Appendix 7 to Water Use Licence QZ96-006

Where there is a discrepancy between this appendix and the terms and conditions of Licence QZ96-006, then the terms and conditions of Licence QZ96-006 shall prevail.

CONSTRUCTION QUALITY ASSURANCE MANUAL

For Waste Dumps, Tailings/Water Dam,
Mill Water Pond, and Diversion Ditch
Minto Project, Yukon

submitted to:

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prepared by:

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1.0 GENERAL

This manual addresses construction quality assurance (CQA) for construction of the tailings/water dam and ancillary components of the Minto Project, Yukon. This manual is to be used in conjunction with the proper technical Specifications and construction Drawings. The QA Monitor and all Contractors are required to become fully familiar with the technical Specifications and contract Drawings. Responsibilities of the various parties involved in the construction are defined along with the testing and documentation for the following tasks, construction and installation:

- waste dump foundation evaluation
- waste dump design review
- additional site exploration
- clearing and grubbing
- access road construction
- waste dump construction and monitoring
- material borrowing and processing
- dam excavation
- dam foundation preparation
- curtain grouting
- dam embankment construction
- spillway and cut-off wall construction
- diversion ditch construction
- mill water pond construction
- dam monitoring program
- construction records report
- annual review reports

Quality control for manufactured materials will be the responsibility of the manufacturers, suppliers and installation contractors, all of whom will be responsible to the General Contractor, referred to in the Specifications and this manual as the Contractor.

2.0 DEFINITION OF OPERATIONS AND RESPONSIBILITIES

Parties who may be involved in the production, delivery, and installation of materials, and construction with on-site materials for the project are listed and defined below.

Designer:

EBA Engineering Consultants Ltd. is responsible for the Design, Contract Drawings and Specifications for the constructed products.

Owner:

Minto Exploration Ltd. is the Owner and will be responsible for operating and maintaining the facility and interfacing with the regulatory agencies. The Owner will appoint a representative to co-ordinate field activities. The Contractor will be responsible to the Owner's representative.

Contractor:

Responsible for completion of all the work on the Project. The Contractor may sub-contract out the specialty work such as grouting.

Regulators:

Applicable departments of the Federal and Territorial Governments having jurisdiction over the affairs and activities associated with the work and the Project.

Engineer:

To be an employee of the Designer, independent of the Owner and the Contractor, responsible for the observation and documentation of activities pertaining to the assurance of the quality of the installation of manufactured products and the construction of on-site products. The Engineer will certify compliance with design and must be a registered Professional Engineer in the Yukon Territory.

Quality Assurance (QA) Monitor:

The QA Monitor will work for and report to the Engineer.

Supplier:

Responsible for the manufacture and supply of geosynthetic products to the Installer. Depending on the Installer, the supplier may also be the manufacturer and fabricator of the product.

Installer:

Responsible for field handling, storing, placing, seaming and other site specific aspects of geosynthetics. The Installer may also be responsible for transportation to site. Responsible for anchor trenches and all temporary anchoring or loading required to support the geosynthetics during installation. Installer will be responsible to the Contractor.

Communications:

The QA Monitor will report items complying with the Specifications to the Engineer during construction and those not complying to the Engineer and directly to the Owner, who will direct the Contractor in the actions to be taken to enforce compliance. Remedial action will be tracked and reported to the Engineer and to the Owner by the QA Monitor. QA Monitor will report only compliance or non-compliance and will not direct or instruct the Contractor.

3.0 MEETINGS

An initial meeting will be held on site with all parties involved in the construction and quality assurance. This meeting will be used to review critical details in design, construction scheduling and quality control, construction safety and quality assurance procedures, responsibilities and authorities of the parties, lines of communication, methods for documenting and reporting and for the distribution of such documents and reports.

The Owner will hold meetings at least once a week with the Contractor and the QA Monitor to review progress, scheduling, items of concern, safety issues, and the resolution of any outstanding issues relating to Quality Assurance.

4.0 WASTE DUMP EVALUATION AND CONSTRUCTION

4.1 WASTE DUMP FOUNDATION EVALUATION

4.1.1 General

The Owner has selected preliminary locations for the main overburden and waste rock dump and the ice-rich overburden dump. These locations, shown on the Drawings, will be evaluated by the Engineer to confirm their suitability in accordance with the Owner's Type A Water Use License application.

In addition, the evaluation will include the completion of a test program to provide a correlation factor between the bulk frozen density of any permafrost encountered and the moisture content of the material.

4.1.2 Procedure

The waste dump sites will be evaluated by completing an auger drilling program. The drilling program will consist of at least 12 boreholes advanced along the proposed toe lines of the two dumps. The locations of each borehole will be determined by the Engineer. Each borehole will be advanced to a completed depth of at least 33'(10 m) and will be observed, logged and sampled by the QA Monitor. Sampling will be conducted to determine the nature of any permafrost encountered with particular emphasis on determining the thaw stability of any dump foundation.

Sampling will be completed using CRREL permafrost coring equipment, where ever possible, to return suitable samples for determination of bulk frozen density. Thaw stable materials will be considered to have a frozen bulk density of at least 1.7 Mg/m^3.

All samples tested for frozen bulk density will also be tested for moisture content, visible ice content and grain size distribution in order to establish a relationship between moisture content for a given material type and the bulk frozen density of that material. If necessary, additional boreholes may be advanced within the open pit area to obtain further permafrost samples to complete the correlation to the satisfaction of the Engineer.

4.1.3 Actions to be Taken

The Engineer will review the results of the drilling program and will provide recommendations regarding the suitability of the pre-selected areas for use as waste dumps. The primary factor in the decision will be to ensure that the dumps have thaw-stable foundations which entails either unfrozen subsoils or frozen soils with a bulk frozen density of more than 1.7 Mg/m^3. The Engineer may propose revisions to the pre-selected areas and may require further drilling should that be necessary to prove the suitability of the area.

The Engineer will also evaluate the data from all completed tests and provide a correlation between frozen bulk density and moisture content for the various material types. The Engineer may propose additional sampling or additional testing in order to complete the correlation study.

4.1.4 Documentation and Reporting

The QA Monitor will provide the Engineer and the Owner with detailed geotechnical logs from all boreholes, the results of all completed field and laboratory tests, and a plan showing their approximate locations. The Engineer will evaluate this information and provide the Owner with recommendations as to the suitability of the pre-selected waste dumps, according to the criteria defined in the EARP Screening Report and the Type A Water Use license.

The Engineer will also propose a correlation between the moisture content of overburden materials and their frozen bulk density. This correlation will be proposed as an alternative method of segregating thaw stable and thaw unstable materials.

4.2 WASTE DUMP DESIGN REVIEW

4.2.1 General

Following confirmation of the foundation conditions at the pre-selected dump sites, the Engineer will review the proposed design of the main dump to ensure that the factor of safety against failure of the dump slopes is adequate. The Engineer will also evaluate the inclusion of thaw stable overburden within the main dump and will provide criteria for inclusion of the overburden such that the overall dump stability is not compromised.

The ice rich overburden dump will not be evaluated as it is a temporary dump for the thawing and draining of the ice rich overburden. The thawed and drained materials will be re-used for mine reclamation activities. The material will be placed in thin lifts and spread as best determined by the Owner. In addition, the Owner will complete site works, such as stabilizing rock berms or other works as may be necessary to control the ice rich overburden dump. The temporary stability and maintenance of the ice rich overburden will be the responsibility of the Owner in accordance with the recommendations of the Engineer.

4.2.2 Procedure

The Engineer will complete slope stability analyses using models applied through the commercially available software program SLOPE/W. The analyses will be conducted using the foundation parameters determined in Section 4.1 above and the waste rock and overburden parameters previously used by EBA for preliminary analyses. The analyses will consider multiple lifts up to a completed height of 265 feet. The dump geometry will be adjusted if the analyses do not confirm an adequate factor of safety against failure for both short term and long term conditions in accordance with the "Investigation and Design of Mine Dumps, Interim Guidelines" prepared for the British Columbia Mine Dump Committee dated May, 1991.

Following establishment of the rock dump geometry, the analyses will be repeated with the incorporation of thaw stable overburden. The location of the overburden within the dump will initially be set a distance away from the crest and face of the dump such that it falls outside of the critical slip surfaces established in the rock only analyses. The location of the overburden within the dump will be changed, if necessary, until a suitable overall factor of safety is determined for both dump surface and overall deep seated instability.

4.2.3 Actions to be Taken

The Engineer will review the results of the completed analyses and will prepare a construction sequence plan and construction drawings necessary to construct the main dump.

4.2.4 Documentation and Reporting

The Engineer will provide the Owner with a waste dump design report for the main dump that details the dump location, geometry, protocols for incorporation of thaw stable overburden, and the results of stability analyses. The report will also provide site preparation and staging recommendations for the dump.

4.3 WASTE DUMP CONSTRUCTION AND MONITORING

4.3.1 General

The construction of the main dump will be an on-going activity during the life of the mine and will be directed by the Owner according to the design report prepared by the Engineer. During the on-going development, a monitoring program will be enacted by the Owner and the Engineer to observe the performance of the dump. The monitoring program will consist of regular

observations of the dump by the Owner and annual inspections of the dump by the Engineer. The Owner will maintain records throughout the construction of the dump and will submit these to the Engineer for annual review. The Owner has prepared an Environmental Monitoring Plan and this Plan includes the following:

- recording of daily dumping activities
- daily observation of the dump performance
- completion of annual inspections

In the event that evidence of instability or deformations in the dumps is identified, the frequency of the monitoring will be increased as specified by the Engineer until the stability of the dumps has been re-established.

4.3.2 Summary Specification

The frequency and extent of monitoring program to be completed for the main mine dump and associated works will be as specified by the Type A Water Use license issued to the Owner for the operation of the Minto Project. The details and frequencies for monitoring activities specified by the Type A Water Use license will govern the program except that where the frequency and extent of any activity is greater in the Plan, then the Owner will follow the requirements of the Plan.

