Indigenous and Northern Affairs Canada | Affaires autochtones et du Nord Canada

Water Resources Division
Resource Management Directorate
Nunavut Regional Office
P.O. Box 100
Iqaluit, NU, X0A 0H0

Your file - Votre référence
2AM-DOH1323 & 2AM-BOS----

March 29, 2018

Our file - Notre référence
CIDM#1213786

Richard Dwyer
Licensing Administrator
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU, X0B 1J0

Re: Indigenous and Northern Affairs Canada's technical review of TMAC Resources Inc.'s new water licence application 2AM-BOS---- and renewal-amendment no.2 application for water licence 2AM-DOH1323, both for Phase 2 of the Hope Bay Project

Dear Mr. Dwyer,

Thank you for your February 23, 2018 invitation for technical review comments on the above referenced applications.

The Water Resources Division of Indigenous and Northern Affairs Canada (INAC) and our consultant, Arcadis Canada Inc., examined the application. The results of their review are provided in attachment 1, and further results from our review are provided in attachment 2 for the Nunavut Water Board's consideration. Comments have been provided pursuant to INAC's mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Indian Affairs and Northern Development Act*.

INAC appreciates the opportunity to participate in this review. If there are any questions or concerns, please contact me at (867) 975-3876 or by e-mail at sarah.forte@canada.ca.

Sincerely,

Sarah Forté
Water Management Specialist

Canada

Attachment 1

Technical review of Hope Bay Phase 2 water licence applications
2AM-BOS---- & 2AM-DOH1323 amendment no.2
prepared by Arcadis Canada Inc.

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Sarah Forté
Water Management Specialist
Water Resources, Nunavut Regional Office
Indigenous and Northern Affairs Canada

Subject:
Technical review of water licence applications for Phase 2 of TMAC's Hope Bay Belt Project (2AM-HOP---- and 2AM-DOH1323 amendment #2)

ENVIRONMENT

Date:
March 21, 2018

Contact:
Tony Brown

Phone:
416-550-5974

Dear Sarah:

This submission presents a summary of the technical review conducted by Arcadis on the regulatory applications referenced above.

Background

TMAC Resources Inc (TMAC) currently operates the Doris North gold mine in the Hope Bay Belt of Nunavut's Kitikmeot region, approximately 150 km southwest of Cambridge Bay. In order to expand operations to two other deposits in the Belt (Madrid and Boston), TMAC is seeking new and amended permits from the Nunavut Impact Review Board (NIRB) and Nunavut Water Board (NWB) in a coordinated process. The NWB has requested two applications to regulate the expanded scope of activities as requested in the Hope Bay Belt Phase 2 Project Proposal including:

1. an application to amend the current scope of the existing Doris North Type "A" Water Licence (2AM-HOP1323 amendment #2) to expand the scope to include the additional water use and waste deposit activities at the Doris site associated with the Madrid Project and the processing at the Doris site of the additional volumes of ore originating at Madrid and the concentrate from the Boston; and
2. an application for a new and separate Type "A" Water Licence (2AM-HOP----) to govern the water use and waste deposit activities associated with the construction, operation and reclamation of the mining undertaking at the Boston site.

Indigenous and Northern Affairs Canada (INAC) is an interested party in the review of water licence applications processed by the NWB. INAC requested that Arcadis

Canada Inc. (Arcadis) provide a range of technical support related to the water licence applications, including detailed reviews during the NWB's Technical Review Phase. In performing the reviews, INAC requested that Arcadis focus on the following areas of interest:

- Land contamination affecting or possibly affecting water;
- Surface water quality;
- Surface water quantity;
- Groundwater;
- Marine water quality only as affected from land (i.e., discharge from water impoundment area into marine environment; drainage at marine laydown site);
- Permafrost;
- Waste management;
- Tailings management;
- Closure planning; and
- Reclamation cost estimating.

Technical Review Findings

The attached Technical Review Comments 1 through 7 summarize the findings of our review. In general, the information, analysis and presentation of the submissions were good. However, some aspects of the proposed Project remain at a conceptual stage and the applications have fewer details than would typically be required prior to issuance of regulatory approvals. Specifically, the documents and level of detail presented are generally similar (or the same) as those which were used during the Environmental Assessment process. As a consequence, a variety of uncertainties regarding the design and environmental performance of the Project remain. In some cases, TMAC has identified these uncertainties and proposed reasonable strategies to obtain the information necessary to refine designs to ensure the Project achieves its intended environmental outcomes. Nonetheless, based on the information provided to date, there is a potential that some impacts have been under-estimated. This would put into question whether facilities are adequately designed, whether mitigation measures identified are sufficient, and whether additional monitoring programs and/or contingencies need to be developed.

In the opinion of Arcadis, potential impacts associated with the operational phase are generally well understood, are of limited duration and/or can be mitigated through active interventions. In contrast, uncertainties regarding the post-closure performance of the site could result in unintended and difficult to mitigate impacts. We have, therefore, placed an increased emphasis on potential concerns related to the post-closure phase of the Project.

Sarah Forté
March 21, 2018

Closure

We trust that this summary meets your expectations. Feel free to contact me if any additional information is required.

Sincerely,

Arcadis Canada Inc.

Tony Brown, M.Sc., P.Eng.

Enclosures:
Attachment 1: Technical Review Comments

ATTACHMENT 1

Technical Review Comments

Comment #1: Doris Tailings Impoundment Area
Comment #2: Boston Tailings Management Area Seepage
Comment #3: Closure Panning and Requirements
Comment #4: Water Treatment Plant Effluent Quality
Comment #5: Backfill Materials
Comment #6: Long-Term Climate Change Effects
Comment #7: Release of Saline Minewater to the Tundra

Technical Review Comment	**INAC Technical Review Comment #1**
Subject	**Doris Tailings Impoundment Area**
References	P4-21: Hope Bay Project – Doris-Madrid Interim Closure and Reclamation Plan P5-4: Hope Bay Project – Water and Load Balance P5-9: Hope Bay Project – Geochemical Source Term Predictions P5-16: Hope Bay Project – Doris Tailings Management System
Summary	The current closure concept for the Doris TIA involves placement of a simple isolation barrier constructed from quarry rock. Based on the properties of tailings that will be contained in the TIA, the proposed cover concept is generally appropriate. However, clarification is required regarding the water quality criteria that will be used to assess the performance of the cover during the post-closure phase. Additional studies are also needed to refine aspects of the cover design to ensure it is able to achieve its intended environmental outcomes.
Importance of Issue to Water Resources	Flotation tailings are the only material that will be stored on surface during the post-closure phase. To minimize the potential for long-term environmental impacts, the design of the Doris TIA must be optimized.
Detailed Review Comment	The flotation tailings that will be deposited in the Doris Tailings Impoundment Area (TIA) contain excess acid neutralization capacity which makes them non-potentially acid generating (non-PAG) and therefore there are no requirements to prevent their oxidation. While acid generation is not a concern, long-term humidity cell tests indicate that neutral pH metal leaching may develop, with arsenic being of particular concern. Nonetheless, TMAC has stated that, based on the TIA water and load balance, neutral metal leaching does not pose a limitation in ensuring the post closure water quality discharging from the TIA. We note, however, that post-closure water quality criteria have not been established for the project. Based on the above, TMAC determined that an infiltration reduction cover is not required. However, the tailings surface will be susceptible to wind and water erosion which could result in tailings releases to the environment (i.e., as dust and/or suspended solids). To prevent these potential impacts, TMAC's proposed closure concept for the Doris TIA is to place a granular cover over the tailings surface to prevent wind and water erosion. This cover will also function as a separation barrier to prevent tailings contact with humans and wildlife. At post-closure, runoff from the TIA is anticipated to enter the north end of Doris Lake where some localized mixing and dilution with lake water could occur. Potential considerations and concerns related to the Doris TIA are as follows: **<u>Post-Closure Water Quality Criteria</u>** A key closure objective for the Doris TIA (as well as other project components) is to ensure a walk away closure scenario, which implies no requirements for long-

	term water management. While geochemical source term predictions indicate that post-closure tailings seepage will have an upper case arsenic concentration of 0.21 mg/L (document P5-9, Table 4-2), discharges from the facility as a whole will have an average upper case concentration of 0.079 mg/L (document 5-4, Table 7-1). Based on these concentrations, TMAC concluded that post-closure discharges from the Doris TIA will comply with the applicable criteria which they have assumed to be the Metal Mining Effluent Regulations (MMER). Specifically, in the case of arsenic, average post-closure discharges from the TIA are predicted to remain below the proposed revised MMER criterion of 0.1 mg/L. However, we note that the technology-based MMER are intended for operating mines and therefore question the appropriateness of their use during the post-closure phase. Instead, during post-closure, compliance criteria should be derived from the appropriate environmental quality criteria (EQC). For example, in the case of arsenic, the criterion would be set based on the CCME Freshwater Aquatic Life criterion of 0.005 mg/L or the site-specific water quality objective (SSWQO) of 0.028 mg/L. In either case, discharges from the TIA to Doris Lake would be non-compliant until sufficient mixing has occurred within the receiver. Based on the above, TMAC's conclusion that drainage from the TIA will meet applicable criteria is premature; that determination can only be made once the post-closure criteria have been set. While this issue has been raised in relation to the Doris TIA, it also applies to other site components. Specifically, as noted throughout Section 7 of document P5-4, there are multiple water bodies that will consistently exceed the applicable CCME criteria for arsenic and copper during the post-closure phase. **Doris TIA Cover Design** TMAC's proposed closure concept for the Doris TIA involves placing a 0.3 m thick layer run of quarry (ROQ) rock[1]. The 0.3 m thickness is stated as being the minimum thickness of cover that can practically be placed over the tailings surface. The cover will be placed during winter to facilitate equipment traffic on the saturated tailings. Potential issues associated with the proposed cover concept include: 1. **Separation Layer** – The placement of coarse rock covers over saturated tailings can, depending on a variety of factors, result in gradual cover settlement into the tailings and/or vertical "piping" of tailings through the cover to the surface (e.g., tailings boils at the Beaverlodge and Discovery Mines). One potential mitigation is the placement of a separation layer such as a geofabric between the tailings and coarse

[1] Application documents also include statements indicating the cover will be constructed from waste rock (e.g., document P5-16 page 2). Nonetheless, this review is based on the understanding that the cover will be constructed of ROQ rock.

	rock cover. No such layer has been included in the proposed Doris TIA cover design. 2. **Design Thickness** –ROQ typically includes rock sizes of up to 0.3 m. Taking into consideration the proposed cover thickness is only 0.3 m, there is a potential that some tailings will be exposed through void spaces that extend from the tailings surface to the top of the cover. Environmental consequences of this possibility do not appear to have been considered when developing the design (e.g., vegetation growing through the cover voids). This potential would be reduced if the cover is constructed of crushed rock instead of ROQ. 3. **Differential Settling** - TMAC acknowledges that ice lenses, compression consolidation and other factors are likely to result in differential settling of the TIA surface. During the period immediately following closure, this issue will be addressed by filling any depressions that are formed with additional cover or fill material. However, over the long-term, differential settling will continue to occur and may result in ponding that has elevated concentrations of some parameters. While this is not necessarily a concern for the aquatic environment, it does represent a potential exposure pathway for terrestrial receptors. 4. **Predicted Freezeback of Tailings –** The post-closure environmental performance of the Doris TIA will depend, in part, on the extent to which the tailings freeze and remain frozen. TMAC's modelling of the tailings freezeback was based on phase change of porewater at 0˚C which, based on the salinity of the materials involved, may not be appropriate. 5. **Compatibility with Wildlife –** Post-closure, the covered TIA surface could be an attractant to some species. However, the angular ROQ surface may present a hazard to some animals such as caribou. In summary, there are multiple uncertainties related to the design of the Doris TIA cover and its ability to achieve its intended environmental outcomes. TMAC currently has no plans to perform reclamation research to resolve such uncertainties.

Recommendation/ Request	**Recommendation #1** - TMAC should explicitly demonstrate that any proposed post-closure water quality criteria are protective of the receiving environment. Any areas where the criteria will not be met (e.g., within mixing zones) should be clearly defined and potential adverse impacts within those areas should be quantified. While this recommendation is associated with the Doris TIA, it should be applied to all aspects of the Phase II Hope Bay Project. **Recommendation #2** - TMAC should conduct a comprehensive reclamation research plan (RRP) to assist with the design of the Doris TIA cover. The RRP should include field trials to confirm that any proposed cover concepts perform as intended. In addition to evaluating the performance of the proposed cover concept, other configurations should also be assessed (e.g., low permeability covers). Factors that should be considered include but are not limited to: the potential need for separation layers, the influence of variable cover thicknesses and materials, impacts/mitigations of differential settling, freezeback performance and compatibility with terrestrial species. The RRP and field trials should be initiated within one year of licence issuance to ensure that research findings can be incorporated into revised cover designs.

Technical Review Comment	**INAC Technical Review Comment #2**
Subject	**Boston Tailings Management Area Seepage**
References	P4-10: Hope Bay Project – Boston Tailings Management Area – Operation, Maintenance and Surveillance Manual P5-4: Hope Bay Project – Water and Load Balance P5-25: Hope Bay Project – Geochemical Characterization of Waste Rock and Ore from the Boston Deposit P5-26: Hope Bay Project – Boston Tailings Management Area Preliminary Design P5-27: Hope Bay Project – Boston Tailings Disposal Alternatives Assessment
Summary	The environmental performance of the Boston project depends on the extent to which neutral drainage from the TMA is controlled. Towards this end, TMAC's proposed cover concept of a dry stack tailings facility that will be covered by a geomembrane liner is an appropriate closure strategy. However, given the importance of the liner to the environmental performance of the site, the potential water quality impacts associated with partial failure of the liner over the long-term should be evaluated.
Importance of Issue to Water Resources	Higher than anticipated arsenic loadings from the Boston TMA could result in unacceptable impacts to the surface water environment. Potential TMA failure modes should be addressed through proactive maintenance.
Detailed Review Comment	Flotation tailings from the Boston Mine are not predicted to be acid generating. However, the tailings are potentially metal leaching under neutral conditions and are predicted to generate seepage with elevated metal concentrations (arsenic in particular with concentrations of 3.8 mg/L). TMAC's proposed flotation tailings management strategy at the Boston Mine involves the construction of a "dry stack" of filtered tailings. The technology has been used in the Canadian arctic and is currently considered to be the best practice in tailings management. TMAC predicts that seepage from the TMA will be negligible due to the high placed density and the fact that tailings will freeze back and remain frozen for the foreseeable future (other than the active layer). Nonetheless, to reduce seepage volumes to the greatest extent possible, TMAC has elected to construct a low infiltration cover over the tailings. The cover will be constructed of a geomembrane laid directly on the tailings surface, followed by a protective non-woven geotextile, 0.3 m of crushed gravel and 0.7 m run of quarry for erosion protection. The combination of a dry stack facility covered by a low infiltration cover is an appropriate solution for the Boston Mine. However, TMAC correctly notes that the ongoing performance of the facility is strongly correlated to the extent of leakage through the geomembrane. TMAC therefore evaluated what they consider to be a

	"worst case scenario" representing an upper bound of seepage through the geomembrane (Document P5-26, Appendix E). The analysis determined that the maximum leakage rate would be only 0.64 m^3/day for the entire facility. This rate was calculated based on the assumption there would be only one 2 mm hole for every acre of geomembrane. While this imperfection rate may be appropriate for a new membrane installed under ideal conditions, we question its use when assessing the long-term performance of a cover as it ages and leakage rates increase. Furthermore, it is not necessarily representative of a cover installed in a remote arctic location. It is significant to note that TMAC predicts that discharges from the Boston TMA will have an upper case arsenic concentration of 0.079 mg/L (document 5-4, Table 7-1) which is 79% of the proposed MMER arsenic criterion of 0.1 mg/L. It is our understanding that the predicted arsenic concentration is based on the leakage assumptions noted above (i.e., very low imperfection rates in the geomembrane soon after placement). On that basis, arsenic concentrations in the TMA discharges would presumably approach and eventually exceed the MMER criterion if initial leakage rates are higher than predicted and/or as it ages with time and leakage rates increase. In addition, as indicated in Comment #1, we question the appropriateness of using the MMER during the post-closure phase. With regard to cover performance over time, researchers estimate that the half-life (i.e., 50% degradation) of geomembranes is likely several hundred years under "typical" conditions.[2] While liners are expected to continue functioning beyond their half life, leakage rates are anticipated to increase with time until the liner is no longer capable of meeting its design intent. With regard to the Hope Bay Project, there is currently insufficient information to determine if this will occur in decades, centuries or longer. In addition, no information is available regarding the environmental consequences of a partial liner failure. TMAC has demonstrated that the potential for elevated arsenic loadings from the Boston TMA justify the significant expense of constructing a low-permeability cover over the facility. However, based on our review, they have not conducted a sufficiently conservative analysis of the long-term performance of the cover under sub-optimal conditions.

[2] Geosynthetic Institute. 2011. Geomembrane Lifetime Prediction: Unexposed and Exposed Conditions.

Recommendation/ Request	**Recommendation #3** - TMAC should conduct a detailed analysis of long-term failure modes of the Boston TMA (geomembrane degradation/exposure, geotechnical failures, erosion, differential settling, etc.). The analysis should evaluate arsenic loadings for a scenario in which 1% of the geomembrane has "failed" and should also ascertain the likelihood of the scenario occurring over extended periods (e.g., at 50 and 100 years post-closure). **Recommendation #4** - TMAC should specify the anticipated design life of the Boston TMA components, with reference to comparable case studies. Descriptions of maintenance activities that would extend the design life of the facility should also be provided, with a focus on the prevention/mitigation of the potential failure modes described in the response to Recommendation #3. **Recommendation #5** - TMAC should describe any post-closure mitigative actions that could be taken if seepage from the Boston TMA exceeds the applicable MMER criteria. **Recommendation #6** - TMAC should conduct a comprehensive reclamation research plan to assist with the design of the Boston TMA cover. The RRP should include field trials to confirm that any proposed cover concepts perform as intended. The RRP and field trials should be initiated within one year of licence issuance to ensure that research findings can be incorporated into revised cover designs.

Technical Review Comment	**INAC Technical Review Comment #3**
Subject	**Closure Planning and Requirements**
References	P4-14: Hope Bay Project – Hydrocarbon Contaminated Material Mgmt. Plan P4-19: Hope Bay Project – Boston Conceptual Closure and Reclamation Plan P4-20: Hope Bay Project – Boston Conceptual Closure and Reclamation Plan Detailed Cost Estimate P4-21: Hope Bay Project – Doris-Madrid Interim Closure and Reclamation Plan P4-22: Hope Bay Project – Doris-Madrid Interim Closure and Reclamation Plan Detailed Cost Estimate
Summary	From a technical perspective, the closure and reclamation approaches proposed by TMAC appear to be appropriate for the current level of project definition. While there will be opportunities to refine the closure and reclamation plans as the project progresses through its life cycle, uncertainty could be reduced significantly by conducting a more thorough and methodical planning process.
Importance of Issue to Water Resources	Better definition of closure and post-closure requirements will: a) result in more accurate closure cost estimates; and b) provide greater certainty regarding closure expectations.
Detailed Review Comment	In many respects, potential impacts associated with the operational phase of the Hope Bay Project are well understood, are of limited duration and/or are readily mitigated through active interventions. In contrast, uncertainties regarding the post-closure performance of the sites could result in unintended and difficult to mitigate impacts. To minimize these uncertainties, the closure and reclamation planning process is intended to provide a clearly defined, well documented, transparent and rational path towards successful relinquishment. It is therefore in the best interest of TMAC and other parties to ensure that the process is thorough and conforms to all applicable requirements. Potential considerations and concerns related to the closure planning process are as follows: **<u>Compliance With Applicable Guidance</u>** TMAC indicated that the Hope Bay Project CRPs conform with the following document: *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVLWB and AANDC 2013).* Although the NWT guideline does not apply specifically to Nunavut, TMAC stated that the guide was used because it represents current best practice in northern closure planning. Our review therefore assessed the performance of the CRPs against the requirements that are specified in the MVLWB/AANDC guidance. A focus was placed on the current status of the Boston CCRP (document P4-19), as summarized in Table 1.

