EQUINOXGOLD
GREENSTONE MINE

Greenstone Mine
Proposed Project Change

HP-MG003-EV-136-0077_1

April 21, 2025

Date	Rev	Status		Prepared By	Checked By	Approved By
04/21/2025	**1**	**Final**	Signature:	N/A	N/A	<Original signed by>
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GREENSTONE MINE

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List of Abbreviations

amsl	above mean sea level
BMMP	Biodiversity Management and Monitoring Plan
DSM	deep soil mixing
EA	Environmental Assessment
EAA	Environmental Assessment Act
EIS	Environmental Impact Statement
GGM	Greenstone Gold Mines
GL silt	glaciolacustrine silt
IAAC	Impact Assessment Agency of Canada
LAA	Local Assessment Area
MCM	Ministry of Citizenship and Multiculturalism
MECP	Ministry of Environment, Conservation and Parks
Mt	million tonnes
OMS	Operation, Maintenance and Surveillance
PDA	Project Development Area
RAA	Regional Assessment Area
TLRU	Traditional Land and Resource Use
TMF	Tailings Management Facility

1 Introduction

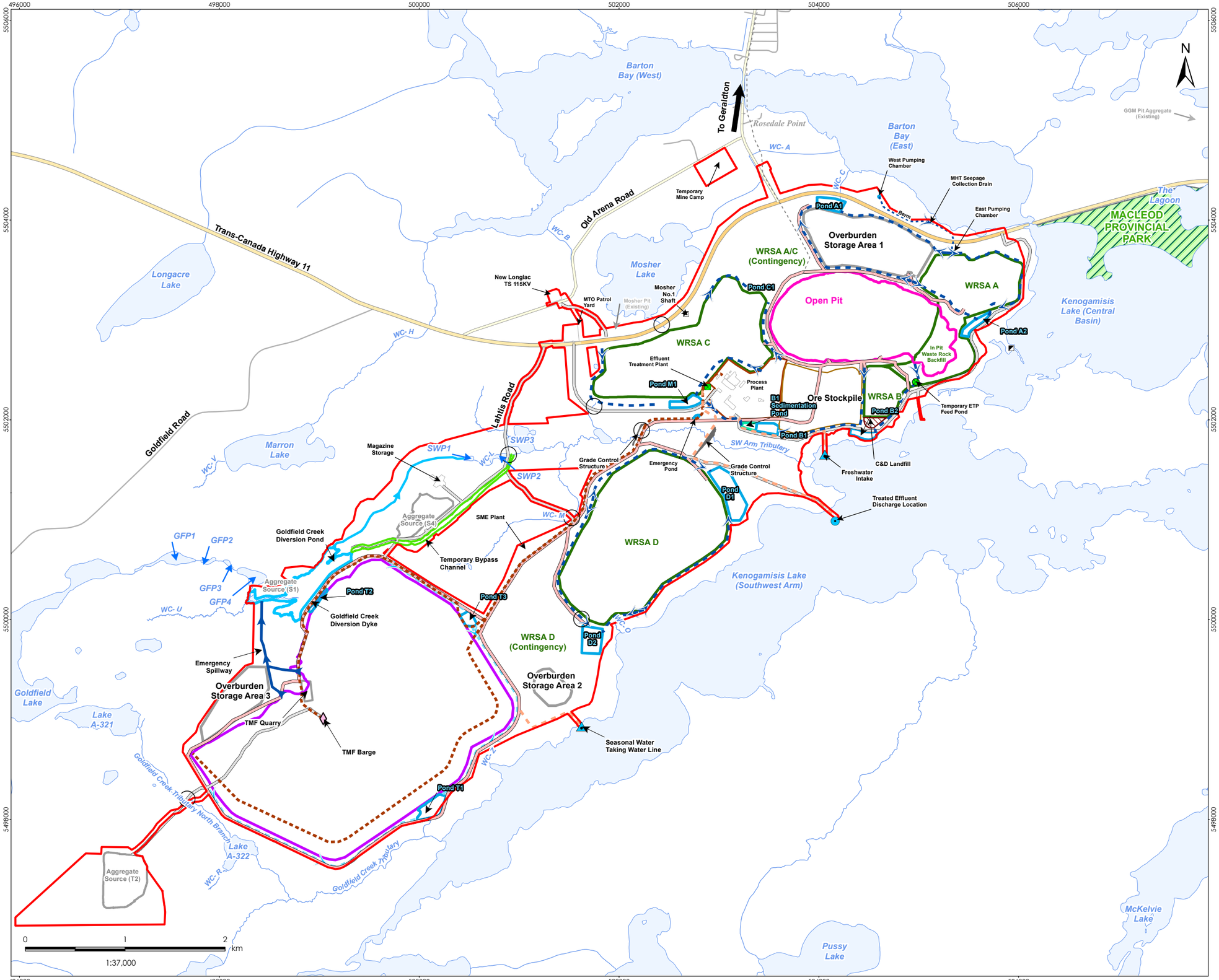
Greenstone Gold Mines GP Inc. (GGM) has constructed, is operating, and will ultimately close an open-pit gold mine and associated processing plant and ancillary facilities, known as the Greenstone Mine (also referred to as the Mine herein). The Mine is located in northwestern Ontario, approximately 275 kilometers northeast of Thunder Bay, in the Municipality of Greenstone, Ward of Geraldton.

Greenstone Mine (formerly the Hardrock Project) was subject to a federal environmental assessment (EA) under the *Canadian Environmental Assessment Act, 2012*. The Decision Statement for the Greenstone Mine's Environmental Impact Statement (EIS) was issued on December 13, 2018. The Decision Statement was amended on February 10, 2021, to account for detailed design of the Mine, and a second amendment was issued on February 28th 2025 to incorporate the temporary bypass channel. In addition to the federal EIS, GGM entered into a Voluntary Agreement with the Ministry of Environment, Conservation, and Parks (MECP) to complete a provincial individual EA under the Ontario *Environmental Assessment Act* (EAA). The provincial EA Notice of Approval to Proceed with the Undertaking under Section 9 of the EAA was issued on March 12, 2019. During the EIS/EA process, GGM provided, consulted, and conducted baseline research within the Project Development Area (PDA) and surrounding areas. The PDA is illustrated in Figure 1 and is defined as the combined Mine footprint of facility components, as well as the anticipated area of physical disturbance associated with each phase of the Project. The PDA was established based on known Mine development requirements, GGM land tenure, and Species at Risk considerations at the time.

GGM is proposing to expand the existing PDA (Figure 2) to accommodate downstream stability berms and seepage collection for the southwestern dam of the Tailings Management Facility (TMF).

GGM is also proposing to modify the reporting periods stipulated in the Federal Decision statement to better align with other provincial reporting requirements. A modified timeline would also provide sufficient time for GGM to receive analytical results from the lab before preparing the report (e.g., fish tissue sampling from the summer).

This document provides a description of the proposed changes to the Decision Statement and Project PDA, as well as summarizes the potential implications for the assessment of potential effects presented in the EIS/EA (Stantec 2017).



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Legend

- Project Development Area

Preliminary Site Plan

- Discharge Location
- Existing Mine Shaft
- Freshwater Intake
- Effluent Treatment Plant
- Temporary ETP Feed Pond
- TMF Barge
- Watercrossing
- Access Road
- Diversion Channel
- Emergency Spillways
- Haul Road
- Pipeline (Intake and Discharge)
- Seepage Collection Ditch
- Subsurface Seepage Collection System
- Contact Water Collection Ditch
- Tailings Pipeline and 13.8 kV Distribution Line
- Temporary Bypass Channel
- Aggregate Source
- Collection Ponds
- Sedimentation Pond
- Open Pit- Full Extent
- Ore Stockpile
- Process Plant Area
- Tailings Management Facility
- C & D Landfill
- Waste Rock Storage Area

Highway Realignment

- New Highway 11 Alignment

Existing Features*

- Highway
- Major Road
- Local Road
- Existing Potable Water Pipeline
- Watercourse
- Provincial Park
- Waterbody

Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

* Existing Features have been removed in the PDA and do not reflect current conditions.

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Client/Project

Greenstone Gold Mines Inc. (GGM)

Figure No.

1

Title

Master Site Plan

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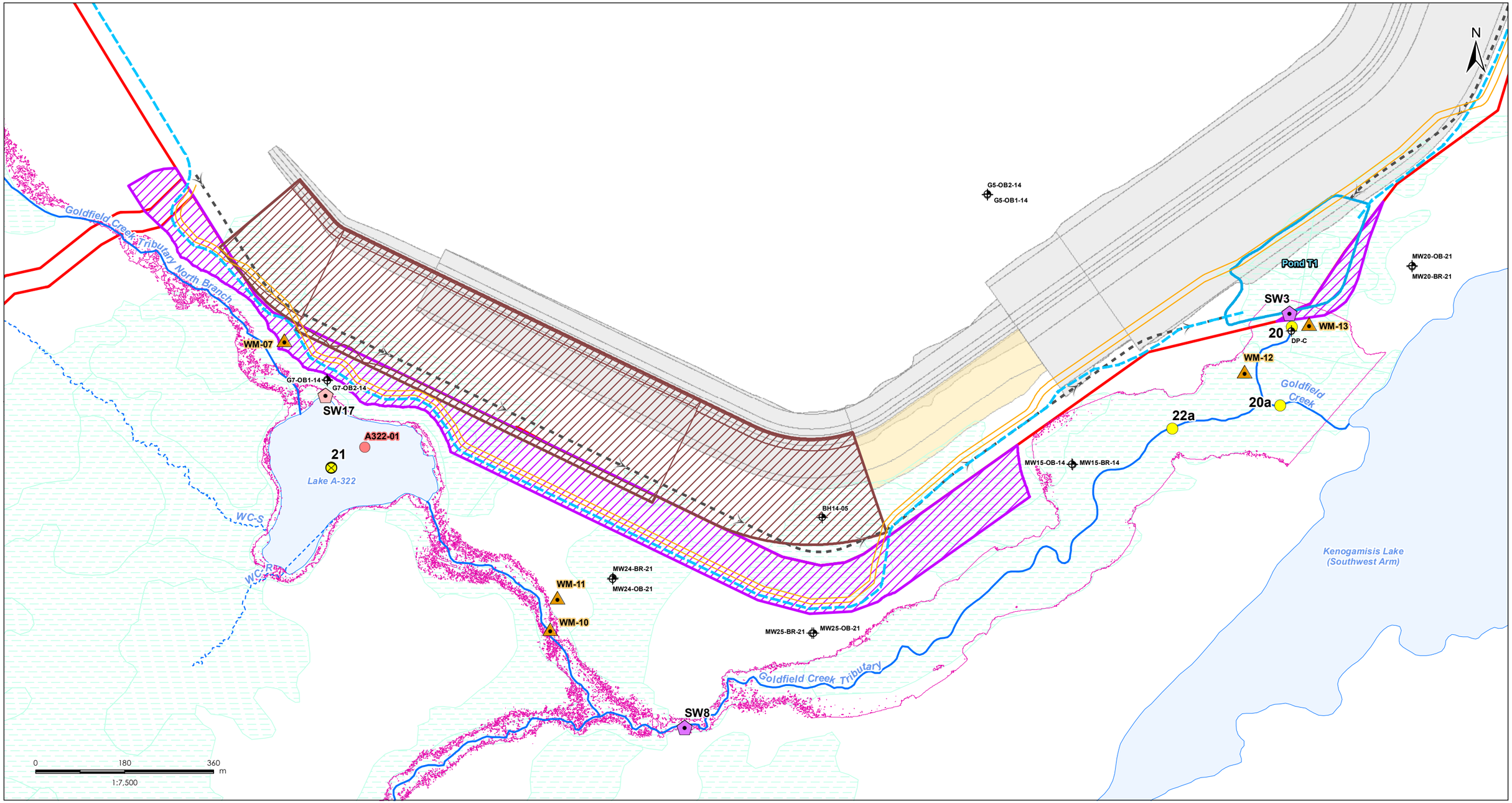

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Revised: 2025-01-30 By: bcowper

January 2025
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Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
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Legend

- Project Development Area
- Proposed PDA Expansion
- Monitoring Well
- Flow Monitoring Station
- Water Level Station
- Wetland Monitoring Location
- Sediment Sampling Station/Benthic Sampling Station
- Routine Water Quality Monitoring
- Temperature/ DO Profile
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- Wetland (Eco-Site Based)
- Collection Ponds
- 2-year Flood Plain
- Existing Seepage Collection Ditch
- Stage 1 Raise Dam and Berm
- Access Road Berm
- Proposed Ditch
- Proposed Access Road
- Stage 2 Raise Dam and Berm

Client/Project

Greenstone Gold Mines GP Inc (GGM)
Greenstone Mine

Figure No.
2

Title
Project Development Area - Proposed Expansion

2 EIS/EA Conditions

Conditions were issued by both the federal and provincial governments as part of the federal Decision Statement and the provincial Notice of Approval with respect to the EIS/EA. Both the federal and provincial conditions include requirements for notification of change to the Project.

Condition 2.14 of the federal EIS Decision Statement requires consultation with Indigenous groups and relevant authorities prior to initiating changes to the Designated Project that may result in adverse environmental effects, and shall notify the Impact Assessment Agency (IAAC) in writing no later than 60 days prior to initiating the changes. Condition 2.15 of the federal EIS Decision Statement also requires GGM to provide IAAC with a description of the potential adverse environmental effects of the changes to the Designated Project. GGM notified IAAC of the expansion of the PDA to accommodate the stability berms of the TMF on November 4, 2024. This document is part of a submission to IAAC to meet the requirements of condition 2.14 of the federal EIS Decision Statement after which a meeting will be arranged with IAAC to confirm the EIS requirements for the proposed changes.

Condition 28.1 of the provincial EA Notice of Approval requires a meeting with the Director to determine if any EAA requirements may be applicable to the proposed changes prior to implementing any proposed changes to the Undertaking. Permitting discussions with respect to the PDA expansion commenced with MECP on October 29, 2024. MECP determined that the proposed PDA expansion did not require an amendment to the provincial EA. An amendment to an Environmental Compliance Approval with the MECP will be required to complete the work.

3 Description of the Proposed Change

3.1 PDA Expansion for Tailings Management Facility

The TMF is located about 5 km southwest of the open pit and process plant and will receive approximately 145 million tonnes (Mt) of mill and historical tailings. A summary of the TMF is provided in the Technical Report on the Greenstone Mine (Equinox 2024) and as follows.

Tailings impoundment is provided by the construction of dams with a final maximum height of 35 m (365 m above mean sea level [amsl]) and crest length of about 7,400 m. The dams are being constructed primarily using waste rock from mining operations. The upstream slope of the dams comprise a low permeability compacted glacial till core keyed into low permeability foundation soils. In places, a deep soil mixing (DSM) seepage cutoff wall has been constructed to connect the core into the low permeability foundation soils. The till core, key trench and DSM wall serve as a low permeability element to mitigate seepage through the dams and their foundations. A seepage collection system is provided at the downstream toes of the ultimate planned dams to collect seepage and runoff and pump the contact water back into the TMF reservoir. The TMF dams will be periodically raised using downstream construction methodology and the core, internal filter zones and rockfill sections of the dams will be extended with each expansion.

The TMF design feasibility study was presented in Appendix K1.2 of the EIS/EA as well as geotechnical investigations (Appendix K2 of EIS/EA) that were used to support the feasibility level design of the TMF. The studies identified an over consolidated layer of interbedded silt layers in the area of the TMF dams. The TMF design feasibility study included recommendations for supplemental geotechnical investigations and laboratory testing for better definition of strength and consolidation properties of the interbedded silt layers encountered in the subsurface soils near the southwest and southeast dams.

A peer review of the TMF design feasibility study was completed and provided in Appendix K3 of the EIS/EA. The peer reviewer noted that the "interbedded silt is a glacio-lacustrine deposit which contains clay varves. While the SPT "N" values clearly indicate that the layer is over consolidated, it is possible that the layer could generate excess porewater pressure and exhibit undrained behaviour under the high loads that will exist in the future under the dam fills." It was recommended that additional geotechnical testing be carried out on the glaciolacustrine silt (GL silt) to better characterize its shear strength and porewater response characteristics and to confirm the stability assessment in the TMF design feasibility study. The recommended testing included obtaining undisturbed samples and carrying out laboratory triaxial shear testing. In Appendix K4 of the EIS/EA, the TMF design feasibility study authors agreed with the recommendations of the peer reviewer and indicated that additional testing would be completed to confirm undrained shear strength and consolidation properties of the GL silt for detailed design of the TMF.

Detailed design engineering for the TMF was completed in 2020 (Wood 2020). The recommendations from the detailed design report noted additional geotechnical investigations should be completed as part of the starter dam construction tender. The design report noted that subsurface conditions at the downstream toes are projected from the subsurface investigations mostly near the dam crest. Therefore, the subsurface conditions in the downstream toe areas required confirmation prior to construction of any raises above the starter dams. A re-assessment of the dam's stability was needed if the findings of further site investigations in the mentioned areas did not confirm the stratigraphy used in the stability analysis. GGM retained Golder Associates Ltd. to complete a technical review of the Wood 2020 design report, at which point GGM transferred the design of the TMF to Golder (now WSP).

The TMF design for the Starter Dam was finalized by WSP/Golder, and construction of the starter dams was completed in 2023 with a crest elevation of 340 m amsl. The engineer of record (EoR) from WSP provided GGM a commissioning approval letter with recommendations to undertake during initial tailings operation, which GGM has been implementing. The TMF started receiving historical tailings in January 2024 with production tailings being sent to the TMF as of April 2024. The first (stage 1) dam raise was completed in 2024 to a crest elevation of 344 m amsl. EoR recommendations are reviewed and tracked in the annual Dam Safety Inspection report. Subsequent dam raises are being designed to build the TMF to the ultimate height of 365 m amsl, with the upcoming 2025 (stage 2) dam raise to a crest elevation of 347 m amsl, and incorporate the most recent foundation information.

Several additional geotechnical investigations have been carried out since construction began to support construction activities and detailed design of future raises of the TMF dams, with additional site

investigations planned for 2025. Several test pits and drill holes were undertaken along the proposed downstream toe of the Southwest Dam, and WSP has used this information in the updated geotechnical and stability assessments. The site investigation summary for 2023 included 41 boreholes, 12 CPTs and 14 test pits, and for 2024 included 179 boreholes, 22 CPTs and 8 test pits.

These site investigation programs were designed by the EoR team (WSP) to provide additional data and characterization of the GL Silt in the foundation of the TMF. The in-situ testing and the advanced laboratory testing programs have indicated that parts of the underlying GL silt deposit are potentially liquifiable (Equinox 2024). The results and plans for these programs were presented to the ITRB for their input and comment. To be conservative, upstream rockfill stability berms were constructed for the starter dam to address post-liquified stability prior to establishment of upstream tailings beaches. Downstream rockfill stability berms were also constructed for the starter dams and Stage 1 dam raises. With each subsequent dam raise, placement of additional permanent downstream stability berms and/ or ground improvements will be required and as a result would extend the TMF footprint beyond the current, approved, PDA boundary for the southwest dam. Design drawings for the TMF stability berm and seepage collection ditch assessment are provided in Appendix A and B.

In the EIS/EA, GGM committed to, and implemented, funding an Independent TMF Review Board (ITRB) for the Mine composed of three external experts. The purpose of the ITRB is to review and advise on the design, construction, operation, performance, and closure planning for the TMF, with the objective of long-term safety and environmental protection. The ITRB was established prior to construction and provides review and advice through closure. The ITRB reviewed the results of the geotechnical investigations of the GL silt in February 2024 ITRB report (ITRB 2024) and provided recommendations that included modified stability analysis accounting for the role of the yield stress and the uncertainty in the remolded shear strength. The ultimate crest embankment design was based on a remolded shear strength of 3 Kpa, which was the lower 33 percentile of the electrical shear vane test remolded strength (from TMF foundation samples). The ITRB recommended evaluating at a lower bound of 1 kPA instead. WSP undertook a sensitivity analysis using the lower bound shear strength of 1 kPa, and the factor of safety in the stability analysis was unchanged. Stability berms and other foundation improvements proposed for shear strength of 3 kPa will also address the lower shear strength scenario of 1 kPa. Changes to the detailed design of the TMF dams are required and may include additional ground stabilization and/or stability berms to address the recommendations from the ITRB. Recommendations from the ITRB are tracked and addressed by GGM, and documented in the ITRB reports and incorporated into the TMF design reports as required.

To accommodate future dam raises that are required commencing in spring 2025, GGM is requesting to expand the PDA by 20 ha from 2,208 ha to 2,228 ha which represents a 1% expansion of the PDA. The proposed PDA expansion area is located downgradient of the TMF southwest dam as shown on Figure 2. Figure 2 also presents the extent of the Stage 2 dam raise, downstream rockfill stability berm, and the realignment of the seepage collection ditch and access road. The new seepage collection ditch will be constructed prior to decommissioning the existing seepage collection ditch.

Submission of stamped drawings and associated design documents are provided to the Ministry of Mines and ITRB on an ongoing basis, which include the glaciolacustrine stability analysis. If there is deviation from the TMF design basis memorandum, a memorandum and studies for the rationale for the deviation is provided and reviewed by the ITRB prior to the submission to the Ministry of Mines. Once constructed, as-built drawings of the dam raise are prepared and stamped by the EoR. The as-built drawings are then submitted to the Ministry of Mines.

