributary." Brook Trout have not been captured in Goldfield Creek. The intent of the Plan was to promote conditions to support a fish community in kind to the resident fish community of Goldfield Creek and the SWAT. However, the currently proposed channel realignment would be expected to support the incidental usage of the channel by Brook Trout in the same capacity as the former channel.
	Pg 4 to 6. Document states, By comparing CPUE in the baseline conditions to the constructed offset measure habitats, it can be clearly demonstrated whether the offset measures have provided a comparable level of productivity. CPUE should be one of a number of metrics monitored within the new channel to determine if it is functioning as designed and provided the required Offset. LLFN would like the entire stream corridor monitored to demonstrate that it is functioning as an entire ecosystem not just for fisheries. When comparing CPUE, it will be important that the level of effort is comparable between that of the baseline conditions and that of the monitoring conditions, i.e. approximately same length of channel surveyed at approximately the same time of year. Because CPUE is	We agree that the efforts used to determine CPUE should be consistent with efforts used to determine baseline values, such as gear types and set duration / effort. Monitoring will include representative areas along the entire length of the realigned channel, from the Goldfield Creek diversion Pond to downstream of the final grade control. In addition to the CPUE metric, species richness will also be compared to species assemblages post construction. In addition to biological sampling the plan includes monitoring of the new channel's stability and physical function.

Long Lake #58 Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project – Comments and Responses Section 1		
Plan Section	**Comment**	**Response**
	a normalized number, changes in methodology between baseline monitoring and post-construction monitoring, particularly time of year and length of channel sampled, can be used to skew the numbers one way or the other.	
1.3. Section 3.0 Location of Proposed Project	Pg. 12. Figure 3-1 Fisheries Impact and Offset Locations, shows the proposed New Valley and Channel Construction for Goldfield Creek diversion is 2.7 km long. For comparative purposes, what is the length of the existing Goldfield Creek channel that presently traverses the proposed tailing pond area?	The segment of Goldfield Creek within the proposed TMF boundary is 4.09 km in length.
1.5. Section 5.0 Description of Proposed Works, Undertaking or Activity Likely to Result in Residual Serious Harm to Fish	Pg. 15. Document states, The flow reductions to various creeks have been estimated and in cases where the reductions are minimal (less than 15% reduction in mean annual flow) the likelihood of serious ham occurring is considered low. Care must be taken when discussing fisheries impacts and annual flow reduction. It is not annual flow that is important to maintaining fish habitat but rather the distribution of those flows over the year. If flows are overall reduced by less than 15% annually but result in much greater flow reductions during critical times of the such as during the summer, the impact to fish habitat can be significant. We feel additional analysis should be conducted to determine flow reductions on a monthly basis and this should be used to determine flow impacts.	All of the channels (with the exception of Goldfield Creek) where flow reductions are predicted have ephemeral to intermittent flow regimes meaning that they mainly experience flow during precipitation and runoff events. The only permanent areas of water are associated with deeper pools or channels which fill during runoff events and drain / evaporate during periods of non-precipitation. As such the available permanent water is mainly influenced by precipitation frequency, backwater conditions from the lake or connectivity with groundwater. The fish communities in these channels are typically simple, often consisting of only Brook Stickleback which can persist in such challenging environments. As per the EIS document, flow reduction was derived from percent watershed reduction. "This approach was taken, given the inability to accurately measure ephemeral flow in low gradient, low volume wetland drainage features (i.e., WC-C, WC-D, WC-F, WC-G, WC-I, WC-M, WC-O, and WC-Z)." (EIS Section 11.4.3.3). We feel that the decision made jointly with DFO to use a percent watershed area reduction as a surrogate to flow reduction and the 15% threshold is reasonable given these conditions.

Long Lake #58 Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project – Comments and Responses Section 1		
Plan Section	**Comment**	**Response**
1.6. Section 6.0 Serious Harm to fish LIKELY to Result from the Proposed Works, Undertaking or Activity	Pg. 16. Document states, Areas with less than 15% flow reduction are considered to be negligibly affected, and not included in the areas of residual serious harm. We feel this assessment should be based on monthly flows not annual flows, as annual flows can 'hide' flow impacts during critical times of the year. What was the 15% flow reduction based on?	As per our response above and the EIS document, flow reduction was derived from percent watershed reduction. We feel this approach was reasonable given the ephemeral classification of the channels. The threshold of 15% flow reduction for areas that would be negligibly affected was determined from the DFO document "Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada" which found that instantaneous changes in flow plus or minus 10% had a low probability of detectable negative effects, as well as the report "A Desk-top Method for Establishing Environmental Flows in Alberta Rivers and Streams" which identifies a threshold of 15% instantaneous reduction from natural flow to protect aquatic ecosystem. Both documents and additional discussion on flow reduction are described and cited in EIS document Section 11.4.3.3.
	Pg. 16. Document states, Areas with more than 15% flow reduction but less than 85% flow reduction are considered partially affected. This is a very large range for partially impacted flows. What are these numbers based on? Again, this analysis should be considered on a monthly basis, as there is a much higher likelihood that these annual flow reductions may be resulting in channels now becoming intermittent during summer low flow months from permanent flow, which would be a significant impact to a fishery.	Consistent with our responses above, the threshold of 15% flow reduction for areas that would be negligibly affected was determined from the DFO document "Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada" as well as the report "A Desk-top Method for Establishing Environmental Flows in Alberta Rivers and Streams". Both documents and additional discussion on flow reduction are described and cited in EIS document Section 11.4.3.3.
	Pg. 17. Table 6-1, under Goldfield Creek, Permanent Alteration: Flow reduction from confluence with Goldfield Creek Tributary to Kenogamisis Lake, -71% Change in Flow. The impact of this flow reduction could be much more than just loss of fish habitat area, as the flow from Goldfield Creek could be attracting spawning fish, particularly in the spring. This spawning function could be lost with flow reductions of 71% and this could have an impact on the habitat functions of Goldfield Creek Tributary	The section of Goldfield Creek identified to experience a flow loss is backwatered by Lake Kenogamisis water levels. All the upgradient fluvial channel (upstream of existing trail crossing) where flow volume and velocity would have been more critical for fish access are already accounted for as 100% lost due to the TMF and support structures (ditches / roads). As such the area of habitat impacted by the 71% flow loss, being within the lake backwater influence is not