4.3.3 Completion Of Dump Inspections and Maintenance of Records

Visual inspections will be completed on a daily basis by the Owner during construction of the dump. In addition, the Owner will maintain daily records of the materials placed within the dump, and the location of those materials. The daily records will differentiate between overburden and waste rock.

In addition to the Owner's inspections, the Engineer will complete an annual visit to site to observe the dump. This visit will be completed in the spring of each year.

4.3.4 Actions To Be Taken

The Engineer will evaluate all monitoring data supplied by the Owner. The Engineer will provide a letter annually, listing the collected data and certifying the performance of the dump. If the Engineer believes that any aspect of the dump's performance is substandard, then a remediation program will be provided to the Owner to correct the performance.

4.3.5 Documentation And Reporting

All obtained monitoring data will be evaluated by the Engineer and reported to the Owner for submission to the Yukon Territory Water Board. The Engineer and the Owner will both maintain independent databases regarding the dump performance and the dump monitoring program. Any areas of poor performance will be identified and records of remediation maintained.

5.0 WATER/TAILINGS DAM CONSTRUCTION

5.1 ADDITIONAL SITE EXPLORATION

5.1.1 General

Site exploration activities will be undertaken by the Engineer with the assistance of the Contractor to further define the subsurface conditions present in areas to be developed for the water/tailings dam and to be used as borrow sources. The exploration will also be conducted to specifically define the excavation limits within the tailings/water dam footprint.

5.1.2 Procedure

The exploration will be completed using a tracked excavator to excavate testpits which will be logged and sampled by the QA Monitor. The locations and depth of all testpits will be determined by the Engineer. All testpits will be surveyed and backfilled.

5.1.3 Actions To Be Taken

The depth to a suitable foundation subgrade for the tailings/water dam will be defined for each testpit. The suitability of materials encountered for construction fills will be determined for both borrow sources and for cut or excavation areas.

5.1.4 Documentation And Reporting

The QA Monitor will provide the Engineer and the Contractor with detailed geotechnical logs for all testpits and a plan showing their locations. The Engineer will evaluate this information and provide the Contractor with directions as to the extent of the excavation which will be necessary for tailings/water dam foundation footprint. The suitability of the materials found in these areas and in the borrow areas for use as construction fill will be recorded.

5.2 CLEARING AND GRUBBING

5.2.1 General

Clearing and grubbing limits will be determined by the Engineer and flagged by the QA Monitor.

Clearing and grubbing is to be completed in the following designated work areas:

- tailings/water dam site
- borrow areas

The Construction Quality Assurance (CQA) program for clearing and grubbing will include:

- observation of clearing and grubbing activities
- observation of disposal locations and methods

5.2.2 Summary Specification

Clearing and grubbing refers to the removal and disposal of all surface vegetation and surface organic matter including trees, logs, brush, stumps, roots, branches, and surface litter.

All work areas will be cleared and grubbed prior to any excavation, filling or any other development activity which will be completed at that location.

Disposal methods must be appropriate and in accordance with the governing statutes or legislation of the Yukon Territory, including the regulations for burning and for the protection of water courses.

5.2.3 Clearing And Grubbing Activities

The QA Monitor will observe all clearing and grubbing activities. The Contractor's methods will be observed and noted. Compliance with the Specifications of a cleared and grubbed area will be determined by the QA Monitor following clearing and grubbing activities.

5.2.4 Disposal

The QA Monitor will check that all materials from the clearing and grubbing operations are disposed of at approved locations and that disposal methods are appropriate.

5.2.5 Documentation And Reporting

The QA Monitor will record on a daily log the areas cleared and grubbed and the locations of all disposal piles as well as the method of disposal. Any non-compliance with Specifications will be reported to the Owner along with recommendations for remedial actions. A record of non-compliance and resolution of non-compliance will be maintained.

5.3 ACCESS ROAD CONSTRUCTION

5.3.1 General

The access road runs from the tailings/water dam to the mill site and mill water pond, and will be a major haul route for construction materials required for all areas of the mine site. It will be constructed as a "sideslope" cut and fill by the Contractor to the line and grade provided by the Engineer. The road will cross short sections of permafrost but will mainly lie along an unfrozen moderately steep (26°) slope. Cross section designs for both permafrost areas and unfrozen areas of the roadway are provided in the Drawings.

The CQA activities during access road construction will include:

- delineation and sampling of suitable fill from cut or borrow areas

- determination of the compaction parameters of suitable fill materials
- observation of the placement and compaction of fill materials
- density testing of compacted fill materials

5.3.2 Summary Specification

The Contractor will construct the access road as a balanced cut and fill at the locations and elevations indicated by the Engineer. The road will be build in accordance with the Specifications and Drawings.

All fill materials will be placed and compacted to at least 95% of Standard Proctor maximum dry density (ASTM D698).

5.3.3 Delineation Of Suitable Fill

The QA Monitor will periodically observe all cutting and borrowing operations to ensure that only suitable materials are incorporated into the road fill. Unsuitable materials will be identified for disposal in designated disposal locations.

5.3.4 Compaction Parameters.

Representative samples of all fill material types will be obtained by the QA Monitor as required to allow the compaction parameters to be determined. Compaction parameters include the optimum moisture content and maximum dry density based on the Standard Proctor test (ASTM D 698).

5.3.5 Fill Placement And Compaction

The QA Monitor will observe the placement of all fill materials to ensure that the required placement techniques are observed. Placement techniques include limiting individual lift thicknesses to a maximum of 300 mm and applying suitable compaction effort to each lift to achieve at least 95% of Standard Proctor maximum dry density.

5.3.6 Compaction Testing

The QA Monitor will perform compaction testing of the placed fill. The testing frequency will be at least one test for each 400 yd^3 of placed fill. The testing will be completed using Nuclear Densometers according to ASTM Standard D2922. Testing will be completed concurrent with the placement and compaction of the fill such that at least every second placed lift is tested.

5.3.7 Documentation And Reporting

The QA Monitor will record on a daily log the areas cut and the areas filled, as well as the elevation of the placed fill and the material used for fill. Results of all completed tests including

compaction parameters, and in situ density and level of compaction will be reported to the Engineer and the Contractor on a daily basis.

Any non-compliance with Specifications will be reported to the Owner along with recommendations for remedial actions. A record of non-compliance and resolution of non-compliance will be maintained.

5.4 MATERIAL BORROWING AND PROCESSING

5.4.1 General

The Owner, with assistance from the Engineer will locate borrow sources to provide the necessary fill materials for the construction of the tailings/water dam and other works at the mine site. Both un-processed and processed materials will be used to complete the site works. The Contractor will be responsible for the borrowing and when necessary the processing of all fill materials at the borrow locations. The necessary materials, as designated in the Drawings and Specifications, include: various native silt, sand and gravel mixtures, processed sand, gravel and cobble mixtures and processed coarse rock mixtures.

The CQA program during borrowing and processing of fill materials will include:

- sampling of borrow sites
- testing of borrow materials
- monitoring of borrowing activities, including stockpiling where appropriate
- sampling of processed materials
- testing of processed materials
- monitoring of processed material production including stockpiling

5.4.2 Summary Specification

Fill materials necessary to construct the tailings/water dam and other works will be borrowed from sources approved by the Owner and the Engineer and processed as necessary to produce the fill materials designated in the Specifications and Drawings. Where native materials are suitable in situ, no processing will be required.

The Contractor will conduct processing of materials, where processing is necessary, concurrently or prior to the on-set of dam foundation excavations. The processed materials include as a minimum all fill types for Zones 3, 4, 5, 6, 7, and 8 for the tailings/water dam and all fill materials used in the diversion ditch construction. These materials are defined below and in the Drawings and Specifications. The gradation limits for the materials required are as follows:

Zone 1 Dam Fill (Upstream Shell)

Zone 1

Sieve	*% Passing (by weight)*
3"	100
1/2"	80 - 100
#4	60- 100
#40	25 - 55
#200	0 -25

Zone 2 Dam Fill (Dam Core)

Sieve	*% Passing (by weight)*
1/2"	100
#4	85 - 100
#10	67 - 85
#20	50 - 70
#40	35 - 55
#100	18 - 36
#200	10 - 25

Zone 3 Dam Fill (Fine Filter)

Sieve	*% Passing (by weight)*
1/2"	100
3/8"	70 - 100
#4	30 - 60
#10	0 - 20

Zone 4 Dam Fill (Intermediate Filter)

Sieve	*% Passing (by weight)*
2"	100
1 1/2"	60 - 100
1"	10 - 45
3/4"	0 - 10

Zone 5 Dam Fill (Coarse Filter)

Sieve	*% Passing (by weight)*
6"	100
4"	50 - 100
3"	10 - 60
2"	0 - 10

Zone 6 Dam Fill (Downstream Shell)

Sieve	*% Passing (by weight)*
24"	100
12"	30 - 80
6"	0

Zone 7 Dam Fill (Downstream Toe)

Sound rock greater than 24 inches in minimum dimension will be required for Zone 7.

Zone 8 Dam Fill (Spillway Riprap)

% Passing	*12 Inch Median Size*	*24 Inch Median Size*
	Rock Size (Inches)	
100	16	40
40 - 80	14	28
20 - 50	12	24
<15	8	14
	Rock Weight (Pounds)	
100	275	3080
40 - 80	130	1050
20 - 50	88	660
<15	22	130

Diversion Ditch Sand Bedding

Bedding sand required for the diversion ditch will be finer than the #4 sieve.

Diversion Ditch Riprap

12 inch median riprap will be used for lining the diversion ditch.