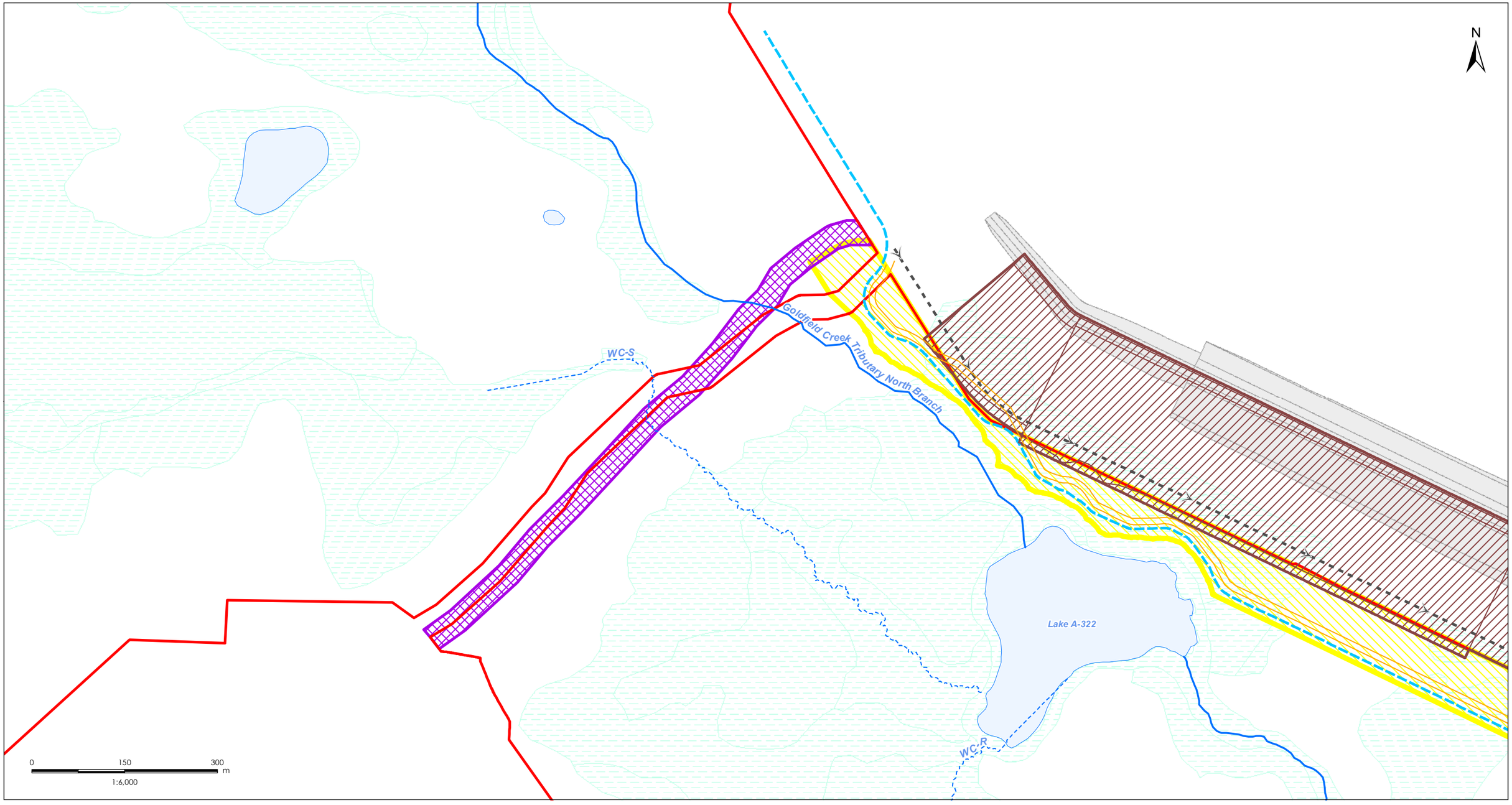
The proposed PDA expansion area is located within GGM leased lands. Specifically, the footprint of the proposed project change and PDA expansion resides within mining lease 109765.

Consistent with the EIS/EA, a set back of 30 m from the high water mark was used for marking the revised PDA boundary. The high water mark was established in the EIS/EA and for offsetting for the Project accepted by Department of Fisheries and Oceans Canada (DFO) and Environment and Climate Change Canada (ECCC) as the "top of bank". DFO defines the high water mark as follows:

> *The usual or average level to which a body of water rises at its highest point and remains for sufficient time to change the characteristics of the land. In flowing waters (e.g., rivers, streams) this refers to the "active channel/bank-full level" which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water body, bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominantly aquatic vegetation to terrestrial vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (i.e., full supply level).*

In the evaluation of the PDA boundary for this proposed Project change, both the change in vegetation and 2 year flow stage water level elevation were evaluated as the top of bank is not well defined. Ultimately the 2 year flow stage water level elevation was used to define the requested PDA expansion which was more conservative than the vegetation assessment. The use of the 2 year flow stage water level and 30 m setback means the PDA is outside the extent of fish habitat under most flow conditions and is substantially greater than the wetted area (i.e. direct fish habitat) that is available to fish at most times of the year (i.e. conservative). Details on the 2 year flow stage water level modelling is provided in Section 5.4.

In addition to the proposed changes outlined above, GGM is proposing to shift the PDA alignment that follows the access road to the T2 aggregate pit, to reflect built conditions. The road distance has not increased from that originally proposed during the EIS/EA process and the resulting shift is generally less than 25 m, except for one portion near the TMF area that is up to 50 m. Figure 2 presents the proposed shift in the PDA to accommodate the T2 aggregate pit access road.



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January 2025
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Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.

Legend

- Project Development Area
- Proposed PDA Expansion
- Road Adjustment
- Watercourse- Permanent
- Watercourse- Intermittent
- Wetland (Eco-Site Based)
- Existing Seepage Collection Ditch
- Stage 1 Raise Dam and Berm
- Proposed Ditch
- Proposed Access Road
- Stage 2 Raise Dam and Berm

Client/Project

Greenstone Gold Mines GP Inc (GGM)
Greenstone Mine

Figure No.

3

Title

Proposed PDA Adjustment (Road Alignment)

3.2 Proposed Change to Federal Reporting Timelines

Condition 1.30 of the Federal Decision Statement defines the reporting year from October 1st to September 30th for each of the reports GGM submits to IAAC. Condition 2.10 requires the annual report to be submitted to IAAC by December 31 following the reporting year to which the report applies.

GGM is proposing to amend Condition 1.30 to define the reporting year as January 1st to December 31st, and amend Condition 2.10 to change the annual report submission date to March 31st of the following year to which the report applies. GGM is not proposing to reduce the monitoring components, just the timeframe when it is reported. This will better align with the provincial reporting requirements and help reduce redundancy in reporting.

4 Consultation and Engagement

GGM is committed to on-going communication and engagement with the following Indigenous communities:

- Aroland First Nation
- Animbiigoo Zaagi'igan Anishinaabek
- Ginoogaming First Nation
- Long Lake #58 First Nation
- Métis Nation of Ontario.

In 2018, GGM established partnership agreements with each of the above listed Indigenous communities. The agreements outline the requirements of consultation during Project permitting and design changes. Furthermore, GGM actively employs five Environmental Technicians from each community who participate in the daily environmental sampling and monitoring of the Project.

GGM and their consultants have participated in meetings and engagement with the Indigenous communities throughout July 2024 to March 2025 in relation to the expansion of the PDA and project change due to the addition of downstream stability berms for the southwest dam of the TMF. Technical discussions with Indigenous communities are summarized as follows and are considered ongoing:

- 3FN (Aroland First Nation, Animbiigoo Zaagi'igan Anishinaabek, Ginoogaming First Nation)
    - July 27, 2024: Meeting to introduce the upcoming proposed project change and provide opportunity for preliminary questions and comments.
    - September 5, 2024: Meeting and site tour to review proposed project change during the Independent Tailings Review Board (ITRB) annual review and provide opportunity for questions and comments with the engineer of record and ITRB members.

  - September 20, 2024: Meeting to provide an update on design progress and approval process regarding the proposed project change.
  - December 3, 2024: Written comments provided to GGM on the Proposed Project Change Memo (HP-MG003-EV-136-0077_0). Written responses were provided April 21, 2025.
  - December 12, 2024: Meeting to discuss the flow reduction impacts on the Goldfield Creek North Branch due to proposed reduction in catchment.

- Long Lake #58 First Nation
  - July 18, 2024: Meeting to introduce the upcoming proposed project change and provide opportunity for preliminary questions and comments.
  - September 5, 2024: Meeting and site tour to review proposed project change during the Independent Tailings Review Board (ITRB) annual review and provide opportunity for questions and comments with the engineer of record and ITRB members.
  - September 24, 2024: Meeting to provide an update on design progress and approval process regarding the proposed project change.
  - December 11, 2024: Meeting to discuss the flow reduction impacts on the Goldfield Creek North Branch due to proposed reduction in catchment.
  - April 1st 2025: On site meeting between LL #58 technical consultant and the EoR to discuss the proposed changes to the TMF in the field.

- Métis Nation of Ontario
  - July 25, 2024: Meeting to introduce the upcoming proposed project change and provide opportunity for preliminary questions and comments.
  - October 8, 2024: Meeting to review proposed project change discussed during the Independent Tailings Review Board (ITRB) annual review and provide opportunity for questions and comments. Update provided on design progression and approval process.
  - December 16, 2024: Meeting to discuss the flow reduction impacts on the Goldfield Creek North Branch due to proposed reduction in catchment.
  - December 17, 2024: Written comments provided to GGM on the Proposed Project Change Memo (HP-MG003-EV-136-0077_0). Written responses were provided February 6th, 2025.
  -

Discussions and concerns expressed from the Indigenous groups to date regarding the proposed project change are summarized as follows:

- Community members reiterated their view that the Mine should avoid overprinting Lake A-322, which was also voiced during the EA consultation process and GGM continues to consider in the alternative assessment evaluation;
- General consensus it would be preferred to meet the original ultimate planned capacity of the facility by slightly expanding the footprint, if the alternative is building a new expansion cell to provide the original planned tailings capacity, which supports GGM's proposal to amend the PDA to allow buttressing to raise the dam to the original ultimate crest elevation;

- Questioned if there could be stability and ground foundation concerns for the other TMF dams, with subsequent discussions with GGM on the ground improvement measures that are required for all the other TMF dams that can be completed within the existing PDA;
- Inquiries into if there is a surveillance monitoring system in place for dam stability, such as vibrating wire piezometers, which was confirmed is documented in the TMF Operations, Maintenance and Surveillance (OMS) Manual developed in accordance with the recommendations of the Mining Association of Canada Guide to the Management of Tailings Facilities (Mining Associations of Canada 2011) and recommendations provided by the ITRB. This OMS Manual is reviewed annually by the EoR;
- Requested water quality monitoring to monitor seepage from the TMF, which already is occurring per GGM's MMMP and will continue;
- Information on the baseline characterization of habitat and wildlife and pre-construction denning/nest surveys were requested, which GGM commits to in this document;
- Long-term plans for the TMF were discussed, including addressing questions if the PDA and TMF footprint will need to be expanded again in the future and how GGM is address the foundation of other dams; and,
- Questions on construction sequencing to ensure seepage collection from the TMF will still remain in place while the seepage collection ditch is realigned, which GGM confirmed is the plan.

5 Assessment of Effects

The assessment of effects presented in the EIS/EA (Stantec 2017) for the Greenstone Mine were reviewed in comparison to the proposed expansion of the PDA to allow the addition of downstream stability berms and the realignment of the seepage collection ditch for the southwest dam of the TMF. The requested changes are not expected to result in environmental effects that exceed the conservative predictions, the conclusions related to mitigation measures, or the identification of residual effects described in the EIS/EA. A specific description of the residual effect of the expansion of the PDA and addition of stability berms and realignment of the seepage collection ditch for the southwest dam of the TMF as it relates to the 13 valued components of the EIS/EA are provided in Sections 5.1 to 5.14.

5.1 Acoustic Environment

The proposed PDA expansion to allow additional stability berms for the TMF is not expected to result in effects to the acoustic environments that exceed the conservative predictions, conclusions related to mitigation measures, or the identification of residual effects described in the EIS/EA.

The construction activities for the TMF stability berms are consistent with the construction activities for the TMF dam raises assessed in the EIS/EA and therefore no change to noise emissions are anticipated. Therefore, the addition of the TMF stability berms and associated works do not change the conclusions of the EIS/EA with respect to the acoustic environment and the characterization of residual effects summarized for the acoustic environment, as presented in the EIS/EA, remain valid.

5.2 Atmospheric Environment

The proposed PDA expansion to allow additional stability berms for the TMF is not expected to result in effects to the atmospheric environment that exceed the conservative predictions, conclusions related to mitigation measures, or the identification of residual effects described in the EIS/EA.

As the footprint of tailings in the TMF will not change and the same construction equipment is being used to construct the buttress, there will be no change in air emissions from the TMF. The loss of carbon storage due to tree removal to accommodate the entire Mine footprint was estimated in the EIS/EA to be negligible. An increase of 1% in the PDA is likewise predicted to result in a negligible loss of carbon storage. Therefore, the addition of the TMF stability berms and associated works do not change the conclusions of the EIS/EA with respect to the atmospheric environment and the characterization of residual effects summarized for the atmospheric environment, as presented in the EIS/EA, remain valid.

5.3 Groundwater

The proposed stability berms will not form part of the water or tailings containment for the TMF as the berms are being placed on ground surface adjacent and downstream to the previously planned TMF dams (WSP 2024a). As a result, the footprint of tailings will not change from that presented in the EIS/EA. The TMF seepage collection ditch will be shifted to align with the proposed PDA expansion boundary, on the downstream side of the TMF and stability berms. As the footprint of the tailings is not changing from the EIS/EA, predictions of the fate of seepage from the TMF and changes to the groundwater flow system in the area of the TMF are anticipated to remain consistent with that predicted in the EIS/EA and subsequent groundwater flow model updates that have been completed per conditions of GGM's ECA. As presented in Table 9-22 and Table 9-23 of the EIS/EA, 88% of the TMF seepage is predicted to be captured by the TMF seepage collection system with the balance of seepage discharging to Goldfield Creek Tributary (8%) and the Southwest Arm of Kenogamisis Lake (4%). Seepage from the TMF is still not predicted to discharge to Goldfield Creek Tributary North Branch or Lake A-322.

Dewatering for construction of the stability berms is not anticipated as the berms will be placed on ground surface. Construction dewatering for the TMF dams was considered in the effects assessment of the EIS/EA and was determined to be short term in duration, moderate in magnitude, and reversible with respect to hydrogeology. If construction dewatering is required, an effects assessment of the specific construction dewatering required will be completed in support of an application for a Permit to Take Water from the MECP if the taking is greater than 50 m^3/day.

Compared with the EIS/EA, the effects of the Project change on groundwater remain similar as the proposed stability berms will be constructed on existing ground surface and will not change the footprint of the tailings within the TMF. The addition of the TMF stability berms do not change the conclusions of the EIS/EA with respect to hydrogeology and the characterization of residual effects summarized for groundwater as presented in the EIS/EA remain valid. The groundwater monitoring currently in place per GGM's MMMP around the TMF, and in between the TMF and Goldfield Creek Tributary North Branch / lake A-322, is adequate to confirm and monitor against these predictions.

5.4 Surface Water

Floodplain mapping was conducted to delineate areal constraints for constructing the TMF stability berm. A one-dimensional HEC-RAS hydraulic model was developed to delineate the 2-year floodplain of Lake A-322 and Goldfield Creek North Tributary. The HEC-RAS model characterizes the North Tributary using 35 cross-sections and Lake A-322 using an additional four cross-sections. LiDAR with a 1 m resolution was used to represent the lake and the tributary in the HEC-RAS model. Additionally, checks were conducted against monitored water levels in Lake A-322. The 2-year flow rate used in the model for the North Tributary was 1.09 m^3/s and was based on Regional Regressions Analysis (Stantec, 2017).

Figure 2 presents the 2-year floodplain of Lake A-322 and Goldfield Creek North Tributary. The proposed PDA expansion boundary is set 30 m or more from the 2-year floodplain of Lake A-322 and the Goldfield Creek North Tributary for further contingency that Mine infrastructure will not be placed within the 2-year floodplain of Lake A-322 and Goldfield Creek North Tributary. The proposed PDA boundary is outside the 2-year floodplain except for a small portion near SW3 where the original PDA boundary already crossed slightly into the 2-year flood plain and was assessed as part of the EIS/EA. Therefore, the TMF stability berms will not be located within the 2-year floodplain.

The same water management strategy as that assessed in the EIS/EA for the TMF is proposed. The TMF seepage collection ditch will be realigned along the inside of the boundary of the proposed PDA expansion. The catchment of Lake A-322 and Goldfield Creek North Tributary with the existing PDA is 411 ha. The realignment of the TMF seepage collection ditch will decrease the watershed catchment of Lake A-322 and Goldfield Creek North Tributary by 20 ha or 5% compared to the PDA presented in the EIS/EA. The decrease in catchment to accommodate expansion of the PDA is minor compared to the size of the catchment assessed in the EIS/EA.

The proposed stability berms will abut the existing and planned TMF dams and will not change the containment footprint of the tailings or water within the TMF. The seepage collection ditch will be located downstream of the TMF berms and dams. Runoff from the berm and TMF dams will be collected by the seepage collection ditch, routed to seepage collection pond T1 and pumped back to the TMF. Therefore, an effect on surface water quality is not anticipated beyond that predicted in the EIS/EA. The capacity of Pond T1 has been reassessed and it was confirmed the additional catchment from the PDA expansion can be accommodated (WSP 2025). Pond T1 is located on the southeast dam.

The flow change resulting from the PDA expansion, compared to the EIS/EA, was evaluated at various locations along Goldfield Creek and for different stages of the mine's development. Monthly flow for each scenario was estimated using the regional regression developed for monthly flow in the EIS/EA, along with estimated seepage from the TMF to the creek. Table 1 summarizes monthly flow changes for different stages of Mine development with respect to the baseline conditions. The following summarizes flow changes in Goldfield Creek Tributary as a result of the PDA expansion:

- At the inlet of Lake A-322: At this location, monthly flows for the existing mine plan are predicted to be reduced by 3% from January through December by the end of operation, during active mine closure, and post-closure. In comparison, for the proposed PDA expansion, there is a 4% reduction in flow compared to baseline conditions in January and February, and a 3% reduction from March through December during the end of operation and active closure. Therefore, a 1% greater reduction in flow is predicted in January and February as a result of the PDA expansion. Flow changes during post-closure are predicted to remain similar to the existing mine plan.
- Outlet of Goldfield Creek North Tributary: At this location, the existing mine plan shows monthly flow reductions across different stages of mine development. During operation and active closure, predicted flow reductions range from 15% to 19% throughout the year compared to the baseline. In post-closure, the predicted reductions are slightly lower, ranging from 12% to 15%. For the proposed PDA expansion, predictions of flow reductions are more pronounced during operation and active closure, with reductions ranging from 19% to 24%. These reductions are higher compared to the existing mine plan. However, the predicted flow changes during post-closure remain similar to the existing mine plan, with reductions ranging from 12% to 15%. In summary, the PDA expansion results in a larger predicted reduction in flow during operation and active closure, with up to a 5% greater reduction compared to the existing mine plan, while post-closure flow changes are consistent with the existing plan.
- Outlet of Goldfield Creek Tributary: At this location, the predicted monthly flow for the existing mine plan is varied across different stages of mine development. During operation and active closure, predicted flow changes range from a 9% decrease to an 18% increase, with fluctuations throughout the year. In post-closure, predicted flow changes generally increase, with values ranging from 0% to 27%, reflecting some recovery in flow over time. For the scenario with the PDA expansion, the predicted flow changes during operation and active closure are generally lower than those in the existing mine plan, with reductions ranging from 6% to 13%. These predicted reductions are more pronounced compared to the existing mine plan, especially in the spring and summer months. The increases in predicted flow during these periods, however, are attributed to seepage from the TMF into the Goldfield Creek tributary. In post-closure, predicted flow changes are still lower than in the existing mine plan, with reductions ranging from 4% to 20%, showing a more significant decrease in flow compared to the post-closure scenario in the existing mine plan. In summary, the PDA expansion results in lower flow increases and more flow reductions during operation, active closure, and post-closure compared to the existing mine plan. The increases in predicted flow observed in the existing mine plan are primarily due to seepage from the TMF to the Goldfield Creek tributary which was assessed in the EIS/EA.

The change in the water level of Lake A-322 due to the PDA expansion is calculated based on the estimated flow change at the lake's outlet. The predicted change in the lake's water level will be less than 1 cm.

Compared with the EIS/EA, the effects of the Project change on surface water remain similar as the change in catchment for applicable watersheds is minor, the proposed infrastructure is not within the 2 year floodplain of adjacent surface water features, and contact water will be collected via the seepage collection ditch consistent with that assessed in the EIS/EA. The expansion of the PDA to accommodate the TMF berms do not change the conclusions of the EIS/EA with respect to the surface water and the characterization of residual effects summarized for surface water as presented in the EIS/EA remain valid. The surface water quality and quantity monitoring currently in Lake A-322 and Goldfield Creek Tributary, per GGM's MMMP and permit requirements, is adequate to confirm and monitor against these predictions.