Long Lake #58 Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project – Comments and Responses Section 1		
Plan Section	**Comment**	**Response**
	if spawning fish no longer access this channel. Further discussion and thought should be considered for the flow reduction at the mouth of Goldfield Creek.	expected to change substantially in terms of wetted area. Nevertheless, we have accounted for a 71% loss of habitat due to potential impairment from reduced flow velocity through the backwatered channel section. We feel this estimate is a conservative representation of the actual impact that will occur given that most of the fish species expected to use this area are lentic (lake dwelling) in nature.
1.8. Section 8.0 Conditions that Relate to Measures and Standards to Avoid or Mitigate Serious Harm to Fish	Pg. 20. Document states, To ensure that the measures and standards described in this plan are implemented as proposed, construction and plan implementation will be monitored by Greenstone onsite monitors, or designates. LLFN or its representatives should be involved in or entirely conducting the monitoring.	LLFN's Environmental Technician will have the opportunity to be involved directly.
	Pg. 20. Document states, Monitoring will be reported to DFO in an "as constructed" report provided within six months of the works being completed. The "as constructed" monitoring report will be as per the sections below. We feel the 6 month time frame is too long. Construction monitoring needs to be on a tighter schedule, i.e. weekly reporting.	The as constructed report is typically a single document provided to DFO at completion of the work to demonstrate that the habitat was constructed as per the plan. It is the intent of GGM to prepare and submit the as constructed report in a timely fashion. The 6-month period was specified to provide sufficient time for an as built topographic survey to be completed / interpreted; and to compile / summarize the extensive monitoring reports and photo documentation records. This timeline also must account for any agreed upon review periods internally and for other parties prior to submission to DFO. Frequent monitoring by onsite monitors will be conducted as part of the overall sites environmental management program, any upset conditions or malfunctions during construction would be reported immediately to regulators as per expected permit conditions and applicable environmental legislation.

Long Lake #58 Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project – Comments and Responses Section 1		
Plan Section	**Comment**	**Response**
	Pg. 21 Document states, A detailed record will be made of any contingency measures that were followed to prevent impacts greater than those covered addressed by this offset plan in the event that mitigation measures did not function as described. A summary of any contingency measures will be provided in the "as constructed" report. LLFN is to be included in the review of any contingency measures.	GGM should and will communicate with the LLFN as per specific agreements (environmental monitors and committees) externally to this Plan.
1.9. Section 9.0 Conditions that Relate to the Offsetting of the Serious Harm to Fish likely to Result from the Authorized Work, Undertaking or Activity	Pg. 23. LL58FN would like to review the calculations to determine the letter of credit for the offsetting works for the project to ensure adequate funds are set aside.	While the estimate can be shared, in due course the costing is based on metrics and unit costs approved by DFO.
	Pg. 24. Document states, Boulder piles (~78) and submerged tree piles (~31) will be spaced in both shallow and deeper zones to provide cover opportunities throughout the pond. We feel the focus should be on boulder piles and creating underwater shoal features, see discussion in the Technical Review, instead of tree piles in the deeper water zones. Tree piles are better along shore margins as would be typical in natural settings.	We appreciate LLFN advice on these habitat features and will reallocate the distribution of boulder piles to focus them in the deeper submerged potions of the pond, and place tree piles in the shallow areas.
	Pg. 24. Document states, Excluding the aggregate extraction area, trees within the permanently wetted area will be mostly removed, but the stump rootmass will be retained in situ or pushed over to expose the roots and create a divot and hummock in the substrate. In light of comments received from the MECP, GGM may want to consider removing all organics for the foot print of the permanently wetted area prior to flooding to reduce the risk of methylmercury production.	We do not currently propose the removal of organics from the diversion pond area. In the event that this condition changes due to requirements of MECP or other agencies, then a sufficient number of stumps would be retained and mechanically repositioned and secured around the edge of the pond to meet the intent of the plan.
	Pg. 24. Document states, The riparian area along the diversion dam and east shoreline will not be vegetated with trees or deep rooting vegetation to protect the integrity of the diversion dam. It is unclear if the other shorelines of the Goldfield Creek diversion pond will be planted with trees or deep rooting vegetation to improve/increase vegetation diversity	Large woody vegetation including trees will be left and encouraged on shorelines that are not incorporated into the diversion dam. Currently we do not propose planting trees on the disturbed slopes but will promote the natural regrowth to merge with the intentionally left standing vegetation. Disturbed areas will be