In addition to the above gradations, all rock used to manufacture processed fill materials must have the following physical properties:

Test	*Method of Test*	*Minimum Requirements*
Abrasion Resistance	Los Angeles Machine (ASTM C535)	Less than 40% loss of weight after 500 revolutions
Soundness	Magnesium Sulphate solution (ASTM C88)	Less than 10% loss of weight after 5 cycles
Specific Gravity	ASTM C127	2.60 Minimum
Absorption	ASTM C127	2.0% Maximum

Transportation and stockpiling of both unprocessed and processed fill materials will be conducted by the Contractor using methods approved by the Engineer to sites approved by the Engineer.

The techniques of borrow excavation and/or processing will be solely the responsibility of the Contractor. The stability of all borrow excavations and all stockpiles will be the responsibility of the Contractor. Environmental protection, including the protection of water courses, will be the responsibility of the Contractor.

5.4.3 Sampling And Testing Of Borrow Sites

The QA Monitor will sample and test all proposed borrow sources prior to the Contractor beginning full scale excavation operations. Testing of the soil borrow materials will consist of sieve analyses and moisture content determination. Testing of rock borrow materials will consist of geologic description, specific gravity and absorption, abrasion resistance and soundness tests. The QA Monitor will report the results of all tests to the Engineer for evaluation.

Following approval of a borrow source by the Engineer, the QA Monitor will continue to obtain and test samples of unprocessed soils on a regular basis. The frequency of testing will be at least one test for each 10 000 yd^3 excavated from a given borrow source or at any time that the QA Monitor believes that the material may deviate from the Specification.

The QA Monitor will determine the compaction parameters of maximum dry density and optimum moisture content for any soil materials which will be used by the Contractor without processing. These parameters determined from the Standard Proctor Test (ASTM D698) will be determined by the QA Monitor whenever the borrow material is deemed to have changed in character.

5.4.4 Monitoring Of Borrowing Activities

The QA Monitor will complete daily inspections of all active borrow sites and activities. The location of excavation and the type of material removed will be noted. A record of the excavation method and materials transportation techniques will be maintained.

5.4.5 Sampling And Testing Of Processed Materials

The QA Monitor will sample and test each type of processed product manufactured on site by the Contractor. Sampling will be conducted at the end of the production stream and testing will consist of sieve analyses of the materials.

The frequency of testing will be as follows: one test per 750 yd^3 for upstream shell, core material or fine filter material; one test for every 1500 yd^3 for bedding material, intermediate and coarse filter materials; and, at least one test for each of the coarse rock fill and riprap materials (Zones 5, 6, and 7). Regardless of these frequencies, at least one test per material per production day for upstream shell, core, fine, intermediate and coarse filters, and bedding materials will be conducted. Furthermore, additional tests of any material will be conducted whenever thought necessary as a result of the QA Monitor's visual inspection.

During production of processed materials, the QA Monitor will complete at least one Standard Proctor Test on any processed Zone 1, 2, or 3 fill materials. The QA Monitor will also complete a Maximum Vibrated Density Test (ASTM D4253) for Zone 3, Zone 4 and Zone 5 materials. Both the Standard Proctor Tests and the Maximum Vibrated Density Tests will be repeated whenever a change in the processed materials warrants.

5.4.6 Monitoring Of Processed Material Production

The QA Monitor will observe the processing of all materials on a daily basis and will sample and test the processed materials as indicated in Section 5.4.5. Records of the materials used, and the materials produced will be maintained.

5.4.7 Monitoring Of Stockpiling

The QA Monitor will observe the stockpiling operations for all borrow materials on a daily basis. The effectiveness of the stockpiling operations in preventing segregation of materials will be recorded. Signs of segregation will be reported to the Engineer as will any other deviations from the Specifications.

5.4.8 Reporting And Documentation

The QA Monitor will maintain daily records of all borrowing and material processing activities, including borrow areas used, materials excavated, processing completed and the results of tests completed. A record of the stockpiling operations will also be maintained. Any material which does not comply with the Specifications will be reported to the Engineer and Owner. A record of non-compliance and resolution of non-compliance will be maintained.

5.5 DAM EXCAVATION

5.5.1 General

Construction of the tailings/water dam will require that all unsuitable foundation soils or rock be removed from within the dam footprint. The depth of excavation will be pre-determined by the Engineer based on testpits and will be verified during excavation. The depth of excavation will vary according to the site conditions and according to the zonal requirements as detailed in the Specifications and Drawings.

The CQA plan for the excavation activities will include:

- observation of de-watering activities
- observation of soil excavation activities
- sampling of possible fill materials
- sampling of frozen materials
- observation of rock excavation activities
- observation of overburden waste disposal

5.5.2 Summary Specification

Excavations within each zone of the dam will be undertaken by the Contractor to the excavation limits and depths directed by the Engineer and detailed in the Drawings and Specifications. The excavations will remove all unsuitable foundation soil and rock including all thaw unstable permafrost within the dam footprint. Thaw unstable permafrost will be permafrost with an in situ bulk frozen density of less than 1.7 Mg/m^3.

Excavated materials will be disposed of at approved spoil locations or if deemed by the Engineer to be suitable, may be used for fill in Zone 1(upstream shell) of the dam.

The Contractor will be solely responsible for the method of excavation which may include manual excavation, hydraulic excavation, ripping, and blasting. The Contractor will also be solely responsible for the control and diversion of surface and subsurface water flows into and around all excavations.

The Contractor will be responsible for all aspects of safety during the excavation operations including the stability of all excavations.

5.5.3 De-Watering

The QA Monitor will observe the Contractor's method of de-watering, including the construction of a coffer dam, on a regular basis. The QA Monitor will inform the Contractor, the Engineer and the Owner if the de-watering methods are not effective in protecting the environment, the dam excavations and other works at the mine site.

5.5.4 Observation Of Soil Excavation Activities

The QA Monitor will observe all soil excavation activities undertaken by the Contractor within the dam footprint. A daily log of excavation activities will be maintained and conveyed to the Engineer. The Engineer will indicate to the Contractor where soil excavation activities are considered to be complete.

5.5.5 Sampling Of Frozen Materials

Where frozen materials are being excavated, the QA Monitor will obtain representative samples for bulk frozen density testing. The results of testing will be provided to the Engineer and to the Contractor. Where the bulk frozen density is less than 1.7 Mg/m^3, the Contractor will be informed to continue excavation of the frozen soils.

5.5.6 Sampling Of Possible Fill Materials

Excavated materials which are judged to be potentially suitable, by the QA Monitor, will be sampled and the grain size distribution determined. The results of all tests will be provided to the Engineer and the Contractor. Suitable materials may be incorporated into Zone 1 (upstream shell) of the dam, as deemed appropriate by the Engineer.

5.5.7 Observation of Rock Excavation Activities

Where deemed necessary by the Engineer, rock excavation will be conducted by the Contractor using either mechanical ripping or blasting techniques. The QA Monitor will observe all rock excavation and will record the method of excavation. If blasting is used, the QA Monitor will observe the blasting operation and will review the results of the Contractor's vibration monitoring program after each blast. The effect of each blast on the excavation surfaces in and around the dam site will be recorded.

5.5.8 Observation Of Overburden Waste Disposal

The QA Monitor will check disposal areas on a daily basis to observe the placement of unsuitable materials.

5.5.9 Documentation and Reporting

The QA Monitor will maintain daily records of all excavation activities, including areas excavated, depths excavated to, and materials encountered. The QA Monitor will geotechnically log the surface of all completed excavations and will provide this information to the Engineer. Complete records of blasting activities will be supplied by the Contractor to the QA Monitor for submittal to the Engineer. Any non-compliance with Specifications will be reported to the Owner along with recommendations for remedial actions. A record of non-compliance and resolution of non-compliance will be maintained

5.6 DAM FOUNDATION PREPARATION

5.6.1 General

After excavation of the dam footprint to expose suitable foundation soil or rock subgrade, the exposed surfaces will be prepared for the placement of embankment fills and/or the completion of curtain grouting activities (Section 5.7). The core zone of the dam will be entirely founded on rock whereas both rock and soil foundation subgrades may be used in the remaining areas of the dam.

Preparation of the foundation subgrade will involve final shaping, moisture conditioning and densification for soil, final shaping and cleaning for rock surfaces not within the core zone of the dam and final shaping, cleaning, sealing and shotcreting for rock surfaces located within the core zone of the dam.

CQA activities during the preparation of subgrade surfaces will include:

- observation of soil shaping and scarifying
- observation of soil moisture conditioning and compaction
- testing of soil compaction
- observation of rock shaping and cleaning
- observation of rock infilling
- observation of rock shotcreting
- inspection of shotcrete surface

5.6.2 Summary Specification

Tailings/water dam foundation subgrade surfaces will be prepared by the Contractor according to the Specifications and Drawings. The upstream and downstream shells of the dam may have either soil or rock subgrades as approved by the Engineer during excavation in those zones. The core zone of the dam must have a rock subgrade.

Preparation of soil subgrade areas will consist of removing oversized clasts and grading the soil to the line and grade designated by the Engineer. The graded surface will be scarified to a minimum depth of 8 inches and be re-compacted to at least 98% of Standard Proctor maximum dry density. Prior to recompaction the scarified subgrade will be moisture conditioned to have a moisture content of 1% to 2% below the optimum moisture content as determined by the Standard Proctor test.

Preparation of rock subgrade surfaces not located within the dam core zone will consist of cleaning of unsuitable materials and removal of minor irregularities as required by the Engineer. The removal of irregularities may require hand tools, pneumatic tools, hydraulic equipment and/or blasting as may be selected by the Contractor.

Preparation of rock surfaces within the core zone will consist of cleaning with the use of pressurized air and water, scaling of loose material and excavation of minor irregularities as required by the Engineer. The excavation may require hand tools, pneumatic tools, hydraulic equipment and/or blasting as may be selected by the Contractor.

After cleaning and shaping, the core zone rock surface will be infilled, where required, using lean concrete and/or mortar to fill all surface voids as directed by the Engineer. Final treatment of the core zone rock subgrade will consist of applying a 2" layer of shotcrete over the rock surface as directed by the Engineer. Shotcrete placement will not commence until the grout curtain detailed in the Specifications and Drawings and in Section 5.7 of this manual is completed. Rock surfaces outside of the core zone will not be shotcreted.