Table 1 Predicted Monthly Flow Changes in Goldfield Creek Tributary

Location	Mine Plan	Mine Stage	January	February	March	April	May	June	July	August	September	October	November	December
Inlet of Lake A-322	Existing Mine Plan	Operation	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%
		Active Closure	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%
		Post Closure	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%
	With TMF Buttress	Operation	-4%	-4%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%
		Active Closure	-4%	-4%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%
		Post Closure	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%	-3%
Goldfield Creek North Tributary	Existing Mine Plan	Operation	-19%	-19%	-16%	-15%	-17%	-18%	-18%	-18%	-17%	-16%	-17%	-18%
		Active Closure	-19%	-19%	-16%	-15%	-17%	-18%	-18%	-18%	-17%	-16%	-17%	-18%
		Post Closure	-15%	-15%	-12%	-12%	-13%	-14%	-14%	-14%	-13%	-12%	-13%	-14%
	With TMF Buttress	Operation	-24%	-24%	-20%	-19%	-22%	-23%	-23%	-23%	-21%	-21%	-21%	-23%
		Active Closure	-24%	-24%	-20%	-19%	-22%	-23%	-23%	-23%	-21%	-21%	-21%	-23%
		Post Closure	-15%	-15%	-12%	-12%	-13%	-14%	-14%	-14%	-13%	-12%	-13%	-14%
Goldfield Creek Tributary	Existing Mine Plan	Operation	11%	18%	-4%	-9%	-9%	-6%	-1%	6%	-1%	-5%	-6%	-2%
		Active Closure	11%	18%	-4%	-9%	-9%	-6%	-1%	6%	-1%	-5%	-6%	-2%
		Post Closure	18%	27%	0%	-6%	-6%	-2%	3%	12%	3%	-2%	-3%	3%
	With TMF Buttress	Operation	6%	14%	-8%	-13%	-13%	-10%	-6%	2%	-5%	-9%	-10%	-6%
		Active Closure	6%	14%	-8%	-13%	-13%	-10%	-6%	2%	-5%	-9%	-10%	-6%
		Post Closure	10%	20%	-6%	-12%	-13%	-9%	-4%	5%	-4%	-8%	-9%	-4%

5.5 Fish and Fish Habitat

The proposed work will not overprint or occur within 30 m of Lake A-322, Goldfield Creek North Tributary, or other nearby watercourses. Riparian vegetation that may be considered indirect fish habitat (i.e. overhanding vegetation, woody debris) will be maintained within this 30 m set back. Therefore, the proposed PDA expansion and associated works do not change the conservative predictions or the conclusions, related to mitigation measures and the characterization of residual effects described in the EIS/EA remain valid.

5.6 Vegetation Communities

A field visit was completed in September 2024 to confirm the ecological classification of the 20 ha that are proposed to be incorporated into the PDA to accommodate the TMF berms and realignment of the TMF seepage collection ditch. Figure 4 presents the locations of the site visit observations (i.e. TMF-01 etc.) The ecological land classification of the proposed PDA expansion area was consistent with that described in the EIS/EA. The 20 ha proposed PDA expansion area is largely undisturbed and composed of native vegetation communities. Upland and wetland communities occupy 5.4 ha and 12.9 ha, respectively (Table 2, Figure 4). Upland areas are dominated by coniferous treed communities of jack pine and black spruce, which occupy 18.0% (3.6 ha), while aspen dominated deciduous communities occupy 9.0% (1.8 ha) of the proposed PDA expansion area.

Wetlands are predominately treed and composed of intermediate and rich conifer swamps covering 60.5% (12.1 ha) of the proposed area (Table 2). A small area of sparse treed fen occurs in the southeast of the proposed area and covers 3.5% (0.7 ha) of the proposed PDA expansion area (Figure 4).

Ecological communities in the proposed PDA expansion area are relatively common and widely distributed in the vegetation community Regional Assessment Area (RAA) and Local Assessment Area (LAA) presented in the EIS/EA and do not represent rare vegetation communities (MNRF 2015). No SAR or rare vegetation species were identified in the LAA during the EIS/EA which included the proposed PDA expansion area. The proposed PDA expansion area has low potential to support plant SAR and rare vegetation species.

Table 2 Summary of Ecological Land Classification in the Proposal PDA Expansion Area

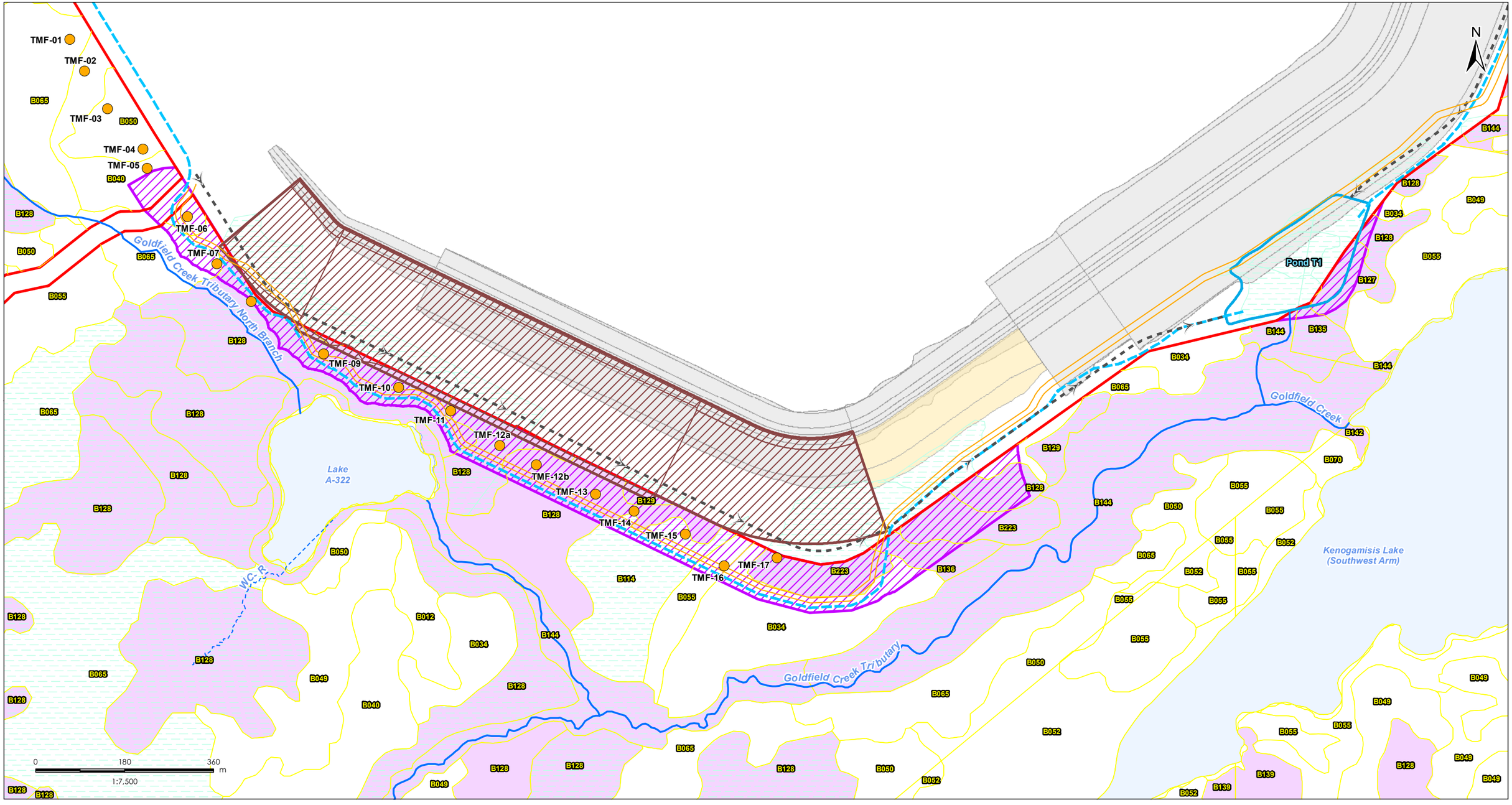
Realm	Ecosystem Class	Ecosite Code	Ecosite Name	Area (ha)	Area (%)
Upland	Upland Conifer Treed	B034	Dry, Sandy: Jack Pine - Black Spruce Dominated	1.6	8.0
		B065	Moist, Coarse: Pine - Black Spruce Conifer	0.9	4.5
		B114	Moist, Fine: Pine - Black Spruce Conifer	1.1	5.5
	Subtotal Upland Conifer Treed			*3.6*	*18.0*
	Deciduous Treed	B040	Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood	1.3	6.5
		B055	Dry to Fresh, Coarse: Aspen - Birch Hardwood	0.5	2.5
	Subtotal Upland Deciduous Treed			*1.8*	9.0
	Total Upland			**5.4**	**27.0**
Wetland	Wetland Treed	B127	Organic Poor Conifer Swamp	0.8	4.0
		B128	Organic Intermediate Conifer Swamp	8.7	43.5
		B129	Organic Rich Conifer Swamp	0.3	1.5
		B223	Mineral Intermediate Conifer Swamp	3.1	15.5
	Subtotal Wetland Treed			*12.1*	*60.50*
	Wetland Untreed	B135	Organic Thicket Swamp	0.1	0.5
		B136	Sparse Treed Fen	0.7	3.5
		B144	Organic Meadow Marsh	0.0	0.0
	Subtotal Wetland Untread			0.8	4.0
	Total Wetland			12.9	64.50
Anthropogenic	T2 Aggregate Pit Access Road (already cleared)			0.9	4.5
Grand Total				**20.0**	**100.0**

Up To 5.4 ha of merchantable crown forest may be cleared for the proposed PDA expansion area. Removal of timber on crown land may require a permit to remove trees on crown land from the Ministry of Natural Resources (MNR), which will be obtained prior to removal of timber for clearing.

Vegetation removal will be required for development of the proposed PDA expansion area. To reduce the impact to vegetation communities, mitigation measures from the EIS/EA and Biodiversity Management and Monitoring Plan (BMMP) will be implemented including the following:

- Prior to clearing all boundaries will be clearly marked with flagging tape;
- Vegetation clearing will be restricted to areas within the proposed PDA expansion area;
- Vegetation clearing will occur during winter where practicable to reduce disturbance to organic layers through machine operation;
- Use of standard forestry practices to remove merchantable timber;
- Progressive reclamation of vegetation communities and follow-up monitoring of reclaimed areas will occur as outlined in the Closure Plan Amendment (GGM 2024) and the BMMP (GGM 2022);
- Use of seed mixture and native plant species recommended in the BMMP; and
- Use of clean, coarse fill material for grading to reduce the potential for introducing or spreading non-native, or invasive plant species.

The characterization of residual effects of the development of the PDA expansion area on vegetation communities is consistent with the residual effects for vegetation communities in the EIS/EA. The removal of vegetation from the 20 ha PDA expansion area will be permanently lost.



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January 2025
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Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
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Legend

- Project Development Area
- Proposed PDA Expansion
- Ecological Land Classification Plot
- Watercourse- Permanent
- Watercourse- Intermittent
- Waterbody
- Wetland (Eco-Site Based)
- Collection Ponds
- Stage 1 Raise Dam and Berm
- Access Road Berm
- Existing Seepage Collection Ditch
- Proposed Realignment of TMF Seepage Ditch
- Proposed Access Road
- Stage 2 Raise Dam and Berm
- Eco-Site Boundary
- Wetland

Eco-Site Description

B012 – Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer
B034 – Dry, Sandy: Jack Pine - Black Spruce Dominated
B037 – Dry, Sandy: Spruce - Fir Conifer
B040 – Dry, Sandy: Aspen - Birch Hardwood
B049 – Dry to Fresh, Coarse: Jack Pine - Black Spruce Dominated
B050 – Dry to Fresh, Coarse: Pine - Black Spruce Conifer
B052 – Dry to Fresh, Coarse: Spruce - Fir Conifer
B055 – Dry to Fresh, Coarse: Aspen - Birch Hardwood
B065 – Moist, Coarse: Pine - Black Spruce Conifer
B070 – Moist, Coarse: Aspen - Birch Hardwood
B114 – Moist, Fine: Pine - Black Spruce Conifer
B127 – Organic Poor Conifer Swamp
B128 – Organic Intermediate Conifer Swamp
B129 – Organic Rich Conifer Swamp
B135 – Organic Thicket Swamp
B136 – Sparse Treed Fen
B137 – Sparse Treed Bog
B139 – Poor Fen
B141 – Open Extremely Rich Fen
B142 – Mineral Meadow Marsh
B144 – Organic Meadow Marsh
B223 – Mineral Intermediate Conifer Swamp
Water – Water

Client/Project

Greenstone Gold Mines GP Inc (GGM)
Greenstone Mine

Figure No.
4

Title
Project Development Area – Ecological Classification

5.7 Wildlife and Wildlife Habitat

The PDA will be expanded by 20 ha to accommodate the TMF stability berms and seepage collection ditch which is represented as an encroachment of about 30 to 115 m beyond the existing PDA boundary as shown in Figure 2. Within a certain proximity of existing roads, wildlife habitat such as denning locations is unlikely. Given the current state of activity along the existing PDA boundary that is proposed to be modified (i.e., TMF and TMF access road), the proposed area of expansion of the PDA is unlikely to be ideal wildlife habitat. No denning sites were identified during the September 2024 site visit.

Prior to construction, the proposed PDA expansion footprint will be swept for denning sites and other occupied habitat features and wildlife observations recorded as per the BMMP. Environmental Technicians from each Indigenous community will have the opportunity to participate in these activities.

During the construction of the TMF stability berm and realignment of the TMF seepage collection ditch there will be tree harvesting and vegetation clearing. To limit impacts to wildlife the following mitigation measures, consistent with that identified in the EIS/EA and BMMP, will be implemented:

- Delineation of clearing boundaries
- Avoid clearing during the migratory bird nesting season (May 1 to August 31) where practicable to avoid impacts to nesting migratory birds and maternal roosting bats. If clearing needs to occur in the migratory bird nesting season, bird nest sweeps will be completed to identify nesting birds per the BMMP.

5.7.1 Species at Risk

The assessment of effects for wildlife and wildlife habitat in the EIS/EA focused on a regional assessment area (RAA), local assessment area (LAA), and Project Development Area (PDA). The LAA and RAA for wildlife and wildlife habitat encompasses the proposed PDA expansion area. No wildlife species at risk (SAR) or SAR habitat has been identified in the proposed PDA expansion area and the expansion is not expected to impact SAR or SAR habitat.

5.8 Labour and Economy

The construction of the TMF dam raise in 2025 is work that was planned to occur in the original project schedule assessed in the EIS/EA. As the work is temporary, and no long-term increase in workforce demand will result as a consequence of the proposed work, no impacts to labour and economy are anticipated. Conversely, should the construction of the proposed stability berms and associated dam raises experience long delays, GGM would run of the risk of having to shut down operations of the mine until the permits were obtained to construct the southwest buttress, negatively impacting the local economy and workforce.

5.9 Community Services and Infrastructure

The proposed PDA expansion is not anticipated to impact community services and infrastructure. The work will occur on GGM mining leases and is not proposed to overlap with public or private infrastructure.

5.10 Land and Resource Use

Recreational land use opportunities pertain to hunting, fishing, use of trails, and camping. The proposed PDA expansion area is not overprinting surface water features and so effects to fishing are not anticipated. The removal of vegetation in the proposed PDA expansion area is not expected to affect the long-term persistence or viability of wildlife within the LAA and RAA and therefore opportunities for hunting are anticipated to be consistent with that predicted in the EIS/EA. There are no known trails or areas used for camping in the proposed PDA expansion area and therefore effects to use of trails or camping are not anticipated.

For commercially-based land and resource use, the harvesting area for GE022 will be reduced. In the EIS/EA the total trapping area for GE022 was identified as 13,583 ha with 2,173 ha (16%) being overprinted by the PDA. With the PDA expansion area, an additional 20 ha of the GE022 trapping area will be overprinted resulting in a 0.2% decrease in trapping area relative to that assessed in the EIS/EA.

There are no changes anticipated to navigable waters as the PDA expansion area is not overprinting surface water features.

The proposed PDA expansion area is predicted to have a negligible effect on land and resource use and is not expected to result in effects to land and resource use that exceed the conservative predictions, the conclusions related to mitigation measures, or the characterization of residual effects described in the EIS/EA.

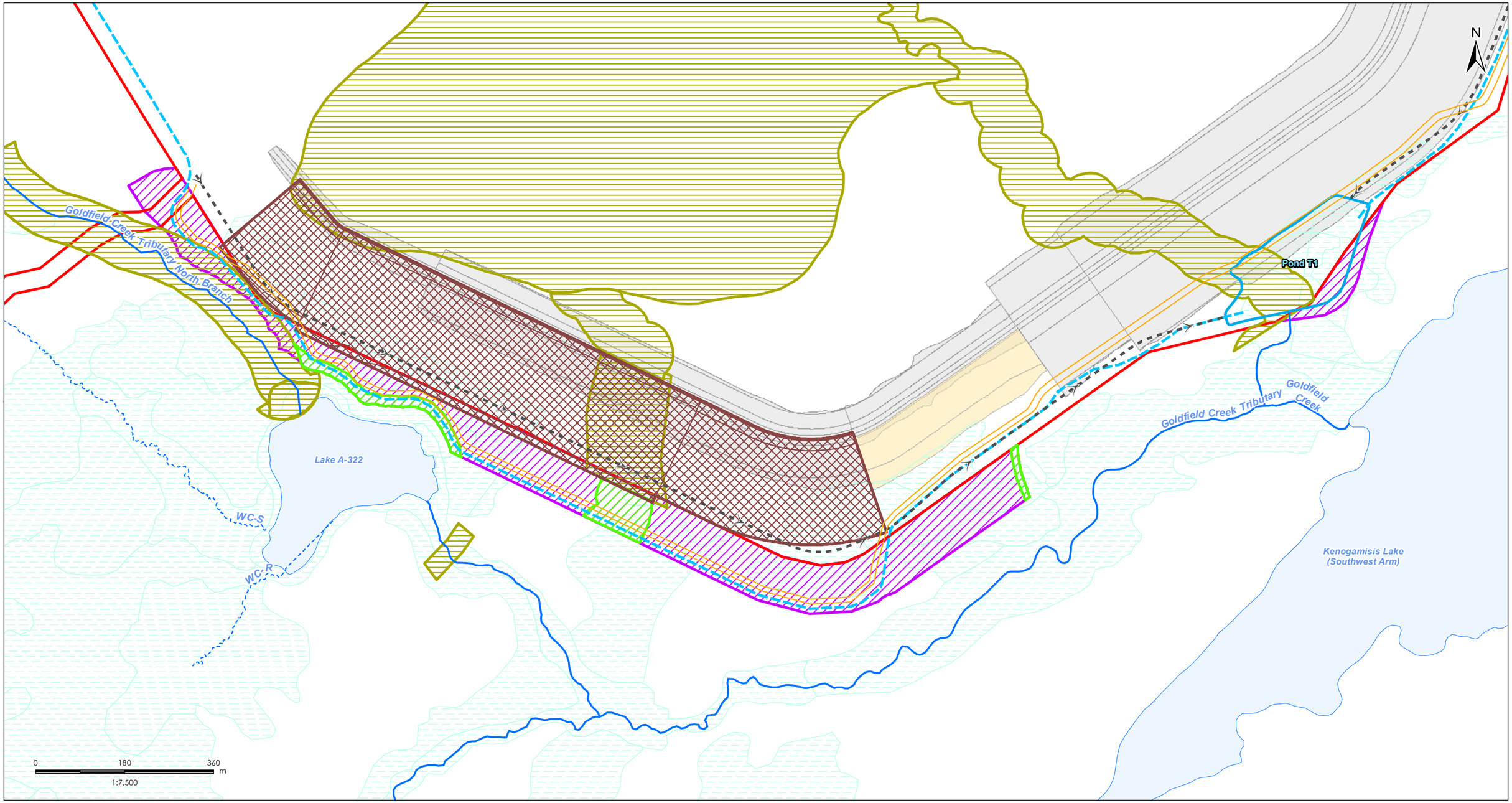
5.11 Heritage Resources

The proposed PDA expansion area was included in the Stage 1 archaeological assessment completed as part of the EIS/EA (Appendix E11 of the EIS/EA). The Stage 1 archaeological assessment was completed in accordance with the requirements of the Archaeology Program Unit of the Ministry of Citizenship and Multiculturalism (MCM) and the 2011 Standards and Guidelines for Consultant Archaeologists (Government of Ontario 2011). The Stage 1 archaeological assessment concluded that Stage 2 archaeological assessment was required along natural surface water features and roads and trails since archaeological potential was considered to exist along these features. Stage 2 archaeological assessment was completed within key areas of the Stage 1 archaeological assessment study area as part of the EIS/EA but did not include the proposed PDA expansion area. Stage 2 archaeological assessment will be completed for portions of the PDA expansion that will have ground disturbance and are located within 50 m of a watercourse or lake. Swampy or low and wet areas are considered by the MCM to have low archaeological potential, and as a matter of professional practice are not subject to physical assessment.