Long Lake #58 Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project – Comments and Responses Section 1		
Plan Section	**Comment**	**Response**
	and/or wildlife habitat and life-cycle opportunities. Details are lacking on the holistic ecosystem approach and the resulting terrestrial/wetland habitats around the diversion pond and how it will mesh with the existing vegetation and wildlife communities.	treated with either a native wetland seedbank if available, or a wetland seed mix, along with a nurse crop to promote both short term and long-term vegetation stability. Consistent with other comments received by LLFN, seed mixes would consist of native, non-invasive species. Additional notes regarding areas of tree protection and restoration will be added to the diversion pond drawing as needed. GGM and LLFN have agreed to install and monitor the broader ecosystem features within the Biodiversity Plan.
	Pg. 25. Document states, Floodplain enhancement was a recommendation during stakeholder discussion to date, and specifically the objective to incorporate habitats that would benefit terrestrial (e.g., birds and furbearing) and semi aquatic (e.g., frogs and turtles) wildlife as well as fisheries. This is very important to LLFN and more details need to be provided, demonstrating how the entire ecosystem of the stream corridor is being designed in a holistic ecosystem approach.	Additional descriptions of the holistic ecosystem approach that GGM will integrate into the channel realignment has been provided in Section 9.2.6 of the Plan including measures such as snags, bat boxes, woody material and boulder piles. Theses measures will be integrated into the constructed floodplain which is designed to inundate regularly in flows greater that bankfull conditions. However, specific commitments for the abundance and the monitoring of such measures will need to be specified externally to this Plan as the Federal government (DFO) is unlikely to accept the monitoring of terrestrial wildlife features as a component of the Plan which is intended to specifically address impacts and offsets for fish habitat. GGM and LLFN have agreed to install and monitor the broader ecosystem features within the biodiversity management and monitoring plan.
	Pg. 25. Details are lacking on the holistic ecosystem approach and the resulting terrestrial/wetland habitats along the shoreline and littoral zone edges of the Goldfield Creek new valley and channel.	Additional descriptions of the holistic ecosystem approach that GGM will integrate into the channel realignment has been provided in Section 9.2.6 of the Plan including measures such as snags, bat boxes, woody material and boulder piles.

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		GGM and LLFN have agreed to install and monitor the broader ecosystem features within the biodiversity management and monitoring plan.
	Pg. 26. Document states, The existing Lahtis Road culverts will be replaced with new structures capable of passing the bankfull flow unrestricted, and designed to pass as a minimum the 1 in 10 year storm event without overtopping. Why is only up to the 10 year event being passed through the culvert? There is concern that this restrictive culvert size may cause downstream channel instability during larger storm events, as flows will be overtopping the road, and flow velocities through the culvert maybe quite high. We are also concerned about fish passage during all storm events. Please demonstrate that the culvert allows for fish passage.	The 10 yr design storm was selected as a compromise to provide flow conveyance for the more frequent high-water events, while maintaining a low road profile to decrease encroachment further into either the upstream pond, or the downstream riparian habitats. Additional assessment of this crossing, (including fish passage considerations) is ongoing. LLFN will be advised if a modification results.
	Pg. 26. Document states, The permanent grade control structures will develop a shallow zone of standing water similar to a beaver pond condition that will dissipate flow velocity across the wide wetted cross section, effectively mitigating the risk of significant erosion. How is significant erosion defined? How is the channel downstream of the grade control structures going to be maintained so that they are not at risk for erosion from the higher flows?	Significant erosion was in reference to the condition that may have developed if the increased flow was directed to the SWAT in absence of the grade controls causing the existing channel to degrade and widen. The downstream grade control has been placed to create the described backwater condition through the SWAT valley up to the toe of the upstream grade control. Downstream of the final grade control, the existing channel is influenced by the lake levels, and is wider than the new channel's designed cross-section. We expect that the larger cross section and backwatered lake condition will also dissipate flow and minimize the risk of erosion.
	Pg. 27. Document states, Although there will be a net increase in permanent wetted area of approximately 14.5 ha resulting from the ponds, we have not carried this value into the final offset calculation in this draft pending further discussion with DFO and MNRF on the potential that these ponds may naturalize over the long term and the corresponding wetted area may adjust naturally as well. The LLFN should	Agreed. Although we do not currently propose including the 2 SWAT grade control ponded areas as measured offsetting areas within the habitat accounting; a decision to do otherwise would include discussions with the LLFN.

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	be appraised of these discussions and have the opportunity to review any documentation resulting therefrom.	
	Pg. 27. Document states, The moderate increase in flows at closure from the TMA are expected to be accepted by the then stable channel without significant erosion. Please provide the analysis that demonstrates the channel stability under the predicted increased flows.	This statement is a remnant from earlier drafts. The proposed channel has been sized to accommodate the ultimate watershed, including the future TMF drainage at closure. Detailed hydraulic analysis will be provided with permit applications.
	Pg. 27. Document states, The analysis shows that the Southwest Arm Tributary has sufficient capacity to contain and pass the diverted Goldfield Creek flows without conflicting with existing or proposed infrastructure, with the possible exception of water management ponds (Pond M1). In this case, a flood protection berm will be incorporated into detailed design if required to isolate the creek flood flows from the pond system. We feel that flows should be isolated from the water management ponds.	We agree with LLFN and have relocated Pond M1 out of the proposed flood inundation areas.
	Pg. 28. Contingency Measures, the Document states, If the results of the monitoring required in Section 9.4.2 indicate that the offsetting measures are not completed by the date specified and/or are not functioning according to the criteria in Table 9-2, the Proponent will give written notice to DFO and shall implement the contingency measures and associated monitoring specified in Table 9-2. LLFN should receive all monitoring reports and any contingency measures implemented.	The reference to monitoring and reporting is specifically referring the requirement for GGM to communicate to and with DFO as the Federal agency responsible for administering the fisheries Act and the conditions of the Plan. GGM will work through the LLFN EAC should contingencies be required.
	Pg. 28. Contingency Measures, the Document states, Monitoring of the implemented contingency measures prelisted in Table 9-3 will follow the criteria specified in Table 10-1. The period of monitoring in Table 10-1 will be extended until the success criteria are achieved or as otherwise agreed to in writing by DFO. In the event that the overall Project schedule and timelines for offset plan implementation are changed, the monitoring timelines will be adjusted accordingly and provided in writing to DFO for	The reference to monitoring and reporting is specifically referring the requirement for GGM to communicate to and with DFO as the Federal agency responsible for administering the fisheries Act and the conditions of the Plan. GGM will work through the LLFN EAC should changes be required.