5.6.3 Soil Shaping and Scarifying

The QA Monitor will observe the grading and scarifying of the approved soil subgrade. The QA Monitor will walk over the area with the Contractor and ensure that all clasts larger than 6 inches are removed from the scarified surface.

5.6.4 Soil Moisture Conditioning and Compaction

The moisture content of the subgrade will be determined by the QA Monitor and the Contractor will be informed whether moisture conditioning is required. Following moisture conditioning, if necessary, the QA Monitor will observe the Contractor's recompaction of the soil subgrade.

5.6.5 Testing of Soil Compaction

The QA Monitor will complete compaction tests on the recompacted soil subgrade following completion of the compaction by the Contractor. A minimum of one compaction test for each 500 yd^2 of subgrade area will be conducted. Test results will be provided by the QA Monitor to the Contractor and Engineer.

5.6.6 Rock Shaping and Cleaning

Cleaning and shaping of the rock subgrade will be observed by the QA Monitor. All cleaned and shaped areas will be mapped for significant geologic features by the QA Monitor and the map provided to the Engineer for review.

5.6.7 Rock Infilling

Within the core zone of the dam, infilling of voids, depressions or openings on the rock surface with lean concrete and/or mortar will be completed as directed by the Engineer. The QA Monitor will observe all aspects of the infilling including, mixing of concrete and/or mortar and placement of these products. Locations of infilling will be documented by the QA Monitor upon completion.

5.6.8 Shotcreting

The QA Monitor will observe all aspects of the shotcreting process. Records of the applied thickness and shotcrete mix used will be maintained. Following curing of the shotcrete and prior to placement of embankment soils, the QA Monitor will sound the shotcrete and report to the Engineer whether it is properly adhered to the rock surface.

5.6.9 Documentation and Reporting

The QA Monitor will maintain daily records of all foundation preparation activities. Areas not meeting specification will be identified to the Owner and the Engineer.

5.7 CURTAIN GROUTING

5.7.1 General

To reduce the amount of seepage underneath the tailings/water dam, a grout curtain will be constructed. The grout curtain will decrease the permeability of the underlying bedrock and will extend along the core centreline from the north abutment to the south abutment. The grout curtain will be constructed by pressure grouting 1.5" diameter drillholes spaced along the core axis. The spacing of these holes and the grouting pressures will be determined by the Engineer during grouting. The holes will have a maximum spacing of 10' unless otherwise directed by the Engineer.

The CQA program to monitor and direct the curtain grouting will include:

- review of grout mix designs and test results
- equipment approval
- monitoring of primary and exploratory hole drilling
- cleaning and pressure testing
- selection of grouting sequence and pressures
- monitoring and direction of grouting

5.7.2 Summary Specification

The Contractor will complete the curtain grouting operations as shown on the Drawings and further described in the Specifications. The Engineer will provide technical direction to the Contractor and can alter the program on an on-going basis depending on the results of pressure tests and grouting records.

The Contractor will provide all the necessary equipment and materials as detailed in the Specification and approved by the Engineer.

The Contractor will be solely responsible for correcting drillholes that deviate from the orientation specified by the Engineer.

The QA Monitor will direct the grouting process on site and will provide the Contractor with instructions regarding grouting mixes used, grouting pressures, durations and sequences.

5.7.3 Review Of Grout Mix Designs And Test Results

Prior to on-set of grouting operations, the Contractor will submit all proposed mix designs for both non-sanded and sanded grouts to the Engineer for approval. The mix designs will include all proposed admixtures and will be based on confirmed laboratory test results.

5.7.4 Equipment Approval

Prior to mobilization, the Contractor will permit the Engineer to inspect the proposed grouting equipment which will include all pumps, mixers, gauges and ancillary equipment as described in the Specifications.

5.7.5 Monitoring Of Primary And Exploratory Hole Drilling

The QA Monitor will observe all drilling operations and will provide the Engineer's directions for drilling to the Contractor. The QA Monitor will record the depth, location and orientation of all drillholes. The sequence of drilling will be provided to the QA Monitor and the Contractor by the Engineer.

5.7.6 Cleaning And Pressure Testing

The QA Monitor will observe the washing and cleaning of each drillhole by the Contractor. Each hole will be washed after drilling and will be washed until the water return is clear. Pressure testing will be completed on holes selected by the Engineer and will be monitored by the QA Monitor.

Pressure testing will consist of isolating sections of the hole with a double packer arrangement and pressurizing the sections as directed by the Engineer. The pressure, flow and test time will be recorded by the QA Monitor.

5.7.7 Selection Of Grouting Sequence And Pressures

The Engineer will provide the Contractor with the sequence of grouting to be completed in each hole. The grouting pressures and the grout mixes will be as detailed in the Specifications and may be modified only at the direction of the Engineer.

5.7.8 Monitoring and Direction Of Grouting

The QA Monitor will record all grouting activities and will direct the Contractor in regards to changes in grout mixes and grout pressures. The QA Monitor will determine the acceptance or completion of grouting in each hole.

The grouting records will include the following information:

- hole number
- hole location
- depth and grouting sequence
- volume of grout in each stage
- grout mix in each stage
- grouting pressure at each stage
- grouting duration at each stage

All grouting records will be provided to the Engineer on a daily basis for review. The Engineer will review the QA Monitor records and will determine if additional holes are required.

5.7.9 Documentation and Reporting

The QA Monitor will provide an as-built report based on grouting records which will detail all grouting activities including the results of all pressure tests.

5.8 DAM EMBANKMENT CONSTRUCTION

5.8.1 General

Construction of the tailings/water dam will entail the placement of at least eight unique embankment fill materials in eight zones across the dam section. These materials will be borrowed and processed as described in Section 5.4 of this manual. The Contractor will haul, spread and compact each material within the prescribed zones shown on the Drawings and Specifications according to the Specifications for that zone and that material.

The CQA program during placement of the embankment fills will include:

- observation of the fill materials
- observation of the placement procedures
- observation of moisture conditioning
- observation of compaction
- testing of compaction

5.8.2 Summary Specification

The Contractor will haul all required embankment fills from the approved and tested borrow sources and/or stockpiles, and place the materials in the zones and areas designated in the Drawings and Specifications.

The required fill materials are as described in Section 5.4 of this manual and in the Drawings and Specifications. The Contractor will place, spread, moisture condition and compact the fill materials as described in the Specifications and summarized in the tables below.

Specified Lift Thicknesses

Zone/Material	*Maximum Lift Thickness (Uncompacted Thickness)*
Zone 1	1'
Zone 2	8"
Zone 3	1'
Zone 4	1'
Zone 5	1'
Zone 6	3'
Zone 7	6'
12" Riprap	18"
24" Riprap	40"

Moisture Conditioning

Zone/Material	*Specified Moisture Range*
Zone 1	1% to 2% below optimum moisture content
Zone 2	At optimum moisture content to 1% below
Zone 3	0 to 2% below optimum moisture content
Zone 4	As required to achieve compaction
Zone 5	As required to achieve compaction
Zone 6	As required to achieve compaction
Zone 7	As required to achieve compaction
12" Riprap	No moisture required
24" Riprap	No moisture required

Specified Compaction

Zone/Material	*Specified Compaction*
Zone 1	98% of SPMDD[1]
Zone 2	98% of SPMDD
Zone 3	95% of VDTMDD[2]
Zone 4	At least two passes of approved vibratory roller
Zone 5	At least two passes of approved vibratory roller
Zone 6	Not specified[3]
Zone 7	Not Specified
12" Riprap	Not specified
24" Riprap	Not Specified

NOTES:

1. SPMDD is Standard Proctor maximum dry density.

2. VDTMDD is Vibrated Density Test maximum dry density.

3. Not specified means that the level of compaction will be achieved through mechanical spreading of the material and will not be measured.

All placed lifts will be spread in a homogenous manner and will be compacted in a homogenous manner using equipment and techniques approved by the Engineer.

The Contractor will limit haul routes over compacted fills to the routes approved by the Engineer, using methods approved by the Engineer. Over compaction of the Zone 3, 4, and 5 materials will not be permitted. The Contractor is solely responsible for the protection of all completed fills until such a time as indicated by the Engineer.

5.8.3 Observation Of The Fill Materials

The QA Monitor will observe the loading and dumping of all fills and note whether the materials are suitable and meet the criteria provided in Section 5.4 If materials appear to deviate from previously determined and accepted criteria, the QA Monitor will sample the materials and complete any necessary tests to confirm their suitability.

5.8.4 Observation Of The Placement Procedures

The placement of all fill materials will be observed by the QA Monitor. The thickness and spreading method will be noted. Lift thickness will be limited to the values detailed in Section 5.8.2. The QA Monitor will carefully note the occurrence of any segregation and will notify the Contractor and Engineer in this regard.

5.8.5 Observation Of Moisture Conditioning

The method of moisture conditioning will be observed by the QA Monitor to ensure that a uniform moisture content is achieved. The QA Monitor will determine the in situ moisture content to ensure that it falls within the specified limits detailed in Section 5.8.2.

5.8.6 Observation Of Compaction

The QA Monitor will observe the compaction of placed fills and will note the type of equipment and level of effort utilized by the Contractor.

5.8.7 Testing Of Compaction

For fills which have a specified level of compaction, as detailed in Section 5.8.2, the QA Monitor will complete in-place compaction tests. Compaction tests will be completed using Nuclear Densometers according to ASTM D2922. The frequency of tests will be at least one test for each 150 yd^2 of each placed lift. Furthermore, regardless of the amount placed, at least one test will be completed for each testable fill type placed in a shift. Only Zones 1, 2, 3, 4, and 5 fill types are testable.

5.8.8 Documentation And Reporting

The QA Monitor will compile daily reports which detail the filling activities of each shift and itemizes the results of all completed tests. The Engineer and Owner will be informed of all inadequate test results and of any areas not in compliance with specifications.