Table 1 – Assessment of the Boston CCRP Against MVLWB/AANDC Closure Planning Guidance

CCRP REQUIREMENT	PROVIDED?
Project Environment	Yes
Project Description	Yes
Objectives	Prelim.
Criteria	No
Options Analysis	No
Evidence of Preferred Option Performance	No
Predicted Residual Effects	No
Progressive Reclamation	Prelim.
Temporary Closure	Yes
Uncertainties	No
Reclamation Research	No
Contingencies	Prelim.
Post Closure Monitoring/Maintenance Plan	Prelim.
Engagement / Consultation	No
Financial Security	Yes

As indicated in Table 1, the CRPs do not meet the requirements of the guidance in multiple areas. Notable deficiencies include:

- **Objectives and Criteria** – Proposed objectives are identified for some but not all components. These objectives form the basis of the CRPs and should be explicitly identified. Criteria are generally not defined at all. This is acceptable for preliminary closure plans but should be addressed in all subsequent iterations.
- **Options Analysis** – TMAC does not identify or analyze potential closure options. Instead, the preferred approach is presented, with very limited information regarding the rationale for its selection.
- **Evidence of Preferred Option Performance** – With the exception of statements indicating the preferred options have been used at other sites, limited information is presented describing their performance under comparable conditions.
- **Uncertainties and Reclamation Research** – Important gaps/uncertainties are not identified and there are no proposed reclamation research initiatives.
- **Engagement / Consultation** – No evidence is presented indicating that interested parties have been engaged or consulted on the proposed plans.

Despite these deficiencies, the proposed closure strategies presented in the CRPs generally appear to be appropriate from a technical/engineering perspective. Specifically, there are no significant technical flaws in the plans.

	Nonetheless, the deficiencies should be addressed to ensure there is greater clarity regarding the expectations, rationale and thresholds that will need to be met for site relinquishment. **<u>Definition of Post-Closure Maintenance and Surveillance Requirements</u>** A key determinant in the setting and relinquishment of reclamation securities is the extent to which maintenance and surveillance (monitoring) are required during the post-closure phase. These potentially costly requirements are often overlooked until a mine is approaching the end of its operational life, thereby creating uncertainty for proponents, regulators and interested parties. To reduce this uncertainty, post-closure maintenance and surveillance requirements should be conceptually defined as early as possible during the mining life-cycle, ideally prior to the issuance of authorizations. Post-closure requirements should be assessed within the context of an appropriate post-closure timeframe (e.g., 100 years). All post-closure assets (e.g., tailings covers, dams) should be assessed qualitatively to determine their anticipated performance throughout this timeframe by evaluating potential failure modes/consequences and any maintenance and/or surveillance actions that may be necessary to mitigate the risks or consequences. When determining the extent of maintenance that might be required, precedent suggests that conservatism is justified. For example, after experiencing multiple unplanned maintenance requirements in its portfolio of northern mine sites, INAC's Northern Contaminated Sites Program has found that the following general guidance is appropriate when determining post-closure maintenance requirements and costs: 1. **Year 10 Post-Closure Repair Event:** 10% of the original closure cost of relevant components *(e.g., tailings covers, dams and water conveyance channels)*; 2. **Year 35 Post-Closure Risk Event:** An additional 20% of the original closure cost of relevant components; 3. **Mobilization / Demobilization / Camp:** 80% of the original mob/de-mob and camp costs, applied to each of the Year 10 and Year 35 events. These anticipated maintenance requirements are being built into the Department's long-term plans and budgets. Based on our review, the current versions of TMAC's CRPs provide limited information on the post-closure maintenance and surveillance requirements. While statements indicating potential requirements are made, a systematic evaluation of potential requirements is not presented. Failure to define post-closure maintenance and surveillance expectations has the potential to undermine project certainty and could affect relinquishment.

	<u>Clarity Regarding Post-Closure Land Use</u> Closure and reclamation plans should be based on clearly defined and consistent post closure land uses. With regard to precedent, the majority of northern mine sites have selected "parkland" (or equivalent) land use designations when designing their CRPs. However, in the case of the Hope Bay Project, there is a lack of clarity regarding post-closure land use. For example, the following documents indicate that "industrial" land use remediation guidelines will be used: • Hydrocarbon Contaminated Material Management Plan (P4-14) • Doris-Madrid Interim Closure and Reclamation Plan (P4-21) Clarity is required regarding the proposed post-closure land use of the Hope Bay sites. This issue should be resolved as early as possible in the closure planning process.
Recommendation/ Request	**Recommendation #7** - TMAC should comply with all requirements of the applicable closure planning guidance, both in content and structure, when submitting all subsequent revisions of the Hope Bay Project CRPs. **Recommendation #8** - TMAC should fund and establish a stakeholder working group (or equivalent mechanism) to promote effective engagement/consultation related to closure planning. The working group should be actively involved when determining foundational aspects of the CRPs (closure principles, objectives, criteria, etc.) **Recommendation #9** - TMAC should clearly define the long-term post-closure maintenance and monitoring requirements of the Hope Bay Project. The requirements should be directly linked to a systematic review of all site components to determine potential failure modes and necessary mitigations. **Recommendation #10** - Working with interested parties, TMAC should specify the post-closure land uses for the Hope Bay properties.

Technical Review Comment	**INAC Technical Review Comment #4**
Subject	**Water Treatment Plant Effluent Quality**
References	P5-4: Hope Bay Project – Water and Load Balance
Summary	The effluent quality of the proposed water treatment plants is highly optimistic. Additional information is required to confirm that predicted effluent quality concentrations are achievable.
Importance of Issue to Water Resources	Loadings from the water treatment plants are a key variable when assessing potential water quality impacts from the project.
Detailed Review Comment	Contact water quality modelling for the Boston project predicts that elevated concentrations of arsenic and cadmium are a concern. A two-stage contact water treatment process has therefore been proposed. The process will target arsenic removal with ferric co-precipitation, followed by lime neutralization to reduce cadmium concentrations to discharge limits. The Boston Process Plant will also use ferric co-precipitation and lime neutralization but with the addition of a biological process to address ammonia. With regard to the Doris and Madrid sites, once the Madrid project comes online, arsenic concentrations in the mine water and Doris TIA are predicted to exceed the proposed MMER regulations for arsenic (0.1 mg/L). A Doris contact water treatment plant will therefore be required to remove arsenic. The process will use the first stage of the Boston contact water treatment plant (i.e., arsenic removal via ferric co-precipitation). TMAC's analysis of potential environmental impacts from the Hope Bay Project is based on assumptions regarding the treatment efficiency and effluent quality from the various water treatment plants. Of particular importance, document P5-4 (Table 3-19) indicates the Boston Contact Water Treatment Plant will achieve an arsenic concentration of 0.01 mg/L in its treated effluent.[3] The other treatment plants at Boston and Doris will reportedly achieve the same effluent quality. We consider this to be highly optimistic for a field application of ferric co-precipitation and question the ability of the treatment plants to achieve such low concentrations. None of the reviewed documentation describes the treatment processes in detail, nor is any evidence provided to substantiate the reported effluent quality

[3] Appendix C-1 of the same document indicates the Boston Contact Water Treatment Plant will have average dissolved arsenic concentrations of 0.00074 mg/L and the Process Water Treatment Plant will achieve effluent concentrations of 0.0035 mg/L

Recommendation/ Request	**Recommendation #11** - TMAC should provide a conceptual design of its proposed water treatment processes. The study should clearly indicate the anticipated effluent quality of the systems and provide evidence of comparable results being achieved in full-scale mining operations.

Technical Review Comment	**INAC Technical Review Comment #5**
Subject	**Backfill Materials**
References	P4-11: Hope Bay Project – Waste Rock, Ore and Mine Backfill Mgmt. Plan P4-19: Hope Bay Project – Boston Conceptual Closure and Reclamation Plan P4-21: Hope Bay Project – Doris-Madrid Interim Closure and Reclamation Plan
Summary	There is a lack of clarity regarding TMAC's rationale for sourcing additional backfill from quarried rock instead of readily available filtered tailings at the Boston site.
Importance of Issue to Water Resources	Development of quarries to source incremental backfill presents potential environmental impacts and additional closure requirements.
Detailed Review Comment	The closure plans for the Hope Bay Project involve backfilling the underground with the entire inventory of filtered detoxified cyanide leach tailings and waste rock. TMAC predicts that the volume of detoxified tailings and waste rock will be insufficient to meet the backfill requirements and proposes to source the additional backfill from rock quarries. Based on current estimates, approximately 1.8 million tonnes of additional backfill will be required at the Doris-Madrid properties and an additional 0.9 million tonnes will be needed at the Boston site. The total backfill deficit is therefore approximately 2.7 million tonnes. With regard to other potential sources of backfill, we note that the project will produce 18 million tonnes of low solids slurried flotation tailings that will be deposited in the Doris TIA and 5.1 million tonnes of filtered flotation tailings that will be placed in the Boston "dry stack" TMA. While we assume that TMAC assessed whether these waste streams could be used as backfill instead of quarried rock, we have not identified any descriptions of these assessments in the project documentation. For example, potential advantages of using the Boston filtered tailings as a source of mine backfill include: 1) the capacity of the Boston TMA could be reduced by approximately 50%; and 2) the need for an incremental 2.7 million tonnes of quarried backfill could be eliminated.
Recommendation/ Request	**Recommendation #12** - TMAC should describe their rationale for using quarried rock instead of filtered flotation tailings to address backfill volume deficits at the Hope Bay sites.

Technical Review Comment	**INAC Technical Review Comment #6**
Subject	**Long-Term Climate Change Effects**
References	P5-1: Hope Bay Project – Climate Change Analysis Approach Report
Summary	Flotation tailings will remain on surface in perpetuity. Natural freezing is one of the mechanisms that will be used to isolate these wastes, thereby reducing their metal leaching potential. Climate modelling predicts that temperatures will increase more than 5°C by the year 2100 and will result in increased active zone depths. Despite the inherent challenges of long-term climate modelling, additional efforts are needed to characterize climate change impacts beyond this point. This information will help to ensure closure plans are sufficiently conservative.
Importance of Issue to Water Resources	Thawing of frozen tailings could result in elevated metal leach rates and impacts to surface water receivers. This situation would not become apparent until decades after closure of the mines. Conservatism is therefore justified when predicting potential impacts and closure strategies.
Detailed Review Comment	There is agreement within the engineering community that climate change is occurring, and that it should be integrated into engineering designs. Towards this end, TMAC prepared a climate change analysis report for the Hope Bay Project which provides the climate change projections for key climatic and hydrologic design parameters for use in engineering designs (document P5-1). The report concluded that the mean annual air temperature (MAAT) at Doris, which includes Madrid, is expected to increase by 6.8°C by 2100. In the case of the Boston site, the MAAT is predicted to increase by 5.5°C over the same period. These and other predictions compare well with estimates from independent studies, including the International Panel on Climate Change (IPCC). It is important to note that TMAC's climate modelling extended only to the year 2100 which is generally accepted to be the maximum reasonable timeframe for climate change predictions. Beyond that point there is a high degree of uncertainty regarding climate change modelling. In terms of potential climate change impacts, the depth of the active layer at the Hope Bay Project will play an important role in the post-closure chemical and physical stability of the sites. For example, the potential flux of contaminants from the Doris TIA and Boston TMA will be influenced by the depth of the active layer. TMAC predicts that climate change up to 2100 will result in a 0.93 m increase in the thickness of the active layer (in clay overburden) and we assume this has accounted for in the geochemical load balance. While we acknowledge the uncertainties associated with climate modelling past 2100 and accept TMAC's approach, consideration should also be given to potential climate change impacts that might credibly extend beyond that point.

	This could be addressed by performing sensitivity analyses that project further into the future using the predicted climate data for 2100. For example, if the climate were to remain constant from 2100 onward, would the thickness of the active zone increase further? At what depth would the active zone become stable? Would this affect the overall environmental performance of the site (e.g., would there be increased seepage/leaching)? Answers to these questions would help to provide perspective on potential climate change impacts and could be used to determine the required level of conservatism that should be factored into the designs. This is particularly important given the metal leaching potential of the flotation tailings that will be stored on surface in perpetuity (i.e., long after 2100).
Recommendation/ Request	**Recommendation #13** - TMAC should confirm that the geochemical source terms used to assess project impacts have accounted for anticipated climate changes up to 2100. **Recommendation #14** - TMAC should perform sensitivity analyses that projects climate change effects to 200 years post closure using the predicted climate data for 2100. The sensitivity analyses should assess any incremental environmental impacts that might occur (e.g., additional seepage from tailings). The findings of the sensitivity analyses should be considered when developing the next revisions of the Closure and Reclamation Plans.

Technical Review Comment	**INAC Technical Review Comment #7**
Subject	**Release of Saline Minewater to the Tundra**
References	P4-3: Hope Bay Project - Spill Contingency Plan P4-7: Hope Bay Project – Doris-Madrid Water Management Pan P4-19: Hope Bay Project – Madrid Water Management Design P4-18: Hope Bay Project – Aquatic Effects Monitoring Plan P5-4: Hope Bay Project – Water and Load Balance FEIS Volume 7 – Accidents and Malfunctions
Summary	Overburden materials in the vicinity of the mining developments are ice rich. Permafrost degradation in such soils has the potential to compromise their structural integrity and to cause environmental impacts (e.g., erosion). Degradation is a particular concern when ice rich soils are exposed to high salinity fluids. Large volumes of saline mine water will be handled throughout the construction and operational phases of the project. It is therefore important that consideration be given to potential impacts from accidental releases of saline mine water to the tundra.
Importance of Issue to Water Resources	Permafrost degradation in ice rich soils could result in structural failures, erosion, sedimentation and impacts to surface water receivers/receptors.
Detailed Review Comment	Madrid North and Madrid South will be developed within a portion of the taliks of Patch and Wolverine lakes in the Doris Watershed. Groundwater within these taliks will be saline and is expected to seep into the underground mines. This inflow will be intercepted pumped to surface, transported via pipelines and discharged to a marine outfall diffuser in Roberts Bay. The salinity of the minewater is anticipated to reach peak chloride concentrations of 18,000 mg/L. This is similar to seawater which has a freezing point of approximately −2 °C. Overburden materials throughout the development areas are dominated by marine silts and clays containing ground ice at concentrations of up to 50% (some drill holes at Boston have also reported ice up to 70% in overburden). The elevated ice content of these soils makes them susceptible to permafrost degradation which, in turn, can compromise the physical properties of the soils, causing structural failures (e.g., subsidence), erosion, sedimentation and other environmental impacts to surface water receivers/receptors. Based on the above, there is a potential that inadvertent discharges of saline mine water to the tundra would have adverse effects on the environment. This issue is addressed partially in Volume 7 of the FEIS which concluded that a pipeline rupture or significant leak is considered “possible” and that the associated environmental consequences would be “moderate”. However, that analysis did not explicitly consider the impact of releasing large volumes of high salinity mine

	water in areas with ice rich soils. This represents a gap in the analysis of potential project impacts and required mitigations.
Recommendation/ Request	**Recommendation #15** - TMAC should explicitly evaluate the failure modes and consequences of high salinity water (including mine water) being discharged to the tundra, with an emphasis on potential impacts to ice rich soils. The analysis should include case studies of similar events. Subject to the findings of this evaluation, modifications should be made to the project's management plans to further prevent such events and/or mitigate their impacts.

Attachment 2

Water Resources technical review of Hope Bay Phase 2 water licence applications 2AM-BOS---- & 2AM-DOH1323 amendment no.2

Technical Review Memorandum

To: Richard Dwyer, Licensing Administrator, Nunavut Water Board

From: Sarah Forté, Water Management Specialist, Water Resources Division, INAC

Date: March 29, 2018

Re: Review of Water Licence Applications for Hope Bay Phase 2, Type A Licences 2AM-DOH1323 amendment no.2 and 2AM-BOS----

Applicant: TMAC Resources Inc.
Project: Hope Bay Phase 2, Doris-Madrid and Boston
Region: Kitikmeot

A. BACKGROUND

On February 23, 2018 the Nunavut Water Board (Board or NWB) provided notification of beginning of the technical review period for TMAC Resources Inc.'s (TMAC or the applicant) renewal-amendment no.2 application for Type A water licence 2AM-DOH1323 and new application for Type A water licence 2AM-BOS---- for the Hope Bay Phase 2 Project.

The Hope Bay Project is in a greenstone belt approximately 80 km long abutting on Robert's Bay on Coronation Gulf in the Kitikmeot region of Nunavut. It is approximately 150 km southwest of Cambridge Bay. TMAC currently has an operating gold mine at Doris North, situated at the north end of the belt, which is referred to as Phase 1 of the project. The applications under consideration are Phase 2 and consist of plans for operating gold mines at Madrid North, Madrid South and Boston, approximately 9, 10 and 60 km south of Doris North respectively. Though two separate water licence applications were submitted at the request of the NWB, the project plan is integrated and all mines make use of common infrastructure.

The Board requested interested parties review the applications and make representations by March 23, 2018. Indigenous and Northern Affairs Canada (INAC) was unable to meet this deadline.

B. RESULTS OF REVIEW

On behalf of INAC Water Resources, the following comments, information requests and recommendations are provided for the Board's consideration. No separation has been made between the two applications, though some comments pertain to only one of the two, others cover both applications. Please consider comments 1-7 and recommendations 1-15 included in the Arcadis review. The numbering of the comments

and recommendations in this document continues where the Arcadis left off, so they do not begin at 1. The numbering for information requests starts at one, since these are the first we are making and the Arcardis review doesn't have any.

8. Water licences for Hope Bay belt

Reference:

- NWB Renewal Licence No. 2BE-HOP1222, Hope Bay Regional Exploration Program, Nunavut Water Board, June 30, 2012
- NWB Type "A" Water Licence No. 2AM-DOH1323 Amendment No.1– Doris North Project, Nunavut Water Board, November 6, 2016
- NWB Renewal Water Licence No. 2BB-BOS1727, Nunavut Water Board, July 26, 2017
- TMAC's Water Licence No. 2BB-MAE1727 Amendment No.1 for Madrid Advanced Exploration Program, Nunavut Water Board, January 12, 2018
- P2-1 Project Description, Amendment no.2 Type A Water Licence 2AM-DOH1323 (Doris and Madrid), TMAC Resources Inc., December 2017
- P2-2 Project Description, Type A Water Licence Boston, TMAC Resources Inc., December 2017
- P4-12 Water and Ore/Waste Rock Management Plan for the Boston Site, SRK Consulting Inc., January 2017

Comment:

Presently, TMAC has four water licences regulating their activities in the Hope Bay belt:

1) **2BE-HOP1222** – Exploration licence covering the use of water and disposal of waste during camp operations and exploration drilling at the 180 person Windy Lake Camp associated with the Hope Bay Regional Exploration Program. Associated infrastructure includes fuel storage, water intake, wastewater treatment, quarries A, B & D, and Doris-Windy all weather road. Permitted water use includes 63 m^3/day for potable water, 80 m^3/day for drilling purposes, and 200 m^3/day seasonally from Windy Lake for dust suppression on the Doris-Windy road. The licence includes discharge criteria for treated sewage, contact water from the bulk fuel storage facility and contact water from the quarries. The geographical extents covered by this licence are: 67°29'11.226' to 68°12'30.017"N and 106°8'3.172" to 106°45'0.001"W.

2) **2BB-MAE1727** – Advanced exploration licence allowing for geologic and geophysics mapping, surface and underground diamond drilling (including off ice drilling), test stoping and bulk sampling of two 50 000 tonne samples at Madrid North and Madrid South. Infrastructure includes roads and culverts, surface ore and waste storage pads, fuel storage facilities, pollution control ponds and sumps, vent raises, and offices and emergency shelters. Permitted water use includes 5 m^3/day for potable water use and 290 m^3/day for industrial use. The licence includes discharge criteria for contact water from pollution control pond, contact water from the bulk fuel storage facility and contact water from quarries G, H & I. The geographical extents covered by this licence are: 68°00'07'' to 68°06'34"N and 106°29'00" to 106°40'29"W.

3) **2BB-BOS1727** – Advanced exploration licence allowing for prospecting, surface land based drilling and on-ice diamond drilling, diamond and reverse circulation drilling, on-site core splitting and logging, bulk sampling, the operation of a bulk sampling and crushing and sorting plant, a camp including domestic use of water, treatment and disposal of greywater and sewage, further underground development and underground exploration drilling, and the operation of a landfarm and bulk fuel storage facilities. Infrastructure includes a 30 person camp, sewage treatment facility, containment Pond, bulk fuel storage facility, landfarm facility, and contaminated soil temporary storage area, and portal decline. Water use permitted is 100 m^3/day for all purposes. The licence includes discharge criteria for contact water from the containment pond, portal, landfarm, bulk fuel storage area and for treated sewage. The geographical extents covered by this licence are: 67°36'13'' to 67°41'41"N and 106°19'22" to 106°26'27"W.