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	approval. LLFN should be involved in the monitoring of the contingency measures. This could be added as a condition of the DFO permit.	
	Pg. 29. Table 9-2: Criteria and Timing to Assess Offsetting Measures Implementation and Effectiveness Success: • Physical construction of offset measures: As-built survey demonstrate that measures are constructed as per the approved plans: Within 6 months following construction. These plans need to be submitted and approved prior to flows being diverted into the newly constructed channel. It is much more difficult to adjust any construction deficiency if flows have been diverted into the channel. • Stability of Structures: Channel banks and offset features are stable and not eroding (greater than 80% of features are considered stable). GGM should provide rational for the 80% threshold. Is this 80% from the as-built condition or between monitoring periods?	The as-built condition will be reported in the as constructed report to DFO for demonstrating that the channel was constructed as per the approved plans, and that the mitigation measures specified were implemented. Detailed quality assurance and quality control measures will be put in place by GGM for construction with the site Contractors will ensure that the channel is constructed to plan prior to diverting flows. The 80% value was selected to recognize that it can take several years for a new channel to become fully stable and vegetated; and that by design the channel will begin natural adjustments to plan and profile, resulting in localized areas of instability. The 80% criteria is to be met by the end of the 5 year monitoring period.
	Pg. 30. Table 9-3: Contingency Measures for Implementation Success: • Physical construction of offset measures: LLFN to review proposed corrective actions. • Physical function of offset measures: LLFN to review corrective actions.	The reference to monitoring and reporting is specifically referring the requirement for GGM to communicate to and with DFO as the Federal agency responsible for administering the fisheries Act and the conditions of the Plan. GGM will work through the LLFN EAC should contingencies be required.
	Pg. 30. Are any monitoring proposed to assess the success or failure of any proposed terrestrial/wetland restoration plantings along the shorelines and littoral zones of the Goldfield Creek diversion pond and the Goldfield Creek new valley and channel. Vegetation restoration and concomitant wildlife habitat restoration as we understand are to be part of the fish compensation and the LLFN position of a holistic ecosystem approach, but details are lacking.	With respect to vegetation monitoring, Table 9-2 of the Plan currently specifies that riparian vegetation cover and plantings achieve 80% coverage of area, and or survival of planted stock as a success criterion.

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	LLFN requests further information about, and commitment to, many of the issues discussed in the breakout sessions from the public consultation meetings. Most of these have not been properly discussed and explained within the Fish Habitat Compensation Plan. While recognizing that this plan is for Fish Habitat, the creation of this habitat will produce many impacts to the terrestrial habitats surrounding this work. Opportunities for creating benefit to more than only fish species presents itself in the various terrestrial habitats of the creek riparian zone and the broader channel valley, as well as the benthic and littoral zones of the ponds. Beyond the channel and habitat redesign plans included already, LLFN requests the following considerations: • When clearing vegetation for access and undertaking the channel redesign, efforts should be made to maintain standing snags to provide cavities for nesting/sheltering birds, mammals, bees and other wildlife. Snags with flaking/loose bark should also be left standing to provide roosting shelter for bats. • To reduce the risk of introducing non-native plant species when colonizing newly created riparian and littoral habitats, utilize native plants already growing on the site that will be removed for development. These can come in the form of whole plant transplants, roots, sod, seeds (collected or in seed bank soils). This material may help to colonize and stabilize the disturbed areas more quickly, and it will utilize and maintain microbiotic and macrobiotic conditions and relationships already present in the soil. • Native plants used for restoration/habitat creation activities should all be native to the region (preferably species already growing in the RAA). • Selection of native plant species used for restoration activities should consider uses by wildlife (food, shelter).	The LLFN have provided a number of bullet point recommendations in this comment that have been incorporated into the Plan or will be implemented into other site plans such as the biodiversity plan, including: • Efforts during site access and clearing to maintain standing snags to provide cavities for resting/sheltering birds, mammals, bees and other wildlife. Snags with flaking/loose bark should also be left standing to provide roosting shelter for bats; • Use of seed bank material where feasible to minimize non native species and increase restoration success; • Use of native species (native to the region where commercially available) for channel restoration plantings; • Consider species for traditional uses as well as species used by wildlife when selecting restoration specie; and, • Position tree pile in the pond shallows to provide above water habitat. Beaver will not need to be actively managed in most of the alignment, except for road crossings or other infrastructure where localized periodic management may be necessary to protect property, similar to what is currently done along the existing channels. Additional descriptions of the holistic ecosystem approach that GGM will integrate into the channel realignment have been provided in Section 9.2.6 of the Plan. GGM has agreed to incorporate more holistic ecosystem habitat features into the realigned channel such as snags, wood structure, boulder piles and bat boxes. However, it is preferred to finalize the commitments for

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	• The selection of native plants to be used in restoration/habitat creation activities should incorporate traditional uses, such as food and medicines. • GGM has provided some verbal assurances that beaver has been accounted for in the design, however specifics have not been provided. • In the development of the ponds, designs provide for "Tree Piles". LLFN requests that these Tree Piles also be designed and installed to provide above-water habitat components, such as basking for turtles and snakes, and preening stations for waterfowl. • During post-project monitoring, success criteria should also include values for wildlife, not just fish.	the abundance and the monitoring of such measures externally to this Plan as the Federal government (DFO) is unlikely to accept the monitoring of terrestrial wildlife features as a component of the Plan which is intended to specifically address impacts and offsets for fish habitat. GGM and LLFN have agreed to install and monitor the broader ecosystem features within the biodiversity management and monitoring plan.
1.10. Section 10 Conditions that Relate to Monitoring and Reporting of Implementation of Offsetting Measures	Pg. 32. Document states, The Proponent shall report to DFO on whether the offsetting measures were conducted according to the conditions of the authorization by providing the reports listed in Table 10-1. All reports are to be provided to LLFN for their review.	The reference to monitoring and reporting is specifically referring the requirement for GGM to communicate to and with DFO as the Federal agency responsible for administering the fisheries Act and the conditions of the Plan. GGM will work through the LLFN EAC on applicable report reviews.
	Pg. 33. Document states, Table 10 Physical construction of offset measures. As built survey will be conducted within 6 months of completion of off-set measures. As-constructed Report due to DFO within 6 months of construction. As per Section 1.8 pg. 20 construction reporting should be on a tighter time frame, i.e., weekly reporting.	As per previous responses, the as constructed report is typically a single document provided to DFO at completion of the work to demonstrate that the habitat was constructed as per the plan. Monitoring by onsite monitors will be conducted as part of the overall sites environmental management program, any upset conditions or malfunctions during construction would be reported immediately as per expected permit conditions and applicable environmental legislation.