5.9 SPILLWAY AND CUT-OFF WALL CONSTRUCTION

5.9.1 General

The tailings/water dam will have a continuous flow spillway structure located as shown on the Drawings. The spillway will be a riprap lined channel incised into the downstream shell and dam crest as noted in the Drawings. The spillway channel will be constructed during the placement of embankment fill or by subsequently cutting the channel from placed fills.

Control of the flow into this spillway will be established by a cut-off wall set into the core zone at the crest of the dam. The cut-off wall at the dam crest will be constructed using preserved wood timbers, geosynthetic clay liners, granulite fill and riprap materials.

CQA activities during construction of the spillway and cut-off wall will include:

- observation of the spillway channel and cut-off wall trench excavations
- observation of the cut-off wall construction
- observation of the trench backfilling
- observation of the geosynthetic clay liner placement
- observation of granulite placement and compaction
- observation of riprap placement

5.9.2 Summary Specification

The spillway and cut-off wall will be constructed by the Contractor according to the Drawings and Specifications. The work will include excavation of the spillway channel, where it has not been already formed during fill placement activities, and placement of the riprap materials.

Where the spillway crosses over the core (Zone 2) and the fine chimney filter (Zone 3), the excavation will extend into these zones to allow for the placement of both a coarse filter layer (1' thickness) and a Granulite insulation layer (4' thickness) underneath the specified riprap layer.

A cut-off wall, consisting of an approved 25 mil geosynthetic clay liner (GCL) sandwiched between 4" x 4" preserved wood timbers, will be embedded into the spillway at the crest of the dam. This wall will be embedded within the spillway as shown on the Drawings.

In association with the cut-off wall, a GCL cover will also be placed in front of and behind the cut-off wall, entirely covering the top of the core zone and the fine filter zone across the full extent of the cut-off wall.

The Contractor will be solely responsible for all aspects of the spillway and cut-off wall construction and will retain an Installer to supply and install the GCL as shown in the Drawings and described in the Specifications.

The stability of all excavations will be the responsibility of the Contractor. Any damage that is incurred to adjacent areas or works on the dam during the spillway construction will be the responsibility of the Contractor.

5.9.3 Observation of Excavations

Where completed, the QA Monitor will observe the excavation of placed fills to form the spillway channel. It is expected that the excavation will be limited to the crest of the dam because the downstream shell portion of the channel may be formed during the embankment fill placement. The QA Monitor will record the excavation activities and note the channel shape.

In addition, the QA Monitor will observe the excavation of a suitable trench to construct the cut-off wall and to facilitate placement of geosynthetic clay liner and granulite fill. The depth, location and slopes of the trench will be recorded.

The QA Monitor will observe the hauling and disposal or stockpiling of excavated materials and will note any damage to completed areas of the dam that may be created by the excavation activities.

5.9.4 Observation Of The Cut-off Wall Construction

The QA Monitor will observe the assembly of the cut-off wall and record the materials used.

5.9.5 Observation And Testing of Trench Backfilling

Backfilling of the trench for the cut-off wall will be observed by the QA Monitor. The use of bentonite and bentonite enhanced backfill will be recorded. The level of compaction achieved will be determined by completing compaction tests. The Engineer will be informed if any areas of the trench do not meet or exceed the compaction requirement of 98% of Standard Proctor maximum dry density.

5.9.6 Observation Of The Geosynthetic Clay Liner Placement

Placement of the geosynthetic clay liner in the spillway at the crest of the dam and along the cut-off wall will be observed by the QA Monitor. The QA Monitor will record the materials used and all aspects of the liner placement. The use of overlaps between adjacent rolls and condition of the subgrade underneath the liner will be recorded.

5.9.7 Observation Of Granulite Placement And Compaction

Placement of the granulite fill will be observed by the QA Monitor. The QA Monitor will note the thickness of the placed granulite lifts and the level of compactive effort used.

5.9.8 Observation Of Riprap Placement

The QA Monitor will observe the Contractor placing riprap along the spillway channel.

5.9.9 Documentation and Reporting

The QA Monitor's daily report will record all spillway and cut-off wall activities. Any areas of non-compliance with the Specifications and Drawings will be reported to the Engineer and the Owner. A record of non-compliance and resolution of non-compliance will be maintained.

5.10 INSTRUMENTATION

5.10.1 General

Geotechnical instrumentation necessary to monitor the performance of the dam will be installed by the Engineer, with the co-operation of the Contractor during construction. The instrumentation will include pneumatic piezometers, standpipe piezometers, survey hubs, thermistors, and painted spillway rocks.

CQA activities during installation of instrumentation will include:

- installing, connecting and accurately locating all instruments/instrumentation sites
- completing reading sets during installation
- observing the backfilling of all instruments installed into the dam embankments
- completing reading sets until the end of the construction season
- providing as-built drawings of all instrumentation

5.10.2 Summary Specification

The Engineer will select the location and elevation for all geotechnical and survey instrumentation installed in and around the tailings/water dam. Instrumentation will include six pneumatic piezometers, three standpipe piezometers, four thermistor strings, seven survey hubs and five painted spillway rocks. The approximate locations for all planned instrumentation are detailed on the Drawings.

All instrumentation will be installed by the QA Monitor, who will complete initial reading sets, where appropriate, prior to backfilling by the Contractor. The QA Monitor will also survey the location of all instrumentation.

The Contractor will backfill any trenches or pits that may be required to place instrumentation within the dam or the dam foundation. The Contractor will follow Engineer's directions for the backfilling procedure(s) and will obey the directions of the Engineer in protecting any installations from damage during subsequent construction operations.

The Contractor will co-operate with the QA Monitor during instrumentation installations and will provide access and space as required to facilitate the installations by the QA Monitor.

The QA Monitor will complete regular reading sets, where appropriate, of the instruments during construction and will submit these with detailed as-built drawings to the Engineer at the end of construction.

5.10.3 Locating And Surveying

The QA Monitor will survey the location of all instruments, including the base and any surface extension and trench lines that may be part of the instruments.

5.10.4 Installing

The QA Monitor will install all instrumentation and will connect all fixings, lines, tubes and conduits to the instrument. The Contractor will co-operate fully with the QA Monitor and provide assistance as requested.

5.10.5 Monitoring

The QA Monitor will complete an initial reading set prior to any backfilling and will complete another reading set immediately after completion of the first backfill lift. The QA Monitor will continue to monitor and read the instrument on a weekly basis during construction and at any time extensions or additions are added to the instrument.

5.10.6 Backfilling

The Contractor will backfill all trenches and/or pits used to install the instruments. The backfilling must be conducted according to the directions of the Engineer.

5.10.7 As-Built Drawings And Readings

At the completion of construction, the QA Monitor will prepare as-built drawings of all instrument installations and will provide a report containing all readings sets completed during the construction period.

5.11 DAM MONITORING PROGRAM

5.11.1 General

Following construction of the tailings/water dam, a monitoring program will be enacted by the Owner and the Engineer to observe the performance of the dam and works adjacent to the dam. The monitoring program will consist of regularly reading the instrumentation installed in and adjacent to the dam, completing periodic surveys of the dam and visually observing the dam.

The owner has prepared an Environmental Monitoring Plan and this Plan includes the following:

- readings of piezometers and standpipes
- readings of thermistors
- completion of dam surveys
- completion of dam inspections

5.11.2 Summary Specification

The frequency and extent of monitoring program to be completed for the tailings/water dam and associated works will be as specified by the Type A Water Use license issued to the Owner for the operation of the Minto Project. The details and frequencies for monitoring activities specified by the Type A Water Use license will govern the program except that where the frequency and extent of any activity is greater in the Plan, then the Owner will follow the requirements of the Plan.

5.11.3 Readings Of Piezometers And Standpipes

A total of six pneumatic piezometers and three standpipe piezometers will be installed within the tailings/water dam. These instruments will provide information regarding the interior pore pressures and water levels within the dam embankment zones and within the dam foundation.

Readings from these instruments will be taken by the QA Monitor during construction. Readings will be taken on a daily basis, starting as soon as water is allowed to impound adjacent to the dam.

After construction, the readings will continue to be taken at least two times weekly until the reservoir is completely filled. Readings taken following construction may be taken by either the Owner or by the QA Monitor, if present on site.

For the first full year of operation, following filling of the reservoir, the piezometers should be read on a weekly basis during the months of November, December, January, and February. Twice weekly readings sets should be obtained during the remaining months.

After the first full year of service, the reading frequency should be re-evaluated. Provided that the Engineer is satisfied and provided that it is acceptable under the terms of the Type A Water Use license, the frequency of measurement will be reduced to one reading set per month, except for the months of March, April and May, where two reading sets per month will be required.

All reading sets will be provided to the Engineer for evaluation. The Engineer may request that additional reading sets be completed if this information is deemed necessary to evaluate the performance of the dam.

5.11.4 Readings Of Thermistors

Four thermistor strings will be installed in the native soils along the frozen south side of the dam. A fifth thermistor suite will be installed within the dam spillway at the crest of the dam. The locations of these thermistor suites are indicated in the Drawings. In addition, an existing thermistor suite is already in place adjacent to the dam site. These instruments will allow the ground temperature at these locations to be monitored at any time.

Readings from these instruments will be taken by the QA Monitor during construction. Readings will be taken on a weekly basis, starting as soon as the thermistors are installed.

After construction is complete, the readings will continue to be taken at least two times monthly for the first full year after construction. Readings taken following construction may be taken by either the Owner or by the QA Monitor if present on site.

After the first full year of service, the reading frequency should be re-evaluated. Provided that the Engineer is satisfied and provided that it is acceptable under the terms of the Type A Water Use license, the frequency of measurement will be reduced to one reading set per month.

All reading sets will be provided to the Engineer for evaluation. The Engineer may request that additional reading sets be completed if this information is deemed necessary to evaluate the performance of the dam.