4) **2AM-DOH1323** – Mine undertaking licence with many components, allowing for the Doris North gold mine project. The geographical extents covered by this licence are: 68°02'55'' to 68°11'13"N and 106°31'37" to 106°39'15"W.

In their project descriptions, TMAC explain how they would like the present type B licences handled by requesting:

- *"To expand the scope of Licence 2AM-DOH1323 Amendment No. 1 by incorporating into this Licence the scope of all facilities and activities authorized under the Type B Licence 2BB-MAE1727. TMAC requests that the Madrid Type B Water Licence 2BB-MAE1727 be maintained until such time that the bulk sample is completed and the decision is made to enter into production at Madrid."*
- *"TMAC will retain Type B Licence 2BB-BOS1217 for ongoing exploration activities of the Boston deposits."*

INAC is of the opinion that licences should cover distinct undertakings with as little overlap as possible for clarity on the proponent's obligations and responsibilities for monitoring, inspections and reclamation associated with each licence. As such, the applicant's request to keep concurrent licences for the same activities is problematic.

With respect to Madrid, it is not clear if TMAC wants to hold off on amendment no.2 until they have made a decision to enter into production there. If this is the case, we can also hold off on evaluating this application until such time the applicant decides to proceed. If TMAC is in fact requesting that the infrastructure permitted under 2BB-MAE1727 also be permitted under 2AM-DOH1323 amendment no.2, INAC does not believe this request should be granted because it would not be possible to sort out obligations and responsibilities from both licences.

TMAC is also requesting to keep the advanced exploration licence at Boston. The infrastructure proposed for the 2AM-BOS---- licence includes some of what is licensed under 2BB-BOS1727 or will be built over existing licensed infrastructure. Keeping two

licences in this instance leads to confusion, as is already apparent from the application, for example:

- Camp size: Table 1.2-1 of the project description (P2-2) the camp under 2BB-BOS is for 65 people and that for 2AM-BOS is for 300 people, which totals 365 people. Yet Section 5.1 of the same document states accommodations at the Boston Site will initially be 65 persons at the existing camp and will increase to 300 persons.
- Water and Ore/Waste Rock Management Plan for Boston: The plan presented is the one associated with the 2BB-BOS1727 licence and is different than the Waste Rock, Ore and Mine Backfill Management Plan that applies to all of the Hope Bay mines including Boston. It contains statements such as: "*If an opportunity to process this material (ore) arises*" and "*If further mine development is considered, this plan will be updated at that time to reflect the change.*", which do not account for the new type A application.

Since the area for exploration covered by the 2BB-BOS1727 licence is also covered by 2BE-HOP1222, authorization for exploration activities would not be lost if the 2BB-BOS1727 licence was rolled into a type A licence. The component which would be lost was the possibility of taking a bulk sample at Boston.

Information Request:
IR 1: The applicant should clarify whether they want to hold off on the amendment to 2AM-DOH1323 to include the Madrid project until they have made a decision regarding entering production, or if they are requesting to hold two water licences (a type B and a type A) to cover the same infrastructure at Madrid.

Recommendation:
R 16: INAC recommends that, if granted, a 2AM-BOS licence incorporate the scope of activities and facilities authorized under 2BB-BOS1727, so that the type B licence can be cancelled.

9. Industrial water treatment plant at Doris

Reference:

- P3-1 Application for Water Licence Amendment (2AM-DOH1323 no.2), TMAC Resources Inc., December 20, 2017
- P2-1 Project Description, Amendment no.2 Type A Water Licence 2AM-DOH1323 (Doris and Madrid), TMAC Resources Inc., December 2017
- P4-7 Doris-Madrid Water Management Plan, TMAC Resources Inc., December 2017
- P5-4 Madrid-Boston Project Water and Load Balance, SRK Consulting Inc., November 2017
- P5-19 Madrid Water Management Engineering Report, SRK Consulting Inc., November 2017

Comment:

Box 15 of the amendment application indicates "*an industrial water treatment plant will be added to Doris site. Refer to P5-4 Madrid-Boston Project Water and Load Balance for additional details*." There is no reference to this treatment plant in the Project Description (P2-1) and the only place it appears in the Water Management Plan (P4-7) is in Figure 1. The same Figure 1 with a "Doris Contact Water Treatment Plant" is part of the Madrid Water Management Engineering Report, though no mention of it is made in the text.

The description in the Water & Load Balance is: "*A Doris contact water treatment plant will be required to remove arsenic. The process will employ the first stage of the Boston contact water treatment plant, which is arsenic removal via ferric co-precipitation. In the model, the arsenic and iron concentrations from the Boston contact water plant effluent were applied to the Doris contact water plant.*"

Given the information provided, it is difficult to assess the adequacy of the proposed plant.

Information Request:
IR 2: The applicant should provide information on the industrial water treatment plant including:

- Its approximate physical location;
- Whether a surge pond will be necessary, as at Boston. If so, preliminary design of the pond should be provided;
- Technology to be used and how effective it can be (related to **R 11**);
- The plant's capacity; and
- Planned construction date.

Recommendation:
R 17: INAC recommends that TMAC integrate answers to **IR 2** into the Doris-Madrid Water Management Plan. An Operation and Management Plan for the plant should also be provided.

10. Water & load balance model validation

Reference:

- P5-4 Madrid-Boston Project Water and Load Balance, SRK Consulting Inc., November 2017

Comment:
The water & load balance model was calibrated using data from 2010 to 2016. "*Five flow stations were selected as points to validate the model calibration.*" According to Figures 5-3 to 5-5 and 5-7, the years covered by validation were also 2010 to 2016.

It is not clear if the data was used for validation was also used for calibration. If it was, it would render the validation unconvincing.

Information Request:

IR 3: The applicant should clarify if data from the five flow stations used for model validation were also used for calibration

11. Aquatic Effects Monitoring Plans

Reference:

- P4-18 Madrid-Boston Aquatic Effects Monitoring Plan, TMAC Resources Inc., December 2017
- Doris Aquatic Effects Monitoring Plan, TMAC Resources Inc., June 2016
- P5-4 Madrid-Boston Project Water and Load Balance, SRK Consulting Inc., November 2017

Comments:

i. The Madrid-Boston Aquatic Effects Monitoring Plan (AEMP) is meant to supplement the existing Doris AEMP. In some areas, it is not clear how the two documents fit together. For example, the Doris AEMP includes a site for ice thickness, temperature and dissolved oxygen monitoring at the north end of Doris Lake, and the Madrid-Boston AEMP also includes a site at the north end of Doris Lake, but this one is for many more parameters including water quality, chlorophyll a, benthos and sediment quality. Another example is chloride being included as a water quality parameter in the Madrid-Boston AEMP, but not in the Doris AEMP. As well, the Doris AEMP includes a Response Framework, which is not included or mentioned in the Madrid-Boston AEMP.

ii. Water quantity monitoring is included in the Madrid-Boston AEMP: "*To monitor potential effects of water withdrawal and groundwater removal on the surface water, lake water level monitoring will occur in Wolverine, Patch, Doris, Windy, and Aimaokatalok lakes.*" Further detail is provided as to station locations: "*Hydrometric monitoring stations will be installed in each lake, preferably at accessible locations near exposed bedrock (for survey purposes) and deeper water (to allow year-round under-ice data collection).*" It is not clear if flow data from the lake outflows will be measured or estimated, as has been done for the hydrology data described in the Water and Load Balance, which includes both level and flow for the lake outflows.

    The Water and Load Balance model predicts impacts to lake elevation and lake outflow, with the greatest changes in the Doris watershed. Outflow reductions of 56%, 23% and 32% are estimated for Wolverine, Patch and Doris Lakes, respectively. It may be easier to identify changes in the stream outflows rather than lake levels so they should be included in the monitoring.

iii. The Madrid-Boston AEMP includes monitoring of Reference Lake B in an adjacent watershed outside the project's expected area of influence. Water levels are to be monitored in five lakes in the study area but not at Reference Lake B. Measuring lake levels at Reference Lake B might allow the applicant to tease out

project effects from climate change effects, particularly since the requested licence term of 25 years could be sufficiently long to measure impacts. The AEMP states "*lake water levels … will be compared to baseline information and environmental impact statement (EIS) predictions*" and because those predictions incorporate the effects of climate change on the hydrometerological system, measuring water level changes on Reference Lake B is relevant.

iv. No monitoring is proposed for Imniagut Lake in the Madrid-Boston AEMP. Since the Water and Load model predicts a lake level decrease of more than 1.5 m, which can have an important effect in a relatively small lake, some monitoring this lake should be undertaken.

v. In the plan, the applicant proposes reducing monitoring during closure or temporary closure: "*During the Closure and Temporary Closure (i.e., care and maintenance) phases, sampling will continue as prescribed under the Metal Mining Effluent Regulations (MMER) at sites related to MMER Environmental Effects Monitoring (EEM) discharge sampling in Aimaokatalok Lake (as identified in Table 3.1-1). Water level monitoring will also continue as long as combined winter water withdrawal and groundwater inflows are greater than 10% of lake volume. Due to the reduction of site activities, other sampling addressing non-point-source inputs will be suspended during Closure and Temporary Closure unless effects have been detected in the immediately preceding years.*"

Although site activities would be reduced under closure or temporary closure, some important non-point source inputs will still be present. For example, the tailings will remain exposed to wind. The reduced site presence associated with care and maintenance, sustaining monitoring activities is critical to ensuring management measures for the ore, waste rock, fuel, quarries and infrastructure are effective at protecting water.

vi. The analysis method proposed for evaluating potential effects in water quality data is the before-after-control-impact (BACI) design. "'*Before' data will be that collected at a site prior to potential effects*", however the plan does not specify a minimum duration of 'before' data collection. Several years of water quality data may be necessary to understand natural variability.

vii. INAC **R 1** requests an explicit demonstration that post-closure water quality criteria are protective of the receiving environment. The Response Framework in the Doris AEMP states: "*For water quality, the following trigger conditions will be considered for the Low action levels:*

- *identification of a significant difference in the "before" and "after" periods in the AEMP effects analysis (section 3.2) for that water quality variable; and*
- *exceeding the 75% percentage of a Canadian Council of Ministers of the Environment (CCME) water quality benchmark.*"

One of the low action level responses from the Doris AEMP Response Framework may be "*a review of the water quality benchmark or development of a*

site-specific water quality objective (SSWQO)." and we are aware that TMAC has proposed site specific water quality objectives for arsenic.

In light of the Water and Load Balance model predicting concentrations of certain elements in lakes exceeding CCME water quality guidelines for the protection of aquatic life after closure, further discussion on SSWQOs is warranted. In order to evaluate whether proposed water treatment and waste management options presented in the application are adequate, it is necessary to know and agree on water quality objectives. The AEMP might be an appropriate place to develop the response.

Information Requests:

IR 4: The applicant should provide more information on the hydrological measurements planned, including:

- Station locations; and
- If lake outflows will be calculated, and if so what rating curves will be used and how often will they be verified.

IR 5: The applicant should clarify the minimum duration of 'before' water quality data collection for the BACI analysis.

Recommendation:

R 18: INAC recommends the AEMP be modified so that:

- A single plan be produced for the Hope Bay belt, as TMAC has done with many other management plans;
- Lake water levels are monitored on Reference Lake B;
- Some monitoring of conditions in Imniagut Lake be included;
- Complete monitoring during closure or temporary closure be maintained; and
- Information is presented to support setting water quality objectives higher than CCME guidelines for elements predicted to exceed the guidelines by the Water and Load Balance model: fluoride, chloride, aluminum, arsenic, copper, chromium, mercury and iron.

12. Contact water pond design

Reference:

- Contact Water Berm Design, SRK Consulting Inc., November 2017
- Geotechnical Design Parameters and Overburden Summary Report, SRK Consulting Inc., November 2017
- Madrid North Surface Infrastructure Preliminary Design, SRK Consulting Inc., November 2017

Comment:

Overburden in the Hope Bay belt is largely comprised of marine clays and silts, as described in the Overburden Summary Report. The design for contact water ponds for

Boston, Madrid North and Madrid South makes use of the low permeability of this material. Specifically the Contact Water Berm Design states: "*The contact water ponds are unlined ponds that use the permafrost and naturally low permeability of the foundation materials to contain the contact water on the bottom of the pond and a geomembrane acts as the impermeable layer within the berm. The contact water pond berm design hinges on the contact between the geomembrane and permafrost soil remaining frozen.*"

The design document includes the results from a numerical model to evaluate the proposed berm's stability. Results from a thermal model are also presented "*to verify the minimum berm thickness required to maintain the liner frozen within the key-trench.*" For both models, a marine clay base is assumed. It is 20 m thick for the thermal model, and there is no vertical scale for the stability model, where the clay appears to be approximately 5 m thick.

Isopach maps of overburden thickness for Madrid North (Figure 11) and Boston (Figure 12) are presented in the Overburden Summary Report and include an overlay of underground workings. The proposed infrastructure locations are not included on the maps, so it is not possible to see the overburden thickness at proposed contact water pond locations. The Madrid North Surface Infrastructure Preliminary Design offers some information: "*Isopach maps developed from exploration and geotechnical drill holes indicate that depths of overburden under the mining infrastructure is expected to range from 0 to 10 m, with most areas having less than 3 m of overburden.*" And "*Additional geotechnical investigations will be completed prior to detailed engineering*."

It seems quite possible that additional geotechnical investigations might find the thickness of marine clays is not the 20 m used for the model, which may have an incidence on the ponds since the properties of the underlying material is an integral part of the contact water pond design.

Information Request:

IR 6: INAC requests further information on the implementation of the contact water berm design including:

- Maps where the proposed pond locations can be seen in conjunction with overburden thickness;
- The minimum marine clay thickness required for the contact water ponds to perform as designed; and
- Mitigation measures considered if the ground at the proposed contact water pond locations proves to be unsuitable.

13. Cyanide testing

Reference:

- NWB Type "A" Water Licence No. 2AM-DOH1323 Amendment No.1– Doris North Project, Nunavut Water Board, November 6, 2016

- o P4-27 Quality Assurance and Quality Control Plan, TMAC Resources Inc., December 2017

Comment:
Water licence 2AM-DOH1323 amendment no.1 requires testing of certain cyanide parameters including free cyanide, total cyanide, WAD cyanide, cyanate and thiocyanate. A new amendment to this licence or another type A for an identical gold processing plant will likely have the same requirements.

The list of analytical parameters water quality parameters to be measured presented in appendix B of the Quality Assurance and Quality Control Plan does not include cyanide. Nor could we find it in the list of parameters ALS Environmental is accredited for.

Information Request:
IR 7: The applicant should state where they get there cyanide samples tested and confirm that the lab is accredited for those parameters.

14. Maximum camp size at Doris

Reference:
- o P2-1 Project Description, Amendment no.2 Type A Water Licence 2AM-DOH1323 (Doris and Madrid), TMAC Resources Inc., December 2017
- o P4-4 Domestic Wastewater Treatment Management Plan, TMAC Resources Inc., December 2017
- o P5-4 Madrid-Boston Project Water and Load Balance, SRK Consulting Inc., November 2017

Comment:
Table 1.2-1 of the Project Description calls for accommodations for 400 people at the Doris site, which matches the number used for Doris Camp in the Water and Load Balance. However, Section 3.2 specifies that "*An additional 100 beds may be required for the peak construction period.*"

The Wastewater Treatment Plan states: "*The Doris Camp has two modular Sanitherm® membrane biological reactor (MBR) wastewater treatment plants (WTPs) housed in multiple 40-foot long containers. Each plant has the capacity to manage the average waste volume generated by 150 people as well as the capacity to accept raw wastewater and sludge from other WTPs into its surge and conditioning tanks. A third MBR WTP is available onsite as a contingency plant in the event that one WTP malfunctions*."

Wastewater treatment capacity therefore seems to be below what is required for the camp size. If the third contingency MBR is used, it would be possible to meet the requirements of a 400 person camp, but not the 500 people predicted during construction.

Information Request:
IR 8: The applicant should explain how they propose to treat wastewater generated by a camp with potentially as many as 500 people.

15. Requested water volumes

Reference:

- P3-1 Application for water licence amendment (2AM-DOH1323 no.2), TMAC Resources Inc., December 20, 2017
- P2-1 Project Description, Amendment no.2 Type A Water Licence 2AM-DOH1323 (Doris and Madrid), TMAC Resources Inc., December 2017

Comment:
The quantity of potable water requested in the Doris amendment no.2 application, 120 m^3/day, is equivalent to 300 L/person for the 400 person camp proposed. This quantity per person is the same as what has been requested at Boston. The project description states "*An additional 100 beds may be required for the peak construction period.*" We did not find any information on if water would be managed differently for a 500 person camp, or if more potable water would be used than what is requested.

Industrial water is to be drawn from Doris Lake. The quantities requested in box 13 of the application are at odds. It is presented as 2 460 m^3/day and 1 930 000 m^3/year. Multiplying the first number by 365 yields 897 900 m^3/year, so it is not clear how the second value was reached.

Information Request:
IR 9: The applicant should clarify:

- How they propose to manage potable water for a 500 person camp; and
- What quantity of industrial water they are requesting and more details on why the daily and yearly rates differ.

16. Waste rock volumes in relation to void volumes

Reference:

- P2-1 Project Description, Amendment no.2 Type A Water Licence 2AM-DOH1323 (Doris and Madrid), TMAC Resources Inc., December 2017
- P4-19 Boston Conceptual Closure and Reclamation Plan, SRK Consulting Inc., November 2017

Comment:
The same strategy for waste rock is proposed for the Doris, Madrid and Boston mines. As described in the amendment application, "*Waste rock will be used as underground backfill to the maximum extent possible. Backfilling is an integral part of the mining operation and is predicted to consume all of the Project waste rock. A predicted shortfall in available backfill will be made up from surface quarries, as required.*"

The total mass to be mined, as well as the mass of waste rock and additional quarry rock required as backfill for Boston are presented in the Boston Conceptual Closure and Reclamation Plan. We were unable to find equivalent numbers for the Madrid mines.

Sufficient space for storing all waste rock, detoxified tailings, industrial water treatment plant sludge and some hydrocarbon contaminated soils in the underground mines is critical for reclamation as planned and it is difficult to find numbers supporting statements made to the effect that there will be sufficient space.

Information Request:
IR 10: The applicant should provide a table estimating the volumes of waste rock, detoxified tailings and industrial water treatment plant sludge generated by the projects, as well as an estimate of the underground mine void volume, for each Boston, Madrid North and Madrid South.

17. Detoxified tailings deposition at Madrid

Reference:

- P4-11 Waste Rock, Ore & Mine Backfill Management Plan, TMAC Resources Inc., December 2017
- P5-13 Hydrogeological Characterization and Modeling of the Proposed Boston, Madrid South and Madrid North Mines, SRK Consulting Inc., November 2017

Comment:
The Boston and Doris mill produce two tailings streams; flotation tailings (comprising approximately 92-94% of the overall volume) and detoxified leach tailings (comprising about 6-8% of the overall volume). Flotation tailings will be deposited in the Doris TIA or Boston TMA. "*Detoxified leach tailings will be filtered, mixed with mine waste rock and used for underground mine backfill.*" The Waste Rock, Ore & Mine Backfill Management Plan specifies: "*These tailings will be moved underground into voids that will remain frozen within permafrost on a daily basis.*"

The plan also specifies the sequencing: "*Detoxified tailings from the Doris processing plant are transferred underground in the Doris mine on a daily basis as they are generated. Later in the mine life, detoxified tailings from the Doris processing plant will be placed as backfill in the Madrid North mine.*"

More than half the Madrid North mine is estimated to be outside permafrost and the zone within permafrost will be the first to be mined. There is no discussion of whether there will be sufficient voids in permafrost to store detoxified tailings from the Doris mill throughout the 13 years of proposed Madrid North mine life.

The project schedule has the Madrid South mine operating for a year after the Madrid North mine has stopped operating. Since the Doris mill is also proposed for processing

ore from Madrid South, it is not clear where the detoxified tailings will be disposed of during the last year of mill operation.