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1.11. Section 11.0 Fisheries Offset Accounting and Balancing	Pg. 34. Document states, An additional 2 ha of the Southwest Arm tributary channel will be altered from its current conditions, but not seriously harmed as it is still expected to retain the resident species of fish in comparable abundance. Consequently the Southwest Arm Tributary is not included in the impact calculation. It is not clear what "altered from current conditions" entails, additional information is requested from GGM to better understand this statement. The two grade control structures will result in the flooding and altering of channel habitat. Why is this impact not or should not be accounted for?	The areas with the SWAT that will be altered include the footprints of the grade control structures, and the upstream areas that will become permanently inundated. Rather than small defined channels separating ponds, this section of watercourse will be become one large ponded segment. Although the habitat will be altered, the rational for not considering the change to be a serious harm, is that the resulting habitat will still support most species found in the watercourse, and there will be no reduction in available habitat. In fact there will be a net increase in total wetted area, but we have not claimed this to be an offsetting measure.
	Pg. 34. Document states, The offset plan will result in the development of approximately 7.5 ha of new pond habitat (GFDP) and 1.6 ha of new channel habitat for a total of 9.1 ha of newly constructed Goldfield Creek habitat. In Section 9.2.1 the report states that GFDP will create 19.17 ha of habitat, which is higher than the value listed in Section 11.0. The discrepancy between the two numbers needs to be clarified.	The correct value for the new Goldfield Creek Diversion Pond is 19.17 ha. We will ensure that the Plan consistently reflects this value.

EA = Environmental Assessment
DFO = Fisheries and Oceans Canada
ECCC = Environment and Climate Change Canada
MECP = [Ontario] Ministry of Environment Conservation and Parks
MDMER = Metal and Diamond Mining Effluent Regulations
MNRF = Ministry of Natural Resources and Forestry
EEM = Environmental Effects Monitoring

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April 1, 2019

Tc150320

Attn: Stephen Lines, M.Sc., P.Biol
Environmental Assessment and Permitting Manager
Greenstone Gold Mines

Via E-mail:

Dear Mr. Lines,

RE: Métis Nation of Ontario Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood), is pleased to provide Greenstone Gold Mines (GGM) with technical responses and clarification to the Métis Nation of Ontario (MNO), February 21, 2019 Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project. The responses to the "key comments" are provided in the text below, with responses to the Appendix A comments provide in the attached table.

KEY COMMENTS

The key comments as described in the MNO letter are provided in full below (in italics) followed by our technical response or clarification.

Key Comment No.1: Timeline of the offsetting measures and plan

The overall goal of offsetting is to balance the impacts to fish and fish habitat. Typically, there is a time lag before the balance between the impact and the offset is achieved, because it takes time for the offset to become effective. Time lags between the damage caused by the impact and the functioning of the fish habitat may range from months to years. Timing to assess the offsetting measures implementation and effectiveness is identified as up to 5 years following construction (for stability of structures, species presence, full life cycle usage and fish abundance). MNO should be involved in the assessments (year 1, 3 and 5) through the to-be-identified MNO environmental monitor. This will ensure MNO is fully apprised of GGM's goals and can reconcile those goals with the needs of MNO citizens.

Response to Key Comment No.1

We agree with the MNO that consideration of the time lag between construction of the offset measures and full function being achieved should be considered in the development and implementation of the offset plan. To this end we have ensured a positive net increase in fish habitat within the offset plan at a

ratio of approximately 3 to 1. By replacing the 7 ha of impacted habitat with 20 ha of replacement habitat the amount for fish production initially lost due to the project will be replaced sooner, and as the replacement areas naturalize further, there will be an overall increase in fish production.

An equally important consideration is that GGM plans to construct the replacement habitat as early in the Project as allowed under the required permits and approvals from both the Federal and Provincial regulators. This will decrease the time between the impacts to fish habitat, and the replacement habitat becoming naturalized and comparable to existing conditions

GGM will continue to engage with the MNO to meet the agreed upon environmental monitoring commitments.

Key Comment No.2: MNO's input in the monitoring and assessment of the offsetting measures and plan

The use of MNO traditional knowledge and input can help GGM understand whether the habitats are functioning as intended and are restored to a state that meets the needs of MNO citizens. This means that an this document should approach offsetting to ensure a 'net gain' rather than 'no net loss'. This will guarantee there is sufficient land, resources and water available for the MNO in the exercise of their rights and way of life.

GGM is approaching offsetting to allow for a 'net gain' in hectares of fish habitat. However, before finalizing the Plan, we recommend that MNO input should be sought in further development of the following:

- *Monitoring implementation of the offsetting and contingency measures, including in-water work time windows, site response plan, surface water quality and fish population and health;*
- *Participation in the preparation of the "as constructed" monitoring report and performance monitoring reports;*
- *The objectives of fisheries management, restoration priorities and the fish habitat features; and*
- *The riparian edge management design in relation to the Goldfield Creek Diversion Pond.*

Response to Key Comment No.2

GGM and Wood appreciated the opportunity to meet with the MNO on March 5th, 2019 to resolve this comment and agree that GGM and the MNO will continue to develop opportunities for the inclusion of MNO environmental monitoring and traditional knowledge participation within the implementation of the Project. Additional clarification to the individual points made above are provided to specific comments in Appendix A.