Figure 5 presents the location of completed Stage 2 archaeological assessment and the locations within the PDA expansion area that are within 50 m of a watercourse, relic watercourse, or trail that would require a Stage 2 archaeological assessment prior to development. The results of the Stage 2 archaeological assessment will be documented in a report and submitted to the MCM for archaeological licensing compliance review and entry into the Ontario Public Register of Archaeological Reports. If an archaeological resource is found during the Stage 2 archaeological assessment, protocols to protect or further investigate the heritage resources will be implemented as per the Archaeological Resource Management Plan (GGM 2020).

In the event of an archaeological resource chance find during construction of the works within the PDA expansion area, work will stop immediately. Protocols to protect heritage resources will be implemented in the event of a chance find as per the Archaeological Resource Management Plan (GGM 2020), which include notification to, and collaboration with, Indigenous communities.

Effects on archaeological resources will be avoided, having carried out archaeological assessment programs in areas of archaeological potential prior to ground disturbance activities. As noted, additional areas of Stage 2 archaeological assessment will be undertaken in the PDA expansion area prior to ground disturbance. Furthermore, protocols to protect archaeological resources will be implemented in the event of a chance find. Therefore, no residual adverse effect on archaeological resources is anticipated with the expansion of the PDA.



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Revised: 2025-01-30 By: bcowper

January 2025
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Legend

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- Watercourse- Permanent
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- Wetland (Eco-Site Based)
- Collection Ponds
- Existing Seepage Collection Ditch
- Stage 1 Raise Dam and Berm
- Access Road Berm
- Proposed Realignment of TMF Seepage Ditch
- Proposed Access Road
- Stage 2 Raise Dam and Berm
- Stage 2 Archaeological Assessment Required if Area is to be Developed
- Stage 2 Archaeological Assessment Completed

Client/Project

Greenstone Gold Mines GP Inc (GGM)
Greenstone Mine

Figure No.

5

Title

Project Development Area - Archaeological Assessments

5.12 Traditional Land and Resource Use

In the EIS/EA, Traditional Land and Resource Use (TLRU) locations and activities were assumed to occur within the RAA even if Indigenous communities did not specifically identify these activities or site-specific uses. The potential change to availability of plant species and access to plant harvesting sites, availability of fish species and access to fishing areas, availability of hunted and trapped species and access to hunting and trapping areas, as well as change to cultural or spiritual practices, sites, or areas was assessed as part of the EIS/EA and were considered in this proposed PDA expansion.

In the EIS/EA, residual effects were anticipated for plant gathering within the PDA. MNO identified plant harvesting locations within the PDA, AFN identified subsistence areas within the PDA, and AFN and LL#58 reported plant harvesting in the PDA, however specific locations as well as details of access were not disclosed. The PDA expansion area will result in loss of 20 ha of vegetation. The plant species are not limited to the habitat of the PDA expansion area or LAA and the vegetation communities that support these plant species are common throughout the RAA. Indigenous community members will have the opportunity to harvest plant species of interest prior to development. The removal of habitat that supports plant species of interest to Indigenous communities from the PDA expansion area is not anticipated to affect the viability of populations of these species in the LAA or RAA as defined in the EIS/EA for TLRU. Therefore, availability of plant species and access to plant harvesting sites or activities is not anticipated to be affected by the PDA expansion.

The proposed PDA expansion area is not overprinting surface water features and as a result there will be no change in availability of fish species and access to fishing areas and activities.

The PDA expansion area is not anticipated to change availability of hunted and trapped species but would reduce the area for hunting and trapping by 20 ha. Changes to patterns in access are not anticipated to be affected as a result of the PDA expansion compared to the EIS/EA as main corridors for access will be maintained with that predicted in the EIS/EA. In closure, following the completion of rehabilitation, regrowth of vegetation and return of wildlife is predicted to occur gradually over decades following rehabilitation.

There were no cultural or spiritual sites identified in the EIS/EA that are located within the proposed PDA expansion area. Access to cultural or spiritual sites will be maintained, consistent with that identified in the EIS/EA for TLRU. To limit potential for loss, displacement, or disruption of historical resources due to subsurface ground disturbance, Stage 2 archaeological assessments will be completed prior to ground disturbance within the PDA expansion area.

5.13 Human and Ecological Health

The proposed construction work for the TMF stability berms is similar to other work that has taken place at the Mine that was assessed in the EIS/EA, and is temporary and short term. Adverse effects to human health as a result of the proposed work are not anticipated.

5.14 Summary of Effects

The assessment of effects of the TMF stability berms, relocation of TMF seepage collection ditch, and associated expansion of the PDA (20 ha or 1% expansion of the existing PDA) are considered minor. The expansion of the PDA will result in minor residual effects for Vegetation Communities by way of loss of 20 ha of vegetation and Land and Resource Use and TLRU by way of a 0.2% reduction in available trapping area relative to that assessed in the EIS/EA. These additional residual effects do not exceed the conservative predictions, conclusions related to mitigation measures, or the characterization of residual effects described in the EIS/EA. The proposed PDA expansion is not expected to result in residual effects to Atmospheric and Acoustic Environments, Groundwater, Surface Water, Fish and Fish Habitat, Wildlife and Wildlife Habitat, Labour and Economy, Community Services and Infrastructure, Heritage Resources, and Human and Ecological Health not already considered in the EIS/EA.

6 Follow-Up Programs and Management and Monitoring Plans

A series of follow-up programs and management and monitoring plans were developed for the Mine to confirm the assessment of effects in the EIS/EA and to address conditions of the federal Decision Statement and the provincial Notice of Approval. This includes monitoring surface water level (SW17), flow (SW8), and quality (stations 20, 20a, 21, and 22) through Goldfield North Tributary and Lake A-322 and groundwater monitoring located downgradient of the TMF seepage collection system (G7-14, MW24-21, MW25-21, MW15-14, MW20-21). Wetland function is also monitored along Goldfield Creek North Tributary (WM-07, WM-10, WM-11, WM-12, and WM-13) and aquatic monitoring of Lake A-322 (A322-01). The locations of the monitoring stations in the area of the PDA expansion is provided in Figure 2.

Given the design of the TMF stability berms, relocation of the TMF seepage collection ditch, and associated expansion of the PDA, no modifications of the mitigation and follow-up program measures identified in the Decision Statement or Notice of Approval are necessary. Monitoring and mitigation measures for the construction of TMF stability berms are consistent with that stated in the EIS/EA and follow-up programs and management and monitoring plans with specific details addressed through the permitting process. Key aspects of the monitoring and mitigation measures as they pertain to the construction of the TMF stability berms and relocation of the TMF seepage collection ditch include the following:

- As per the BMMP (GGM 2022) sweeping the footprint of the proposed PDA expansion area for denning sites and other occupied habitat features and wildlife observations will be recorded using GGM's wildlife sighting report form. Clearing and construction crews will be notified of the feature and operational constraints to protect the occupied habitat feature. Environmental Technicians from each Indigenous community will have opportunity to participate in these activities.
- Avoid clearing activities during the migratory bird nesting season (May 1 to August 31) where practicable with clearing of vegetation during the winter to reduce disturbance to organic layers through machinery operations in frozen ground conditions. GGM's onboarding and training process

ensures staff and contractors know to report wildlife sightings to the Environment department, and that tree clearing and site preparation requires bird nest surveys during the appropriate window.

- Stage 2 archaeological assessments are to be completed for the areas of archaeological potential identified in Figure 5.
- While the potential for an archaeological find is limited during construction of the TMF stability berm and realignment of the TMF seepage collection ditch, the Archaeological Resource Management Plan (GGM 2020) chance find archaeological resource protocol (Section 6.1.2) will be implemented should an archaeological resource be identified during construction. The protocol includes notification to, and collaboration with, Indigenous communities.
- GGM will stake and flag the revised PDA boundary, if approved, so the limits of the construction area are visible and encroachment beyond the PDA is mitigated. Silt fencing, or suitable equivalent, will be placed along the length of the construction area, which will further delineate the work area.

7 Conclusion

Stability berms for the southwest dam of the TMF is critical to ongoing functioning of the TMF and Mine operations.

Condition 2.14 of the federal EIS Decision Statement requires consultation and notification to IAAC prior to initiating changes to the Designated Project that may result in adverse environmental effects. GGM notified IAAC of the proposed changes on November 4th, 2024. Condition 2.15 of the federal EIS Decision Statement requires GGM to provide IAAC with a description of the potential adverse environmental effects of the changes to the Designated Project which has been provided herein.

Condition 28.1 of the provincial Notice of Approval requires GGM to arrange a meeting with the MECP Director to determine if there are any provincial EAA requirements for the proposed changes. Based on the current stability berm design, and as the work area would be located on lands leased by GGM, no provincial EAA requirements are anticipated. However, this will be confirmed with the Director as per provincial condition 28.1 of the Notice of Approval.

GGM analyzed the proposed Project changes related to the construction of the TMF stability berm, realignment of the TMF seepage collection ditch, and expansion of the PDA and the potential adverse environmental effect of those changes. The project changes are minor in nature and the expansion of the PDA is predicted to have minor residual effect to Vegetation Communities by loss of 20 ha of vegetation during operations, and Land and Resource Use and TLRU by way of 0.2% reduction in available trapping area relative to that assessed in the EIS/EA. These additional residual effects do not exceed the conservative predictions, conclusions related to mitigation measures or characterization of residual effects in the EIS/EA. The proposed PDA expansion is not expected to result in residual effects to Atmospheric and Acoustic Environments, Groundwater, Surface Water, Fish and Fish Habitat, Wildlife and Wildlife Habitat, Labour and Economy, Community Services and Infrastructure, Heritage Resources, and Human and Ecological Health not already considered in the EIS/EA.

Modifications of the mitigation and follow-up program measures identified in the federal Decision Statement, or the management and monitoring plans identified in the provincial Notice of Approval, are not necessary.

We trust that this letter provides sufficient information for IAAC and MECP to allow GGM to construct the TMF stability berms and realigned seepage collection ditch and expand the Greenstone Mine PDA by 20 ha from 2,208 ha to 2,228 ha (1% expansion) as well as realignment of the T2 aggregate pit access road. The proposed PDA change is requested to commence as soon as feasible/permissible to allow construction of the Stage 2 dam raise stability berm for the southwest dam to commence in May 2025. If GGM is unable to meet this target, interruption or cessation of mine operation and ore processing may result.

8 Reference Documents

Equinox Gold Corp. (Equinox). (2024). Technical Report on the Greenstone Gold Mine, Geraldton, Ontario. Effective Date of June 30, 2024 and Report Date of October 1, 2024.

Government of Ontario. 2011. *Standards and Guidelines for Consultant Archaeologists*. Toronto: Ministry of Tourism, Culture and Sport.

Greenstone Gold Mines (GGM). 2020. Archaeological Resource Management Plan. Document control number: HP-GGM-EV-130-00045_0. August 19, 2020.

Greenstone Gold Mines (GGM). 2022. Biodiversity Management and Monitoring Plan. Document control number: HP-MG004-EV-130-0002_2. June 3, 2022.

Greenstone Gold Mines (GGM). 2024. Closure Plan Amendment. Document control number: HP-MG003-EV-130-0019_1. May 2024.

Independent Tailings Review Board (ITRB). 2024. Greenstone Gold Mines Inc., Hardrock Project, Geraldton, Ontario, ITRB Report No. 7. February 20, 2024.

Ministry of Natural Resources and Forestry (MNRF). 2015. Significant Wildlife Habitat Criteria Schedules. January 2015.

Stantec Consulting Ltd. (Stantec). 2017. Hardrock Project, Final Environmental Impact Statement/ Environmental Assessment Amendment, Updated in accordance with Provincial EA Approval Condition 27-2019. EA Reference number 14175, EA File Number EA-02-10. Prepared for Greenstone Gold Mines GP. Inc. Document control number HP-MG003-EV-136-0004-00_1. 2019

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood). 2020. Tailings Management Facility Design Report. Document control number: HP-EG011-342-G-268-0005_2. Prepared for Greenstone Gold Mines. October 2020.

WSP (WSP). 2024a. Greenstone Tailings Management Facility, Southwest Dam Stage 2 (2025) Raise Initial Layouts and Slope Stability Analyses. October 31, 2024. Prepared for Greenstone Gold Mines. Document Control Number HP-EG018-342-C-119-0131_2.

WSP (WSP). 2025. Southwest Dam Perimeter Ditch and T1 Seepage Collection Pond Designs Update. February 3, 2025. Prepared for Greenstone Gold Mines. Document Control Number HP-EG018-342-C-119-0134_2.

EQUINOXGOLD
GREENSTONE MINE

Appendix A
Greenstone Tailings Management Facility, Southwest Dam Stage 2 (2025)

EQUINOXGOLD
GREENSTONE MINE

Appendix B

Southwest Dam Perimeter Ditch and T1 Seepage Collection Pond Designs Update

TECHNICAL MEMORANDUM

DATE February 3, 2025 **Reference No.** HP-EG018-342-C-119-0134_2

TO Heather Brickner
Greenstone Gold Mines (GGM)

CC Braeden Connor and Kendra Button (GGM); Michael Etezad and Ken Bocking (WSP)

FROM Rafiullah Rahmani, Adriana Parada and Darrin Johnson **EMAIL** **michael.etezad@wsp.com**

SOUTHWEST DAM PERIMETER DITCH AND T1 SEEPAGE COLLECTION POND DESIGN UPDATE

1.0 INTRODUCTION

Greenstone Gold Mines (GGM) has retained WSP Canada Inc. (WSP) to provide engineering services for design and construction monitoring of the Tailings Management Facility (TMF) and associated infrastructure for the Greenstone Gold Mine.

Construction of the TMF Starter Dam was completed in 2023 and the Stage 1 Raise construction to reach a crest elevation of Elev. 344 masl was completed in October 2024. The tailings deposition is currently ongoing. The TMF Stage 2 Raise for the Year 2025 to Elev. 347 masl will require the construction of ground improvement downstream of the dams and/or flattening of the downstream slopes by extending the downstream toe berms.

A seepage collection system was constructed for the Starter Dams to collect and pump dam seepage back into the TMF. This system comprises ditches that can collect seepage and runoff and direct it to three seepage collection ponds located along the perimeter of the TMF which are T1 (Southeast Dam), T2 (West Dam) and T3 (North Dam). Specifically, the Southwest Ditch runs along the toe of the Southwest Dam (from approximately Sta. 7+300 to 4+700) and the Southeast Ditch runs along the toe of the Southeast and East Dams (from approximately Sta. 2+700 to 4+300) collecting seepage and runoff from the downstream slopes of the Southwest and Southeast/East Dams, respectively, and conveying these inflows into the T1 Seepage Collection Pond.

The current Southwest Ditch was constructed within the current Project Development Area (PDA) boundary. A new alignment of the Southwest Ditch has been designed considering a proposed new PDA boundary extension and a setback distance from Lake A-322 and its tributaries. The new PDA boundary is required to allow construction of an extended downstream toe berm for the Southwest Dam as part of the TMF Stage 2 Raise.

This technical memorandum provides the Southwest Ditch design update and a re-assessment of the T1 Seepage Collection Pond storage considering the proposed Southwest Ditch re-alignment and the corresponding re-delineation of the drainage area. The Southeast Ditch design update is provided under a separate cover.

2.0 DESIGN CRITERIA

The Southwest Ditch and T1 Seepage Collection Pond design criteria are presented in Table 1.

Table 1: Southwest Ditch and T1 Seepage Collection Pond Design Criteria

Parameter	Definition	Value	Rationale
Southwest Ditch			
Design flow	Maximum capacity of the ditch	100-year 24-hr storm event: 105.8 mm	Specified by WSP as part of the TMF Stage 1 Design (WSP 2024)
Bed slope	Minimum ditch slope required for drainage	0.5% If this cannot be met due to topographical constraints, the bed slope will be as recommended by the design engineer	Assumed criterion by WSP
Base width	Minimum base width for constructability purposes	1.0 m	Assumed criterion by WSP
Side slopes	Side slopes required for geotechnical stability	2H:1V	Assumed criterion by WSP
Freeboard	Minimum freeboard above the maximum design water level	0.3 m	Assumed criterion by WSP
T1 Seepage Collection Pond			
Dead storage	Defined as the minimum water level for pump operation	0.5 m	Assumed criterion by WSP
Seepage rate	Seepage from TMF Southwest and Southeast Dams reporting to T1 Seepage Collection Pond	0.01 m^3/s	7.44×10^{-7} $m^3/s/m$ for SW Dam for a total dam length of 2.7 km and 3.6×10^{-6} $m^3/s/m$ for SE Dam for a total length of 1.9 km (Estimated by WSP(1))

Table 1: Southwest Ditch and T1 Seepage Collection Pond Design Criteria

Parameter	Definition	Value	Rationale
Storage volume	Live volume contained in the T1 Seepage Collection Pond (seepage + surface runoff)	100-year 24-hr storm event: 105.8 mm, assumed to occur in May	Specified by Environmental Compliance Approval (ECA) No. 0231-CXVJ6H issued on December 18, 2023
Pumping rate	Rate required to pump the storage volume over a specific period of time	Pumping the 24-hr storm runoff/seepage volume plus the 13 days of runoff/seepage volume (based on the average inflow for the month of May) over 14 days	Specified by WSP as part of the TMF Design (WSP 2024)
Freeboard	Vertical distance between the T1 dyke crest and the maximum water elevations	0.3 m	Assumed
Culvert Crossing			
Design flow	Maximum capacity of the culvert	100-year 24-hr storm event: 105.8 mm	Specified by WSP

Note: (1) The seepage value previously used was 3,159 m^3/day (Wood, 2020). The estimated seepage rate for the Stage 1 design has decreased from 3,159 m^3/day (Wood,2020) to 765 m^3/day. The updated seepage value was calculated using the Seep/W software developed by Seequent and considered an improved understanding of subsurface conditions and material properties. The ultimate dam geometry and pond elevation were used in the analysis and the water flux at downstream of the dam was calculated.

3.0 DITCH DESIGN UPDATES

The updated alignment of the Southwest Ditch considering a new PDA boundary and future expansion of the TMF Southwest Dam is presented in Figure 1. The new ditch alignment will be aligned parallel to the PDA boundary from west to east for a total distance of 3,390 m with a bed slope ranging from 0.1% to 6.0%.

3.1 Capacity Assessment Methodology and Inputs

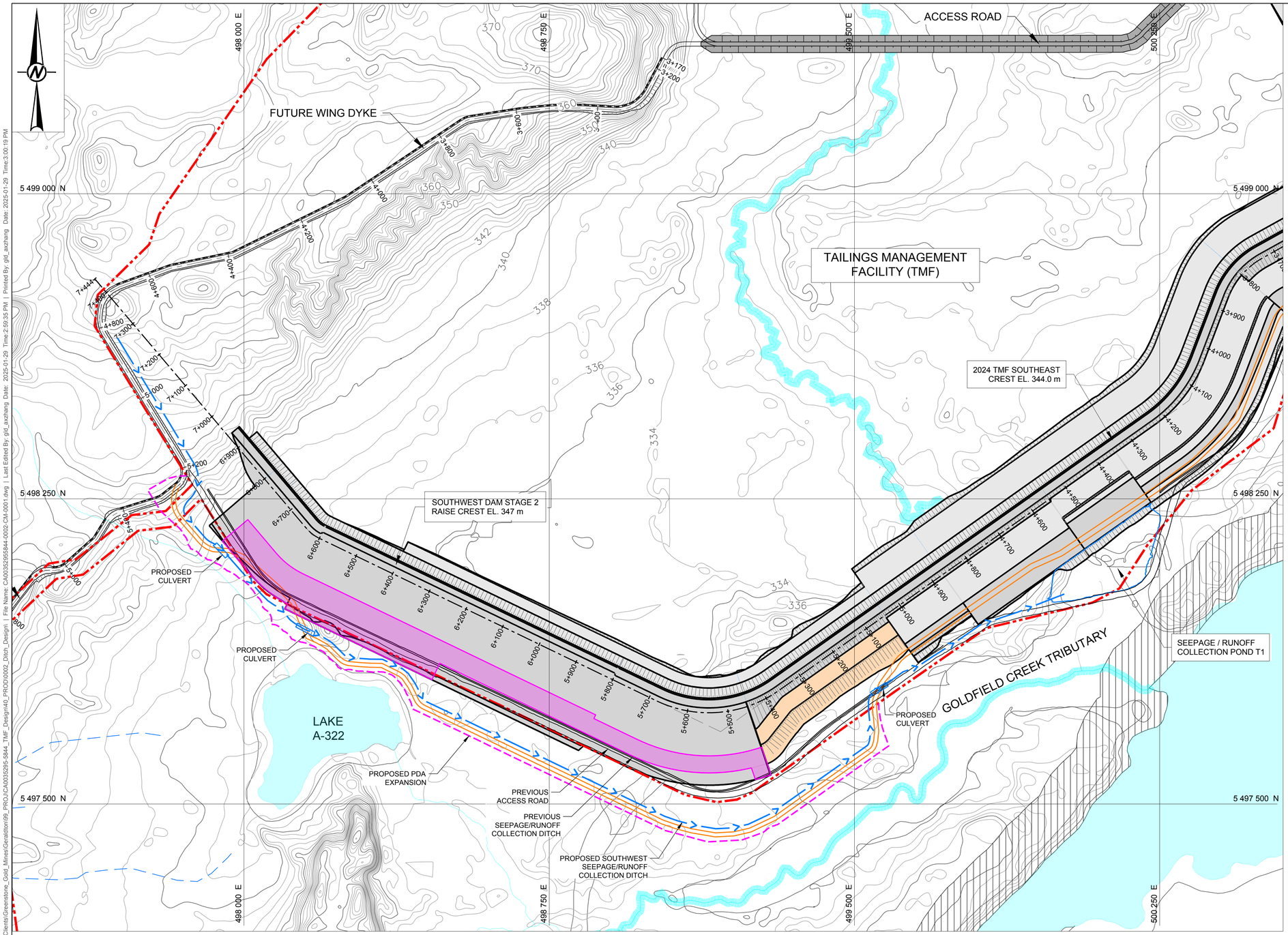
3.1.1 Hydrological Model Development

A hydrological model was developed using the HEC-HMS (Hydrologic Engineering Center Hydrologic Modelling System) software Version 4.12 (USACE 2024) for the 100-yr 24-hr storm event to assess the capacity of the updated ditch and existing T1 Seepage Collection Pond. The key inputs to the model are shown Table 2.