Information Request:
IR 11: The applicant should provide further information on how detoxified tailings from the Doris mill could be stored in the permafrost parts of Madrid North mine once the mining is in the talik parts of the mine, and once the mine is no longer operating.

18. Mine water at Boston

Reference:

- P5-13 Hydrogeological Characterization and Modeling of the Proposed Boston, Madrid South and Madrid North Mines, SRK Consulting Inc., November 2017
- P4-6 Groundwater Management Plan, TMAC Resources Inc., December 2017
- P4-8 Boston Water Management Plan, TMAC Resources Inc., December 2017

Comment:
The Boston mine is not expected to produce any mine water because it is modelled to be entirely within permafrost. The limited permafrost data available at Boston does not fit the model used for Madrid and Doris. Specifically: "*The offshore position of the -2°C isotherm cannot be explained by the present-day lake configuration nor by lateral heat flow from the adjacent land. Therefore, it is postulated that the permafrost beneath Aimakatalok Lake has been submerged with lake expansion.*" In order to fit measured data, a site specific model for Aimaokatalok Lake is created with a reduced lake size (5 m below present levels) for 5 000 to 500 years before present and the actual size for 500 years until present. No explanation is provided as to why lake levels might rise 5 m at Aimaokatalok Lake and not at all only 50 km away at Patch Lake, which suggests there is not a full understanding of permafrost conditions on site.

Risk zone mapping as outlined in the Groundwater Management Plan will help identify areas where the model is inaccurate and where groundwater infiltration might occur. The Groundwater Management Plan also includes a Boston Mine Inflow Management Program with specific actions to be taken at different measured mine inflows of 30, 60, and 360 m^3/day.

In contrast, the Boston Water Management Plan simply states there will be no groundwater inflow.

Information Request:
IR 12: INAC would like to understand what contingency measures have been considered if groundwater should be encountered in the Boston mine, and if the proposed industrial water treatment plant could process saline mine water to remove chloride.

19. Madrid mine water transport

Reference:

- P5-13 Hydrogeological Characterization and Modeling of the Proposed Boston, Madrid South and Madrid North Mines, SRK Consulting Inc., November 2017
- P4-6 Groundwater Management Plan, TMAC Resources Inc., December 2017
- P4-7 Doris and Madrid Water Management Plan, TMAC Resources Inc., December 2017
- P5-19 Madrid Water Management Engineering Report, SRK Consulting Inc., November 2017

Comment:

Hydrogeological modeling was used to predict mine groundwater inflows during active mining. They are 1 180 m^3/day after year 7 at the Madrid North mine and 550 m^3/day after six months of development at the Madrid South mine. There is a lot of uncertainty with these estimates since the models were built with limited data. There will be important quantities of mine groundwater to be dealt with if the estimates are accurate and there could potentially be twice the original estimate.

The groundwater is saline with chloride concentrations of 19 000 mg/L for the 75th percentile. This is of the same order as sea water salinity, making it harmful if it were to be released to the freshwater environment around Madrid.

The plans presented offer very little detail on how Madrid mine water will be handled and the information is not always consistent. The Groundwater Management Plan states: "*The combined discharge from the Madrid North mine and Madrid South mine is to be at a rate of 3,000 m^3/day to Roberts Bay via the marine mix box (MMB), or if required via the TIA.*" Both the Doris and Madrid Water Management Plan and the Madrid Water Management Engineering Report say: "*Mine water will be pumped or hauled to the MMB and discharged to the ocean*." The Madrid Water Management Engineering Report includes more information, namely a schematic (Figure 1) where a line for mine water is drawn between Madrid North and South mines, and the Doris contact water treatment plant, as well as two references to pipelines. The mine water pipelines are mentioned in the context of moving water from the contact water ponds: "*Dewatering of the pond will be by pumping to the concentrator for use as make-up water to reduce the freshwater draw from Windy Lake; or pumping to the Doris TIA via the tailings discharge line; or pumping to the MMB via the mine water line.*" and "*Water within the primary contact water pond will be pumped to Madrid North via the mine water pipeline or an independent contact water pipeline*".

A coherent, feasible and effective plan is necessary for managing mine water at Madrid.

Information Request:

IR 13: The applicant should provide more information on Madrid mine water management including:

- A discussion of the hauling and piping options;

- If a pipeline is considered, a preliminary alignment should be presented;
- An explanation of the conditions under which mine water will be send to the marine mixing box, the TIA or the contact water treatment plant; and
- If mine water will be transported directly from the mine sumps, or whether a holding tank or pond will be necessary.

Recommendation:
R 19: INAC recommends that TMAC integrate answers to **IR 13** into the Doris-Madrid Water Management Plan and the Groundwater Management Plan.

20. Non-hazardous waste disposal

Reference:

- P4-13 Hope Bay Project Non-hazardous Waste Management Plan, TMAC Resources Inc., December 2017
- P4-21 Doris-Madrid Interim Closure and Reclamation Plan, SRK Consulting Inc., November 2017
- P4-19 Boston Conceptual Closure and Reclamation Plan, SRK Consulting Inc., November 2017
- P5-28 Boston Surface Infrastructure Preliminary Design, SRK Consulting Inc., November 2017
- September 26-27, 2015 Water Licence Inspection Form, Indigenous and Northern Affairs Canada, September 27, 2015
- November 4-5, 2016 Water Licence Inspection Form, Indigenous and Northern Affairs Canada, November 6, 2016
- October 10-11, 2017 Water Licence Inspection Form, Indigenous and Northern Affairs Canada, October 11, 2017

Comment:
As described in the Non-hazardous Waste Management Plan, non-hazardous waste will be "*collected and transported to centralized waste management facilities to be properly packaged and temporarily stored until the waste is disposed of onsite in a certified landfill or prepared for shipment to a designated waste transfer station*." There is no information provided regarding possible onsite landfills.

Limited information on the landfills is presented in the Closure and Reclamation Plans. At Doris: "*Once quarry operations are complete, a non-hazardous waste landfill will be constructed in the northeast corner of the developed quarry. The landfill will contain only inert waste and no leachate will be generated.*" The quarry referred to is Q3, which will be used as a source of rock for the tailings cover. We can therefore expect the landfill to be operational only towards the end of the closure phase.

At Boston, the timing of landfill construction is not described, but we are told: "*The Non-hazardous Waste Landfill proposed at Boston will be located in Quarry V, near the Boston Mine.*" The Boston Surface Infrastructure Preliminary Design does include landfill design and operation.

An important proportion of the material to be landfilled will be generated at closure when the mine infrastructure is dismantled. However all material generated during operations will have to be stockpiled or shipped off site at Doris, according to what has been presented. It is not clear when the landfill will be constructed at Boston or if the same stockpiling will be necessary. Presently both non-hazardous and hazardous waste generated at Doris Mine are stockpiled in the waste management area, and as indicated in the 2015, 2016 and 2017 inspection reports, there is an accumulation that has not been backhauled. This material includes historical waste and that generated by approximately one year of operations. The mine plan calsl for 14 years of operations before closure and the area allocated to waste management facility appears inadequate to deal with non-hazardous waste generated if the current plan continues to be followed.

Information Request:
IR 14: The applicant should provide the expected timing of landfill construction at Boston.

Recommendation:
R 20: We recommend that the applicant provide further information in the Non-hazardous Waste Management Plan, describing expected volumes of waste and how they will be stored in the areas allocated for waste management. If landfill construction is to be proposed before closure, further details on design, lift covers, and water management would need to be included.

21. Effect of saline water in tailings impoundment area on frozen core dam

Reference:

- P5-16 Doris Tailings Management System Phase 2 Design, SRK Consulting Inc., November 2017
- P5-4 Madrid-Boston Project Water and Load Balance, SRK Consulting Inc., November 2017

Comment:
An updated thermal model was presented to predict the behaviour of the frozen core in the North Dam. "*The calibrated model, with consideration for climate change and conservative inputs indicate the frozen core will remain below the required -2°C under normal operating conditions.*" It is not clear if the normal operating conditions include storage of saline groundwater. Temporary storage of saline groundwater in the TIA is a possibility. The Water and Load Balance evaluates the effect on the chloride concentration in the TIA water from pumping groundwater to the TIA for different durations.

Another mine in Nunavut is currently encountering difficulties with a frozen core containment structure being used to store unexpectedly large quantities of saline groundwater. This has demonstrated a potential effect of storing salt water in a structure designed for freshwater.

Information Request:
IR 15: The applicant should clarify whether the operating conditions used as input in the thermal model of the North Dam included temporary storage of saline water in the TIA.

22. Crown pillar recovery at Doris North

Reference:

- P5-9 Geochemical Source Term Predictions for the Madrid-Boston Project, SRK Consulting Inc., November 2017
- P5-12 Madrid and Boston Crown Pillar Recovery Concepts, SRK Consulting Inc., November 30, 2017

Comment:
During a site visit in October 2017, TMAC staff pointed out an area next to Doris Lake where a crown pillar recovery trench was planned. They mentioned that this would be included in the amendment application being prepared. The trench at Doris also seemed to be considered in the Geochemical Source Term Predictions for the Madrid-Boston Project because estimates of the water quality in the trench are included in Table 4-2.

However, the memo relating to the Madrid Boston Crown Pillar Recovery Concepts does not speak to a possible trench at the Doris North mine.

Information Request:
IR 16: The applicant should clarify whether they plan to do a crown pillar recovery trench at Doris North. If so, they should provide information such as the location, approximate size and estimated duration of excavation.

C. RECLAMATION COST ESTIMATE

Closure and reclamations plans are required as part of the water licence applications. Following the *Mine Site Reclamation Policy for Nunavut* (INAC, 2002), the plans are used to estimate the cost of reclamation by a third party, should be applicant be unable to fulfil their reclamation obligations. Security associated with the water licences is set according to the cost estimates

INAC contracted Arcadis Canada Inc. to prepare reclamation cost estimates for both applications. The estimates were prepared based on the *Doris-Madrid Interim Closure and Reclamation Plan* (SRK Consulting Inc., November 2017) and the *Boston Conceptual Closure and Reclamation Plan* (SRK Consulting Inc., November 2017) presented in the water licence applications. If these plans are modified in the course of the technical review, modifications of the reclamation estimates may be required.

The results are summarized in the table below and reports detailing the estimate calculations are in appendix A for the Doris-Madrid amendment-renewal and in appendix B for the new Boston application.

Application	Total reclamation cost estimate	Water liability	Land liability
2AM-DOH1323 Doris-Madrid	$75,373,137	$43,724,543 (58%)	$31,648,594 (42%)
2AM-BOS----	$41,934,353	$25,006,854 (60%)	$16,927,500 (40%)

The estimate for Doris-Madrid does not include reclamation costs associated with the jetty, cargo dock or marine outfall as they are not covered by the water licence. They will be assessed separately and covered under land leases.

Currently, the total security under water licence 2AM-DOH1323 amendment no.1 is set at $30,725,650. The Kitikmeot Inuit Association holds $17,635,650 and INAC holds the balance of $13,090,000. The water-land liability division in this estimate is 48%-52% ($14,883,035 water liability - $15,842,613 land liability). The project is situated entirely on Inuit owned lands.

R 21: INAC recommends that reclamation security requirements of $75,373,137 and $41,934,353 be included in any licence issued for 2AM-DOH1323 amendment no.2 and 2AM-BOS----, respectively.

We will undertake discussions with the Kitikmeot Inuit Association and TMAC regarding the amount of security necessary and an acceptable manner of dividing the total amount between parties.

D. TIMING OF NEXT STEPS IN REVIEW PROCESS

Review of TMAC's Hope Bay Phase 2 project by the Nunavut Impact Review Board (NIRB) and NWB is occurring concurrently. The next steps in the process review map circulated by the NIRB on January 17, 2018 are:

- April 4, 2018 : Proponent responds to NIRB technical review comments
- April 19, 2018 : Parties submit presentations for NIRB final hearing
- May 8-12, 2018 : NIRB final hearing

The NWB has not yet set dates for the steps following the submission of NWB technical comments, but in discussions with both the NWB staff and the proponent, the possibility of holding a technical meeting immediately after or shortly after the NIRB final hearing was raised.

INAC is of the opinion that holding the NWB technical meeting prior to the project certificate workshop would reduce the effectiveness of the meeting. For certain components of the project, the level of detail provided in the application is sufficient for the environment impact assessment but not for the water licencing stage. An example is the disposal of Madrid mine water. The application states it will be disposed of at sea which may be appropriate for evaluating environmental impacts, but details on how water over up to 3000 m^3/day of saline water will be stored and transported over 10 km are necessary to determine the adequacy of proposed management methods.

INAC still has three outstanding concerns related to freshwater in the NIRB review process, items to be covered by any water licence issued. These challenges will likely not be resolved until the NIRB hearing, or shortly before it, and time may be necessary to develop implementation plans for changes. We reserve the right to ask further information requests or present more technical comments on information pertaining to water presented or discussed at the NIRB final hearing.

INAC recommends that a NWB technical meeting be held after the project certificate workshop. It is included as a possibility in the process review map circulated on January 17, and would be an effective means of discussing issues raised in the water licence technical review.

Appendix A

Reclamation cost estimate for water licence application
2AM-DOH1323 amendment no.2 (Doris-Madrid)
prepared by Arcadis Canada Inc.

ARCADIS Design & Consultancy for natural and built assets

INDIGENOUS AND NORTHERN AFFAIRS CANADA

RECLAIM ESTIMATE FOR HOPE BAY PROJECT DORIS - MADRID SITES

Water Licence Application

2AM-DOH1323

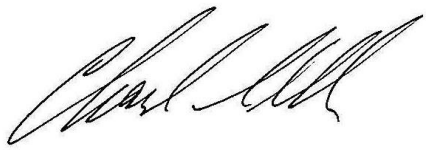
22 March 2018

702774-000

RECLAIM ESTIMATE FOR HOPE BAY PROJECT DORIS - MADRID SITES

Water Licence Application

2AM-DOH1323



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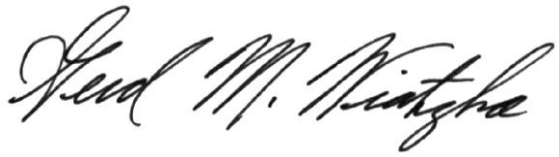

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VERSION CONTROL

Issue	Revision No	Date Issued	Page No	Description	Reviewed by
Draft	0	15 March 2018	37	Quantum of Security Estimate for Hope Bay Project: Doris-Madrid Sites	
Final	1	22 March 2018	45	Quantum of Security Estimate for Hope Bay Project : Doris-Madrid Sites	Gerd Wiatzka

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TABLES

APPENDICES

ACRONYMS AND ABBREVIATIONS

Arcadis	Arcadis Canada Inc.
ICRP	Interim Closure and Reclamation Plan
ESA	Environmental Site Assessment
INAC	Indigenous and Northern Affairs Canada
IOL	Inuit Owned Lands
NIRB	Nunavut Impact Review Board
NPAG	Non-Potentially Acid Generating
NWB	Nunavut Water Board
PAG	Potential Acid Generating
TMAC	TMAC Resources Inc.
TIA	Tailings Impoundment Area
WRSF	Waste Rock Storage Facility

EXECUTIVE SUMMARY

Further to the request of INAC, Arcadis was retained to complete an independent quantum of security estimate for the proposed Hope Bay mine development project as part of a water licence application request set forth by TMAC. TMAC has applied to the NWB for amendment to the existing Type A Water Licence (No. 2AM-DOH1323) to reflect the current and future state of mine development for the Hope Bay Doris-Madrid sites. It is understood that TMAC has made a separate Water Licence application for the Boston mine portion of the Hope Bay project. The quantum of security for the Boston mine site has been provided to INAC under separate letterhead. For the purposes of this quantum of security review it is assumed that the infrastructure to the Boston site will still come through the Hope Bay mine infrastructure and that some economies of scale may be realized as a result of this synergy.

In order to prepare the quantum of security estimate, Arcadis reviewed the following documents;

- TMAC Resources, Hope Bay Project Doris-Madrid Interim Closure and Reclamation Plan, November 2017;
- SRK Consulting Inc., Hope Bay Project Doris-Madrid Interim Closure and Reclamation Plan, Detailed Cost Estimate, November 2017; and
- RECLAIM ESTIMATE for the Boston Project, as prepared by SRK Consulting and provided to INAC on 26 February 2018.

Arcadis used the latest version of the RECLAIM model as provided by INAC to prepare the quantum of security estimate. In general, the material, equipment and labour quantities, and reclamation activities outlined in the Interim Closure and Reclamation Plan, as prepared by TMAC and SRK Consulting, informed the basis of the quantum of security estimate.

A summary of the direct and indirect costs with a comparison to the 26 February 2018 TMAC RECLAIM estimate is provided in Table 1. Based on the outcome of the Arcadis review, it is recommended that the quantum of security estimate for the Hope Bay project be set at $75,373,137.

Of this amount, the RECLAIM capital cost of $47,089,803 was $8,074,158 above the $39,015,645 estimated by TMAC. The difference was primarily the result of higher costs calculated by Arcadis for the liabilities associated with residual petroleum hydrocarbon disposal, minor differences in waste containerization and disposal costs, site regrading and scarifying costs, and interim care and maintenance costs.

Similarily the RECLAIM total indirect cost of $28,283,333 is $8,332,678 higher than the $19,950,655.46 reported by TMAC. The difference is largely related to aggregate costs associated with Mobilization and Post-Closure over a longer period time period than that assumed by TMAC (i.e. 25 yrs vs 10 yrs), and to a lesser extent the indirect costs increased as a function of percentage of the higher direct costs.

The split of the security amount between Land and Water based liabilities is $31,648,594 and $43,724,543 respectively. More details on the distribution are provided on the worksheets in Appendix A.

TABLE 1: SUMMARY OF COSTS

Cost Items	TMAC Security	Arcadis RECLAIM
CAPITAL COSTS		
Open Pit	$0	$0
Underground Mine	$245,455	$329,785
Tailings Facility	$6,373,305	$20,481,445
Rock Pile	$12,459,577	$290,126
Building and Equipment	$11,648,475	$14,598,548
Chemicals and Contaminated Soil Management	$2,989,659	$3,610,542
Surface and Groundwater Management	$1,923,414	$660,059
Water Treatment(Note 1)	$277,151	see below
Interim Care and Maintenance	$3,098,609	$7,119,300
SUB-TOTAL	$39,015,645	47,089,803
INDIRECT COSTS		
Mobilization/Demobilization	$2,178,406	$9,805,516
Post-Closure Monitoring and Maintenance	$8,069,693	$4,350,877
Engineering (5%)	$0	$2,354,490
Project Management (5%)	$1,899,428	$2,354,490
Health and Safety Plans/Monitoring & QA/QC (1%)	$0	$0
Bonding/Insurance (1%)	$0	$0
Contingency (20%)	$7,803,129	$9,417,961
Market Price Factor Adjustment	$0	$0
SUB-TOTAL	$19,950,656	$28,283,333
TOTAL COSTS	$58,966,301	$75,373,137

Note 1 – water treatment costs are included in Post Closure in the Arcadis Estimate

1 INTRODUCTION

1.1 General

Arcadis was retained by INAC to complete a quantum of security evaluation for the Hope Bay Phase 2- Doris-Madrid Project. The security estimate was to be prepared based on the existing information provided by the proponent as part of their annual update to the quantum of security as allowed under water licence amendment application process for the Hope Bay project.

1.2 Background

The Hope Bay Project consists of two phases: Phase 1 (Doris project), which is currently being carried out under an existing Water Licence, and Phase 2 (Madrid-Boston project) which is in environmental assessment and regulatory stage. Phase 1 includes mining and infrastructure at Doris, while Phase 2 includes mining and infrastructure at Madrid and Boston located approximately 10 and 60 km south of the Doris holding respectively.

At the Doris-Madrid site, the Madrid-Boston Project focuses on mining of the Doris, Madrid North and Madrid South deposits by utilizing and expanding upon the Doris Project infrastructure for the integrated development of the Hope Bay Belt. Doris-Madrid construction activities will overlap with the operation activities at the Doris Site (Phase 1). The proximity of the Madrid area to the Doris Site, process plant and TIA means that the Project can utilize existing infrastructure at the Doris property. This will minimize the footprint and time required to develop the Madrid deposit. The permitted infrastructure and facilities at Roberts Bay and the Doris Site have sufficient capacity to support Project construction for Phase 2.