5.11.5 Completion Of Dam Surveys

Following construction of the dam, a complete as-built survey of the dam should be completed. The survey should provide detailed contours of the tailings/water dam as well as tie in all significant features such as survey hubs, and all instrumentation.

During filling of the dam reservoir, a level survey of the dam crest and all established survey hubs should be completed on a weekly basis. The level survey should also record the water level at the time of the survey.

After the reservoir has been filled, a full contour survey should be completed to provide a comparison with the as-built survey. The re-survey should be conducted when there is no snow cover at the dam site.

Surveying of the dam crest should be completed on a bi-annual basis following initial filling of the reservoir. Such surveys of the dam crest and established survey hubs should be completed once during the months of May and September,

All reading sets will be provided to the Engineer for evaluation. The Engineer may request that additional reading sets be completed if this information is deemed necessary to evaluate the performance of the dam.

5.11.6 Completion Of Dam Inspections

Visual inspection of the dam will be completed on a daily basis by the Owner or QA Monitor during initial filling of the dam reservoir. Following filling of the reservoir, the Owner will complete visual inspections of the dam on at least a weekly basis and on any occasion following a significant storm event.

In addition to the Owners inspections, the Engineer will complete an annual visit to site to observe the dam. This visit will be completed in the spring of each year.

5.11.7 Actions To Be Taken

The Engineer will evaluate all monitoring data supplied by the QA Monitor or the Owner. The Engineer will provide a letter annually listing the collected data and certifying the performance of the dam. If the Engineer believes that any aspect of the dam's performance is substandard, then a remediation program will be provided to the Owner to correct the performance.

5.11.8 Documentation And Reporting

All obtained monitoring data, both during and subsequent to construction, will be evaluated by the Engineer and reported to the Owner for submission to the Yukon Territory Water Board. The Engineer and the Owner will both maintain independent databases regarding the dam performance and the dam monitoring program. Any areas of poor performance will be identified and records of remediation maintained.

6.0 MILL WATER POND

6.1 SITE CONDITIONS

The site of the mill water pond has been selected to be on the north side of the Minto Creek valley, downstream of the open pit. To confirm that the subsurface conditions underlying the footprint of the mill water pond comprise thaw stable soils, a drilling program will be undertaken by the Engineer prior to construction to confirm no permafrost exists.

6.2 CLEARING AND GRUBBING

6.2.1 General

Both hand clearing as well as mechanical clearing and grubbing will be completed at the mill water pond. The limits for both will be determined by the Engineer and flagged by the QA Monitor. Clearing and grubbing is to be completed in the following designated work areas:

- pond site areas with thaw stable subsoils
- borrow areas

Hand clearing only will be completed in all areas with thaw unstable subsoils.

The Construction Quality Assurance (CQA) program for clearing and grubbing will include:

- observation of clearing and grubbing activities
- observation of disposal locations and methods

6.2.2 Summary Specification

Hand clearing refers to the hand cutting and removal of all standing trees and shrubs. Clearing and grubbing refers to the removal and disposal of all surface vegetation and surface organic matter including trees, logs, brush, stumps, roots, branches, and surface litter.

All work areas with thaw stable subsoils will be cleared and grubbed prior to any excavation, filling or any other development activity which will be completed at that location. All work areas that are determined to have thaw unstable or ice rich permafrost subsoils will only be hand cleared prior to filling operations.

Disposal methods must be appropriate and in accordance with the governing statutes or legislation of the Yukon Territory, including the regulations for burning and for the protection of water courses.

6.2.3 Clearing And Grubbing Activities

The QA Monitor will observe all clearing and grubbing activities. The Contractors methods will be observed and noted. Compliance with the Specifications of a cleared and grubbed area will be determined by the QA Monitor following clearing and grubbing activities.

6.2.4 Disposal

The QA Monitor will check that all materials from the clearing and grubbing operations are disposed of at approved locations and that disposal methods are appropriate.

6.2.5 Documentation And Reporting

The QA Monitor will record on a daily log the areas cleared and grubbed and the locations of all disposal piles as well as the method of disposal. Any non-compliance with Specifications will be reported to the Owner along with recommendations for remedial actions. A record of non-compliance and resolution of non-compliance will be maintained.

6.3 MATERIAL BORROWING AND PROCESSING

6.3.1 General

The Owner, with assistance from the Engineer will locate borrow sources to provide the necessary fill materials for the construction of the mill water pond. Both unprocessed and processed materials will be used to complete the site works. The Contractor will be responsible for the borrowing and when necessary the processing of all fill materials at the borrow locations. The necessary materials, as designated in the Drawings and Specifications, include: various native silt, sand and gravel mixtures, processed sand, gravel and cobble mixtures and processed coarse rock mixtures.

The CQA program during borrowing and processing of fill materials will include:

- sampling of borrow sites
- testing of borrow materials
- monitoring of borrowing activities, including stockpiling where appropriate
- sampling of processed materials
- testing of processed materials
- monitoring of processed material production including stockpiling

6.3.2 Summary Specification

Fill materials necessary to construct the mill water pond will be borrowed from sources approved by the Owner and the Engineer and processed as necessary to produce the fill materials designated in the Specifications and Drawings. Where native materials are suitable in situ, no processing will be required.

The Contractor will conduct processing of materials, where processing is necessary, concurrently or prior to the onset of pond constructions. The processed materials include as a minimum the sand bedding for the liner and rock fills for the pond. These materials are defined below and in the Drawings and Specifications. The gradation limits for the materials required are as follows:

Common Fill (Residuum)

Sieve	*% Passing (by weight)*
3"	100
1/2"	80 - 100
#4	60 - 100
#40	25 - 55
#200	0 - 25

Common Rock Fill (Waste Rock)

All chemically suitable waste rock which does not contain excessive amounts of sand may be used for common rock fill. A specification band is shown below, oversize would be acceptable for this material.

Sieve	*% Passing (by weight)*
36"	100%
#4	0 - 25%

Drain Rock

Sieve	*% Passing (by weight)*
24"	100
12"	30 - 80
6"	0

Sand Bedding

Sieve	*% Passing (by weight)*
#4	100
#200	0 - 15

Transportation and stockpiling of both unprocessed and processed fill materials will be conducted by the Contractor using methods approved by the Engineer to sites approved by the Engineer.

The techniques of borrow excavation and/or processing will be solely the responsibility of the Contractor. The stability of all borrow excavations and all stockpiles will be the responsibility of the Contractor. Environmental protection, including the protection of water courses, will be the responsibility of the Contractor.

Within the footprint of the mill water pond, only common residuum fill as specified above shall be used as embankment fill supporting the liner. The common waste rock fill should only be used outside the footprint of the mill water pond. A minimum 3 foot thick layer of residuum fill should be placed over the waste rock fill as a transition zone where sand fill for the liner is being placed.

6.3.3 Sampling And Testing Of Borrow Sites

See Section 5.4.3

6.3.4 Monitoring Of Borrowing Activities

See Section 5.4.4

6.3.5 Sampling And Testing Of Processed Materials

The QA Monitor will sample and test each type of processed product manufactured on site by the Contractor. Sampling will be conducted at the end of the production stream and testing will consist of sieve analyses of the materials.

The frequency of testing will be as follows: one test per 1500 yd^3 for bedding material, and, at least one test for each of the coarse rock fills. Regardless of these frequencies, at least one test per material per production day for bedding materials will be conducted. Furthermore, additional tests of any material will be conducted whenever thought necessary as a result of the QA Monitor's visual inspection.

During production of processed materials, the QA Monitor will complete at least one Standard Proctor Test on the bedding material. Additional tests will be conducted whenever a change in the processed material warrants.

6.3.6 Monitoring Of Processed Material Production

See Section 5.4.6

6.3.7 Monitoring Of Stockpiling

See Section 5.4.7

6.3.8 Reporting And Documentation

The QA Monitor will maintain daily records of all borrowing and material processing activities, including borrow areas used, materials excavated, processing completed and the results of tests completed. A record of the stockpiling operations will also be maintained. Any material which does not comply with the Specifications will be reported to the Owner. A record of non-compliance and resolution of non-compliance will be maintained

6.4 POND EXCAVATION

6.4.1 General

Construction of the mill water pond will require that excavation to line and grade as detailed in the Specifications and Drawings. Excavations will only be conducted in areas designated by the Engineer to have thaw stable subsoils.

The CQA plan for the excavation activities will include:

- observation of dewatering activities
- observation of soil excavation activities
- sampling of possible fill materials
- sampling of frozen materials
- observation of rock excavation activities
- observation of overburden waste disposal

6.4.2 Summary Specification

Excavations for the mill water pond dam will be undertaken by the Contractor to the excavation limits and depths directed by the Engineer and detailed in the Drawings and Specifications. Under no circumstances will the Contractor be permitted to disturb areas not designated for excavation.

Excavated materials will be disposed of at approved spoil locations or, if deemed by the Engineer to be suitable, may be used for common fill.

The Contractor will be solely responsible for the method of excavation which may include manual excavation, hydraulic excavation, ripping, and blasting. The Contractor will also be solely responsible for the control and diversion of surface and subsurface water flows into and around all excavations.

The Contractor will be responsible for all aspects of safety during the excavation operations including the stability of all excavations.

6.4.3 Dewatering

The QA Monitor will observe the Contractor's method of dewatering, including if necessary the construction of a coffer dam, on a regular basis. The QA Monitor will inform the Contractor, the Engineer and the Owner if the dewatering methods are not effective in protecting the environment, the dam excavations and other works at the mine site.

6.4.4 Observation Of Soil Excavation Activities

See Section 5.5.4

6.4.5 Sampling Of Possible Fill Materials

Excavated materials which are judged to be potentially suitable, by the QA Monitor, will be sampled and evaluated. The results all evaluations will be provided to the Engineer and the Contractor. Suitable materials may be incorporated as common fill, as deemed appropriate by the Engineer.