Table 2: Hydrological Model Inputs

ID	Catchment Areas				Lag Time (min)	SCS Curve Number	Initial Abstraction [2] (mm)
	Natural Ground Area (km^2)	Rockfill (km^2)	Pond Surface (km^2)	Total Area (km^2)			
Southwest Ditch	0.16	0.50	-	0.67	47	83.6	10
Southeast Ditch[1]	0.10	0.36	-	0.46	24	83.9	10
T1 Seepage Collection Pond	-	0.01	0.03	0.04	-	97.1	0

Note: [1] Design details of the Southeast Ditch are provided in a separate Technical Memorandum.
[2] This parameter accounts for all losses prior to runoff and consists mainly of interception, infiltration, evaporation, and surface depression storage losses.



NOTES:

1. ALL ELEVATIONS, GRID COORDINATES AND DIMENSIONS ARE IN METERS. GRID COORDINATES ARE REFERENCED TO UTM NAD 83 ZONE 16 DATUM. CONTOUR INTERVAL AT 1.0 m.
2. EXISTING GROUND CONTOURS PRODUCED FROM LIDAR FLOWN MAY 27 2014, COMPILED BY KBM RESOURCES GROUP.
3. THE PROFILE CHAINAGES REFER TO THE ULTIMATE TMF DAM CENTERLINE.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GEOTECHNICAL INVESTIGATION REPORT, DESIGN REPORTS AND TECHNICAL SPECIFICATIONS.
5. SOUTHWEST SEEPAGE/RUNOFF COLLECTION DITCH REFERENCE TO DRAWING "SOUTHWEST DAM PERIMETER DITCH PROFILE AND TYPICAL CROSS SECTION".

LEGEND:

- GROUND SURFACE CONTOUR (1 m INTERVAL)
- WATERCOURSE
- EXISTING ROADS/HIGHWAYS
- PROPOSED ROADS/HIGHWAYS
- EXISTING DITCHES
- PROPOSED DITCHES
- PDA - PROJECT DEVELOPMENT AREA
- PROPOSED PDA EXPANSION
- WETLAND
- SURFACE RIGHTS RESERVE
- CONSTRUCTION REFERENCE STATION LINE
- 120 m OFFSET FROM LAKE
- TMF DAM STAGE 1 RAISE
- ACCESS ROAD BERM
- TMF DAM STAGE 2 RAISE
- ZONE 9 TOE BERM FILL FOR POTENTIAL DSM
- PROPOSED SHEAR KEY
- POTENTIAL SHEAR KEY AREA
- PROPOSED SOUTHWEST SEEPAGE/RUNOFF COLLECTION DITCH
- PROPOSED CULVERT

0 200 400
1:4,000 METRES

CLIENT
GREENSTONE GOLD MINES

CONSULTANT
wsp

LICENSED PROFESSIONAL ENGINEER 2025-02-03 D. C. JOHNSON PROVINCE OF ONTARIO

YYYY-MM-DD	2025-01-29
DESIGNED	ME/RR
PREPARED	AZ
REVIEWED	AP/DCJ
APPROVED	KAB

PROJECT
TAILINGS MANAGEMENT FACILITY ENGINEERING AND CONSTRUCTION QUALITY ASSURANCE

TITLE
PROPOSED SOUTHWEST SEEPAGE/RUNOFF COLLECTION DITCH

PROJECT NO.	CONTROL	REV.	FIGURE
CA0035295-5844	0002	1	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

The lag time was calculated based on the time of concentration of the longest flow path for each drainage area. The time of concentration was calculated using the TR-55 method from the Natural Resources Conservation Service (NRCS) formerly known as the Soil Conservation Service (SCS) (NRCS, 2010) using a factor of 0.6 to convert time of concentration to lag time.

Infiltration losses along the flow path were simulated using the SCS Curve Number (CN) for antecedent condition II and a CN of 76 was assumed for natural ground and a CN of 86 was assumed for the rockfill areas. No losses were assumed for the pond surface.

The distribution of the storm used in the hydrological analysis corresponds to the SCS Type II, which is conservative as it has a peak with greater intensity.

The seepage inflow draining to the T1 Seepage Collection Pond considered in the hydrological model from the Southwest and Southeast Dams is 0.01 m^3/s or 765 m^3/day.

3.1.2 T1 Seepage Collection Pond

The bathymetric survey of the T1 Seepage Collection Pond was completed on October 5, 2024 and the details of the survey were provided by GGM on October 15, 2024 and December 20, 2024. The storage capacity curve for the T1 Seepage Collection Pond used in the assessment was calculated based on the berm survey information provided by GGM on October 15, 2024, to elevation 332.38 masl and the bathymetry data provided by GGM on December 20, 2024. Table 3 shows the available volume in the T1 Seepage Collection Pond considering storage losses for the extension of the Southwest Dam rockfill toe berm for the ultimate configuration into the T1 Seepage Collection Pond.

Table 3: Current T1 Seepage Collection Pond Storage Capacity

Elevation (masl)	Initial Pond Volume (m^3)	Volume Lost to Rockfill (m^3) (Note 2)	Updated Available Water Storage Volume (m^3)
329.0	0	0	0
329.5	21,152	1,438	19,714
330.0	36,754	2,597	34,157
331.0 (Note 1)	71,219	5,286	65,933
332.1 (Note 1)	110,763	8,820	101,943
332.38 (Note 1)	120,871	9,494	111,377

Notes:
(1) This value was calculated assuming linear extrapolation and side slopes of 3H:1V.
(2) Considers volume of rockfill placed in an area of approximately 5,200 m^2 across the T1 Seepage Collection Pond and 35% porosity for the rockfill is available for water storage (i.e., 65% of rockfill volume cannot store water).

3.1.3 Southwest Ditch

The hydraulic capacity of the Southwest Ditch with a total length of 3,126 m was determined using Manning's equation (Chow 1973). The parameters presented in Table 4 were used in the design calculations.

Table 4: Hydraulic Assessment Inputs

Hydraulic Structure	Manning's n	Slope Range (%)	Base Width (m)	Channel Side Slopes (XH:1V)
Southwest Ditch	0.035(1)	0.1% to 6.0%	2.0 to 3.0	2

Note: (1) Assuming the channel is lined with riprap

3.1.4 Culverts at Road Crossings

A hydraulic model was developed for the road crossing culverts shown in Figure 1 using the hydraulic analysis software HY-8 Version 7.80.0.2 (FHWA 2022) to assess flow conveyance under the design event. The input parameters used for the hydraulic model are summarized in Table 5. Figure 2 shows the typical cross-section for the culvert at the road crossing.

Table 5: Culvert Hydraulic Model Parameters

Parameter	Unit	Crossing 1	Crossing 2	Crossing 3
Peak flow	m^3/s	4.5	4.5	8.6
Road Crest Elevation	m	339.5	334.7	332.6
Road Crest Width	m	22.0	21.0	29.5
Tailwater Ditch Elevation	m	336.16	332.27	329.80
Culvert Size	mm	1,000	1,200	1,600
Number of Culverts	-	2	2	2
Culvert Inlet Invert Elevation	m	336.94	332.32	329.84
Culvert Approx Station	-	0+613	0+894	2+628
Culvert Outlet Invert Elevation	m	336.16	332.27	329.80
Road Embankment Height	m	2.0	2.2	2.6
Culvert Length	m	30	30	40
Culvert Slope	m/m	0.027	0.0015	0.0011
Culvert (Manning) Roughness	-	0.024		
Culvert Material	-	Corrugated steel pipe		

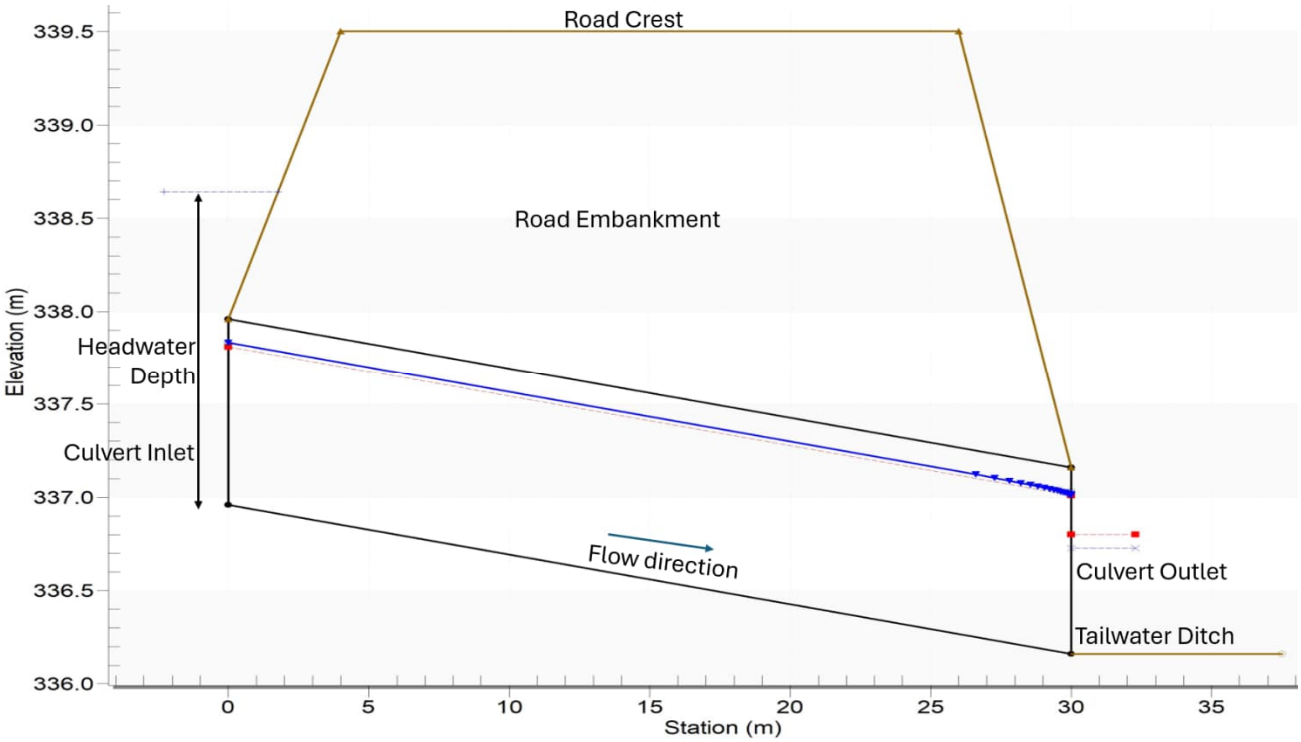


Figure 2 : Culvert at Road Crossing Typical Cross-Section

3.2 Capacity Assessment Results

3.2.1 T1 Seepage Collection Pond

The hydrological model results under the 100-yr 24-hr storm event for the updated ditches and existing T1 Seepage Collection Pond are provided in Table 6.

Table 6: Hydrological Model Results

ID	Peak Inflow (m^3/s)	Inflow Volume (m^3)
Southwest Ditch	8.6	41,990
Southeast Ditch	7.2	28,860
T1 Seepage Collection Pond	16.5	76,430[(1)]

Note: [(1)] Approximately 5,580 m^3 is from direct precipitation on the pond plus the inflow seepage/runoff volume from the Southwest Ditch and Southeast Ditch

The results of the T1 Seepage Collection Pond capacity are provided in Table 7. These results reflect using the existing T1 Seepage Collection Pond to store the inflow volume from the design event.

The total active storage volume between 329.5 masl (to account for 0.5 m of dead storage) and 332.1 masl (0.3 m below the pond crest to account for freeboard) is approximately 82,230 m^3. The results provided in Table 7 indicate that there is adequate active storage capacity in the T1 Seepage Collection Pond to store the volume from the design storm event (24-hr 100-yr storm) of 76,430 m^3.

Table 7: T1 Seepage Collection Pond Sizing

Inflow/Outflow	Parameter	Value
Inflow to the pond	13 days of seepage (m^3)	11,690
	100-yr 24-hr storm runoff plus seepage (m^3)	76,430
	13-day May runoff (m^3)(1)	81,020
	Total runoff plus seepage (m^3)	169,610
Pumping to TMF	Pump rate (m^3/hr)	550
	On-Level (masl)	329.5
Pond Volume	Initial pond volume (m^3)	19,710
	Maximum allowable (m^3)	101,940
	Maximum volume during the event (m^3)	96,600
	Final volume after 14 days of pumping (m^3)	19,370
Pond Surface Elevation	Initial (masl)	329.5
	Maximum allowable (masl)	332.1
	Maximum during the event (masl)	331.9
	Final after 14 days of pumping (masl)	329.5

Note: (1) In the detailed design (Wood 2020), this number was 19,292 m^3 equivalent to 13 days of average rainfall. This number has been updated to reflect that the design storm event occurs in the month of May with higher rainfall.

3.2.2 Southwest Ditch

The water depth and flow velocity in the Southwest Ditch under the design storm event for the seven design sections of the ditch are summarized in Table 8. The Issued for Review drawings including the Southwest Ditch profile, ditch and culvert typical cross-sections are provided in Appendix A.

Table 8: Southwest Ditch Hydraulic Assessment Results

Section	Peak Flow (m^3/s)	Peak Flow Velocity (m/s)	Slope (%)	Base Width [w] (m)	Flow Depth (m)	Minimum Channel Depth(1) [D] (m)	Riprap D50 (mm)	Riprap Thickness (mm)
1	2.0	1.9	2.5	2.0	0.4	0.7	200	400
2	2.0	2.6	6.0	2.0	0.3	0.6	300	600
3	4.5	2.6	2.9	2.0	0.6	0.9	300	600
4	4.5	2.5	2.7	2.0	0.6	0.9	300	600
5	4.5	1.5	0.7	2.0	0.8	1.1	Min. 100	Min. 200
6	6.2	1.0	0.2	2.0	1.4	1.7	Min. 100	Min. 200
7	8.6	0.9	0.1	3.0	1.6	1.9	Min. 100	Min. 200

Note: (1) Includes 0.3 m of freeboard

3.2.3 Culverts at Road Crossings

The results of the hydraulic analysis for the culvert crossings under the design event (i.e., 100-yr, 24-hr storm event) are summarized in Table 9.

Table 9: Results of Culvert Hydraulic Analysis

Crossing	Peak Discharge (m^3/s)	Culvert Diameter (mm)	Number of Culverts	Headwater Depth (m)	Outlet Depth (m)	Outlet Velocity (m/s)
1	4.5	1,000	2	1.7	0.9	3.2
2	4.5	1,200	2	1.8	1.2	2.0
3	8.6	1,600	2	2.2	1.6	2.2

The headwater elevation will be 0.7 m above the obvert at the culvert inlet for the first crossing, 0.6 m above the obvert at the culvert inlet for the second crossing, and 0.6 m above the obvert at the culvert for the third crossing. The inlet section and outlet sections of the culverts were designed deeper to avoid any overflowing from backwater effects in the ditches.

4.0 PROPOSED CHANGES TO ENVIRONMENTAL COMPLIANCE APPROVAL

Please find proposed changes to the Environmental Compliance Approval (ECA) No. 0231-CXVJ6H issued on December 18, 2023. Please note deletions are shown with ~~strikethrough~~, additions are shown in ***bold italics***.

List of Sewage Works

One (1) T1 Runoff and Seepage Collection Pond bordering the south side of the ~~East and~~ Southeast ~~Starter~~ Dam ***partially filled with rockfill***, contained by the TMF perimeter Access Road and having a ***total*** capacity of ~~83,143~~ ***111,377*** m^3, sufficient to contain the 100-yr return period 24-hr precipitation event without overtopping. Water collected in the seepage collection pond above ~~329.7~~ ***329.5*** masl is to be pumped out with a submersible pump (one duty one standby) located at the north end of the pond, with a minimum capacity of ~~412~~ ***550*** m^3/h via a ~~200~~ ***300*** mm discharge pipeline into the TMF;

Schedule A – Table A (Table 10***)***

Table 10: Table A: Summary of Seepage Collection Pond Performance Levels

Pond	Berm Crest Elevation (masl)	Pond Capacity (m3)	Minimum Operating Level (masl)	Maximum Operating Level (masl)
T1	~~330.5~~ ***332.38***	~~*83,143*~~ ***111,377***	~~329.0~~ ***329.5***	~~330.0~~ ***332.1***

5.0 CLOSURE

We trust this technical memorandum meets your present requirements. Please contact the undersigned if you have any questions or require any clarification.

WSP Canada Inc.

Rafiullah Rahmani
Water Resources Consultant

Adriana Parada, M.Eng., P.Eng.
Principal Water Resources Engineer

Darrin Johnson, P.Eng.
Senior Principal Geotechnical Engineer

RR/AP/ME/KAB/DCJ/sv

REFERENCES

Chow V. T. 1993.Open Channel Hydraulics, McGraw Hill Book Co. Inc., New York, 1973.

Federal Highway Administration (FHWA). HY-8 Software Version 7.80.0.2. Released on November 22, 2022.

Natural Resources Conservation Service (NRCS). 2010. Chapter 15 Time of Concentration. Part 630 Hydrology – National Engineering Handbook. United States Department of Agriculture. May 2010

Ontario Ministry of the Environment, Conservation and Parks (MECP) 2023, Environmental Compliance Approval, Greenstone Gold Mines GP Inc., Reference Number 5606-CXTQZ, Draft, December 8, 2023.

WSP Canada Inc. (WSP). 2024(a). Greenstone Tailings Management Facility – Design Basis Memorandum, Technical Memorandum. Rev 1, Reference No. HP-EG018-000-G-119-0062_1. March 7, 2024.

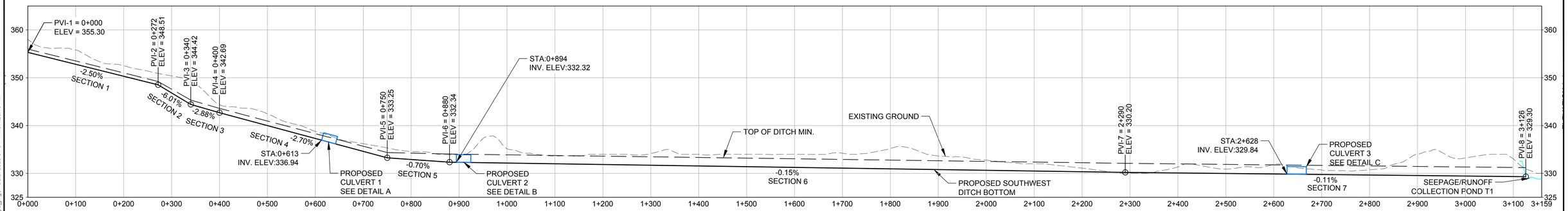
WSP Canada Inc. (WSP). 2024(b). Greenstone Tailings Management Facility – Southwest Dam Perimeter Ditch and T1 Seepage Collection Pond Designs Update, Technical Memorandum. Rev 1, Reference No. HP-EG018-342-G-119-0134_1. October 29, 2024.

U.S. Army Corps of Engineers - USACE (2024). Hydrologic Engineering Center Hydrological Modelling System (HEC-HMS). Version 4.12. May 2024.

Wood. 2020. Hardrock Mine Detailed Engineering – Geraldton, Ontario - Tailings Management Detailed Design Report, Document No. HP-EG011-342-G-268-0005 2, October 2020.