The Doris-Madrid Project timeline, as described in the Interim Closure and Reclamation Plan (IRCP) prepared by TMAC (November 2017), involves construction, operation and closure of underground mines at Doris, Madrid North and Madrid South as well as mineral processing facilities at Dories and Madrid North. In addition, the Project will consist of extended operations, then closure of existing facilities at Doris and Roberts Bay. The stages associated with the Project are as follows:

- Operations, Phase 1: Operations of the Doris Mine, already permitted under an existing water licence (2016 to 2012)
- Construction, Bulk Sample
    - Madrid North Mine (2018)
    - Madrid South Mine and access road to Madrid South (2019)
- Construction, Phase 2
    - Madrid North Mine (2019)
    - Madrid South Mine (2029)
    - Boston Mine and access road to Boston (2019 to 2023)

    - Expansion of the TIA infrastructure at Doris (2019)
    - Expansion of the Doris infrastructure (cargo dock, fuel storage) to support Phase 2 (2019 and 2020)
- Operations, Phase 2
    - Madrid North Mine (2019 to 2031)
    - Madrid South Mine (2029 to 2032)
    - Boston Mine (2022 to 2029)
    - Extended operations of the infrastructure at Doris (2019 to 2032)
- Closure: Closure of all facilities (2032 to 2035)
- Post-Closure: Post-closure monitoring (2034 to 2044).

More details on the Phase 2 Project life cycle are provided in the Hope Bay Project Doris-Madrid ICRP.

1.3 Scope of Work

The scope of work (SOW) developed by INAC for the quantum of security evaluation is outlined in Section 2 of this report. In general, the SOW for this task was to review existing documentation on the closure and reclamation of the Hope Bay Doris-Madrid Project and prepare a quantum of security estimate based on the RECLAIM Version 7.0 model for the costing of mine reclamation programs.

2 METHODOLOGY

2.1 General Approach

Arcadis' approach to this quantum of security review consisted of the following:

- A review of the TMAC Resources, Hope Bay Project Doris-Madrid Interim Closure and Reclamation Plan, November 2017;
- A review of the SRK Consulting Inc., Hope Bay Project Doris-Madrid Interim Closure and Reclamation Plan, Detailed Cost Estimate, November 2017;
- A review of the RECLAIM ESTIMATE for the Hope Bay Project, as prepared by SRK Consulting and provided to INAC on 26 February 2018.
- A review of the TMAC quantum of security estimates, as prepared by SRK Consulting, (December 2016) for the entire Hope Bay Project (including Boston Mine);

- An inspection of the Doris mine site and related infrastructure in October 2017; and
- A review of the RECLAIM Version 7.0 Manual.

The security review was completed considering the application of the financial security provisions of the Mine Site Reclamation Policy for Nunavut (INAC, 2002) summarized as follows:

- Total financial security for final reclamation should be equal to the total outstanding reclamation liability for land and water combined. The financial security should be sufficient to cover the highest liability over the applicable time period.
- Reclamation cost estimates for financial security purposes should be based on the cost of having the reclamation work completed by a third-party contractor if the operator defaults.
- Estimates should include a contingency that is appropriate to the particular work to be undertaken.
- A recognized methodology such as RECLAIM or some other appropriate model should be used to calculate reclamation costs.
- Consideration should be given to alternate or innovative forms of security.
- Financial security requirements should be clearly set out in water licences, land leases and other regulatory instruments. Alternatively, the security requirements can be specified within a separate agreement if this approach is more applicable.
- Mine operators should be credited for approved progressive reclamation, and the value of financial security required should be adjusted in a timely fashion.

Arcadis initially completed its quantum of security estimate using the TMAC security estimates (not done using the RECLAIM model but summarized in a manner similar to the RECLAIM summary output) and reviewed the differences between the two to make sure the Arcadis assumptions were reasonable and consistent with other security estimates done on mine properties in Nunavut.

2.2 Limitations

The quantum of security estimate is based on the information provided by INAC to Arcadis and, as such, the assessment is primarily based on the ICRP prepared by TMAC for the Hope Bay Phase 2 program.

Should any of the underlying assumptions outlined in the ICRP change over the lifetime of the mine site, then the quantum of security estimate should be reviewed in light of any new information. Under the existing Water Licence the proponent will have the opportunity to amend the quantum of security based on progressive reclamation works. It is assumed that this provision will remain in the amended Water Licence.

3 FINDINGS

3.1 General

The RECLAIM worksheets detailing the direct and indirect costs used to develop the Arcadis quantum of security estimate are provided in Appendix A. A copy of the security estimate as prepared by SRK Consulting for TMAC (i.e. version provided to Arcadis February 2018) is provided in Appendix B. Further discussion on each major cost item is provided herein, organized based on the RECALIM 7.0 layout developed and used by INAC.

3.2 Direct Costs

The Direct Costs for the Arcadis RECLAIM estimate are provided in the worksheets found in Appendix A. The Land and Water Liability costs are presented in these worksheets. In summary, the Land Liability has been calculated to be $19,772,642 while the Water Liability has been calculated to be $27,317,161. Given that the site is completely contained within IOL lands, we have not provided a breakdown of the costs into IOL versus Crown land.

3.2.1 Open Pit

Not applicable to this water licence application.

3.2.2 Underground Mine

On the basis of the information provided by TMAC this work will entail decommissioning the infrastructure associated with the mine openings (i.e. vent raises and portals), transferring the demolition waste to the local non-hazardous landfill, sealing a vent raise with a concrete cap, grading vent raise location and using local waste rock/quarry material to construct the portal seal. The quantities and rates provided by TMAC are reasonable for the nature of the work and have been used by Arcadis in this RECLAIM estimate with the exception of the quantities of material related to the removal of electrical equipment and the like from the underground which were missing for the Madrid North property and the costs associated with the transfer of explosives was increased to account for containerization and temporary storage of the explosives and not just their haulage. Other than this difference the TMAC and Arcadis estimates are not materially different for this work activity.

3.2.3 Tailings Facility

The security amounts included in the Arcadis RECLAIM estimate used the quantities and unit rates provided by TMAC in their recent submission, however the distribution of costs varied between the two estimates whereby costs for capping the TIA where not carried by TMAC under this work item. A direct comparison of the costs related to this work item is therefore not possible. In general, there was no major difference in the approach and cost estimate derived for this work.

More details are provided in the detailed costing sheet provided in Appendix A.

3.2.4 Waste Rock Pile

As noted above, the distribution of work items by TMAC was different from the standard RECLAIM structure and as such a direct comparison of the costs included under this work item is not possible.

In general, the quantities of work and the rates provided to execute the work are reasonable except as it relates to grading work. The unit rate of $\$0.01/m^2$ is not reasonable and as such the low end RECLAIM unit rate ($\$0.95/m^2$ or $\$1.23/m^2$) for grading work was used by Arcadis to calculate the value of this work. Given the amount of grading work required at closure this represented a significant different between the TMAC and Arcadis security estimates.

More details are provided in the detailed costing sheet provided in Appendix A.

3.2.5 Buildings and Equipment

For the purposes of the Arcadis estimate, the building footprint areas and facility layouts provided by TMAC in the 2017 Phase 2 ICRP were used to estimate the building removal costs and grading/contouring of the various waste rock pads underlying the buildings as well as site infrastructure. In addition to these cost items, costs were also included for an assumed laydown area that were part of common areas not included in the building area footprints.

In general, the costs for the decommissioning and dismantling of buildings and equipment, as well as management of the associated wastes, are higher in the Arcadis estimate. The higher costs typically related to waste haulage costs that were not included by TMAC or the unit rate for the work that was considered too low and as such another unit rate provided by SRK for similar work was used as being more representative of the cost that would be incurred to execute the particular task. In general, Arcadis has flagged when a different set of rates were used to cost the work in the RECLAIM costing sheets, provided in Appendix A,.

More details are provided in the RECLAIM worksheet in Appendix A.

3.2.6 Chemicals and Contaminated Soil Management

The work under this task includes; completing a Phase I/II ESA; decontaminating the various facilities on site including power house and fuel storage facilities; removal of hazardous wastes (i.e. batteries, waste fuel/oil, glycol, etc.); management of petroleum hydrocarbons and reagents as well as de-icing impacts.

Given the methods used to prepare the respective security estimates it is not possible to complete a direct comparison of the two; however, in general the quantities and rates provided by TMAC are reasonable for the level of effort required to decommission the infrastructure and manage the anticipated volume of contaminated soils.

The main difference in the two estimates relate to the costs assigned for the management of impacted soils from the de-icing pad which is to be disposed of below ground. TMAC has two different rates for the haulage and disposal of mega bags underground, however in the Arcadis estimate only the higher unit rate of $\$15.37/m^3$ was used. In addition, the rate to manage residual fuel is too low at $0.02/L and as such a rate of $0.43/L as used by TMAC in its earlier estimate (SRK, December 2016) has been applied in the Arcadis estimate.

More details are provided in the RECLAIM worksheet in Appendix A.

3.2.7 Surface and Groundwater Management

The work included under this task entailed; the breaching of the contact water berms, decommissioning the water discharge line from the treatment plant and the sewage treatment plant discharge line, and removal of equipment (pumps) and liners associated with the contact ponds. A cost has also been included for the removal of a pipeline that will likely be constructed between the Madrid North concentrator to the TIA water treatment plant which is not currently included in the ICRP but is discussed in other documents provided by TMAC as part of the Water Licence application. The material quantities used by Arcadis in its estimate for the removal and/or relocation of on-site material are the same as those presented by TMAC in their estimate, however in some instances the rates have been increased to reflect additional effort required to complete a task or to account for missing work such as haulage of waste to the landfill.

The treatment and management of water during the Closure and Post-Closure phases is covered under the Post-Closure and Interim Care and Maintenance Costs, as applicable.

As with other portions of the security estimate, TMAC has included work items herein that are normally provided in other sections of the RECLAIM estimate and as such a direct comparison is not feasible.

More details on the Arcadis RECLAIM estimate are provided in Appendix A.

3.2.8 Interim Care and Maintenance (ICM)

Normally INAC would ask for a five-year care and maintenance period to be included in a security estimate as part of the water licence process, however for this estimate Arcadis has applied a three-year ICM period using TMAC's unit rates to derive a quantum of security that would be reasonable to cover five years of care and maintenance on this property. The unit rates used by TMAC in their 1.5 year care and maintenance schedule are, in the opinion of Arcadis, conservative and as such ensure there would be sufficient security in place if a five year ICM period were required.

The main difference between the two security estimates relates to the inclusion of water treatment costs associated with the tailings impoundment pond which were not included in the TMAC estimate but Arcadis is of the opinion are necessary to address this potential concern with impacted seepage water leaching from the TIA.

More details on the Arcadis RECLAIM estimate are provided in Appendix A.

3.2.9 Summary of Direct Cost Review

The net result of the Arcadis assessment was a total capital or direct cost of $47,089,803 as compared to a cost of $39,015,645 reported by TMAC. The $8,074,158 difference was primarily the result of higher costs calculated by Arcadis for the liabilities associated with residual petroleum hydrocarbon disposal, minor differences in waste containerization and disposal costs, site regrading and scarifying costs, and interim care and maintenance costs. It should be noted that the distribution of costs in the TMAC and Arcadis estimates are very different and as such it is not readily evident where the costs are different. To help with this some colour coding and comments were provided in the RECLAIM spreadsheets, in Appendix A, to highlight some of the differences that have been identified.

3.3 Indirect Costs

The Indirect Costs for the Arcadis RECLAIM estimate are provided in the RECLAIM worksheets found in Appendix A. The Land and Water Liability costs are presented in these worksheets. In summary, the Land Liability has been calculated to be $11,875,952 while the Water Liability has been calculated to be $16,407,382. Given that the site is completely contained within IOL lands there is no division of liabilities between the IOL and Crown held lands.

3.3.1 Mobilization and Demobilization

For the purposes of the Arcadis security assessment, it was assumed that equipment would need to be mobilized to site in order to complete the site closure and reclamation

works. The equipment for the reclamation work would be sourced from Southern Canada. The costs provided by TMAC are reasonable and have been used herein.

In general, the costs for the movement and housing of staff during the closure and reclamation works were consistent with those used by TMAC. Small differences were calculated where TMAC had not considered the cost that would be incurred mobilizing works to and from the site. The reason for the differences between the report TMAC and Arcadis costs within this line item relate to where the post closure monitoring costs have been carried and as such the aggregate cost of Mobilization/Demobilization and Post-Closure Monitoring should be considered when reviewing this security item.

3.3.2 Post-Closure Monitoring and Maintenance

The Post-Closure Monitoring and Maintenance costs are based on 25 years of monitoring for geotechnical and environmental concerns. The 25 years is based on current INAC practice and has been set to protect against uncertainties related to the long-term water quality of the site. Those uncertainties include, but are not limited to, the effectiveness of the proposed waste rock cover on the TIA and the potential for metal loadings to surface water receivers to be higher than currently predicted. There is insufficient information available to state for certain whether or not there will be an issue with seepage water quality from the TIA and as such Arcadis has included an allowance to cover some water treatment pending the results of further testing to confirm the quality of the leachate being released from within the TIA.

More details on this are provided in the worksheet in Appendix A.

3.3.3 Engineering

Consistent with other quantum of security estimates provided by Arcadis for a mine such as the proposed Doris-Madrid mine development, and others in Nunavut, Arcadis has used a rate of 5% of direct costs for this security estimate. TMAC has incorporated engineering costs into other components of the work and as such there is not direct comparison of the liability item provided in the TMAC estimate.

3.3.4 Project Management

TMAC has provided a security estimate based on the number of days of field supervision required to complete the reclamation work (i.e $1,899,428). Given the level of effort required to reclaim the respective sites, which will be completed concurrently thus necessitating additional staff, Arcadis has assigned a project management percentage of 5% in the Arcadis RECLAIM estimate.

3.3.5 Health and Safety Plans/Monitoring and QA/QC

No cost was assigned to these items as they are considered to be part of the Engineering and Project Management costs.

3.3.6 Bonding/Insurance

No cost was assigned to these items as they are considered to be part of the Engineering and Project Management costs.

3.3.7 Contingency

Given the level of mine development, a 20% contingency is appropriate. This is consistent with the approach used by TMAC.

3.3.8 Market Factor Adjustment

No market factor adjustment was used in the Arcadis estimate. This is consistent with the approach used by TMAC.

3.3.9 Summary of Indirect Cost Review

The net result of the Arcadis assessment was a total indirect cost of $28,283,333 as compared to a cost of $19,950,655.46 reported by TMAC. The $8,332,678 difference was largely due to the difference in costs associated with aggregate of the Mobilization and Post-Closure costs (longer period than that assumed by TMAC – 25 yrs vs 10 yrs) and to a lesser extent that the indirect costs increased on the basis of percentage of increased direct costs.

4 CONCLUSIONS AND RECOMMENDATIONS

On the basis of the review completed by Arcadis, the quantum of security has assessed to be $75,373,137. This estimate is approximately $16.4M higher than the TMAC estimate and is based primarily on increased costs for the management of surface water within the TIA, variances in the costs to manage onsite debris related to decommissioning and demolition works, interim care and maintenance costs, post-closure monitoring, and indirect costs linked to direct costs not carried directly by TMAC (e.g. health and safety or engineering). A comparison of the two security estimates is tabulated below.

Table 2: SUMMARY OF COSTS

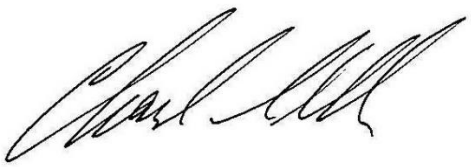
Cost Items	TMAC Security	Arcadis RECLAIM
CAPITAL COSTS		
Open Pit	$0	$0
Underground Mine	$245,455	$329,785
Tailings Facility	$6,373,305	$20,481,445
Rock Pile	$12,459,577	$290,126
Building and Equipment	$11,648,475	$14,598,548
Chemicals and Contaminated Soil Management	$2,989,659	$3,610,542
Surface and Groundwater Management	$1,923,414	$660,059
Water Treatment(Note 1)	$277,151	see below
Interim Care and Maintenance	$3,098,609	$7,119,300
SUB-TOTAL	$39,015,645	47,089,803
INDIRECT COSTS		
Mobilization/Demobilization	$2,178,406	$9,805,516
Post-Closure Monitoring and Maintenance	$8,069,693	$4,350,877
Engineering (5%)	$0	$2,354,490
Project Management (5%)	$1,899,428	$2,354,490
Health and Safety Plans/Monitoring & QA/QC (1%)	$0	$0
Bonding/Insurance (1%)	$0	$0
Contingency (20%)	$7,803,129	$9,417,961
Market Price Factor Adjustment	$0	$0
SUB-TOTAL	$19,950,656	$28,283,333
TOTAL COSTS	$58,966,301	$75,373,137

Note 1 – water treatment costs are included in Post Closure in the Arcadis Estimate

The split in the Arcadis estimate between Land and Water liabilities is $31,648,594 for Land based liabilities and $43,724,543 for Water based liabilities. The entire property is on IOL lands and as such there is no split in the security holding between IOL and Crown lands.

5 CLOSURE

We trust the information provided herein meets your current needs. Should you require any additional information please do not hesitate to contact us.



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Principal Engineer

6 REFERENCES

Hope Bay Project, Doris Madrid Interim Closure and Reclamation Plan, TMAC Resources, prepared by SRK Consulting, November 2017.

Hope Bay Project – Doris Madrid Interim Closure and Reclamation Plan, Detailed Cost Estimate, SRK Consulting, November 2017.

Hope Bay Project –Doris Madrid Interim Closure and Reclamation Plan, Detailed Cost Estimate (EXCEL tables only), SRK Consulting, February 2018.

Hope Bay Project, Phase 2 Conceptual Closure and Reclamation Plan, TMAC Resources, prepared by SRK Consulting, November 2016.

Hope Bay Project – Phase 2 Conceptual Closure and Reclamation Plan, Detailed Cost Estimate, SRK Consulting, December 2016.

Indian and Northern Affairs Canada (INAC), 2002. Mine Site Reclamation Policy for Nunavut. ISBN 0-662-32073-5. Copyright: Minister of Public Works and Government Services Canada.

Mackenzie Valley Land and Water Board, 2014. Guidelines for Closure and Reclamation Cost Estimates for Mines.