Should you have any questions regarding this scope please do not hesitate to contact the undersigned.

Yours truly,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Prepared by:

<original signed by>

Per: Mark Ruthven, C.E.T., CAN-CISEC
Head, Environmental Assessment
Senior Associate

Reviewed by:

<original signed by>

Per: Dan Russell, P.Geo.
Associate Geoscientist

Attachment

Métis Nation of Ontario Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project – Comments and Responses				
No.	**Plan Section**	**Section**	**MNO Comment**	**Response**
1	1.2 Stakeholder Consultation and Engagement	PDF page 6, Document Page 2 Likewise, there has been engagement with other stakeholders such as First Nation and Métis representatives and Provincial regulators (MNRF) during the draft plan preparation. The early consultation feedback on alternatives assessment shaped the preferred alignment for the Goldfield Creek diversion.	Indigenous groups, including the MNO, are rights holders and should be disaggregated from stakeholders. Where specific MNO input was used to shape the revised plan, it should be identified.	During the EA we heard from several communities about components and themes to incorporate into the Plan. Examples are, the removal of a two channel design within the SWAT, and incorporation of an ecosystem approach to the channel realignment to benefit both aquatic and terrestrial species. These inputs were incorporated as guiding principles rather than individual comments for the purpose of managing permit applications. However, we agree and appreciate that Indigenous groups, including the MNO, are unique from other stakeholders and value the input.
2	1.3 Background and Environmental Setting	PDF Page 6 – 8, Document Page 2 – 4	No details of Métis use of the identified watercourses was included in the environmental setting description. The MNO uses various watercourses for the exercise of their rights and way of life. Please update the environmental setting to include a reference to MNO use.	Section 1.3 will be updated as requested to include a reference to MNO use.
3	Table 1-1: Fish Species of Local Waterbodies Affected by Project Section 9.2 Scale and Description of Offsetting Measures	PDF Page 9, Document Page 5 *and* PDF Page 28-29, Document Page 24-25 The works associated with the above four offset measures will mainly contribute to local baitfish production with potential enhancements to the existing use by Walleye and Pike (Particularly in the	The summarized baseline conditions for Goldfield Creek identified Pickerel (Walleye) as a species within the waterbody (Table 1-1). Pickerel is a species of importance to MNO. Please confirm that conditions within the Goldfield Creek Diversion Valley and Channel will be conducive to Pickerel spawning including rocky shoals (boulder clusters).	We heard during the EA that that the realigned Goldfield Creek should support similar species to those that the creek and SWAT support now. To that end the realigned creek is designed to promote smaller bodied fish such as minnows and stickleback. Low numbers of Walleye were recorded in the Goldfield Creek and SWAT; although not in an abundance that would suggest a meaningful spawning run occurs.

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		diversion pond), which are highly valued recreational and sustenance species in the region.		Notwithstanding the current use of the creeks, we have incorporated rock material and channel gradients into the downstream face of two grade control structures in the lower SWAT. These two structures will provide potential Walleye habitat in the spring. An additional area of likely walleye use will be the Goldfield Creek Diversion Pond constructed at the north end of the new channel diversion. This 19 ha pond will have suitable depths, substrate and cover to support Walleye, and rock shoals have been incorporated into the design for potential spawning opportunities.
4	Figure 1-1: Project Location	PDF Page 11, Document Page 7	Caramat is represented in the incorrect location on this Figure. Caramat should be located south of highway 11. Please amend.	Figure 1 will be revised to show Caramat in the correct location.
5	5.0 Description of Proposed Works, Undertaking or Activity Likely to Result in Residual Serious Harm to fish 6.0 Serious Harm to Fish Likely to Result from the Proposed Works, Undertaking or Activity	PDF Page 19, Document Page 15 Impacts summarized in Table 6-1 reflect both serious harm to fish as per Paragraph 35 of the Fisheries Act, as well as the proposed deposition of deleterious substances into waters frequented by fish requiring Schedule 2 listing as per the MDMER. Table 6-1: Summary of Residual Serious Harm or MDMER Schedule 2 Listing	Pursuant to Applications for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations1, the residual serious harm to fish after implementation of avoidance and mitigation measures and standards requires "a quantitative description of the anticipated serious harm to fish that is likely to result from the work, undertaking or activity despite the implementation of the measures and standards referred to in section 9". GGM's summary of residual serious harm to fish in Section 5.0 is mostly descriptive. It is important to accurately characterize the residual serious harm to fish in order to estimate the consequences on fisheries productivity and, in	We agree with the MNO comment and will modify Section 5 and Section 6 to clearly separate the impacts and residual serious harm that will result from the project, and which legislation the impacts are administered by.

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			turn, to quantify the loss to be counterbalanced by the offsetting measures. Please provide an integrated Table 6-1 which addresses the residual serious harm to fish listed in both Section 5.0 and Section 6.0.	
6	7.1 Seasonal Construction Constraints	PDF page 23, Document Page 19 As such, inwater works are to be avoided between April 1 and June 15 of any given year to comply with the inwater timing constraints for spring spawning species as per MNRF Inwater work timing window guidelines (OMNR 2013); and, DFO's Ontario Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (DFO 2017). Once the initial isolation of specific areas are complete and the risk of impacting downstream habitats is removed, this timing window would no longer apply. In the event that an exemption to the specified timing window is necessary, a request for alternate work periods will be made to the MNRF and copied to DFO.	The working timing window should also take MNO's traditional knowledge into account. It should be noted that the MNO and the Proponent are currently working out the details of an MNO environmental monitor. Any information about a specified timing window could be communicated between GGM and MNO through this individual, as well as the established MNO liaison.	The current inwater timing constraints in the Plan (April 1 and June 15 of any given year) were careful derived to using the Provincial (MNRF) "Inwater work timing window guidelines" (OMNR 2013); and, Federal (DFO's) "Ontario Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat" (DFO 2017). Both guidelines base the timing windows on the individual species that reside in the waterbody, as well as on the geographic region of the work and these have generally been consistent with TK. GGM looks forward to working with the MNO environmental monitor.
7	8.3 Dates that the Measures and Standards shall be Implemented	PDF page 25, Document Page 21 The measures and standards and contingencies listed in Table 8-1 shall be implemented and/or ready for use	Pursuant to Section 27.1 (2)(g) of the Metal and Diamond Mining Effluent Regulation (MDMER), the compensation plan shall contain "…the time required to implement the plan that allows for the achievement of the plan's purpose within a	The measures and standards in Table 8-1 are associated with the construction phase of the plan and as such it would be difficult to assign specific timelines to potential upset conditions that require contingency measures