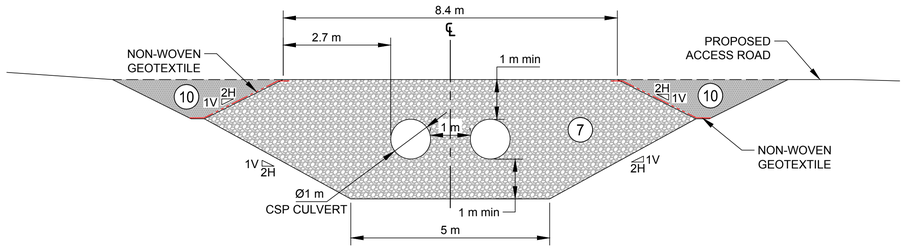
APPENDIX A

Drawings

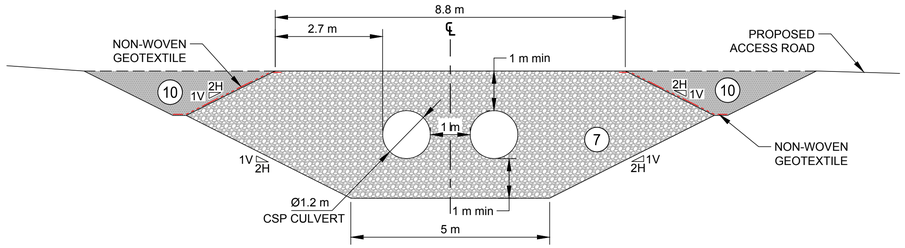


SOUTHWEST DITCH PROFILE

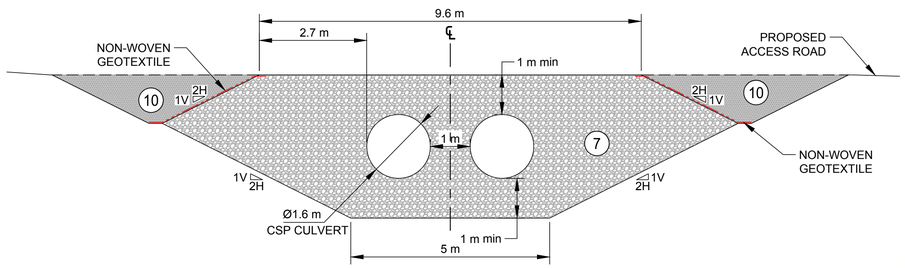
SCALE 1:4,000 m



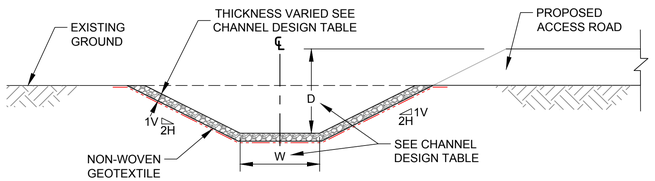
SCALE 1:75 m (A) TYPICAL CROSS-SECTION OF CULVERT 1



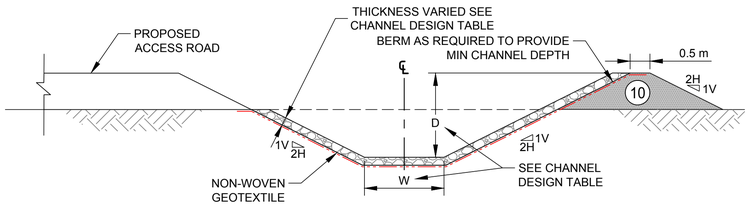
SCALE 1:75 m (B) TYPICAL CROSS-SECTION OF CULVERT 2



SCALE 1:75 m (C) TYPICAL CROSS-SECTION OF CULVERT 3



SCALE 1:75 m (E) TYPICAL CROSS SECTION OF SOUTHWEST DITCH-2 (STA. 0+643 TO 0+894 & 2+668 TO 3+126)



SCALE 1:75 m (D) TYPICAL CROSS SECTION OF SOUTHWEST DITCH-1 (STA. 0+000 TO 0+613 & 0+924 TO 2+628)

SETOUT TABLE

POINT No.	EASTING (m)	NORTHING (m)	ELEVATION (m)
PVI-1	497689.47	5498645.13	355.300
PVI-2	497830.95	5498412.82	348.510
PVI-3	497866.32	5498354.75	344.420
PVI-4	497887.63	5498299.76	342.690
PVI-5	498028.44	5498032.08	333.250
PVI-6	498123.50	5497944.92	332.340
PVI-7	499367.50	5497527.40	330.200
PVI-8	499985.01	5498004.00	329.300

CHANNEL DESIGN

SECTION	BASE WIDTH [W] (m)	MINIMUM CHANNEL DEPTH [D] (m)	RIPRAP THICKNESS (m)	RIP RAP TYPE
1	2.0	0.7	0.4	5A
2	2.0	0.6	0.6	5A
3	2.0	0.9	0.6	5A
4	2.0	0.9	0.6	5A
5	2.0	1.1	0.2	5
6	2.0	1.7	0.2	5
7	3.0	1.9	0.2	5

0 2.5 5
1:75 METRES

0 200 400
1:4,000 METRES

LEGEND

- TOP OF DITCH
- EXISTING SRUFRACE
- PROPOSED SOUTHWEST DITCH BOTTOM
- 542 g/m² NON-WOVEN GEOTEXTILE

CONSTRUCTION MATERIALS

- (5) LOW RIP RAP (D50=0.1m)
- (5A) MEDIUM RIP RAP (D50=0.3m)
- (7) SAND AND GRAVEL (75mm MINUS)
- (10) ESKER AND OVERBURDEN SOIL (200mm MINUS)

NOTE(S)

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED.
2. GRID COORDINATES ARE REFERENCED TO UTM NAD83 ZONE 16 DATUM.
3. EXISTING GROUND CONTOURS PRODUCED FROM LIDAR FLOWN MAY 27 2014, COMPILED BY KBM RESOURCES GROUP.
4. PRIOR TO CONSTRUCTION, THE EXISTING GROUND SHALL BE SURVEYED AND SUBMITTED TO THE ENGINEER. CONSTRUCTION SHALL NOT PROCEED UNTIL THE ENGINEER HAS REVIEWED AND APPROVED THE EXISTING GROUND SURVEY.
5. THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE TECHNICAL SPECIFICATIONS.
6. CONTRACTOR SHALL BE RESPONSIBLE FOR SURVEY CONTROL DURING CONSTRUCTION. CONTRACTOR SHALL SURVEY THE EXISTING GROUND SURFACE PRIOR TO ANY EXCAVATION AND SHALL MAINTAIN A CONTINUOUS SURVEY RECORD OF CONSTRUCTION FOR AS-BUILT PURPOSE.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR CONSTRUCTING ANY TEMPORARY ACCESS ROADS WHERE REQUIRED AND FOR MAINTAINING EXISTING ACCESS ROADS USED DURING CONSTRUCTION. THE OWNER SHALL APPROVE THE LOCATION OF THE TEMPORARY ACCESS ROADS.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, CONSTRUCTION, MAINTENANCE AND PERMITTING OF ALL TEMPORARY COFFERDAMS, DEWATERING SYSTEMS, PUMPING FACILITIES, AND THE LIKE REQUIRED FOR THE SATISFACTORY MANAGEMENT OF WATER ON THE SITE TO PERMIT CONSTRUCTION IN DRY CONDITIONS.
9. THE CONTRACTOR SHALL REMOVE FROM WITHIN THE LIMITS OF CONSTRUCTION, ALL BOULDERS, ORGANICS, SNOW, ICE, WET, SOFT, VERY LOOSE AND OTHER UNSUITABLE MATERIALS. THE EXPOSED SUBGRADE SHALL CONSIST OF COMPETENT OVERBURDEN.

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2025-01-31	ISSUED FOR CONSTRUCTION	RR	AZ/JG	DCJ	KAB
A	2025-01-07	ISSUED FOR REVIEW	RR	AZ/MM	DCJ	KAB

SEAL

LICENCED PROFESSIONAL ENGINEER
2025-03-03
D. C. JOHNSON
PROVINCE OF ONTARIO

CLIENT
GREENSTONE GOLD MINES

CONSULTANT
WSP Canada Inc.
6925 Century Avenue, Suite #600, Mississauga
ONTARIO, L5N 7K2
CANADA
[+1] (905) 567 4444

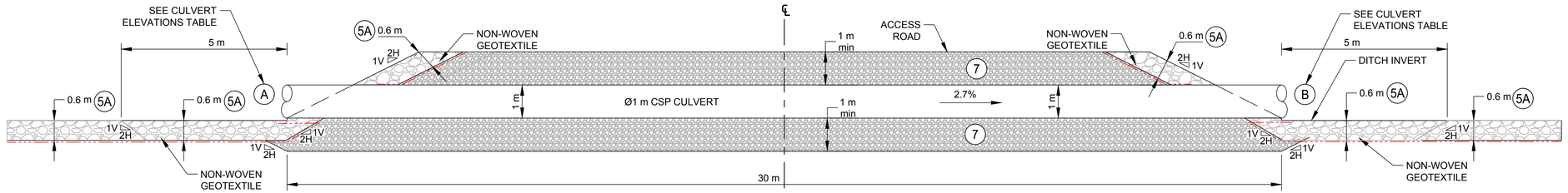
PROJECT
TAILINGS MANAGEMENT FACILITY ENGINEERING AND CONSTRUCTION QUALITY ASSURANCE

TITLE
SOUTHWEST DAM PERIMETER DITCH PROFILE AND TYPICAL CROSS SECTIONS

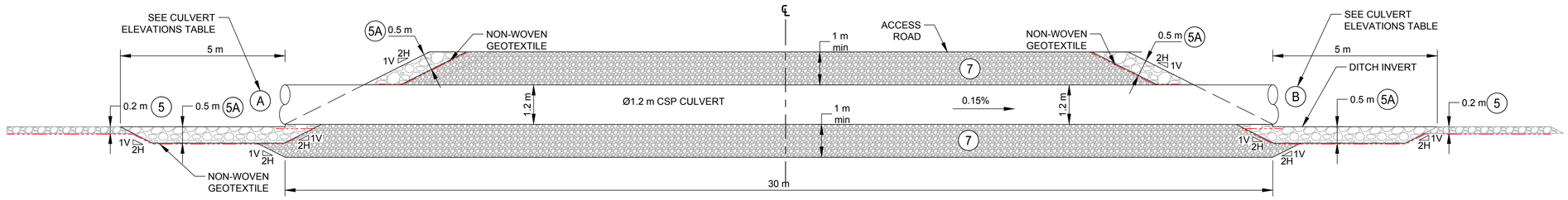
PROJECT NO.	CONTROL	REV.	of	DRAWING
CA0035295-5844	0007	0		1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

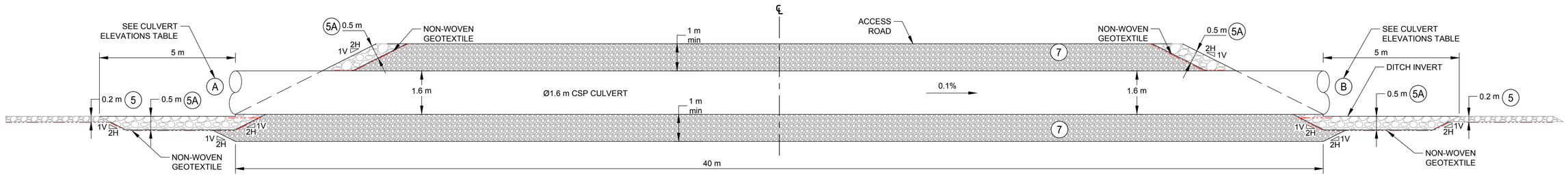
0 25 mm



SCALE 1:75 m — A — TYPICAL CROSS-SECTION OF CULVERT 1



SCALE 1:75 m — B — TYPICAL CROSS-SECTION OF CULVERT 2



SCALE 1:75 m — C — TYPICAL CROSS-SECTION OF CULVERT 3

CULVERT ELEVATIONS

CULVERT ID	CULVERT INVERT ELEVATION (m)	PVI
CULVERT 1-A	336.94	0+613
CULVERT 1-B	336.16	0+642
CULVERT 2-A	332.32	0+894
CULVERT 2-B	332.27	0+924
CULVERT 3-A	329.84	2+627
CULVERT 3-B	329.80	2+667

LEGEND

- TOP OF DITCH
- EXISTING SRUFRACE
- PROPOSED SOUTHWEST DITCH BOTTOM
- 542 g/m^2 NON-WOVEN GEOTEXTILE

CONSTRUCTION MATERIALS

- (5) LOW RIP RAP (D50=0.1m)
- (5A) MEDIUM RIP RAP (D50=0.3m)
- (7) SAND AND GRAVEL (75mm MINUS)
- (10) ESKER AND OVERBURDEN SOIL (200mm MINUS)

NOTE(S)

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9. THE CONTRACTOR SHALL REMOVE FROM WITHIN THE LIMITS OF CONSTRUCTION, ALL BOULDERS, ORGANICS, SNOW, ICE, WET, SOFT, VERY LOOSE AND OTHER UNSUITABLE MATERIALS. THE EXPOSED SUBGRADE SHALL CONSIST OF COMPETENT OVERBURDEN.

0 2.5 5
1:75 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2025-01-31	ISSUED FOR CONSTRUCTION	RR	AZ/JG	DCJ	KAB
A	2025-01-07	ISSUED FOR REVIEW	RR	AZ/MM	DCJ	KAB

SEAL

LICENCED PROFESSIONAL ENGINEER — D. C. JOHNSON — PROVINCE OF ONTARIO — 2025-02-03

CLIENT
GREENSTONE GOLD MINES

CONSULTANT
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[+1] (905) 567 4444

PROJECT
TAILINGS MANAGEMENT FACILITY ENGINEERING AND CONSTRUCTION QUALITY ASSURANCE

TITLE
SOUTHWEST DAM PERIMETER DITCH TYPICAL CROSS SECTIONS

PROJECT NO.	CONTROL	REV.	of	DRAWING
CA0035295-5844	0007	0		2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 — 25 mm

APPENDIX B

Specifications

TECHNICAL SPECIFICATIONS
PERIMETER SEEPAGE COLLECTION DITCHES

TABLE OF CONTENTS

GENERAL NOTES:

1. This set of Technical Specifications is to be read in conjunction with the accompanying Construction Drawings.

2. The Contractor shall examine the subsurface data and the requirements for construction shown on the Construction Drawings and described in the Technical Specifications. The Contractor shall satisfy themselves as to the adequacy of the data for construction and make their own interpretations as it affects their proposed construction methods, equipment selection, scheduling and the like. Any discrepancies shall be immediately brought to the attention of the Owner's Representative.

3. Modifications or deviations from these Technical Specifications and/or the corresponding Construction Drawings shall only occur with written approval of WSP Canada Inc.

4. The construction schedule and sequence shall be proposed by the Contractor and approved by the Owner or Owner's Representative.

5. All work shall conform to the lines, grades, cross-sections and details indicated on the Construction Drawings and meet the requirement of the Technical Specifications, including care and control of water and sediment, processing of materials as necessary, material and stockpile management, material loading, hauling, fill placement, and compaction. Material processing may including crushing, sorting and/or screening as necessary to produce materials that conform to the required gradations.

TECHNICAL SPECIFICATIONS
PERIMETER SEEPAGE COLLECTION DITCHES

SPECIFICATION NO. 0100
FOR
SCOPE OF WORK

REVISION HISTORY

Rev.	Description	Prepared By	Reviewed By	Approved By	Date
0	Issued for Approval				
1	Issued for Construction (IFC)	RR	DCJ	KAB	January 31, 2025

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LIST OF TABLES

1.0 GENERAL

1.1 Site Location

The proposed Greenstone Gold Mine is located immediately south of the Town of Geraldton in Northwestern Ontario, Canada, approximately 250 km northeast of the city of Thunder Bay, Ontario. The project site is well accessible by Highway 11, as well as local roads in the area such as Lahtis Road.

1.2 General Description of the Work

These Technical Specification and accompanying Construction Drawings outline the materials, equipment, and services required to perform the Work. This Specification describes the Scope of Work for construction of the Southeast dam perimeter seepage collection ditch and drainage crossing southeast of the Greenstone Gold Mine Site in Ontario, Canada.

Should a conflict between the Construction Drawings and Technical Specifications exist, the Construction Drawings shall govern.

1.3 Site Conditions and Other Works

Before tendering for the Work under this Contract the Bidder shall become familiar with the site, including making all enquiries, testing and carrying out investigations necessary to determine all the pertinent conditions and restrictions applicable to the Work. No claims shall be entertained based on the assertion by the contractor that he/she was not aware of the special conditions or restrictions pertinent to the Work.

2.0 DEFINITIONS

For the purpose of this project, the following definitions shall apply:

- Owner – Greenstone Gold Mines.
- Construction Manager – represents the owner on this construction project.
- Contractor – an independent earthworks and civil construction company.
- Engineer – the engineering firm, WSP Canada Inc., which is taking responsibility for the design of the TMF.
- Owner's Representative – represents the owner on site and has authority to approve aspects of the work following the design intent and specifications.
- Drawings – issued for construction (IFC) drawings prepared by the Engineer.
- Specifications – technical specifications prepared by the Engineer.
- Work – the entire or separately identifiable construction activities required to be completed under this contract.
- Site – the project area where the work is to be performed.
- Approval – a written engineering or geotechnical opinion, concerning the progress and completion of the work from an authorized person.

- Embankment – a generic term for the part of a dam constructed with soil or rock fill.
- Fill material – uncemented natural or processed material that has been placed.
- Dam - a water retaining embankment.
- Quality Assurance – Planned and systematic activities that provide adequate confidence to the Owner that quality control is being implemented effectively.
- Quality Control – A planned system of inspection testing carried out according to accepted standard specifications to ensure the quality of construction work.
- Construction Drawings – Issued for Construction Drawings prepared by the Engineer.
- Overburden – refers to natural or processed natural material produced by the physical or chemical disintegration of rock either transported or in-situ.
- Rock – solidified material in solids beds or masses which can only be excavated by blasting. Rock shall also include weathered seams within intact rock.

3.0 ROLES AND RESPONSIBILITIES

The Owner is responsible for obtaining all relevant permits, payments required for the Work, and providing access to the Work areas and borrow areas.

The Construction Manager has the authority to direct all aspects of the Work. The Construction Manager is responsible for coordinating all project communications, arranging daily and weekly meetings as required and holding meetings for resolution of quality control and quality assurance issues.

The Contractor shall be responsible for construction and quality control of the Work including any Work performed by its sub-contractors. The Contractor reports to the Construction Manager. The Contractor shall provide all materials (except where specifically noted otherwise), equipment, and labour necessary to complete the construction in accordance with the Technical Specifications and Construction Drawings.

WSP Canada Inc. (WSP) will act as the Engineer and Owner's Representative during the construction campaign. WSP will report to the Construction Manager. WSP will have a representative(s) on-site during construction. WSP will be generally responsible for:

- Project design and preparation of design briefs
- Providing the Issued for Construction Drawings
- Providing construction Scope of Work and Technical Specifications
- Approving all design and Specification changes, modifications, or clarifications prior to and/or during construction

- Implementing Construction Quality Assurance (CQA)
- Preparing the as-built drawings from the as-built survey data provided by the Contractor and verifying the adequacy of the construction covered by each set of as-built Drawings

4.0 CONSTRUCTION DRAWINGS

The following drawings will form part of this Contract:

Table 4-1: List of Drawings

No.	Description	Document Number
PERIMETER SEEPAGE COLLECTION DITCHES		
103	General Site Layout Plan	HP-EG003-342-C-202-0024
304	TMF Southeast Dam Plan and Profile	HP-EG018-342-C-202-0019
0001	Proposed Southeast Seepage Runoff Collection Ditch	CA0035295-5844-0007-CM-0001
0002	Southeast Dam Perimeter Ditch Profile and Typical Cross Section	CA0035295-5844-0007-CM-0002
3	Southwest Dam Perimeter Ditch Profile and Typical Cross Sections	CA0035295-5844-0007-3
4	Southwest Dam Perimeter Ditch Typical Cross Sections	CA0035295-5844-0007-4

5.0 TECHNICAL SPECIFICATIONS

The following technical documents will form part of this Contract including this scope of work document:

Table 5-1: List of Technical Specifications

Description	Document Number
1. Scope of Work	0100
2. Site Preparation	0200
3. Excavation and Foundation Preparation	0300
4. Earthworks	0400
5. Geotextile	0500
6. Flow Conveyance Structures	0600
7. Sediment and Erosion Control	0700
8. Survey Control and QAQC Plan	0800

6.0 SCOPE OF WORK

The construction work includes but is not limited to the following activities:

- Mobilization
- Implementation of safety, health, and security programs as required to ensure smooth execution of the Work
- Setting out survey control points to the lines and levels as shown on the drawings
- Providing quality control, field and laboratory testing of materials and on the construction of the Work
- Assisting the Owner's Representative by providing all necessary assistance in his quality assurance activities in terms of sampling, testing, documentation review, etc.
- Carrying out dewatering, drainage and environmental protection works in all areas of the Work, including roads, borrow, and waste disposal areas
- Sediment, erosion and dust control during construction including water management and care for water
- Dewatering to keep the working areas dry
- Clearing, stripping and grubbing in the Southeast dam perimeter seepage collection ditch area
- Excavation of unsuitable soils in the foundation area and foundation preparation
- Excavation in overburden and bedrock for construction of Southeast dam perimeter seepage collection ditch.
- Installation of erosion protection (riprap underlain by geotextile) for channels excavated in overburden
- Construction of culverts along access roads
- Providing as-built drawings in digital CAD format with all as-built zones distinguished
- Submission of Quality Control (QC) data including laboratory test results and field compaction control in digital format
- Preparation of weekly, monthly and completion of QC reports and as-built survey drawings in digital format
- Demobilization including cleaning up and restoration of the construction site upon completion of the construction

7.0 WORK RESPONSIBILITIES

Construction of the diversion ditch and culverts will involve foundation preparation, embankment construction, geotextile installation, fill placement and supply and installation of corrugated steel pipes. Table 7-1 outlines the

scope of work to be carried out and the various parties responsible. Greenstone may elect to delegate the scope of work to sub-contractors.