APPENDIX A

ARCADIS RECLAIM Worksheets

SUMMARY OF COSTS

CAPITAL COSTS	COMPONENT NAME	COST	LAND LIABILITY	WATER LIABILITY
OPEN PIT		$0	$0	$0
UNDERGROUND MINE	Doris -Madrid	$329,785	$314,809	$14,976
TAILINGS FACILITY	Doris-Madrid Mines	$20,481,445	$10,364,472	$10,116,972
ROCK PILE	Doris - Madrid	$290,126	$145,063	$145,063
BUILDINGS AND EQUIPMENT	Doris - Madrid	$14,598,548	$7,220,857	$7,377,691
CHEMICALS AND CONTAMINATED SOIL MANAGEMEN		$3,610,542	$1,727,441	$1,883,101
SURFACE AND GROUNDWATER MANAGEMENT		$660,059	-	$660,059
INTERIM CARE AND MAINTENANCE		$7,119,300	-	$7,119,300
	SUBTOTAL: Capital Costs	**$47,089,803**	**$19,772,642**	**$27,317,161**
	PERCENT OF SUBTOTAL		**42%**	**58%**

INDIRECT COSTS		COST	LAND LIABILITY	WATER LIABILITY
MOBILIZATION/DEMOBILIZATION		$9,805,516	$4,117,260	$5,688,256
POST-CLOSURE MONITORING AND MAINTENANCE		$4,350,877	$1,826,899	$2,523,977
ENGINEERING	5%	$2,354,490	$988,632	$1,365,858
PROJECT MANAGEMENT	5%	$2,354,490	$988,632	$1,365,858
HEALTH AND SAFETY PLANS/MONITORING & QA/QC	0%	$0	$0	$0
BONDING/INSURANCE	0%	$0	$0	$0
CONTINGENCY	20%	$9,417,961	$3,954,528	$5,463,432
MARKET PRICE FACTOR ADJUSTMENT	0%	$0	$0	$0
	SUBTOTAL: Indirect Costs	**$28,283,333**	**$11,875,952**	**$16,407,382**
TOTAL COSTS		**$75,373,137**	**$31,648,594**	**$43,724,543**

1 **Underground Mine Name** **Doris -Madrid** **UG Mine # 1**

ACTIVITY/MATERIAL	Notes	Unit	Qty	Code	Unit Cost	Cost	Land	Land Cost	Water Cost	
CONTROL ACCESS										
Fence		m		#N/A	$0.00	$0		$0	$0	
Signs	Doris/Madrid South/Madrid North	each	6	SH	$37.08	$222	100%	$222	$0	
Block roads		m3		#N/A	$0.00	$0		$0	$0	
Berm		m3		#N/A	$0.00	$0		$0	$0	
Concrete wall in portals		m3		#N/A	$0.00	$0		$0	$0	
Backfill portal Doris	DM-012	m3	710	TMAC	$24.53	$17,416	100%	$17,416	$0	rounded qty
Backfill Portal Madrid North	MN-012	m3	710	TMAC	$24.53	$17,416	100%	$17,416	$0	rounded qty
Backfill Portal Madrid South	MS-016	m3	710	TMAC	$24.53	$17,416	100%	$17,416	$0	rounded qty
Cap Vent Raises	DM-030, DM-033 & DM-034	each	3	TMAC	$14,300.00	$42,900	100%	$42,900	$0	rounded unit rate up
Cap Vent Raises	MN-018	each	3	TMAC	$14,300.00	$42,900	100%	$42,900	$0	rounded unit rate up
Cap Vent Raises	MS-015	each	2	TMAC	$14,300.00	$28,600	100%	$28,600	$0	rounded unit rate up
Cap shaft #2		m3		#N/A	$0.00	$0		$0	$0	
Backfill adits		m3		#N/A	$0.00	$0		$0	$0	
Backfill open stope		m3		sc3h	$14.20	$0		$0	$0	
Concrete cap over open stope		m3		#N/A	$0.00	$0		$0	$0	
Other - crown pillar study		LS		#N/A	$25,000.00	$0		$0	$0	
REMOVE HAZARDOUS MATERIALS										
Remove hazardous materials, U/G labor		mandays		#N/A	$500.00	$0		$0	$0	
Remove/decontam. stationary & elect. equip	DM-012, DM-030, DM-033 & DM-034	lm	400	TMAC	$119.02	$47,608	100%	$47,608	$0	
	Doris remove equipment from underground M	each	3	TMAC	$680.00	$2,040	100%	$2,040	$0	no quantity given in latest estimate so kept earlier number
	MN-012 & MN-018	lm	400	TMAC	$119.02	$47,608	100%	$47,608	$0	
	MS-015 & MS-016	lm	300	TMAC	$119.02	$35,706	100%	$35,706	$0	N/C
Remove/decontam. mobile equipment		each		#N/A	$0.00	$0		$0	$0	
Remove misc. haz. mat & explosives	Remove explosives from AWR storage	m3	2,176	TMAC	$13.14	$28,593	50%	$14,296	$14,296	added containerization cost C.4.01
	Cargo dock controller removal	each	2	TMAC	$679.52	$1,359	50%	$680	$680	
Other	Relocate debris from Raise MN									
	Relocate debris from Raise MS									
INSTALL BULKHEADS										
Bulkheads to control water flow		each		#N/A	$0.00	$0		$0	$0	
Grout bulkhead		m3		#N/A	$0.00	$0		$0	$0	
FLOOD MINE										
Supply/install pump		each		#N/A	$0.00	$0		$0	$0	
Supply/install piping system		each		#N/A	$0.00	$0		$0	$0	
Operate pumps to flood workings		m3		#N/A	$0.00	$0		$0	$0	
Other				#N/A	$0.00	$0		$0	$0	
INSTALL GROUNDWATER COLLECTION SYSTEM										
Excavate/install sumps		m2		#N/A	$0.00	$0		$0	$0	
Install pumping wells		m3		#N/A	$0.00	$0		$0	$0	
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0		$0	$0	
SPECIALIZED ITEMS										
Install water quality monitoring pipes		each		#N/A	$0.00	$0		$0	$0	
Install permanent pumping system		each		#N/A	$0.00	$0		$0	$0	
Other				#N/A	$0.00	$0		$0	$0	
					Total	$329,785		$314,809	$14,976	
					% of Total			95%	5%	

1 **Tailings Impoundment Name:** **Doris-Madrid Mines** **Pond # 1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost	
CONTROL ACCESS										
Fence		m		#N/A	$0.00	$0		$0	$0	
Signs		each		#N/A	$0.00	$0		$0	$0	
Berm		m3		#N/A	$0.00	$0		$0	$0	
Block roads		m3		#N/A	$0.00	$0		$0	$0	
Other				#N/A	$0.00	$0		$0	$0	
STABILIZE EMBANKMENT(S)										
Toe buttress, drainage layer		m3		#N/A	$0.00	$0		$0	$0	
Toe buttress, bulk fill		m3		#N/A	$0.00	$0		$0	$0	
Rip rap		m3		RB2	$17.80	$0		$0	$0	
Vegetate		ha		#N/A	$0.00	$0		$0	$0	
Raise crest		m3		#N/A	$0.00	$0		$0	$0	
Flatten slopes		m3		#N/A	$0.00	$0		$0	$0	
Other				#N/A	$0.00	$0		$0	$0	
COVER TAILINGS										
Grade/shape tailings surface	Windy Development Area Layout work for regrading	day	1	TMAC	$7,190.00	$7,190	50%	$3,595	$3,595	
Liner bedding		m3		#N/A	$0.00	$0		$0	$0	
Subgrade preparation - compact		m2		#N/A	$0.00	$0		$0	$0	
Supply geotextile/geosynthetic		m2		#N/A	$0.00	$0		$0	$0	
Supply & Install geotextile/geosynthetic	TIA-005 placement of NWG for erosion prevention	m2	54340	TMAC	$30.02	$1,631,287	50%	$815,643	$815,643	
Soil cover		m3		SC4L	$9.30	$0		$0	$0	
Rock cover	Prepare rock cover aggregate (drill and blast) TIA-001	m3	510000	TMAC	$23.16	$11,811,600	50%	$5,905,800	$5,905,800	
	Place 300 mm cover for TIA-001	m3	510000	TMAC	$8.94	$4,559,400	50%	$2,279,700	$2,279,700	
	Install nonwoven geotextile at TIA-005	m2	54340	TMAC	$30.02	$1,631,287	50%	$815,643	$815,643	
	Place Rip Rap over NWG at TIA-005	m3	24700	TMAC	$8.82	$217,854	50%	$108,927	$108,927	
	Produce and Place Rip Rap in channel	m3	18150	TMAC	$32.10	$582,615	50%	$291,308	$291,308	
	Windy Development Area cover	m3	665	TMAC	$12.69	$8,439	50%	$4,219	$4,219	
Vegetate		ha		VHF	$4,000.00	$0		$0	$0	
Other		m3		TMAC	$24.71	$0	50%	$0	$0	
BURY PAG ROCK										
Relocate PAG rock		m3		#N/A	$0.00	$0		$0	$0	
Place cover over PAG rock		m3		#N/A	$0.00	$0		$0	$0	
Raise crest of dam		m3		#N/A	$0.00	$0		$0	$0	
Other				#N/A	$0.00	$0		$0	$0	
STABILIZE DECANT SYSTEM										
Excavate and replace		m3		#N/A	$0.00	$0		$0	$0	
Plug/backfill with concrete or clay		m3		#N/A	$0.00	$0		$0	$0	
Other				#N/A	$0.00	$0		$0	$0	
REMOVE TAILINGS DISCHARGE										
Cyclones		m3		#N/A	$0.00	$0		$0	$0	
Pipe	SR-002 tailings pipeline from Doris to TIA	m	2170	TMAC	$13.49	$29,273	50%	$14,637	$14,637	Added unit rate for haulage to landfill
Remove reclaim barge		allow		#N/A	$0.00	$0		$0	$0	
CONSTRUCT DIVERSION DITCHES										
Excavate ditches -soil		m3		#N/A	$0.00	$0		$0	$0	
Excavate ditches -rock		m3		#N/A	$0.00	$0		$0	$0	
Rip rap in channel base		m3		#N/A	$0.00	$0		$0	$0	
FLOOD TAILINGS										
Doze tailings to final contour		m3		#N/A	$0.00	$0		$0	$0	
Raise crest of dam		m3		#N/A	$0.00	$0		$0	$0	
Other				#N/A	$0.00	$0		$0	$0	
UPGRADE SPILLWAY										
Excavate channel, rock		m3		#N/A	$0.00	$0		$0	$0	
Excavate channel, soil		m3		SC3H	$14.20	$0		$0	$0	
Concrete		m3		#N/A	$0.00	$0		$0	$0	
Rip rap		m3		RB4H	$30.75	$0		$0	$0	
Geotextile		m2		GSTL	$3.44	$0		$0	$0	
CONSTRUCT SEEPAGE COLLECTION POND										
Excavate seepage collection pond		m3		#N/A	$0.00	$0		$0	$0	
Doze & spread excavated material		m3		#N/A	$0.00	$0		$0	$0	
Vegetate spread material		ha		#N/A	$0.00	$0		$0	$0	
Bedding layer		m3		#N/A	$0.00	$0		$0	$0	
Supply geomembrane		m2		#N/A	$0.00	$0		$0	$0	
Install geomembrane		m2		#N/A	$0.00	$0		$0	$0	
Install Silt Fencing	Patch Lake Devleopment Area	LS	1	TMAC	$2,500.00	$2,500	50	$125,000	-$122,500	
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0	
INSTALL GROUNDWATER COLLECTION SYSTEM										
Excavate/install sumps		m3		#N/A	$0.00	$0		$0	$0	
Install pumping wells		m3		#N/A	$0.00	$0		$0	$0	
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0		$0	$0	
SPECIALIZED ITEMS										
Install permanent instrumentation, supply & technican		each		#N/A	$30,000.00	$0		$0	$0	
Install permanent instrumentation, drilling		each		#N/A	$30,000.00	$0			$0	
TREAT SEEPAGE - see "Water Management" and "Water Treatment"										
TREAT SUPERNATANT										
Pump water (to pit, U/G)		m3		#N/A	$0.00	$0		$0	$0	
Equipment maintenance and parts		allow		#N/A	$100,000.00	$0		$0	$0	
Supply reagents		tonne		#N/A	$0.00	$0		$0	$0	
					Annual treatment costs	$0				
Number of years of treatment		years								
					Total treatment costs	$0			$0	
					Total	$20,481,445		$10,364,472	$10,116,972	
					% of Total			51%	49%	

* for construction of passive treatment system refer to "Water Management"

1 **Rock Pile Name:** **Doris - Madrid**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost	
STABILIZE SLOPES										
Grade Waste Rock Pile		m3		TMAC	$1.23	$0	50%	$0	$0	
Grade Overburden	Roberts Bay Overburden Pile RB-007	m2	14205	DSI	$0.95	$13,495	50%	$6,747	$6,747	
	Quarry 2 Overburden Pile Q2-002 (slopes to 3:1)	m2	8785	TMAC	$3.27	$28,727	50%	$14,363	$14,363	
	Quarry 2 Overburden Pile Q2-002 (top)	m2	18440	DSI	$0.95	$17,518	50%	$8,759	$8,759	Don't agree with SRK rate of $0.01
	Patch Lake Tank Farm PLA-001 regrade (dozer)	m2	200	TMAC	$1.23	$246	50%	$123	$123	
	Patch Lake Tank Farm PLA-001 regrade (excavator)	m2	3630	TMAC	$5.50	$19,965	50%	$9,983	$9,983	
	Doris Windy AWR Explosive facility regrade (DM-010	m2	2805	DSI	$0.95	$2,665	50%	$1,332	$1,332	Don't agree with SRK rate of $0.01
	Windy camp Regrading Bldg foot prints (WC-002)	m2	1248	DSI	$0.95	$1,186	50%	$593	$593	
Grade Laydown Areas	Roberts bay Laydown Area RB-006	m2	63300	DSI	$0.95	$60,135	50%	$30,068	$30,068	Don't agree with SRK rate of $0.01
	Reagent Pad - Equipment (RP-001)	m2	35244	DSI	$0.95	$33,482	50%	$16,741	$16,741	Don't agree with SRK rate of $0.01
	Reagent Pad - Material (RP-002)	m2	25421	DSI	$0.95	$24,150	50%	$12,075	$12,075	Don't agree with SRK rate of $0.01
	Reagent Pad - ANFO Storage Area (RP-003)	m2	2481	DSI	$0.95	$2,357	50%	$1,178	$1,178	Don't agree with SRK rate of $0.01
	Waste Management Landfarm (WM-001)	m2	4385	DSI	$0.95	$4,166	50%	$2,083	$2,083	Don't agree with SRK rate of $0.01
	Waste Management Batch Plant Pad (WM-002)	m2	740	DSI	$0.95	$703	50%	$352	$352	Don't agree with SRK rate of $0.01
	Waste Management Burn Pan Pad (WM-003)	m2	400	DSI	$0.95	$380	50%	$190	$190	Don't agree with SRK rate of $0.01
Grade Old Camp Ore Pile		m3		TMAC	$1.23	$0	50%	$0	$0	
Grade Ore Stockpile		m3		#N/A	$0.00	$0		$0	$0	
Buttress	Windy Tank Farm (WC-001)	m3	600	TMAC	$12.27	$7,362	50%	$3,681	$3,681	
Toe buttress, fill mat'l A		m3		#N/A	$0.00	$0		$0	$0	
Toe buttress, fill mat'l B		m3		#N/A	$0.00	$0		$0	$0	
Other				#N/A	$0.00	$0		$0	$0	
ROCK COVER										
Subgrade preparation - doze surface		m3		#N/A	$0.00	$0		$0	$0	
Soil cover - excavate,haul,spread&compact		m3		SB1L	$4.30	$0		$0	$0	
Prepare debris for capping		m3		TMAC	$86.72	$0		$0	$0	
Prepare aggregate		m3		TMAC	$24.71	$0		$0	$0	
Rock cover - excavate,haul & spread		m3		TMAC	$16.35	$0		$0	$0	
Excavate downslope drainage channel & chute		m3		#N/A	$0.00	$0		$0	$0	
Rip rap drainage channel and chute		m3		#N/A	$0.00	$0		$0	$0	
Vegetate		ha		#N/A	$0.00	$0		$0	$0	
Other	Patch Lake Tank Farm PLA-001 cover 1m	m3	3000	TMAC	$24.53	$73,590	50%	$36,795	$36,795	
VERY LOW PERMEABILITY COVER (in addition to above)										
Liner subgrade preparation - compact		m2		#N/A	$0.00	$0		$0	$0	
Supply geomembrame		m2		#N/A	$0.00	$0		$0	$0	
Install geomembrane		m2		#N/A	$0.00	$0		$0	$0	
Protective cover - excavate,haul,spread&compact		m3		#N/A	$0.00	$0		$0	$0	
Vegetate		ha		#N/A	$0.00	$0		$0	$0	
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0	
CONSTRUCT DIVERSION DITCHES										
Excavate ditches -soil		m3		#N/A	$0.00	$0		$0	$0	
Excavate ditches -rock		m3		#N/A	$0.00	$0		$0	$0	
Rip rap in channel base										
CONSTRUCT SEEPAGE COLLECTION POND										
Excavate seepage collection pond		m3		#N/A	$0.00	$0		$0	$0	
Doze & spread excavated material		m3		#N/A	$0.00	$0		$0	$0	
Vegetate spread material		ha		#N/A	$0.00	$0		$0	$0	
Bedding layer		m3		#N/A	$0.00	$0		$0	$0	
Supply geomembrane		m2		#N/A	$0.00	$0		$0	$0	
Install geomembrane		m2		#N/A	$0.00	$0		$0	$0	
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0	
INSTALL GROUNDWATER COLLECTION SYSTEM										
Excavate/install sumps		m3		#N/A	$0.00	$0		$0	$0	
Install pumping wells		m3		#N/A	$0.00	$0		$0	$0	
Install pumps/pipelines/power supply		allow		#N/A	$0.00	$0		$0	$0	
RELOCATE DUMPS										
Load, haul, dump or doze		m3		SC3L	$8.90	$0		$0	$0	
Add lime		tonne		#N/A	$0.00	$0		$0	$0	
Contour reclaimed area		ha		#N/A	$0.00	$0		$0	$0	
Other		allow		#N/A	$20,000.00	$0		$0	$0	
SPECIALIZED ITEMS										
Install permanent instrumentation		allow		Ea	$50,000.00	$0		$0	$0	
Install permanent instrumentation, drilling		each		#N/A	$0.00	$0		$0	$0	
TREAT ROCK PILE SEEPAGE - see "Water Management"										
HEAP LEACH SEEPAGE TREATMENT - Cyanide Detox										
Cyanide destruction water treatment pumping		m3		#N/A	$0.00	$0		$0	$0	
Reagents		tonnes		#N/A	$0.00	$0		$0	$0	
Electrician/mechanic to maintain treatment plant		allow		#N/A	$0.00	$0		$0	$0	
Equipment maintenance and parts		allow		#N/A	$0.00	$0		$0	$0	
					Annual treatment costs	$0				
Number of years of treatment		years								
					Total treatment costs	$0				$0
HEAP LEACH SEEPAGE TREATMENT - ARD/ML**										
Upgrade/modify pumping system - report to WTP		allow		#N/A	$0.00	$0				$0
					Total	$290,126		$145,063	$145,063	
					% of Total			50%	50%	

* For construction of passive treatment system refer to "Water Management". ARD/ML seepage treatment becomes post-closure water treatment cost