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		prior to the start of the works and maintained in a functional or prepared state until completion of the works specified in the plan.	reasonable time". GGM should specify more details about the timeline contemplated for each measure and contingency measure.	as each event would be different. The measures listed are provided to give guidance to the corrective action that will be taken if specified standards or measures are not effective or require additional controls to be added. In all cases, the duration of the contingency measure will be until the success criteria has been met. Measures to ensure achievement of the plans purpose and timing of the monitoring of measures are also provided in Section 10 of the Plan.
8	8.4.1 Monitoring of Avoidance and Mitigation Measures	PDF page 25, Document Page 21 To ensure that the measures and standards described in this plan are implemented as proposed, construction and plan implementation will be monitored by Greenstone onsite monitors or designates. Monitoring will be reported to DFO in an "as constructed" report provided within 12 months of the works being completed.	Pursuant to Section 27.1(2)(e) of the MDMER, the compensation plan shall contain "…a description of the measures to be taken to monitor the plan's implementation". MNO notes that MNO participation should be included in the monitoring of the plan implementation. It should be noted that the MNO and the Proponent are currently working out the details of an MNO environmental monitor. MNO understands that MNO would participate in the monitoring as part of the monitoring measures of the implementation of the offset and compensation plan.	The current Plan provides both the monitoring measures and the reporting conditions as required under the MDMER; but is specifically referring the requirement for GGM to communicate to and with DFO as the Federal agency responsible for administering the Fisheries Act and the conditions of the Plan. GGM is pleased that the MNO environmental monitor is being initiated and will have an active role in the plan's implementation, including monitoring."
9	8.4.2 Demonstration of Effective Implementation	PDF Page 25, Document Page 21 To demonstrate effective implementation and function of the avoidance and mitigation measures,	Pursuant to Section 27.1(2)(f) of the MDMER, the compensation plan shall contain "…a description of the measures to be taken to verify the extent to which the plan's purpose has been achieved". MNO has previously raised concerns about the	Additional detail will be added to Section 9.3 and Table 9-2 to better describe the sampling that will be conducted to verify that the new fish habitat is supporting all life

Métis Nation of Ontario Comments on the Fisheries Act, Paragraph 35(2)(b) Authorization, Offset Plan and MDMER Schedule 2 Fish Habitat Compensation Plan for the Hardrock Project – Comments and Responses				
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		GGM will maintain the following documentation and provide summaries of the documents in the "as constructed" report. Records include: A detailed photographic record from consistent vantage points and inspection reports will be kept to document measures and standards employed and their effectiveness to limit the serious harm; A record of all fish removal efforts carried out with the numbers of fish removed and relocation locations; and A record of any contingency measures that were implemented and the effectiveness of the measures.	success and accessibility of the alternate fish habitat created through the compensation and offset plan as re- establishment of fish habitats could take years and these habitats may not be used as frequently. The success criteria and the measures, i.e. to provide documentation in the "as constructed" report do not fully address the MNO's concerns – whether and when the created fish habitat would reach full ecological functionality (that is, supporting fish reproduction, growth, and survival) and whether MNO citizens would be able to continue to harvest in the area and manner as they prefer. The MNO and the Proponent are currently working out the details of an MNO environmental monitor. MNO understands that this environmental monitor/liaison would contribute to the verification of the effectiveness of the measures proposed under the offset and compensation plan. For example, fish population and fish health surveys can be conducted to verify that the changes in water quality, nutrient levels, algae abundance, and dissolved oxygen levels in Kenogamisis Lake and Southwest Arm Tributary.	stages and functions including reproduction, rearing, foraging and overwintering. With respect to the reviewer's comments regarding water quality, these attributes will be monitored under other follow-up monitoring commitment from the EA process, and environmental permit conditions. For example, detailed water quality monitoring will be a component of the provincial Environmental Compliance Approvals; and water quality, sediment quality invertebrates and fish population/health surveys will be a requirement under MDMER environmental effect monitoring (EEM).
10	8.4.3 Contingency Measures	PDF page 27, Document Page 22 Table 8-1: List of Measures and Standards, Success Criteria and Contingency Measures	The list of measures and contingency measures do not specifically address: the potential methylmercury contamination if wetland areas are flooded due to watercourse realignment as MNO citizens may use these areas for harvesting; and	The MNO is correct that Table 8-1 does not address contingencies for water quality deterioration due to the project. Similar to our response to comment 9, the Plan as required for DFO and ECCC, is necessarily focused on physical habitat and fish productivity, while water quality and potential