Table 7-1: Construction Scope of Work and Responsibilities

Scope of Work	Responsibility
Sourcing and development of construction material borrow sources including processing to meet the Technical Specifications	Greenstone
Preparation and maintenance of construction access roads	Greenstone
Foundation preparation and excavation for embankment construction	Greenstone
Placement and compaction of embankment fill	Greenstone
Placement and compaction of granular erosion protection materials	Greenstone
Supply and installation of culverts	Greenstone
Supply and installation of geotextile	Greenstone
Survey control, Material testing QC and as-built surveying	Greenstone
QA and as-built report	Greenstone / Owner's Representative

8.0 CODES AND STANDARDS

Work shall conform to, but not be limited to, the requirements of the latest editions of the following standards and codes which form part of these Specifications:

- Mine Health and Safety Act of Ontario.
- Mine Health and Safety Regulations of Ontario.

Additional specific codes and standards that should be followed are included under each technical specification.

TECHNICAL SPECIFICATIONS
PERIMETER SEEPAGE COLLECTION DITCHES

SPECIFICATION NO. 0200

FOR

SITE PREPARATION

REVISION HISTORY

Rev.	Description	Prepared By	Reviewed By	Approved By	Date
0	Issued for Approval				
1	Issued for Construction (IFC)	RR	DCJ	KAB	January 29, 2025

TABLE OF CONTENTS

1.0 GENERAL

This document defines the Technical Specifications for clearing, grubbing, and stripping as well as the disposal and/or management of materials during construction and development of the Perimeter Seepage Collection Ditches.

2.0 DEFINITIONS

“Clearing” is defined as removal of all trees, brush, and other materials within the limits of the required work area.

“Grubbing” is defined as removal of stumps, roots, embedded logs and debris left after clearing.

“Stripping” shall include removal of surface boulders, topsoil, peat, organics and materials contaminated with organics.

3.0 SITE PREPARATION

3.1 Area of Clearing and Grubbing

The area of clearing and grubbing shall extend a minimum of 3 m beyond the plan area of the Works indicated on the Construction Drawings.

3.2 Clearing

All trees, brush and other materials, including fallen trees and logs within the limits of the required work area shall be cut and removed. Tree stumps and brush shall be cut to within 150 mm of the existing ground surface.

3.3 Grubbing

Regardless of whether a prior grubbing operation has been carried out, all stumps, roots, embedded logs and all debris shall be removed to a depth of no less than 300 mm below the original ground surface while grubbing and shall be disposed of in areas designated for disposal of grubbed materials.

Grub all stumps, roots, logs, brush, vegetation, debris, perishable material, fallen trees, boulders, and all other surface obstructions remaining in the dam footprint after the clearing operation.

3.4 Stripping

Strip any remaining organic soil, organic debris or other perishable materials from the dam, decant and spillway areas following clearing and grubbing operations. The stripped materials shall be disposed of in areas designated for disposal of stripped materials.

The stripped area shall be kept free of vegetation during construction.

3.5 Disposal of Materials

Dispose all material generated by the above operations by stockpiling at the designated disposal area as directed by the Owner’s Representative.

Burning of any materials is not permitted without prior approval from the Owner.

3.6 Decommissioning and Protection of Existing Instrumentation

The Contractor shall note if there is existing monitoring instrumentation on the property and shall exercise care not to damage or interfere with any of the instruments outside of the proposed Works footprint. Any instruments which have been damaged without the prior approval of the Owner's Representative shall be replaced at the Contractor's cost. The Contractor shall notify the Owner and Owner's Representative of any instruments identified within the limits of construction.

TECHNICAL SPECIFICATIONS
PERIMETER SEEPAGE COLLECTION DITCHES

SPECIFICATION NO. 0300

FOR

EXCAVATION AND FOUNDATION PREPARATION

REVISION HISTORY

Rev.	Description	Prepared By	Reviewed By	Approved By	Date
0	Issued for Approval				
1	Issued for Construction (IFC)	RR	DCJ	KAB	January 31, 2025

TABLE OF CONTENTS

1.0 GENERAL

This Section defines the Technical Specifications required for the excavation and foundation preparation for the perimeter seepage collection ditch and pond construction. This specification will also be applicable for excavation and foundation preparation for access roads and culverts areas.

The term “excavation” applies to soil, cobbles and boulders less than 2 m3 in volume. Removal of rock by blasting, barring and breaking by power driven tools or by some other recognized method of excavation in solid rock may be required for construction of seepage collection ditch.

All excavated material shall be disposed of in areas designated by the Owner’s Representative. Approximate locations of such areas will be provided by the Owner.

Regardless of the method selected by the Contractor for carrying out various portions of the work, the technical requirements applicable to all portions of the Work must be met.

The Contractor shall be responsible for the design of dewatering, sediment control, and other environmental protection measures.

2.0 EXCAVATION

Lines and Grades: Excavation shall be carried out as required to achieve the lines, grades and dimensions shown on the Construction Drawings and/or as required to expose suitable subgrade materials, which shall be determined by the Owner’s Representative.

Ground Surface: Excavation lines and grades shown on the Construction Drawings have been determined from limited ground and aerial surveys and the actual ground surface may vary from that shown on the Construction Drawings. The Contractor shall survey the ground surface prior to and upon completion of any excavation. The Contractor shall submit an existing ground survey to the Engineer for approval prior to commencement of excavation.

Frozen Ground or Rock: Before excavating frozen ground or rock, the Contractor shall develop a method of excavation that conforms to all applicable laws and regulations and to proven safe practices.

Slopes: Safe and stable temporary slopes shall be maintained at all times in accordance with the requirements of applicable legislation. Trench wall stability is the responsibility of the Contractor. It may be found necessary or advantageous to vary final slopes, grades or dimensions of excavations from those specified or shown on the Construction Drawings. Any variations proposed by the Contractor shall be approved by the Engineer prior to being put into effect.

Tolerances: All excavations shall be completed to within 300 mm horizontally and 100 mm vertically of specified lines and grades unless otherwise approved by the Owner's Representative.

Reuse of Excavated Material: Where excavated material meets the grading requirements for a particular fill material type (in accordance with Specification 0400 Earthworks), the excavated material may be reused as fill, subject to approval by the Engineer.

Disposal: Excavated material which is not reused as fill shall be disposed of in a manner and location approved by the Owner.

3.0 DEWATERING

All work areas and excavation shall be kept dewatered, if required, to permit execution of the Works in-the-dry. Temporary ditching may be required to collect and convey surface runoff away from work areas.

Dewatering shall be continuous through all work stoppages including overnight and holidays to protect the work-in-progress. Unless otherwise approved, the water shall be discharged into an area approved by the Owner's Representative.

Cofferdams may be required to minimize water inflow. Cofferdams shall be of such dimensions and height to permit effective dewatering in the excavation and to the approval of the Owner's Representative. Unless otherwise indicated, all cofferdams shall be removed upon completion of the Works.

The Owner is to ensure all necessary permits are secured as they relate to management of construction water.

4.0 OVERBURDEN EXCAVATION

The Contractor shall remove from within the limits of construction, all boulders, organic, wet, soft, very loose and other unsuitable materials which, in the opinion of the Owner's Representative, may interfere with the proper bonding of the fill to the subgrade or with the compacted material in the Work. The exposed subgrade shall consist of competent overburden or rock that is free of segregation.

5.0 FOUNDATION PREPARATION

General: Soil subgrade preparation shall include the excavation and removal of all unsuitable overburden from the foundation areas of the Work which, in the opinion of the Owner's Representative, could interfere with the proper bonding of the fill materials to the subgrade, or with the proper construction and/or intended performance of the structure. Foundation preparation includes removing snow and ice, stripping and scalping organic hummocks and removing boulders protruding more than 300 mm above the ground.

Sub-excavation: If, in the opinion of the Owner's Representative, particular area(s) will not provide adequate support, then the Owner's Representative may direct the Contractor to sub-excavate the affected area(s). Sub-excavation shall involve excavation of unsuitable soil to a depth(s) and over an area(s) directed by the Owner's Representative. Excavated material shall be disposed of as directed by the Owner's Representative. Areas which have been sub-excavated shall be compacted and brought back up to design grade as directed by the Owner's Representative with fill material that is placed and compacted according to Technical Specification 0400 Earthworks.

Subgrade Compaction: Unless directed otherwise by the Owner's Representative, subgrades shall be compacted to a density of at least 95% of the Standard Proctor Maximum Dry Density (SPMDD) of the subgrade material.

Approval: The prepared subgrade or foundation surface shall be inspected and approved in writing by the Owner's Representative prior to fill placement.

Protection from Weather: If the prepared subgrade becomes damaged or loosened by a change in the moisture condition or by frost it shall be repaired by removal or reworking of any materials affected over the full extent of the damage. The restored subgrade shall then be proof rolled to provide an acceptable subgrade. The restored subgrade shall be subject to inspection and approval by the Owner's Representative before any further work is done in this area.

TECHNICAL SPECIFICATIONS
PERIMETER SEEPAGE COLLECTION DITCHES

SPECIFICATION NO. 0400

FOR

EARTHWORKS

REVISION HISTORY

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1.0 SCOPE

This Technical Specifications defines the requirements for materials, labour, equipment, and performance for earthworks to construct the seepage collection ditches and drainage crossings for the Greenstone Gold Mine.

1.1 Abbreviations

The abbreviation listed below, where used in these Specifications, shall have the following meaning:

- ASTM - ASTM International.
- CSA - Canadian Standards Association.
- OPSS – Ontario Provincial Standard Specification.
- OPSD – Ontario Provincial Standard Drawing.

2.0 GENERAL

The Contractor shall construct the various fill zones according to the lines and grades and elevations shown on the Construction Drawings.

No fill shall be placed on any subgrade or against or upon any structure until foundation preparation, as specified in Specification 0300 Excavation and Foundation Preparation, has been completed and such portions have been approved in writing by the Owner's Representative.

No brush, branches, roots, stumps, frozen fill material, sod or other unsuitable materials shall be placed in the fill.

Fill materials shall not encroach into adjacent zones any further than allowed by the tolerances for the Work.

Fill materials generally shall be well graded within the specified gradation limits.

Fill materials shall be free of segregation.

Dewatering of excavations and foundations shall be carried out as required to keep the foundation and fill surface dry during the progress of the Work. Dewatering shall be carried out as specified in Specification 0800 Sediment and Erosion Control.

The Contractor shall complete the Works in accordance with the Construction Drawings and Specifications. The Owner’s Representative may modify the design during construction based on the conditions encountered.

3.0 CODES AND STANDARDS

Unless otherwise specified or shown, the latest issue of the following codes and standards shall apply to the extent indicated by references herein:

- ASTM C127 Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
- ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate
- ASTM D75 Methods for Sampling Aggregates.
- ASTM D422 Method for Particle Size Analysis
- ASTM D6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
- ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 [600 kN-m/m^3]).
- ASTM D854 Test Method for Specific Gravity of Soils.
- ASTM D1140 Test Method for Amount of Material in Soils Finer than the No. 200 Sieve.
- ASTM D2216 Method for Laboratory Determination of Water (Moisture) of Soil, Rock and Soil-Aggregate Mixtures.
- ASTM D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- ASTM D3017 Test Methods for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- OPSS 1010- Material Specifications for Select Aggregates - Base, Subbase, Select Subgrade and Backfill material.
- OPSS 501- Construction Specifications for Compacting.
- OPSS 209- Construction Specifications for Embankments over Swamps and Compressible Soils.
- OPSS 206 – Construction Specifications for Grading.
- OPSS1801- Material Specifications for Corrugated Steel Pipe Products.
- OPSD 802.010 – Flexible Pipe Embedment and Backfill Earth Excavation.
- OPSD802.0103- Flexible Pipe Embedment and Backfill Rock Excavation.
- All applicable codes and standards in effect in the Province of Ontario.

4.0 TOLERANCES

Dimensions shall not be less than those specified and final slopes shall not be steeper than those indicated on the Construction Drawings. Unless otherwise shown on the Construction Drawings, dimensional tolerances for the earthworks shall be the following:

- Level tolerance +/- 0.1 m
- Horizontal tolerance +/- 0.3 m

The Contractor shall provide and have available at all times during his working hours, the necessary staff and equipment to ensure that proper and correct setting out of the Works is continually maintained during construction. Should any errors in setting out of the Works occur, such errors shall be corrected and any necessary adjustment to previously placed fill materials resulting from such errors shall be made good to the satisfaction of the Owner's Representative prior to further placement of the fill materials.

5.0 FILL MATERIALS

The fill material shall be free from lenses, pockets or layers of material which are significantly different in gradation from the surrounding material within the same zone. Material placed which does not meet the specified gradation requirements shall be removed, blended or otherwise reworked to produce a material which does.

Where gradational requirements allow large variations within a given material zone, material shall be placed so as to prevent the migration of particles from the finer materials into the void spaces of coarser materials. Where the gradation of two adjacent materials are determined by the Owner's Representative to be incompatible and the danger of particle movement exists, a minimum 0.5 m thick layer of material, with an approved intermediate gradation, shall be placed between the fill materials in question.

Oversized particles shall be removed, either at the source or during placement or both. Where reduced lift thicknesses are required, particles larger than 2/3 of the reduced lift thickness shall be removed prior to compaction.

Fill materials shall be sourced by the Contractor. The Contractor shall be responsible for all screening and/or sorting required to meet the specifications outlined herein. In general, materials shall meet the following requirements:

- Be non- acid generating and non-metal leaching (NAG).
- Unconfined compressive (UCS) strength for rock fill ≥ 75 MPa.

- Absorption ≤ 2% according to ASTM C127/OPSS1010.
- Micro-Deval abrasion ≤ 25% loss according to ASTM D6928/OPSS1010.
- Flat and elongated particles ≤ 20% according to ASTM D4791.
- Shape factor < 2.

Earth fill and rockfill materials for perimeter seepage collection ditch and drainage crossing construction are shown on the Drawings and are identified as follows:

- Zone 5: Low Riprap (D50 = 100 mm) (Erosion Protection)
- Zone 5A: Medium Riprap (D50 = 300 mm) (Erosion Protection)
- Zone 7: Sand and Gravel (Minus 75 mm)
- Zone 10: Overburden Soil or 200 mm Minus Rockfill

5.1 Zone 5 – Low Riprap / Erosion Protection (D50 = 100 mm)

100 mm Riprap is required for erosion protection in sections of the ditch with lower flow velocities. The Contractor shall produce this material from quarried bedrock or oversize screened esker consisting of sound, hard, durable, inert cobble and boulder sized particles.

The erosion protection shall be clean, well-graded cobble and boulder sized particles meeting the gradation requirements below:

Table 5-1: Gradation Limits for 100 mm Riprap (Zone 5)

Particle Size (mm)	% Passing by Weight
200	100
150	50-100
100	5-50
75	0-40
45	0-8

- The content of fines (<0.075 mm) shall not exceed 4% by weight.

5.2 Zone 5A – Medium Riprap / Erosion Protection (300 mm)

Medium Riprap is required for erosion protection in sections of the ditch with medium flow velocities and at culvert inlets and outlets. The Contractor shall produce this material from blasted mine rock, available from designated stockpiles. Testing of bedrock sources for this material shall be completed prior to construction to confirm that the rock is not potentially acid generating and will not leach metals.

The erosion protection shall be clean, well-graded cobble and boulder sized particles meeting the gradation requirements below:

Table 5-2: Gradation Limits for 300 mm Riprap (Zone 5A)

Particle Size (mm)	% Passing by Weight
500	100
300	50-100
100	18-50
50	0-35
19	0-20

- The content of fines (<0.075 mm) shall not exceed 4% by weight.

5.3 Zone 7 – Sand and Gravel (75 mm Minus) / Road Surfacing Material

75 mm Minus Sand and Gravel will be used as fill surrounding the culverts and road surfacing material. Zone 7 shall be a well graded, free of organic matters, debris, snow, ice and other unsuitable material. This material shall consist of angular and sub-angular particles, falling within the gradation limits as shown below in Table 5-3 unless otherwise approved by the Owner's Representative. Zone 7 shall have a minimum uniaxial compressive strength of 40 MPa, and no more than 60% loss during the Los Angeles Abrasion test and shall be inert with no potential for acid generation and metal leaching.

Table 5-3: Gradation Limits for 75 mm Minus Sand and Gravel (Zone 7)

Particle Size (mm)	% Passing by Weight
76	100
19	55-100
4.76	31-100
2	18-100
0.42	0-85
0.075	0-5

5.4 Zone 10 – Overburden Soil or 200 mm Minus Rockfill

The Zone 10 fill material is intended as the main fill material for the berm fill and culvert crossing embankments. Zone 10 shall be used to construct the berm and the main embankment supporting the geotextile liner in the culvert crossings as shown on the Construction Drawings.

The Contractor may produce Zone 10 material from excavation of native overburden soil along the ditches (as shown in the Construction Drawings), the ditch footprint area, the esker borrow areas or processed clean (non-acid generating) mine waste rock. The material shall be well-graded within the gradation limits shown below.

Table 5-1: Gradation Limits for Overburden Soil or 200 mm Minus Rockfill (Zone 10)

Particle Size (mm)	% Passing by Weight
200	100
75	65 to 100
50	50 to 100
19	30 to 100
9.6	25 to 80
4.75	20 to 70
2	15 to 60
0.075	0 to 30

6.0 FILL PLACEMENT

6.1 General

- The placement of fill materials includes loading, transporting, unloading, storing, and additional handling when necessary.
- Fill materials shall not be placed on any part of the foundation until the foundation has been inspected and approved in writing by the Owner's Representative.
- Structures shall be constructed to the lines, grades, zoning and cross-sections shown on the Construction Drawings using only suitable materials as defined within the Specifications or approved by the Owner's Representative.
- Equipment suitability, methods of working, rate of progress and quality of work shall be demonstrated during the initial stages of the Work or at any time as requested by the Owner's Representative. In the event that the work performance is unsatisfactory for either quality or schedule requirements, the Contractor shall implement changes as required to ensure the required quality and scheduled completion of the Work.
- During dumping and spreading, waste materials such as, but not limited to, debris, organics, vegetation, or any other unsuitable material shall be removed.
- Materials shall be transported, dumped and spread to avoid segregation, so that each zone is homogeneous, free of horizontal stratification, lenses, pockets, ruts or layers of material of different texture or grading not conforming to the requirements specified for the material of each zone.

- Mixing materials from adjoining zones shall be avoided.
- Accumulations of oversized stones, particularly between different material zones and abutment contacts, shall be removed and replaced with suitable materials as specified herein.
- Compaction of fill materials will vary by type. The Contractor is responsible for carrying out compaction in the fill zones as stated in the Specifications or subject to approval by the Owner's Representative. Initial placement of each type shall involve field trials to determine the required placement and compaction method.
- Prior to fill placement, water, ice, snow or other deleterious materials shall be removed from the foundation surface, to the satisfaction of the Owner's Representative.
- The maximum difference in elevation between adjacent compacted surfaces within the fill shall be one lift thickness.
- Temporary slopes within the fill are undesirable and shall be avoided.

6.2 Medium and Low Riprap (Zones 5 & 5a)

- The erosion protection shall be placed and nominally compacted to form a tightly knit mass.
- Segregation of the material, resulting in discrete accumulations or nests of gravel and/or cobble sized particles, shall not be permitted.

6.3 75 mm Minus Sand and Gravel (Zone 7)

- The maximum un-compacted lift thickness of the material shall be 300 mm.
- Placement of the material around the culverts shall be carried out in accordance with the Culvert Manufacturers recommendations.
- Material placed in the culvert haunches must be compacted prior to continue placement of the surrounding lift.
- Material on each side of the culvert shall be placed simultaneously, at no point shall the levels on each side of the culvert differ by more than 300 mm.
- Segregation of the material, resulting in discrete accumulations or nests of gravel and/or cobble sized particles, shall not be permitted.

6.4 Overburden Soil (Zone 10)

- The maximum uncompacted lift shall be 500 mm.
- Place and compact the embankment fill in horizontal lifts ensuring that no voids exist in the fill.
- Compaction shall achieve 95% SPMDD, or be approved by Owner's Representative.

7.0 COMPACTION

7.1 General

- All fill materials will be placed and adequately compacted as specified in the following sections.
- Prior to compaction, remove accumulations of oversized stones, particularly between different material zones and abutment contacts and replace with suitable materials as specified herein.
- Each lift shall be compacted before placement of the subsequent lift.
- If the compaction of a lift or a portion of a lift is insufficient due to the lack of overlapping of passes, excessive lift thickness, excess or deficient moisture content, insufficient density, or improper compaction equipment, as determined by the Owner's Representative, the Contractor shall improve the condition of the fill in accordance with the requirements specified herein or at the direction of the Owner's Representative, and re-compact the lift. If the additional work cannot provide satisfactory results, the Contractor shall remove and waste such lift, or its portion, and replace with new material.
- Minimize collection of water, snow, ice or other deleterious material(s) on the surface of the fill or foundations. If these materials collect on the surface remove them prior to placement of subsequent lifts of material. If collection of these materials has caused deterioration in the condition of the fill or foundation material, improve the condition to meet the specifications or remove such material, as directed by the Owner's Representative, prior to placement of subsequent lifts.