6.4.6 Observation of Rock Excavation Activities

See Section 5.5.7

6.4.7 Observation Of Overburden Waste Disposal

The QA Monitor will check disposal areas on a daily basis to observe the placement of unsuitable materials.

6.4.8 Documentation and Reporting

The QA Monitor will maintain daily records of all excavation activities, including areas excavated, depths excavated to, and materials encountered. The QA Monitor will geotechnically log the surface of all completed excavations and will provide this information to the Engineer.

Complete records of blasting activities will be supplied by the Contractor to the QA Monitor for submittal to the Engineer. Any non-compliance with Specifications will be reported to the Owner along with recommendations for remedial actions. A record of non-compliance and resolution of non-compliance will be maintained.

6.5 POND FOUNDATION PREPARATION

6.5.1 General

After excavation of the thaw stable areas of the pond footprint to expose suitable foundation soil subgrade, the excavated surfaces will be prepared for the placement of fills. Areas of the pond foundation which have not been excavated due to the presence of ice rich permafrost will not be disturbed by any activity other than hand clearing, prior to placement of fills.

Preparation of the excavated areas of the foundation will involve final shaping, and densification.

CQA activities during the preparation of subgrade surfaces will include:

- observation of soil shaping and scarifying
- observation of soil and compaction
- testing of soil compaction

6.5.2 Summary Specification

Excavated mill water pond subgrade surfaces will be prepared by the Contractor according to the Specifications and Drawings. Preparation of the subgrade areas will consist of removing oversized clasts and grading the soil to the line and grade designated by the Engineer. The graded surface will be scarified to a minimum depth of 6 inches and be re-compacted to at least 95% of Standard Proctor maximum dry density.

Subgrade areas which have not been excavated due to the presence of ice rich permafrost will not be disturbed prior to filling other than by hand clearing activities.

6.5.3 Grading and Scarifying

The QA Monitor will observe the grading and scarifying of the approved soil subgrade. The QA Monitor will walk over the area with the Contractor and ensure that all clasts larger than 6 inches are removed from the scarified surface.

6.5.4 Soil Compaction

The QA Monitor will observe the Contractor's recompaction of the soil subgrade.

6.5.5 Testing of Soil Compaction

The QA Monitor will complete compaction tests on the recompacted soil subgrade following completion of the compaction by the Contractor. A minimum of one compaction test for each 500 yd^2 of subgrade area will be conducted. Test results will be provided by the QA Monitor to the Contractor and Engineer.

6.5.6 Documentation and Reporting

The QA Monitor will maintain daily records of all foundation preparation activities. Areas not meeting specification will be identified to the Owner and the Engineer.

6.6 FILL PLACEMENT

6.6.1 General

Construction of the mill water pond will entail the placement of significant quantities of common soil and/or rock fill as well as the placement of drainage materials and bedding sand. These materials will be borrowed and processed as described in Section 6.3 of this manual. The Contractor will haul, spread and compact each material shown on the Drawings and Specifications according to the Specifications for that material.

In some cases, a geotextile fabric will be used to separate layers and/or zones of finer and coarser fill materials.

The CQA program during placement of the embankment fills will include:

- observation of the fill materials
- observation of the placement procedures
- observation of moisture conditioning
- observation of compaction
- testing of compaction
- observation of geotextile placement

6.6.2 Summary Specification

The Contractor will haul all required fills from the approved and tested borrow sources and/or stockpiles, and place the materials as designated in the Drawings and Specifications.

The required fill materials are as described in Section 6.3 of this manual and in the Drawings and Specifications. The Contractor will place, spread, moisture condition and compact the fill materials as described in the Specifications and summarized in the tables below.

Specified Lift Thicknesses

Zone/Material	*Maximum Lift Thickness (Uncompacted Thickness)*
Common (soil)	1'
Common (Rock)	3'
Drain Rock	3'
Bedding Sand	8"

Moisture Conditioning

Zone/Material	*Specified Moisture Range*
Common Soil Fill	±3% of optimum moisture content
Common Rockfill	No moisture required
Drain Rock	No moisture required
Bedding Sand	±3% of optimum moisture content

Specified Compaction

Zone/Material	*Specified Compaction*
Common Soil Fill	95% of SPMDD[1]
Common Rockfill	Not specified[2]
Drain Rock	Not specified[2]
Bedding Sand	95% of SPMDD[1]

NOTES:

1. SPMDD is Standard Proctor maximum dry density.

2. Not specified means that the level of compaction will be achieved through mechanical spreading of the material and will not be measured.

All placed lifts will be spread in a homogenous manner and will be compacted in a homogenous manner using equipment and techniques approved by the Engineer. Where delineated in the Drawings and in the Specifications, or as required by the Engineer, the Contractor will place a geotextile fabric to separate finer and coarser fill types. The geotextile will be placed according to the manufactures specifications including the use of overlaps.

The Contractor is solely responsible for the protection of all completed fills until such a time as indicated by the Engineer.

6.6.3 Observation Of The Fill Materials

The QA Monitor will observe the loading and dumping of all fills and note whether the materials are suitable and meet the criteria provided in Section 6.3. If materials appear to deviate from previously determined and accepted criteria, the QA Monitor will sample the materials and complete any necessary tests to confirm their suitability.

6.6.4 Observation Of The Placement Procedures

The placement of all fill materials will be observed by the QA Monitor. The thickness and spreading method will be noted. Lift thickness will be limited to the values detailed in Section 6.6.2.

6.6.5 Observation Of Moisture Conditioning

The method of moisture conditioning will be observed by the QA Monitor to ensure that a uniform moisture content is achieved. The QA Monitor will determine the in situ moisture content to ensure that it falls within the specified limits detailed in Section 6.6.2.

6.6.6 Observation Of Compaction

The QA Monitor will observe the compaction of placed fills and will note the type of equipment and level of effort utilized by the Contractor.

6.6.7 Testing Of Compaction

For fills which have a specified level of compaction, as detailed in Section 6.6.2, the QA Monitor will complete in-place compaction tests. Compaction tests will be completed using Nuclear Densometers according to ASTM D2922. The frequency of tests will be at least one test for each 150 yd^3 of each placed lift. Only the common soil fill and the bedding sand are testable.

6.6.8 Observation Of Geotextile Placement

The placement of geotextiles to separate finer and coarser layers or zones of will be observed by the QA Monitor. The QA Monitor will record the types of materials used and obtain and review the roll certifications for each roll before it is deployed. The materials will be deployed and anchored according to the manufactures directions and according to the Specifications and Drawings.

6.6.9 Documentation And Reporting

The QA Monitor will compile daily reports which detail the filling activities of each shift and itemizes the results of all completed tests. The Engineer and Owner will be informed of all inadequate test results and of any areas not in compliance with specifications.

6.7 POND LINER INSTALLATION

6.7.1 General

The mill water pond will be lined with a high density polyethylene (HDPE) liner overlying the placed bedding sand.

The CQA program during the installation of the liner will include:

- observation of the bedding surface
- observation of geosynthetic liner installation
- installer's quality control

6.7.2 Summary Specification

The mill water pond will be completely lined with a 60 mil HDPE liner. The liner will be designed and installed to form a complete water tight seal and will include all necessary details for the sealing of penetrations. The liner will extend up to and over the crest of the pond and will be anchored beyond the crest of the pond.

The Contractor and Installer will be responsible for the installation of the liner and must repair and replace, to the Engineers satisfaction, any damage to the HDPE liner that may develop during construction.

6.7.3 Observation of Bedding Surface

The QA Monitor will observe the bedding surface prior to placement of the liner. The QA Monitor and the Contractor will record the thickness of the bedding sand and will inspect the bedding layers to locate and remove any sharp rocks or objects.

6.7.4 Observation Of HDPE Liner Installation

The QA Monitor will observe the Installer's installation of the HDPE liner. The QA Monitor will record the types of materials used and obtain and review the roll certifications for each roll before it is deployed. The QA Monitor will observe the incorporation of thermal slack and will observe the forming of construction seams by the Installer. The location, construction, and backfilling of anchor trenches will also be observed.

6.7.5 Installer's Quality Control

Non-destructive testing of all seams and repairs will be conducted by the Installer. This testing will be completed as the seaming work progresses. The QA Monitor will observe and record all of the Installer's non-destructive testing results. If there is a discrepancy, the QA Monitor's records will prevail. Non-destructive testing without the presence of the QA Monitor will not be accepted.

6.7.6 Documentation and Reporting

Daily reports will be compiled by the QA Monitor reporting the progress of the HDPE liner installation. The results of all tests completed on the liner will be reported on a daily basis. Any areas of non-compliance will be reported to the Engineer and the corrective actions recorded.

6.8 POND OUTLET CULVERTS

6.8.1 General

Overflow from the mill water pond will be directed to the water/tailings dam diversion ditch through the use of two culverts located at the east end of the pond.

The CQA program during the installation of the liner will include:

- review of pipe supplied
- observation of pipe installation
- observation of liner penetrations

6.8.2 Summary Specification

Discharge and overflow from the mill water pond will be directed into the water/tailings dam diversion ditch through two 4' diameter corrugated steel culverts as specified on the Drawings and in the Specifications. The culverts will be installed with an invert elevation of 2566' and will have a 1% gradient.

The Contractor will be responsible for the installation of the culverts and must repair and replace, to the Engineers satisfaction, any damage that may develop during construction.

6.8.3 Review Of Pipe Supplied

The QA Monitor will check the pipe supplied to the site for compliance with the specifications, and will check for damaged lengths of pipe.

6.8.4 Installation

The QA Monitor will observe the pipe as it is being installed to verify that the pipe is installed in the locations shown on the Drawings. The QA Monitor will confirm that the pipe has been properly placed on a bedding material and is backfilled as specified in the Specifications and on the Drawings. A record of the installation will be made including layout and backfill types and compaction.