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			seepage or discharge from the tailings management facility in the surrounding waterbodies, which may be used by MNO citizens for harvesting. GGM should consider these issues in the list of measures and contingency measures.	contaminants are addressed in follow up monitoring commitments, and environmental permit conditions (e.g. provincial ECAs).
11	8.4.3 Contingency Measures	PDF page 27, Document Page 22 - 23 Table 8-1: List of Measures and Standards, Success Criteria and Contingency Measures Follow site response plan that is to be implemented immediately in the event of a sediment release or spill of a deleterious substance and keep an emergency spill kit on site.	Please provide more details about the site response plan in the event of a sediment release or spill of a deleterious substance. It should be noted that the MNO and the Proponent are currently working out the details of an MNO environmental monitor and an MNO liaison has been established. MNO understands that the MNO liaison would be involved in the site response plan.	The Plan references the site response plan that will be developed and in place for the entire site, and not specific to the fish habitat construction and channel diversion. It is typical for mines to have a detailed spills response plans in place during both the construction and operations phases of the project. The response plan provides a framework for how the site will identify, respond to and report any unexpected spills on site. GGM will ensure that a spills response plan, consistent with Ontario Regulation 675/98, will be in place prior to construction of the Project.
12	9.2 Scale and Description of Offsetting Measures	PDF Page 28, Document Page 24 Discussions with stakeholders to date have indicated a preference for maintaining the existing, primarily small bodied fish communities in the new offset habitats, rather than target the production of large gamefish species in the tributary… Ongoing consultation to develop the final fisheries offset plan will confirm the	MNO input should be sought in the finalization of the objectives of the habitat features and fish restoration priorities for the offset measures. It is understood that the MNO environmental monitor and MNO liaison would contribute in this respect.	The fisheries offsetting objective of maintaining small bodies fish habitats similar to the existing Goldfield Creek and SWAT channels was based on comments received from community meetings, including those with MNO, as well as the current DFO offsetting policy and guiding principles of developing in kind (similar) habitat replacement to the habitat that is being lost. We agree that the MNO Environmental Monitor and liaison will contribute to the

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		objectives of the habitat features for the offset measures described below.		plan's implementation and adaptive management reviews.
13	9.2 Scale and Description of Offsetting Measures	PDF page 29-35, Document Page 25 - 31 Table 9-2 Criteria and Timing to Assess Offsetting Measures Implementation and Effectiveness Success Table 9-3: Contingency Measures for Implementation Success	There is typically a time lag before the balance between the impact and the offset is achieved, because it takes time for the offsetting measures to become effective. Time lags between the damage caused by the impact and the functioning of the fish habitat may range from months to years, which may contribute to fisheries productivity losses. The MNO understands that timing to assess the offsetting measures implementation and effectiveness is identified as up to 5 years following construction (for stability of structures, species presence, full life cycle usage and fish abundance). MNO requires involvement in the identified assessments (year 1, 3 and 5) through the to be identified MNO environmental monitor. This will ensure MNO is fully apprised of GGM's goals and can reconcile those goals with the needs of MNO citizens.	The 5-year monitoring duration is proposed as a reasonable period to allow the channel to stabilize and mature sufficiently and demonstrate that the specified success criteria have been met. However, if after 5 years the success criteria have not been met, GGM will assess the observed results, contingency measures, and additional monitoring with DFO and MNO to ensure that the intent of the Plan is achieved. DFO will continue to hold the irrevocable Letter of Credit for the cost of the plan until such a time as it is agreed that the success criteria have been met.
14	9.2.1 Measure 1- Goldfield Creek Diversion Pond.	PDF page 29, Document Page 25 Based on stakeholder comments and input, a functional and integrated riparian edge and productive littoral zones will be developed to benefit both aquatic species and other wildlife that inhabit the creek valley… The edge management design will be finalized with stakeholder input and included in the final plan.	MNO input should be sought in the final design of the integrated riparian edge of the Goldfield Creek Diversion Pond. This input can be provided through the upcoming MNO environmental monitor and/or the MNO liaison.	A general description of the edge management objectives for the Goldfield Creek diversion Pond is provided in Section 9.2.1 of the Plan. We agree that the MNO environmental monitor would be a valued means of implementing the measures. GGM is pleased that the MNO environmental monitor is being initiated.

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15	9.2.4 Measure 4 – Valley Wide Grade Control Structures within the Existing Southwest Arm Tributary Downstream of SWP3	PDF page 32, Document Page 28 The overall effect will be that the habitat conditions in the Southwest Arm Tributary will be modified, but the resulting conditions are expected to prevent erosion, maintain the resident fish species and provide additional permanently wetted areas with fisheries values comparable to other beaver ponds and impounded habitats in the existing system.	More details should be provided for the extent of habitat modifications in the Southwest Arm Tributary.	As requested, additional detail regarding the expected habitat conditions associated with the areas above the grade controls will be provided in section 9.2.4 of the Plan.
16	10.2 Report Schedule	PDF Page 38, Document Page 34 Table 10-1 Monitoring Criteria and Reporting Schedule of Offsetting Measures Physical function of offset measures: Fish presence within the offset areas will be monitored once per summer in years 1, 3 and 5 post construction to demonstrate fish usage and abundance.	The monitoring criteria for offsetting measures should also include fish health along with upstream and downstream sites. It should be noted that the MNO and the Proponent are currently working out the details of an MNO environmental monitor and an MNO liaison has been established. Through these individuals, the MNO will track key areas of interest such as fish health (including fish tissues and organs) and population.	Similar to our response to comments 9 and 10, the Plan is focused primarily on physical habitat and fish productivity, while water quality and potential contaminants are addressed in follow up monitoring commitments, and environmental permit conditions. Likewise, fish health regarding factors such as tissue and organ conditions, and contaminants will be addressed through the MDMER EEM programs, and follow up monitoring commitment.

EA = Environmental Assessment
DFO = Fisheries and Oceans Canada
ECCC = Environment and Climate Change Canada
MECP = [Ontario] Ministry of Environment Conservation and Parks
MDMER = Metal and Diamond Mining Effluent Regulations
MNRF = Ministry of Natural Resources and Forestry
EEM = Environmental Effects Monitoring