**Heap leach ARD/ML seepage treatment becomes post-closure water treatment cost

1 **Chemicals/Soil Area Name: Doris - Madrid**

Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost	
HAZARDOUS MATERIALS AUDIT										
Hazardous materials audit	Not required	allow		#N/A	$25,000.00	$0		$0	$0	
BUILDING DECONTAMINATION & CONSOLIDATION OF HAZARDOUS MATERIALS										
Environmental technician/coordinator		mandays		#N/A	$0.00	$0		$0	$0	
Drain residual fuel from tanks	RB-013, RB-002, RB-003, & DM-020	each	12	TMAC	$265.00	$3,180	50%	$1,590	$1,590	
Drain, clean and crush empty drums	RB-003	each	150	TMAC	$39.44	$5,916	50%	$2,958	$2,958	
	DM-006 decommission	each	4	TMAC	$680.00	$2,720	50%	$1,360	$1,360	
Removal of Doris fresh water pipeline	DM-006 dismantle	lm	830	TMAC	$11.08	$9,196	50%	$4,598	$4,598	
	DM-006 load, haul & tip debris to Q3 landfill	m3	28.2	TMAC	$16.22	$457	50%	$229	$229	
	SR-002 decommission	each	4	TMAC	$680.00	$2,720	50%	$1,360	$1,360	
Removal of Secondary Road Tailings and R	SR-002 dismantle	lm	8125	TMAC	$11.08	$90,025	50%	$45,013	$45,013	
	SR-002 load, haul & tip debris to Q3 landfill	m3	255.3	TMAC	$15.46	$3,947	50%	$1,973	$1,973	
Drain residual fuel from tank at vent raise	DM-030 drain tank	each	1	TMAC	$265.00	$265	50%	$133	$133	
Drain chemicals and reagent from containers	Doris DM-021	m3	8.3	TMAC	$2,700.00	$22,410	50%	$11,205	$11,205	
	Madrid North Concentrator	m3	4.2	TMAC	$2,700.00	$11,340	50%	$5,670	$5,670	
Decontaminate sewage treatment plant		LS		TMAC	$667.63	$0		$0	$0	
	Roberts Bay and Doris Tank Farms RB-013, RB-002, RB-003, & DM-020	each	14	TMAC	$1,695.57	$23,738	50%	$11,869	$11,869	
Decontaminate bulk fuel storage	Madrid North Fuel Storage Facility MN-011	each	3	TMAC	$1,695.57	$5,087	50%	$2,543	$2,543	include a 1 m3 of sludge to manage in O/W separator
	Madrid South Fuel Storage Facility MS-017	each	1	TMAC	$1,695.57	$1,696	50%	$848	$848	
	Decommission Pipeline	LS	1	TMAC	$680.00	$680	50%	$340	$340	
CDR-004 Cargo Dock Access Road Fuel Transfer Lines	Dismantle pipeline	lm	3250	TMAC	$11.08	$36,010	50%	$18,005	$18,005	
	Remove electrical equipment	LS	2	TMAC	$680.00	$1,360	50%	$680	$680	
	Load, haul and tip debris at Q3 landfill	m3	159.5	TMAC	$15.46	$2,466	50%	$1,233	$1,233	
Drain Reclaim Pond	CM-001 labour	mandays	168	TMAC	$1,890.00	$317,520	50%	$158,760	$158,760	
	CM-001 equipment	LS	1	TMAC	$70,000.00	$70,000	50%	$35,000	$35,000	
	Doris (DM-020, RP-004& WM-001)	m2	12370	TMAC	$0.41	$5,072	50%	$2,536	$2,536	
	Roberts Bay Q1 Tank farm	m2	9933	TMAC	$0.41	$4,073	50%	$2,036	$2,036	
Liner cleaning	Roberts Bay Tank Farm	m2	21800	TMAC	$0.41	$8,938	50%	$4,469	$4,469	
	Madrid North liners (MN-011, -13, -14, & -15	m2	210	TMAC	$0.41	$86	50%	$43	$43	
	Madrid South liners (MS-017, -018 & -019)	m2	545	TMAC	$0.41	$223	50%	$112	$112	
Decontaminate offices/warehouse/accom		m2		BDAL	$25.60	$0		$0	$0	
Removal of asbestos siding on buildings		m2		BDAL	$25.60	$0		$0	$0	
Removal of friable asbestos on equipment		m2		#N/A	$0.00	$0		$0	$0	
Other	Load and Transport drums from Doris Proce	m3	8.32	TMAC	$12.53	$104	50%	$52	$52	added containerization cost of $10.23
	Madrid North drums from Concentrator to RE	m3	4	TMAC	$15.25	$61	50%	$31	$31	added containerization cost of $10.23
HAZARDOUS MATERIALS REMOVAL										
Waste oils		litre		orl	$0.43	$0		$0	$0	
Waste fuel	RB-002, RB-013&DM-020	litre	315000	orl	$0.43	$135,450		$0	$135,450	TMAC is now stating 75000 L only does not match earlier numbers
	Madrid South MS-017	litre	2000	orl	$0.43	$860		$0	$860	Using a different rate.
	Madrid North MN-011	litre	45000	orl	$0.43	$19,350		$0	$19,350	No quanity provided in latest estimate does not match earlier email.
Waste batteries		allow		AE	$3,000.00	$0		$0	$0	
Assay & environmental lab reagents		kg		#N/A	$25.00	$0		$0	$0	
Machine shop paints, solvents etc		litre		AE	$10,000.00	$0		$0	$0	
Glycol		litre		AE	$20,000.00	$0		$0	$0	
Process reagents		kg		#N/A	$2.50	$0		$0	$0	
Nuclear sources		allow		#N/A	$0.00	$0		$0	$0	
Other hazardous materials		allow		AE	$20,000.00	$0		$0	$0	
HAZARDOUS MATERIALS										
Transportation to Roberts Bay	Windy Development Area	m3	2.8	TMAC	$6.90	$19	50%	$10	$10	
Disposal fees	Windy Development Area	m3	2.8	TMAC	$11,275.00	$31,570	50%	$15,785	$15,785	
Waste Ship Off-site	Hazardous waste liquid and solid	m3	160	TMAC	$232.32	$37,171	50%	$18,586	$18,586	
Waste Disposal	Hazardous Waste allowance	allow	1	TMAC	$50,000.00	$50,000	50%	$25,000	$25,000	
Other		allow		ea	$40,000.00	$0	50%	$0	$0	
CONTAMINATED SOILS										
Contam. soil investigation - Phase 1	a report for each site	each	3	CS1L	$7,500.00	$22,500	50%	$11,250	$11,250	
Contam. soil investigation - Phase 2	aggregate cost for Doris and Madrid sites	allow	1	EA	$175,000.00	$175,000	50%	$87,500	$87,500	

1 **Chemicals/Soil Area Name: Doris - Madrid**

Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost	
CONTAMINATED SOIL REMOVAL										
	Doris RB-013, RB-002, RB-003, DM-020 & WM-001 (PHC)	m3	12290	TMAC	$75.03	$922,119	50%	$461,059	$461,059	
	Patch Lake Development Area	m3	245	TMAC	$75.03	$18,382	50%	$9,191	$9,191	
	Windy Development Area	m3	720	TMAC	$75.03	$54,022	50%	$27,011	$27,011	
Excavate and transport Impacted Soil to Portal	Waste Management Area Landfarm	m3	100	TMAC	$75.03	$7,503	50%	$3,752	$3,752	
	Madrid North MN-011 (PHC)	m3	1220	TMAC	$75.03	$91,537	50%	$45,768	$45,768	
	Madrid North Portal Pad	m3	7635	TMAC	$72.73	$555,294	50%	$277,647	$277,647	
	Madrid North MN-014 & -015 Madrid South MS-018 & -019(brine)	m3	26	TMAC	$75.03	$1,951	50%	$975	$975	
	Madrid South MS-017 (PHC)	m3	225	TMAC	$75.03	$16,882	50%	$8,441	$8,441	
	Doris RB-013, RB-002, RB-003, DM-020 & WM-001 (PHC)	m3	12290	TMAC	$15.37	$188,897	50%	$94,449	$94,449	
	Patch Lake Development Area	m3	245	TMAC	$15.37	$3,766	50%	$1,883	$1,883	
	Madrid North MN-011 (PHC)	m3	1220	TMAC	$15.37	$18,751	50%	$9,376	$9,376	
	Madrid North MN-014 & -015 Madrid South MS-018 & -019(brine)	m3	26	TMAC	$15.37	$400	50%	$200	$200	
Place hydrocarbon and other impacted soil underground	Madrid North Portal Pad	m3	7635	TMAC	$15.37	$117,350	50%	$58,675	$58,675	
	Waste Management Area Landfarm	m3	100	TMAC	$15.37	$1,537	50%	$769	$769	
	Windy Development Area	m3	720	TMAC	$15.37	$11,066	50%	$5,533	$5,533	
	Madrid South MS-017 (PHC)	m3	225	TMAC	$15.37	$3,458	50%	$1,729	$1,729	
	Doris RB-013, RB-002, RB-003 & DM-020 excavation of cover soil from liners	m3	24580	TMAC	$2.75	$67,595	50%	$33,798	$33,798	
	Reagent Pad	m3	895	TMAC	$2.75	$2,461	50%	$1,231	$1,231	
Fuel/Reagent/Brine Containment areas remove soil cover from liner	Waste Management Area Landfarm	m3	2590	TMAC	$2.75	$7,123	50%	$3,561	$3,561	
	Madrid North MN-011	m3	2435	TMAC	$2.75	$6,696	50%	$3,348	$3,348	
	Madrid North Water Storage Tank MN-013	m3	260	TMAC	$2.75	$715	50%	$358	$358	
	Madrid South MS-017 and -020	m3	710	TMAC	$2.75	$1,953	50%	$976	$976	
Waste haulage to Landfill	Waste Management Area Landfarm	m3	120	TMAC	$4.70	$564	50%	$282	$282	
Remove Sumps	MN-023, DM-018	each	3	TMAC	$680.00	$2,040	50%	$1,020	$1,020	TMAC has in Water Mgmt
Place Mega Bags into Containers (Transpor	Windy Development Area	m3	720	TMAC	$20.91	$15,055	50%	$7,528	$7,528	
Place soil in Mega Bags and Empty into Cor	Windy Development Area	m3	60	TMAC	$123.38	$7,403	50%	$3,701	$3,701	
Disposal of PHC impacted soil to Madrid Portal from Demolition	Windy Development Area	m3	4265	TMAC	$2.77	$11,814	50%	$5,907	$5,907	
Disposal of PHC impacted soil to Madrid Portal from Demolition	Patch Lake Development Area	m3	245	TMAC	$2.77	$679	50%	$339	$339	
Survey for Soil Remediation	PHC and Metal Impacted Area	LS	2	TMAC	$25,000.00	$50,000	50%	$25,000	$25,000	
In-situ Bio-remediation	Patch Lake Development Area	m3	39	TMAC	$260.00	$10,140	50%	$5,070	$5,070	
Transport PHC impacted soil to offsite facility	W-001 relates to soil that cannot go underground	m3	280	TMAC	$1,114.93	$312,180	50%	$156,090	$156,090	
Contour decontaminated area		m3		dsl	$0.95	$0	50%	$0	$0	
CONTAMINATED SOIL VERY LOW PERMEABILITY COVER										
Supply geomembrame, HDPE, ES3, GCL		m2		#N/A	$0.00	$0		$0	$0	
Upper and lower bedding layers		m3		#N/A	$0.00	$0		$0	$0	
Install geomembrane, HDPE, ES3, GCL		m2		#N/A	$0.00	$0		$0	$0	
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0	
Vegetate		m2		#N/A	$0.00	$0		$0	$0	
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0	
Other				#N/A	$0.00	$0		$0	$0	
OTHER										
				#N/A	$0.00	$0		$0	$0	
					Total	$3,610,542		$1,727,441	$1,883,101	
					% of Total			48%	52%	

1 **Building / Equip Name:** **Doris - Madrid** **Bldg / Equip #:** 1

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost	
DISPOSE MOBILE EQUIPMENT										
Decontaminate and prepare for off-site	Madrid North Concentrator	allow	1	TMAC	$50,000.00	$50,000	50%	$25,000	$25,000	
	Doris Water Intake Generator	each	1	TMAC	$1,370.00	$1,370	50%	$685	$685	
Consolidate Electrical Equipment from Pipelines	Madrid South, Madrid North, Doris freshwater and Tialings/Reclaim water pipelines	m2	11205	TMAC	$14.41	$161,464	50%	$80,732	$80,732	added cost to remove cabling as well ie C3.20
Relocate Containers to Quarry 3 Landfill	current a large inventor of containers that will no longer go off site	ea	250	TMAC	$1,376.00	$344,000	50%	$172,000	$172,000	use units C1.08+C4.15 for the haulage and demolition of contianers at landfill
Relocate Trailers to Quarry 3 Landfill		m3		TMAC	$19.15	$0	50%	$0	$0	
Relocate Camp	Windy Accommodation Camp (relocate to Doris)	m3	32	TMAC	$13.00	$416	50%	$208	$208	added cost to collapse and containerize
Other				#N/A	$0.00	$0		$0	$0	
REMOVE BUILDINGS										
Accomodation Complex	DM-001 Decommission	each	103	TMAC	$679.52	$69,991	50%	$34,995	$34,995	
	DM-001 Demolition cabins/cribs/stairs/Arctic corridor etc.	m3	680	TMAC	$13.12	$8,922	50%	$4,461	$4,461	
	DM-001 Demolition Trailers	m3	11185	TMAC	$13.32	$148,984	50%	$74,492	$74,492	
	DM-001 Consolidate and laod waste	m3	7450	TMAC	$10.23	$76,214	50%	$38,107	$38,107	
	DM-001 Haul waste to landfill	m3	7450	TMAC	$4.70	$35,015	50%	$17,508	$17,508	
Windy Accommodation Camp	Dismantle comm equipment	LS	1	TMAC	$375.00	$375	50%	$188	$188	
	Equipment decommissioning	each	1	TMAC	$679.52	$680	50%	$340	$340	
	manual demolition	m2	890	TMAC	$155.00	$137,950	50%	$68,975	$68,975	
	mechanical demolition	m3	3480	TMAC	$11.23	$39,080	50%	$19,540	$19,540	
	laod and haul waste	m3	1895	TMAC	$15.15	$28,709	50%	$14,355	$14,355	
Roberts Bay Mechanical Shop Complex	decommissioing elec/mech/HVAC	each	7	TMAC	$679.52	$4,757	50%	$2,378	$2,378	
	Demo of steel frame	m3	2400	TMAC	$29.34	$70,416	50%	$35,208	$35,208	
	Demoo of wood frame	m3	285	TMAC	$29.34	$8,362	50%	$4,181	$4,181	
	demo of tent structure	m3	460	TMAC	$29.34	$13,496	50%	$6,748	$6,748	
Process Facilities	DM-021 dismantle & prep for off-site disposal	LS	1	TMAC	$350,000.00	$350,000	50%	$175,000	$175,000	
	DM-021 demolish Mill, crusher and process plant	m3	123540	TMAC	$13.12	$1,620,845	50%	$810,422	$810,422	
	DM-021 haul waste to landfill	m3	8522.2	TMAC	$15.15	$129,111	50%	$64,556	$64,556	added cost for haulage to landfill
	MN-008 Concentrator - disconnection	ea	1	TMAC	$300,000.00	$300,000	50%	$150,000	$150,000	
	MN-008 Concentrator - demolition	m3	23075	TMAC	$13.32	$307,359	50%	$153,680	$153,680	
	MN-008 Concentrator - consolidate and haul	m3	3695	TMAC	$15.15	$55,979	50%	$27,990	$27,990	
Office & Dry Complex	DM-009 MN-005 and MS-006 Decommission facilities	each	9	TMAC	$679.52	$6,116	50%	$3,058	$3,058	
	DM-009 Disconnect assemblies for disposal	each	17	TMAC	$1,370.00	$23,290	50%	$11,645	$11,645	
	DM-009 demolition	m3	265.4	TMAC	$13.12	$3,482	50%	$1,741	$1,741	
	DM-009 Haul assemblies for disposal	m3	145670.5	TMAC	$4.70	$684,651	50%	$342,326	$342,326	
	DM-009 Consolidate and dispose of waste at landfill	m3	265.4	TMAC	$15.15	$4,021	50%	$2,010	$2,010	
	Madrid North Office Trailer - haul and disposal of at landfill	m3	50	TMAC	$15.15	$758	50%	$379	$379	TMAC estimate is inconsistent so volume of haulage used
	Madrid South Office Trailer - demolition	m3	75	TMAC	$13.12	$984	50%	$492	$492	
	Madrid South Office Trailer - haul and dispose of at landfill	m3	50	TMAC	$13.49	$675	50%	$337	$337	TMAC estimate is inconsistent so volume of haulage used
Laydown Area	RB-006 decommission vehicle plugs	ea	8	TMAC	$1,092.00	$8,736	50%	$4,368	$4,368	
	MN-010 decom vehicle plugs	ea	5	TMAC	$1,091.17	$5,456	50%	$2,728	$2,728	
	MS-009 decom vehicle plugs and posts	ea	5	TMAC	$1,091.17	$5,456	50%	$2,728	$2,728	
	MN-010 consolidate and relocate waste to landfill	m2	1475	TMAC	$0.57	$841	50%	$420	$420	
	MS-009 consolidate and relocate waste to landfill	m2	5970	TMAC	$0.57	$3,403	50%	$1,701	$1,701	
	RB-006 consolidate and relocate waste to landfill	m2	63291.6	TMAC	$0.57	$36,076	50%	$18,038	$18,038	
Water StorageTank	DM-005 dismantle and haul to Q3 landfill	ea	1	TMAC	$100,000.00	$100,000	50%	$50,000	$50,000	
	Madrid North Water Storage Tank - cleanout & disconnect piping	ea	1	TMAC	$1,665.00	$1,665	50%	$833	$833	
	Madrid North Water Storage Tank - dismantle tank	ea	1	TMAC	$100,000.00	$100,000	50%	$50,000	$50,000	
	Madrid North Water Storage Tank - prepare, containerize and haul tank pieces to landfill	m3	3	TMAC	$25.38	$76	50%	$38	$38	
	Madrid South Water Storage Tank - cleanout & disconnect piping	ea	1	TMAC	$1,665.00	$1,665	50%	$833	$833	
	Madrid South Water Storage Tank - dismantle tank	ea	1	TMAC	$100,000.00	$100,000	50%	$50,000	$50,000	
	Madrid South Water Storage Tank - prepare, containerize and haul tank pieces to landfill	m3	3	TMAC	$23.72	$71	50%	$36	$36	
	MN-013 recover cover soil from containment	m3	259.2	TMAC	$2.75	$713	50%	$356	$356	
	MN-013 cut liner/load and transport to landfill	m3	3.7	TMAC	$24.31	$90	50%	$45	$45	
Compressor Building	MN-008 dismantle and haul to Q3 landfill	m3	62.5	TMAC	$28.27	$1,767	50%	$883	$883	added cost to containerize and haul to landfill
	MN-008 includes disconnection and off-site transfer of plant	each	2	TMAC	$1,465.00	$2,930	50%	$1,465	$1,465	
	MN-008 haul units to Roberts Bay for off-site transfer	m3	46	TMAC	$15.25	$702	50%	$351	$351	added cost to containerize the units for transfer
	MS-008 dismantle and haul to Q3 landfill	m3	62.5	TMAC	$23.35	$1,459	50%	$730	$730	added containizeation cost to cover laoding and haulage
	MS-008 includes disconnection and off-site transfer of plant	each	2	TMAC	$1,465.00	$2,930	50%	$1,465	$1,465	
	MS-008 haul units to Roberts Bay for off-site transfer	m3	40	TMAC	$15.25	$610	50%	$305	$305	
Power Plant/Generator	DM-011 Decommission and dismantle	each	8	TMAC	$2,155.00	$17,240	50%	$8,620	$8,620	
	DM-011 dismantle stacks and prep for off-site disposal	m	40	TMAC	$763.54	$30,542	50%	$15,271	$15,271	
	DM-011 Haulage to staging point for off-site shipping	m3	430.8	TMAC	$2.30	$991	50%	$495	$495	166 in chemical of TMAC
	DM-011 Load, haul and dispose of waste	m3	90	TMAC	$15.15	$1,364	50%	$682	$682	
	Madrid North Power Plant MN-009 stack haulage to landfill	m3	166	TMAC	$4.92	$817	50%	$408	$408	
	Madrid North Diesel Generator MN-009 disconnection	each	1	TMAC	$2,155.00	$2,155	50%	$1,078	$1,078	
	Madrid North Diesel generator haulage to Roberts Bay	m3	50	TMAC	$15.25	$763	50%	$381	$381	
	Madrid North Diesel generator tent demolition and haulage to landfill	m3	50	TMAC	$23.35	$1,168	50%	$584	$584	added containizeation cost to cover laoding and haulage
	Madrid North dismantle stacks and prep for offsite transfer	m	40	TMAC	$763.54	$30,542	50%	$15,271	$15,271	
	Madrid North Power Plan disconnection	each	4	TMAC	$785.00	$3,140	50%	$1,570	$1,570	
	Madrid North Power Plant Demo	m3	2375	TMAC	$13.32	$31,635	50%	$15,818	$15,818	
	Madrid North Power Plant debris clean up	m2	950	TMAC	$0.37	$352	50%	$176	$176	
	Madrid North Power Plan waste debris load and haul to landfill	m3	740	TMAC	$23.35	$17,279	50%	$8,640	$8,640	Added demolition cost to cover demo and haulage
	Madrid South Diesel Generator disconnection	each	1	TMAC	$785.00	$785	50%	$393	$393	
	Madrid South Demolition of tent and haulage to landfill	m3	50	TMAC	$23.35	$1,168	50%	$584	$584	Added demolition cost to cover demo and haulage
Sewage Treatment Plant	DM-017 Decontaminate, decommission and dismantle	each	9	TMAC	$2,671.89	$24,047	50%	$12,024	$12,024	Not clear why TMAC dropped the costs for dismantling and system flushing removed. Still in the ACI estimate
	DM-017 Haulage to staging point for off-site shipping	m3	671.4	TMAC	$2.30	$1,544	50%	$772	$772	
	DM-017 Load, haul and dispose of waste to landfill	m3	24	TMAC	$15.15	$364	50%	$182	$182	added haulage to landfill
Vent Raises	DM-030, DM-033 & DM-034 Remove heating and ventilation system	each	8	TMAC	$680.00	$5,440	50%	$2,720	$2,720	
	DM-030, DM-033 & DM-034 Prepare heating and ventilation system for off-site disposal	each	3	TMAC	$1,370.00	$4,110	50%	$2,055	$2,055	
	DM-030 Haul enviro-tank and HVAC equipmen tfor off-site disposal	m3	199.2	TMAC	$4.70	$936	50%	$468	$468	
	DM-030, DM-033 & DM-034 Consolidate and dispose of waste at landfill	m3	11.1	TMAC	$14.93	$166	50%	$83	$83	
	Madrid North Vent Raise decommission and dismantle	ea	4	TMAC	$680.00	$2,720	50%	$1,360	$1,360	
	Madrid North HVAC Unit preparation for shipping	ea	4	TMAC	$1,370.00	$5,480	50%	$2,740	$2,740	
	Madrid North Haulage of HVAC units	m3	40	TMAC	$5.02	$201	50%	$100	$100	
	Madrid South Haulage of HVAC units	m3	80	TMAC	$6.29	$503	50%	$252	$252	
	Madrid South Heating Unit preparation for shipping	ea	8	TMAC	$1,370.00	$10,960	50%	$5,480	$5,480	
	Madrid South Vent Raise and Air Heating Facility Decom/Dismantle	ea	8	TMAC	$680.00	$5,440	50%	$2,720	$2,720	
Mixing Facility & CaCl Laydown Area	MN-014 & MN-015 dismantle and haul to Q3 landfill	m3	5	TMAC	$28.27	$141	50%	$71	$71	
	MS-018 & MS-019 demolition and haul to landfill	m3	5	TMAC	$26.61	$133	50%	$67	$67	
Doris Swick Shop	DM-019 Demolition	m3	859.2	TMAC	$13.12	$11,273	50%	$5,636	$5,636	
	DM-019 Collect debris	m2	230	TMAC	$0.37	$85	50%	$43	$43	
	DM-019 Load and haul to landfill	m3	18.3	TMAC	$15.15	$277	50%	$139	$139	
Muster Station	DM-008 Demolition	m3	254.6	TMAC	$13.01	$3,312	50%	$1,656	$1,656	
	DM-008 Load and haul to landfill	m3	48.2	TMAC	$15.15	$730	50%	$365	$365	haulage rate added
Doris Windy AWR Explosives Storage Facility	DW-010 collect surface debris	m2	2805	TMAC	$0.57	$1,599	50%	$799	$799	
	DW-010 demolition, load and haul to landfill	m3	5	TMAC	$13.64	$68	50%	$34	$34	
Warehouse, Shops and Other	RB-004 and DM-022 Remove heating and ventilation system	each	10	TMAC	$680.00	$6,800	50%	$3,400	$3,400	
	RB-004 Prep HVAC for off-site disposal	each	1	TMAC	$1,344.80	$1,345	50%	$672	$672	Not clear why this work was removed from update
	RB-004 & DM-022 demolition	m3	5427.5	TMAC	$13.12	$71,209	50%	$35,604	$35,604	
	RB-004 Haul HVAC equipmentfor off-site disposal	m3	232.4	TMAC	$2.30	$535	50%	$267	$267	Not clear why this work was removed from update
	RB-004 & DM-022 Consolidate and dispose of waste at landfill	m3	1330	TMAC	$15.15	$20,150	50%	$10,075	$10,075	add haulage rate.
	Madrid North MN-007 Mine Equipment Tent demo	m3	2250	TMAC	$13.12	$29,520	50%	$14,760	$14,760	
	Madrid North MN-007 Mine Equipment Tent debris haul to landfill	m3	225	TMAC	$15.15	$3,409	50%	$1,704	$1,704	Not in the estimate but should have been
	Madrid North MN-007 equipment disconnection	ea	2	TMAC	$680.00	$1,360	50%	$680	$680	
	Madrid North MN-007 Mine Equipment Shop demo	m3	1125	TMAC	$13.12	$14,760	50%	$7,380	$7,380	
	Madrid North MN-007 Mine Equipment Shop debris haul to landfill	m3	485	TMAC	$15.15	$7,348	50%	$3,674	$3,674	
	Madrid South MS-004 Mine Equipment Tent demo	m3	2250	TMAC	$13.12	$29,520	50%	$14,760	$14,760	Not in the estimate but should have been
	Madrid South MS-004 Mine Equipment disconnections	ea	4	TMAC	$680.00	$2,720	50%	$1,360	$1,360	
	Madrid South MS-004 Mine Equipment Tent debris haul to landfil	m3	225	TMAC	$13.49	$3,035	50%	$1,518	$1,518	Not in the estimate but should have been
Core Shack/Warehouse	DM-024 Demolition	m3	3610	TMAC	$13.12	$47,363	50%	$23,682	$23,682	
	DM-024 Load Debris	m3	350	TMAC	$10.23	$3,581	50%	$1,790	$1,790	
	Load and haul core boxes	m3	1665	TMAC	$13.49	$22,461	50%	$11,230	$11,230	
	DM-024 haul debris and containers to landfill for disposal	m3	350	TMAC	$4.92	$1,722	50%	$861	$861	