7.2 Compaction

- Compaction of overburden shall be carried out using a smooth drum vibratory compactor. Suitable equipment size to be determined during placement and compaction trials. Compaction of Zones 5 and 5a materials may be by excavator bucket, subject to the approval of the Owner's Representative.
- Carry out rolling over large surfaces and execute turns carefully to obtain uniform compaction.
- One pass of the roller over the area being compacted constitutes a pass.
- Adjacent passes shall overlap by at least 600 mm.
- Each compacted lift shall be inspected by qualified personnel according to Specification 0700 Survey Control and QA/QC Plan. Each lift shall also be checked, approved and signed off by the Owner's Representative prior to the placement of the next lift.
- Fill shall not be placed drier than the optimum water content. The Contractor shall adjust and maintain the fill at the specified water content for compaction in a manner that ensures uniform moisture distribution throughout each lift.

- The speed of compaction equipment shall not exceed 4 km/hr.

8.0 QUALITY CONTROL (QC) AND QUALITY ASSURANCE (QA)

8.1 General

- The Contractor shall provide Quality Control (QC), including survey, inspection and materials testing as required in Specification 0700 Survey Control and QA/QC Plan.
- QA inspection and testing shall be carried out by the Owner's Representative to confirm the Contractor's QC inspection, ensuring compliance with design specifications, which include foundation conditions, material gradation, compaction, and moisture content of fill materials. QA survey to confirm construction grades and limits will be coordinated by the Owner's Representative. The Owner's Representative may request a QA survey at any time.

8.2 Inspection and Testing

- The Contractor shall coordinate QC inspection, sampling and testing, as required by the Specifications, to determine suitability of the fill materials for construction in accordance with the Specifications.
- The Contractor shall perform all necessary inspections, sampling and testing in borrow areas and processed material stockpiles, as applicable, to ensure that only materials of specified composition, gradation and moisture content are supplied for the Work.
- The Owner's Representative shall confirm suitability of material borrow areas including arranging for the required inspections, sampling and testing.
- The Contractor shall perform all necessary inspection sampling and testing to ensure that only materials of the required specified composition, gradation, and moisture content are supplied for the Work.

TECHNICAL SPECIFICATIONS
PERIMETER SEEPAGE COLLECTION DITCHES

SPECIFICATION NO. 0500

FOR

GEOTEXTILES

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1.0 GENERAL

1.1 Scope of Work

This specification describes the:

- Manufacture of nonwoven geotextiles meeting the requirements of this Specification, including quality control requirements that have to be met for both the raw materials and manufactured product;
- Unloading/temporary storage of the geotextile at the Greenstone Gold Mine site;

The purpose of the geotextile is to provide erosion control in ditch cut in overburden. The geotextile separator will be used to separate and prevent mixing of materials of different gradation.

1.2 Applicable Codes and Standards

The following codes and standards apply for the use of geotextiles;

- ASTM D4354 Practice for Sampling of Geosynthetics for Testing.
- ASTM D4355 Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
- ASTM D4491-99a, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- ASTM D4533 Test Method for Trapezoidal Tearing Strength of Geotextiles.
- ASTM D4595-86(2001), Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
- ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles.
- ASTM D4716-01, Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
- ASTM D4751-99a, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- ASTM D4759 Practice for Determining the Specification Conformance of Geosynthetics.
- ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.
- ASTM D4873 Guide for Identification, Storage and Handling of Geotextiles.
- ASTM D4884 Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Geotextiles.
- ASTM D5261 Test Method for Measuring Mass per Unit Area of Geotextiles.
- ASTM D5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.

1.3 Delivery, Storage and Handling

The Contractor shall be responsible for the shipping, storage, and handling geotextile, as per the ASTM, and as well as any related costs, incidental or otherwise, included in the installation price.

The geotextile shall adhere to the labelling requirements of ASTM D 4873 and shipping, handling and storage shall adhere to ASTM D 4873.

1.4 Manufacturer

Geotextile Manufacturer(s) to be approved by the Engineer prior to placement.

1.5 Waste Management and Disposal

Separate waste materials for reuse and recycling in accordance with instructions from the Owner's Representative.

1.6 Submissions

The Contractor shall provide to the Owner's Representative a certificate stating the name of the manufacturer, product name, style number, chemical composition of filaments / yarns, and other information that will fully describe the geotextile.

2.0 MATERIAL TYPE

The geotextile shall be of non-woven synthetic fibre, supplied in rolls:

- Composed of minimum 85% by mass of polypropylene with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
- Physical properties of the geotextile shall include:
- Nominal thickness of 4.1 mm (ASTM D 5199);
- Mass per unit area of 542 g/m2 (ASTM D 5261);
- Tensile strength of 1.64 kN (ASTM D 4632);
- Elongation at break: 50% (ASTM D 4632);
- Trapezoidal Tear Strength of 0.64 kN (ASTM D 4533);
- Puncture strength of 1.0 kN (ASTM D 4833);
- Mullen Burst – minimum 5170 kPa;
- UV resistance: minimum 70% of that stated in ASTM D4355; and
- Minimum interface friction angle to textured geomembrane of 28° (ASTM D 5321).

- The hydraulic properties of the supplied geotextile shall conform to the following:
- Apparent opening size of 0.2 mm (ASTM D 4751);
- Minimum water flow rate of 2,000 l/min/m2 (ASTM D 4491); and
- Permittivity of 0.7 s-1.
- Material acceptance shall adhere to ASTM D 4759.

3.0 GEOTEXTILE PLACEMENT

- Place geotextile on approved subgrade following the required excavation and stripping, site preparation for geotextile installation and smooth-rolling the prepared subgrade surface.
- Place geotextile smooth and free of tension stress, folds, wrinkles and creases.
- Geotextile placement on slopes shall be started from the toe to the upper extent of the geotextile.
- The geotextile shall be joined by overlaps, the minimum overlap being 500 mm.
- Any damaged geotextile shall be promptly repaired or replaced to the approval of the Owner's Representative.
- Protect placed geotextile from displacement, damage or deterioration before, during and after placement of material layers.

TECHNICAL SPECIFICATIONS
PERIMETER SEEPAGE COLLECTION DITCHES

SPECIFICATION NO. 0600

FOR

FLOW CONVEYANCE STRUCTURES

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1.0 GENERAL

This Specification provides the requirements for ditch culverts as shown on the Construction Drawings.

2.0 CULVERT INSTALLATIONS

- General: The requirements for culvert installations across access roads as shown on the Construction Drawings are provided below. The Contractor shall be responsible for installing culverts across any temporary access roads required to complete the Work.
- Method: The Contractor shall prepare shop drawings showing details of proposed construction. The approval of Contractor's work plan and shop drawings does not relieve the Contractor's obligation under the Contract. The proposed work plan must be compatible with Manufacturer's recommended method of installation.
- Materials: Corrugated Steel Pipe (CSP) round Culverts shall conform to AASHTO M36 and M218 with pipe ends having no less than 2 round corrugations on each end. CSP shall be zinc-coated (galvanized) with a minimum coating weight (total both sides) of 610 g/m^2 in accordance with ASTM A123-78.
- Product:
- The corrugated steel pipes shall be 1.6 meter diameter (or diameter shown on the Construction Drawings) with a thickness of 3.5 mm and corrugation of 125 mm by 25 mm manufactured by Canada Culvert or equivalent.
    - Culverts shall support fully laden Caterpillar 775 Haul Truck or/and 120-ton B-train transport trucks with the indicated cover. The structural capacity of culvert shall be certified by a Professional Engineer in Ontario from the culvert supplier.
    - The Contractor shall supply all materials and equipment required for the completion of the culverts.
- Allowable Deflections: Upward or downward crown deflection shall not exceed 2% of the rise unless otherwise approved by the Owner's Representative. Longitudinal and transverse alignments shall be maintained.
- Subgrade Preparation: Subgrade soils beneath Culvert installations shall be prepared in accordance with Specification 0300 Excavation and Foundation Preparation.
- Culvert Backfill: Backfill around the culverts shall be 75 mm Minus Sand and Gravel (Zone 7) placed and compacted in accordance with the provisions regarding placement and compaction of fill materials set out in Specification 0400 Earthworks. Backfill shall be raised evenly on both sides of the culvert. Backfill within 300 mm of the culvert walls shall be free of stones exceeding 75 mm in size. Heavy equipment shall not be allowed within 1.0 m of the culvert walls.

TECHNICAL SPECIFICATIONS
PERIMETER SEEPAGE COLLECTION DITCHES

SPECIFICATION NO. 0700

FOR

SEDIMENT AND EROSION CONTROL

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1.0 GENERAL

The Contractor is responsible for sediment and erosion control during the Work. The Contractor shall implement a sediment and erosion control plan to control siltation to the water course to the lowest level practically achievable during the course of construction. Such silt control plan shall be submitted for the approval of the Owner's Representative prior to construction.

The Contractor shall use materials, construction practices, mitigation techniques and monitoring of operation at every water crossing in order to prevent harmful alteration, disruption or destruction of fish habitat or the impairment of water quality.

2.0 EROSION AND STORMWATER RUNOFF CONTROL

The Contractor shall phase the construction activities to limit the size of the disturbed area and the duration of soil exposure. All excavations shall have stable side slopes in accordance with applicable regulations and to minimize erosion. Runoff through the work area shall be reduced by providing temporary berms, ditches, and other diversion measures. Permanent erosion protection or vegetation cover shall be provided as soon as is practicable.

No access roads shall be constructed without prior approval from the Owner or Owner's Representative. Construction equipment will not be permitted to work within a watercourse at any time, without prior approval from the Owner and ensuring appropriate permits from relevant regulatory authorities in place.

Runoff from the work area shall be channelized, monitored for sedimentation, and, if deemed necessary temporarily controlled through a variety of techniques, including as appropriate: silt traps, straw bales, silt fencing, sedimentation ponds, and rock check dams, before discharge to the receiving water course. Temporary sedimentation control measures will be installed, monitored, and maintained at the Contractor's own cost.

3.0 FUEL AND OIL SPILLS

The Contractor shall work in accordance with all environmental regulations and GGM site policies regarding spills of fuels and oils. In the even of an accidental spill on land or into a watercourse, the GGM spill response and reporting procedures shall be strictly adhered to.

Corrosive, toxic, flammable or otherwise polluting fluids shall not be discharged. Spills of such fluid shall be contained and cleaned in accordance with the spill response and reporting procedures. In the event of a hydrocarbon spill, the contaminated soil shall be removed and disposed of as directed by the Owner.

Portable fuel tanks and fuel cans shall not be left at locations near a watercourse of any kind. All fuel tanks must be double walled and equipped with 360° vehicle protection. Refuelling and servicing of construction equipment shall not be permitted within 100 m of a water body. A spill kit and an empty 45-gal drum for spill containment must be provided at each tank. A list of emergency

contact numbers for key personnel must be provided by the Contractor to GGM at the start of construction. Construction vehicles will be parked in the laydown area when not in use.

4.0 MONITORING AND CONTINGENCY PLAN

The Contractor shall monitor the effectiveness of his sedimentation and erosion control measures and provide additional means to control siltation as required.

The Contractor shall prepare a contingency plan to respond, mitigate and remedy, in a timely manner, the effect due to unforeseen events such as floods and spillage of contaminants. To implement the contingency plan, the Contractor shall maintain in custody, adequate supply of material, equipment, and the like throughout the duration of construction.

The Contractor shall report to the Owner any unexpected discharge of silt, sediment, or other deleterious substance to a watercourse.

TECHNICAL SPECIFICATIONS
PERIMETER SEEPAGE COLLECTION DITCHES

SPECIFICATION NO. 0800

FOR

SURVEY CONTROL AND QAQC PLAN

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1.0 GENERAL

This Specification defines the requirements for Survey Control and a Quality Assurance/Quality Control (QA/QC) Plan for the construction of the seepage collection ditches at Greenstone Gold Mine Site.

1.1 Definitions

Inspection and Testing Agency	The company, partnership, or corporation retained to perform the inspections and tests required to determine and verify compliance of the Work with the requirements of this Specification.
Quality Assurance (QA)	Planned and systematic activities that provide adequate confidence to the Owner and various stakeholders that quality control is being implemented effectively.
Quality Control (QC)	A planned system of inspection and testing carried out according to accepted standard specifications to ensure the quality of construction work.

1.2 Responsibility

- The Owner's Representative will be responsible for the Quality Assurance of the Work. The Owner will assume full responsibility for all aspects of construction including Quality Assurance during period of time when the Owner's Representative is not on site.
- The Contractor will be responsible for the Quality Control of the Works.

2.0 SURVEY CONTROL

- Survey Bench Marks: The Owner shall provide the locations, coordinates and elevations of all primary reference points and survey bench marks required by the Contractor for horizontal and vertical control of the Work. The Contractor shall at all times protect and preserve all survey bench marks, reference points and other survey marks established by the Owner. The Contractor shall immediately inform the Owner's Representative if any survey bench mark or reference point established by the Owner has been disturbed or damaged, and shall repair or replace that survey control point. If it becomes necessary to remove any survey control point(s) established, the Contractor shall notify the Owner's Representative at least 3 days in advance of such necessity.
- Setting Out of the Work: The Contractor shall be responsible for correctly setting out the Work as shown on the Construction Drawings and required by the Specifications. The Contractor shall establish, maintain and protect all secondary reference points and bench marks required for the proper setting out and survey control of the Work.

- Staff and Equipment: The Contractor shall provide, and have available at all times during his working hours, the necessary staff and equipment to ensure that proper and correct survey control of the Work is continually maintained during construction.
- Checking: The Contractor shall have ready and available on site, all data relevant to his setting out of the Work and survey control during construction. The data shall be made available to the Owner's Representative for checking, as and when requested. The Contractor shall provide all reasonable assistance required by the Owner's Representative for checking the Contractor's survey control of the Work. Checking by the Owner's Representative shall not in any way relieve the Contractor of his responsibility to provide proper and correct survey control and QC during construction of the Work.
- Errors: Any errors in the Work resulting from improper setting out of the Work or from the disturbance, movement, damage or destruction of reference points or survey bench marks shall be corrected and made good by the Contractor at no cost to the Owner, prior to proceeding with any further work.
- As-Built Documentation: Within 30 days of completing the Work, the Contractor shall provide the Owner's Representative with a detailed, accurate ground survey of the completed Work, in both plans and cross-sections. The As-Built survey shall include the borrow areas. The As-Built information shall be provided to the Owner's Representative in both hard copy (drawings) and in the electronic formats specified by the Owner's Representative.

3.0 QUALITY CONTROL

A QC Plan shall be developed and implemented with the following minimum requirements:

- Outline of Responsibilities;
- Site inspections and testing requirements;
- As-built information requirements; and
- Checklists for Quality Control (QC) of construction activities.

3.1 Site Inspection and Testing

The Contractor shall provide QC during construction. Appropriate QC shall include:

- Experienced and qualified QC personnel;
- Suitable testing equipment, maintained in good repair at all times; and
- A proper facility / location for performing the required testing.

The Owner's Representative shall observe and monitor all construction activities to ensure that work is carried out according to Specifications.

The Engineer shall review all changes which could be considered significant changes to the overall design, to confirm that the changes are consistent with the design intent.

The Engineer shall also review adjustments to the design to suit actual field conditions. In both cases, no work shall proceed on major changes until written approval has been provided by the Owner's Representative.

3.2 Pre-Construction Activities

The criteria and responsibilities of both the Contractor and the Owner's Representative for the pre-construction activities are listed in Table 3-1.

Table 3-1: QA/QC Responsibilities for Pre-Construction Activities

Activities	Criteria	Responsibility	
		Contractor (QC)	**Owner's Representative (QA)**
Survey	Survey conforms to latest drawings.	• Provide qualified surveyor and modern survey equipment in good repair. Survey as required to lay out the work, and as requested by Owner's Representative to verify work; • Survey original ground surface over full footprint of the facility; • Provide temporary bench marks around the facility and protection of the survey stakes; and • Layout Dykes, berms, ditches and conform with drawings.	• Review survey alignments, chainage and layout; • Review survey data provided by QC surveyor; • Determine need for adjustments in field; and • Verify contractor's QC program.

Table 3-1: QA/QC Responsibilities for Pre-Construction Activities

Activities	Criteria	Responsibility	
		Contractor (QC)	**Owner's Representative (QA)**
Construction Materials	Construction with materials meeting specifications.	• Ensure materials meet the Specifications; • Perform required QC testing; • Control material segregation; • Verify equipment is calibrated.	• Verify Contractor's equipment is calibrated; • Verify contractor's QC testing is to standards; • Perform visual inspection of the materials; • Perform random sampling and testing; • Review testing results; and • Provide photographic records.
Foundation Preparation	• Remove snow or water; • Remove any boulders protruding more than 300 mm above ground; • Scalp hummocks; and • Remove any unsuitable materials.	• Identify storage areas for removed materials; • Specify removal methods for unsuitable materials; • Prepare sumps, pumps and lines for dewatering, when needed; and • Report unusual conditions.	• Check surficial features to determine ground ice condition; • Witness foundation excavation and preparations; • Inspect the prepared foundation; • Provide changes or adjustments for unusual conditions; and • Provide photographic record.
Instrumentation	• Ensure existing instrumentation is protected.	• Exercise care to prevent damage to existing instrument.	• Monitor construction method; and, • Approve casing for instrumentation leads.

3.3 Construction Activities

The criteria and responsibilities of both the Contractor and Owner's Representative for the construction activities are listed in Table 3-2.

Table 3-2: QA/QC Responsibilities for Construction Activities

Activities	Criteria	Responsibility	
		Contractor (QC)	**Owner's Representative (QA)**
Survey	Detailed survey to record construction program.	• Survey all material zones, alignments, cut-off trenches, ditches, culverts, instrumentation require to document the construction program with record of dates when construction took place and survey was completed. • Layout Dykes, berms, ditches and cut-off trench lines, excavations, material zones and chainages conform with drawings; • Provide temporary bench marks around the facility and protection of the survey stakes. • Provide detailed survey with sections and plan views of the constructed works.	• Review survey alignments, chainage and layout; • Review survey data provided by QC surveyor; and • Determine need for adjustments in field.

Table 3-2: QA/QC Responsibilities for Construction Activities

Activities	Criteria	Responsibility	
		Contractor (QC)	**Owner's Representative (QA)**
Ditch and Culvert Crossing Excavation and Backfilling	• Excavate ditch and culvert crossings as shown in the Construction Drawings • Prepare and clean ditch and culvert crossings base; • Place and compact erosion protection materials in ditch and culvert crossings as shown in the Construction Drawings; and • Backfill materials must meet gradation and moisture control requirements before being placed.	• Survey lines conform with drawings; • Plan excavation and material storage; • Perform soil sampling and testing during excavation as required; • Provide excavation records; • Remove all in-situ material loosened from drilling, blasting, and excavation from cut-off trench and water ditches; • Report any unusual conditions, e.g. ice-rich soil, thawed ground; • Ensure bedding and backfill materials conform with specifications; • Perform testing on placed material; • Provide field records (date, location, type of compaction, number of passes, moisture conditioning) for bedding and backfill; • Survey extent of any unusual conditions; and • Perform as-built survey.	• Review survey lines and locations; • Review proposed excavation methods; • Perform independent soil sampling and testing; • Inspect soil conditions during excavation; • Inspect and approve excavation and base preparations for the cut-off trench and water ditches before backfill; • Verify construction materials for compliance with Specifications; • Inspect trench backfill quality and installation procedures; • Review testing results; • Report problems and provide resolutions; • Review as-built survey report; and • Provide photographic records of the cut-off trench and water ditches construction steps.
Geotextile Installation	• Geotextile materials meets the project specifications; • Meet the quality control and quality assurance testing requirements detailed in the Project Specification; and • Geotextiles are installed as shown on the construction drawings.	• The Contactor to carryout QC as per Specification 0500 Geotextiles.	• The Owner's representative to carryout QA as per Specification 0500 Geotextiles.

Table 3-2: QA/QC Responsibilities for Construction Activities

Activities	Criteria	Responsibility	
		Contractor (QC)	Owner's Representative (QA)
Fill Placement	• Fill materials quality, gradations and/or moisture conditions meet the specifications; • Fill compaction conforms with the requirements; and • Control material segregation.	• Ensure placement and extent are as per design drawings; • Report on fill lift thickness and compaction efforts; • Perform required sampling and testing on fill materials; and • Survey as-built conditions.	• Witness fill and compaction activities; • Monitor fill material quality and quantities; • Visual inspection and confirmation of placed materials; • Collection of independent samples for testing; • Review contractor's testing results and reports; and • Provide photographic record.

4.0 AS-BUILT REPORT

Upon completion of construction activities, the Contractor shall prepare an As-Built Report. The report shall be submitted to the Owner's Representative within 4 weeks after construction is complete. The As-Built Report shall provide all relevant supporting documentation compiled during implementation of the QC Plan.

The Contractor's As-Built Report shall include, but not be limited to, the following information:

- As-Built drawings based on as-built survey information of surfaces of all materials placed;
- As-built construction quantities;
- All testing records and a summary of all test sample locations (liner and fill), collection methods, and test results;
- Summary of construction problems and resolutions; and
- Installation details of any required instrumentation.

5.0 RECORD KEEPING

The Contractor shall maintain on site all records of correspondence, testing, inspections, calibrations, etc., pertinent to the constructed works. These records shall be made available at any time to the Owner or Owner's Representative for review. All records shall be kept in triplicate, with copies submitted to the Owner and Owner's Representative within 24 hours of works been carried out. All records shall be in paper as well as PDF format. Drawings and survey data shall be in PDF and AUTO CAD formats.