6.8.5 Liner Penetrations

The culverts will penetrate the pond liner at the invert elevation. To seal these penetrations a HDPE boot will be installed over the culvert ends. The QA Monitor will observe the construction of the liner boot and its ancillary components, and will observe the installation process.

6.8.6 Documentation And Reporting

The QA Monitor will record pipe installation activities on his daily report, including areas worked, pipe installed, observations made, and any non-compliance with the Specifications and the resolution of such. Any non-compliance will be reported to the Engineer and the Owner.

6.9 INSTRUMENTATION

6.9.1 General

Geotechnical instrumentation necessary to monitor the performance of the mill water pond will be installed by the Engineer, with the co-operation of the Contractor during construction. The instrumentation will include survey hubs, and thermistors. CQA activities during installation of instrumentation will include:

- installing, connecting and locating all instruments/instrumentation sites
- completing reading sets until completion of the construction season
- providing as-built drawings of all instrumentation

6.9.2 Summary Specification

The Engineer will select the location and elevation for all geotechnical and survey instrumentation installed in and around the mill water pond. Instrumentation will include two thermistor strings, and six survey hubs. The approximate locations for all planned instrumentation are detailed on the Drawings.

All instrumentation will be installed by the QA Monitor, who will complete initial reading sets, where appropriate. The QA Monitor will also survey the location of all instrumentation.

The Contractor will follow Engineer's directions in protecting any installations from damage during construction operations. The Contractor will co-operate with the QA Monitor during instrumentation installations and will provide access and space as required to facilitate the installations by the QA Monitor.

The QA Monitor will complete regular reading sets, where appropriate, of the instruments during construction and will submit these with detailed as-built drawings to the Engineer at the end of construction.

6.9.3 Locating And Surveying

The QA Monitor will have the location of all instruments surveyed, including the base and any surface extension and trench lines that may be part of the instruments.

6.9.4 Installing

The QA Monitor will install all instrumentation and will connect all fixings, lines, and conduits to the instrument. The Contractor will co-operate fully with the QA Monitor and provide assistance as requested.

6.9.5 Monitoring

The QA Monitor will complete an initial reading set prior to any backfilling and will complete another reading set immediately after completion of the backfilling. The QA Monitor will continue to monitor and read the instrument on a weekly basis during construction and at any time extensions or additions are added to the instrument.

6.9.6 As-Built Drawings And Readings

At the completion of construction, the QA Monitor will prepare as-built drawings of all instrument installations and will provide a report containing all readings sets completed during the construction period.

6.10 POND MONITORING PROGRAM

6.10.1 General

Following construction of the mill water pond, a monitoring program will be enacted by the Owner and the Engineer to observe the performance of the pond and works adjacent to it. The monitoring program will consist of regular visual inspections of the pond liner and fills as well as settlement surveys of the adjacent fills and reading of the ground temperature thermistors.

The owner has prepared an Environmental Monitoring Plan and this Plan includes the following:

- readings of thermistors
- completion of settlement surveys
- completion of pond liner inspections

6.10.2 Summary Specification

The frequency and extent of monitoring program to be completed for the tailings/water dam and associated works will be as specified by the Type A Water Use license issued to the Owner for the operation of the Minto Project. The details and frequencies for monitoring activities specified by the Type A Water Use license will govern the program except that where the frequency and extent of any activity is greater in the Plan, then the Owner will follow the requirements of the Plan.

6.10.3 Readings Of Thermistors

Two thermistor strings will be installed in the native soils along the frozen south side of the pond fill. These instruments will allow the ground temperature at these locations to be monitored at any time.

Readings from these instruments will be taken by the QA Monitor during construction. Readings will be taken on a weekly basis, starting as soon as the thermistors are installed.

After construction is complete, the readings will continue to be taken at least monthly for the first full year after construction. Readings taken following construction may be taken by either the Owner or by the QA Monitor if present on site. In the second year the readings may be reduced to bi-monthly and in the third year, once every third month.

After the third year of service, the reading frequency should be re-evaluated. Provided that the Engineer is satisfied and provided that it is acceptable under the terms of the Type A Water Use license, the frequency of measurement will be reduced.

All reading sets will be provided to the Engineer for evaluation. The Engineer may request that additional reading sets be completed if this information is deemed necessary to evaluate the performance of the pond fills.

6.10.4 Completion Of Settlement Surveys

Following construction of the pond, a complete as-built survey of the should be completed. The survey should provide detailed contours of the pond and pond fills as well as tie in all significant features such as survey hubs, and all instrumentation.

Surveying of the six established survey hubs should be completed on a quarterly basis for the first year of operation. This frequency should be reviewed after the first year and likely reduced to biannual readings.

All reading sets will be provided to the Engineer for evaluation. The Engineer may request that additional reading sets be completed if this information is deemed necessary to evaluate the performance of the pond.

6.10.5 Completion Of Pond Liner Inspections

Visual inspection of the pond liner will be completed on a daily basis by the Owner or QA Monitor during initial filling of the pond. Following filling of the pond, the Owner will complete visual inspections of the liner during the spring of each year when the pond has been drawn down to its lowest level.

In addition to the Owners inspections, the Engineer will complete an annual visit to site to observe the pond. This visit will be completed in the spring of each year.

6.10.6 Actions To Be Taken

The Engineer will evaluate all monitoring data supplied by the QA Monitor or the Owner. The Engineer will provide a letter annually listing the collected data and certifying the performance of the pond. If the Engineer believes that any aspect of the pond's performance is substandard, then a remediation program will be provided to the Owner to correct the performance.

6.10.7 Documentation And Reporting

All obtained monitoring data, both during and subsequent to construction, will evaluated by the Engineer and reported to the Owner for submission to the Yukon Territory Water Board. The Engineer and the Owner will both maintain independent databases regarding the pond performance and the pond monitoring program. Any areas of poor performance will be identified and records of remediation maintained.

7.0 DIVERSION DITCH CONSTRUCTION

7.1 General

The diversion ditch will be constructed along the mill site access road and will consist of an excavated channel surfaced with bedding materials, an impermeable geosynthetic liner, geotextile separator fabrics and riprap. In addition to this ditch, several shorter ditches will be constructed entering and leaving the mill water pond.

The CQA program during the construction of the diversion ditches will include:

- observation of excavations
- observation of placement of bedding material
- observation of geosynthetic liner installation
- Installer's quality control
- observation of geotextile placement
- observation of riprap placement

7.2 Summary Specification

The diversion ditches will be constructed to the profile and grade indicated by the Engineer and shown on the Drawings and Specifications. The excavated ditch surface will be surfaced with sand bedding materials and a geosynthetic liner. The geosynthetic liner will be further covered by protective sand bedding materials and geotextiles as shown on the Drawings and described in the Specifications. The geotextiles will in turn be covered by a 1.5' thick layer of 12" median riprap. Placement of the riprap can be by dumping and spreading on the ditch base but must be carefully placed, not dumped, on the ditch side slopes.

The Contractor and Installer will be responsible for the construction of the diversion ditches and must repair and replace, to the Engineers satisfaction, any damage to the geosynthetic liner and geotextiles that may develop during construction.

7.3 Observation Of Excavations

The QA Monitor will observe the excavation of the diversion ditch. The QA Monitor will record the type of material excavated and the will log the exposed surface of the excavations.

7.4 Observation of Bedding Placement

The QA Monitor will observe the placement of the bedding sand throughout the base and sides of the diversion ditch. The QA Monitor and the Contractor will record the thickness of the bedding sand and will inspect the bedding layers to locate and remove any sharp rocks or objects. Both the base layer and the covering layer of bedding sand will be observed and inspected by the QA Monitor.

7.5 Observation Of Geosynthetic Liner Installation

The QA Monitor will observe the Installer's installation of the geosynthetic liner. The QA Monitor will record the types of materials used and obtain and review the roll certifications for each roll before it is deployed. The QA Monitor will observe the incorporation of thermal slack and will observe the forming of construction seams by the Installer. The location and construction of anchor trenches will also be observed.

7.6 Installer's Quality Control

Non-destructive testing of all seams and repairs will be conducted by the Installer. This testing will be completed as the seaming work progresses. The QA Monitor will observe and record all of the Installer's non-destructive testing results. If there is a discrepancy, the QA Monitor's records will prevail. Non-destructive testing without the presence of the QA Monitor will not be accepted.

7.7 Observation Of Geotextile Placement

The placement of both non-woven and woven geotextiles over the geosynthetic liner and bedding materials will be observed by the QA Monitor. The QA Monitor will record the types of materials used and obtain and review the roll certifications for each roll before it is deployed. The materials will be deployed and anchored according to the manufacturers directions and according to the Specifications and Drawings.

7.8 Observation Of Riprap Placement

Riprap will be placed over the geotextiles and bedding materials as indicated in the Drawings and Specifications. The QA Monitor will observe the riprap placement and will note the equipment used for placement. The thickness of the riprap will be recorded. Any damage to the geotextiles will be reported to the Engineer.

7.9 Documentation and Reporting

Daily reports will be compiled by the QA Monitor reporting the progress of the diversion ditch construction. The results of all tests completed on the geosynthetic liner will be reported on a daily basis. Any areas of non-compliance will be reported to the Engineer and the corrective actions recorded.

8.0 CONSTRUCTION RECORDS REPORT

The Engineer will compile a construction records report following completion of the construction and installation. This report will contain the following records from the construction quality assurance and surveys:

- documentation from the CQA defined in all of the proceeding Sections
- site plans showing survey records of layout and elevations
- a copy of the CQA procedures as set forth in this manual and revisions or additions

9.0 ANNUAL REVIEW REPORTS

The Engineer will complete annual inspections of all the major mine structures including the tailings/water dam, mill water pond, the diversion ditch, the ice-rich overburden dump and the main overburden and waste rock dump. The inspection will be completed as described in this manual and will be independent of the mine management. The inspections will be completed on or before July 1st of each year and will be reported to the Owner within 45 days of the inspection for submission to the Yukon Territory Water Board.