1 **Building / Equip Name:** **Doris - Madrid** **Bldg / Equip #:** 1

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost	
Underground Wash Bay	DM-023 Demolition of tent structure	m3	776.9	TMAC	$13.12	$10,193	50%	$5,096	$5,096	
	DM-023 Load and haul to landfill	m3	13.5	TMAC	$15.15	$205	50%	$102	$102	
Fuel tanks	Roberts Bay RB-013, RB-002, RB-003 & DM-020 decommissioning and dismantling	ea	9	TMAC	$100,000.00	$900,000	50%	$450,000	$450,000	
	Roberts Bay Tank Farm - cutting tanks and haul to landfill	m3	129	TMAC	$16.22	$2,092	50%	$1,046	$1,046	
	Roberts Bay Tank Farm - Waste Consolidation and transfer to landfill	m3	400	TMAC	$16.22	$6,488	50%	$3,244	$3,244	
	Doris Tank Farm DM-020 decommissioning and dismantling	ea	5	TMAC	$75,000.00	$375,000	50%	$187,500	$187,500	
	Doris Mine Tank Farm - cutting tanks and haul to landfill	m3	25	TMAC	$14.93	$373	50%	$187	$187	
	Doris Mine Tank Farm - Waste Consolidation and transfer to landfill	m3	85	TMAC	$14.93	$1,269	50%	$635	$635	
	Madrid North Tank Farm MN-011 decommissioning and dismantling	ea	3	TMAC	$75,000.00	$225,000	50%	$112,500	$112,500	
	Madrid North Tank Farm - cutting tanks and haul to landfill	m3	20	TMAC	$15.15	$303	50%	$152	$152	
	Madrid North Tank Farm - Waste Consolidation and transfer to landfill	m3	35	TMAC	$15.15	$530	50%	$265	$265	
	Madrid South Tank Farm MS-017 decommissioning and dismantling	ea	1	TMAC	$75,000.00	$75,000	50%	$37,500	$37,500	
	Madrid South Tank Farm - cutting tanks and haul to landfill	m3	1	TMAC	$13.49	$13	50%	$7	$7	
	Madrid South Tank Farm - Waste Consolidation and transfer to landfill	m3	4	TMAC	$13.49	$54	50%	$27	$27	
	Patch Lake tank farm - sump removal	each	1	TMAC	$7,190.00	$7,190	50%	$3,595	$3,595	
	Windy Tank Farm Haul reusable material to Doris and unload containers	m3	11	TMAC	$36.85	$405	50%	$203	$203	
	Windy Tank Farm load debris into seacans and transport to landfill	m3	12	TMAC	$13.49	$162	50%	$81	$81	
Fuel Containment areas	RB-013, RB-002, RB-003 & DM-020 excavation of cover soil	m3	17334	TMAC	$2.75	$47,669	50%	$23,834	$23,834	
Fuel tank piping and containment structure	RB-013, RB-002, RB-003 & DM-020 includes load and transport to landfill	m3	435.5	TMAC	$24.31	$10,587	50%	$5,294	$5,294	
Backup Generator	DM-002 Decommission	each	4	TMAC	$680.00	$2,720	50%	$1,360	$1,360	
	DM-002 disconnect generator and prep for off-site removal	each	2	TMAC	$785.00	$1,570	50%	$785	$785	
	DM-002 demolition	m3	1296.6	TMAC	$28.27	$36,655	50%	$18,327	$18,327	added cost to containerize and haul to landfill
	DM-002 Haulage to laydown or landfill	m3	89	TMAC	$4.70	$418	50%	$209	$209	
	DM-002 Consolidate and dispose of waste at landfill	m3	21.4	TMAC	$14.93	$320	50%	$160	$160	added haulage cost
Fire Protection pumping station		m		brs1h	$65.00	$0	50%	$0	$0	
Fire Water Storage Tank	Doris Fire Water Storage Tank pad regrade (DM-005)	m2	75	TMAC	$4.70	$353	50%	$176	$176	
	Doris Fire Water Storage Tank (DM-005) decom equipment elec/mech	each	3	TMAC	$1,330.00	$3,990	50%	$1,995	$1,995	
	Remove insulation	each	1	TMAC	$750.00	$750	50%	$375	$375	
	Doris Fire Water Storage Tank (DM-005) disconnect pumps and pipe	each	1	TMAC	$1,370.00	$1,370	50%	$685	$685	
	Doris Fire Water Storage Tank (DM-005) dismantle tank	LS	1	TMAC	$100,000.00	$100,000	50%	$50,000	$50,000	
	Doris Fire Water Storage Tank demo	m3	2	TMAC	$10.23	$20	50%	$10	$10	
	Doris Fire Water Storage Tank haul to landfill	m3	2	TMAC	$4.92	$10	50%	$5	$5	
Freshwater intake	DM-026 Remove water line	lm	25	TMAC	$11.08	$277	50%	$139	$139	
	DM-026 Decommission Structure	each	2	TMAC	$1,330.00	$2,660	50%	$1,330	$1,330	
	DM-026 Disconnect equipment/clean and run O/W separator	each	1	TMAC	$150.38	$150	50%	$75	$75	
	DM-026 Prep Equipment for off-site removal	each	2	TMAC	$1,370.00	$2,740	50%	$1,370	$1,370	
	DM-026 haul containers and debris to landfill	m3	87.7	TMAC	$4.70	$412	50%	$206	$206	
	DM-026 Consolidate and load debris	m3	87.7	TMAC	$10.23	$897	50%	$449	$449	
	Windy Potable Water Supply Decommission and Dismantle	each	1	TMAC	$1,865.00	$1,865	50%	$933	$933	
	Windy Potable Water Supply unit prep	m3	4	TMAC	$805.00	$3,220	50%	$1,610	$1,610	
	Windy Potable Water Supply relocate	m3	35	TMAC	$13.00	$455	50%	$228	$228	added containerization/loading cost
Roberts Bay Waste Management Facility	RB-005 Prep containers for off-site disposal	each	11	TMAC	$1,370.00	$15,070	50%	$7,535	$7,535	
	RB-005 Dismantle facility	each	2	TMAC	$535.00	$1,070	50%	$535	$535	
	RB-005 demolition	m3	321.6	TMAC	$13.12	$4,219	50%	$2,110	$2,110	
	RB-005 Consolidate and dispose of waste at landfill	m3	189.8	TMAC	$15.46	$2,934	50%	$1,467	$1,467	
Communications Towers	RB-009 & DM-004 Decommission and dismantle	each	3	TMAC	$16,429.23	$49,288	50%	$24,644	$24,644	includes decon and dismantle
	RB-009 & DM-004 Remove equipment	each	16	TMAC	$375.00	$6,000	50%	$3,000	$3,000	TMAC update does not include for 4 units at RB-009 so added back in
	DM-004 Relocate tower equipment for off-site transfer	m3	37.2	TMAC	$2.30	$86	50%	$43	$43	
	DM-004 Remove equipment from Doris Mt.	m3	9	TMAC	$2,509.33	$22,584	50%	$11,292	$11,292	
	DM-004 demolish housing shack	m3	24	TMAC	$13.12	$315	50%	$157	$157	
	DM-004 remove fibre optics and elec.	m	12	TMAC	$680.00	$8,160	50%	$4,080	$4,080	
	RB-009 & DM-004 Load and haul for disposal	m3	32.9	TMAC	$14.93	$491	50%	$246	$246	
Reagent Pad Exploration Drilling Support Shop & Laydown Pads	RP-004 Prep containers for off-site disposal	each	13	TMAC	$1,370.00	$17,810	50%	$8,905	$8,905	
	RP-004 Decommission facility	each	2	TMAC	$680.00	$1,360	50%	$680	$680	
	RP-004 demolition	m3	708.7	TMAC	$28.27	$20,035	50%	$10,017	$10,017	Added cost for containerization and haulage to landfill
	RP-002 Consolidate Debris	m2	60665	TMAC	$0.37	$22,446	50%	$11,223	$11,223	
	RP-003 Remove Liner Cover Soil	m3	1390	TMAC	$2.75	$3,823	50%	$1,911	$1,911	
	RP-001, RP-002, RP-003 & RP-004 Load waste for disposal	m3	77.6	TMAC	$10.23	$794	50%	$397	$397	
	RP-001, RP-002, RP-003 & RP-004 Haul and dispose of demo waste & containers to landfill	m3	561.3	TMAC	$5.23	$2,936	50%	$1,468	$1,468	
Waste Management Area Landfarm, Batch Plant, and Burn Pan Area	WM-001 Treat Contaminated Water	LS	1	TMAC	$5,000.00	$5,000		$0	$5,000	
	WM-001 Remove Cover Soil from Containment	m3	2591	TMAC	$2.75	$7,125	50%	$3,563	$3,563	
	WM-001 & WM-002 load and haul debris to landfill	m3	174.3	TMAC	$14.93	$2,602	50%	$1,301	$1,301	
	WM-002 Demolish Structure & collect debris	m3	3700	TMAC	$13.12	$48,544	50%	$24,272	$24,272	
	WM-003 Consolidate ash from burn pan	m3	0.1	TMAC	$765.00	$77	50%	$38	$38	
	WM-003 Dismantle Burn Pan	each	1	TMAC	$535.00	$535	50%	$268	$268	
	WM-003 load and haul waste	m3	1	TMAC	$14.93	$15	50%	$7	$7	
	Windy Waste Incinerator dismantling	each	1	TMAC	$535.00	$535	50%	$268	$268	
	Windy Waste Incinerator load into containers	m3	7	TMAC	$807.77	$5,654	50%	$2,827	$2,827	
	Windy Waste incinerator - decommissioning mechanical	each	1	TMAC	$1,325.00	$1,325	50%	$663	$663	
	Windy Waste Incinerator consolidate waste and transfer to landfill	m3	1	TMAC	$766.81	$767	50%	$383	$383	
Doris/Windy AWR and Waste Management Core Storage Areas	DW-008 Load and haul core boxes/containers to Q3 landfill	m3	3330	TMAC	$13.49	$44,922	50%	$22,461	$22,461	
	Relocate crusher and hopper	each	2	TMAC	$3,300.00	$6,600	50%	$3,300	$3,300	
	Load and haul equipment to Roberts Bay	m3	35	TMAC	$14.27	$499	50%	$250	$250	added a high unit rate for haulage and loading cost
	DW-008 Collect Debris	m2	20000	TMAC	$0.18	$3,600	50%	$1,800	$1,800	
	DW-008 laod and haul waste to Boston Landfill	m3	12	TMAC	$13.49	$162	50%	$81	$81	
Madrid Boston & Doris Windry AWR Turbine Pad	Waste removal from Pads 1 to 6 and ship to landfill	m3	3480	TMAC	$3.21	$11,171	50%	$5,585	$5,585	
	Collect debris from Pads 1 to 6	m2	30480	TMAC	$0.57	$17,374	50%	$8,687	$8,687	
	Load and haul debris from Pads 1 to 6 to landfill	m3	3480	TMAC	$13.49	$46,945	50%	$23,473	$23,473	added unit rate for haulage to landfill
	Doris Windy AWR turbines dismantling	each	6	TMAC	$500,000.00	$3,000,000	50%	$1,500,000	$1,500,000	
	Doris Windy AWR turbines transport parts to Roberts Bay	each	6	TMAC	$15,000.00	$90,000	50%	$45,000	$45,000	average the cost between the six turbines
	Doris Windy demolition and containerization of sheds demo debris	m3	1740	TMAC	$23.35	$40,629	50%	$20,315	$20,315	added cost for containerization to demo cost
	Doris Windy AWR turbine wiring removal (fibre optic and elec)	lm	33645	TMAC	$14.04	$472,376	50%	$236,188	$236,188	
Roberts Bay Jetty	RB-001 Remove mooring points	LS	1	TMAC	$1,200.00	$1,200	50%	$600	$600	
	RB-01 Remove rock fill and grade	m3	1220	TMAC	$2.75	$3,355	50%	$1,678	$1,678	
	RB-001 Remove mooring buoy	LS	1	TMAC	$2,500.00	$2,500	50%	$1,250	$1,250	
Roberts Bay Cargo Dock	RB-012 Remove rock fill, sheet piling and mooring points, and grade	LS	1	TMAC	$50,000.00	$50,000	50%	$25,000	$25,000	
	RB-012 Remove rock fill and grade	m3	24870	TMAC	$2.75	$68,393	50%	$34,196	$34,196	TMAC has in Water Management
	RB-012 Remove on-shore mooring points	LS	2	TMAC	$1,200.00	$2,400	50%	$1,200	$1,200	
	Load and Haul waste from Cargo Dock demo	m3	110	TMAC	$16.22	$1,784	50%	$892	$892	
All weather road clear span crossing	DW-004	m3	138	TMAC	$15.15	$2,091	50%	$1,045	$1,045	
Waste on Secondary Road	SR-001 Waste clean up	m3	2170	TMAC	$4.17	$9,049	50%	$4,524	$4,524	
Roberts Bay Pipeline Discharge System	PL-001 Decommission	each	11	TMAC	$680.00	$7,480	50%	$3,740	$3,740	
	PL-001 Dismantle	lm	5470	TMAC	$11.08	$60,608	50%	$30,304	$30,304	
	PL-001 load, haul and tip waste at Q3 landfill	m3	1160	TMAC	$16.22	$18,815	50%	$9,408	$9,408	
	PL-001 remove rock cover	m3	485	TMAC	$1.23	$597	50%	$298	$298	
	PI-001 Conduct Survey of submergered section	LS	1	TMAC	$50,000.00	$50,000	50%	$25,000	$25,000	
Pipleines Madrid	PL002 Madrid North - haul debris to landfill	m3	3350	TMAC	$15.25	$51,088	50%	$25,544	$25,544	
	MN - cut into pieces	lm	13395	TMAC	$11.08	$148,417	50%	$74,208	$74,208	
	Decom heat trace	each	25	TMAC	$680.00	$17,000	50%	$8,500	$8,500	
	PL-003 Madrid South	m3	3135	TMAC	$15.25	$47,809	50%	$23,904	$23,904	
	MS - cut into pieces	lm	14310	TMAC	$11.08	$158,555	50%	$79,277	$79,277	
	Decom heat trace	each	25	TMAC	$680.00	$17,000	50%	$8,500	$8,500	
Contact Water Berms Debris	Madrid North	m3	2	TMAC	$15.15	$30	50%	$15	$15	
	Madrid South	m3	4	TMAC	$13.49	$54	50%	$27	$27	
Remove Doris Sewage Lines	DM-016 decontaminate	LS	1	TMAC	$667.63	$668	50%	$334	$334	
	DM-016 disconnet electrical	each	1	TMAC	$680.00	$680	50%	$340	$340	
	DM-016 decommission	each	9	TMAC	$1,370.00	$12,330	50%	$6,165	$6,165	
	DM-016 Dismantle pipeline	lm	1190	TMAC	$11.08	$13,185	50%	$6,593	$6,593	
	DM-016 load, haul and tip debris at Q3 landfill	m3	90.8	TMAC	$14.93	$1,356	50%	$678	$678	
Water Pond Pump Assembles (sump pumps etc.)	DM-015, DM-018 & DM-026 dismantle sump pump assemblies	each	5	TMAC	$680.00	$3,400	50%	$1,700	$1,700	
Water Pond Pump Waste Debris Management	DM-015, DM-018 & DM-026 dismantle sump pump assemblies	m3	107	TMAC	$14.93	$1,598	50%	$799	$799	
Airstrip/Apron and Helipad	DM-007, DM-027 & DM-028 Demolition	m3	120.6	TMAC	$13.12	$1,582	50%	$791	$791	
	DM-007, DM-027 & DM-028 Collect Debris	m2	107180.2	TMAC	$0.37	$39,657	50%	$19,828	$19,828	
	DM-029 Decom elec/HVAC from tower	each	1	TMAC	$375.00	$375	50%	$188	$188	
	DM-029 Airstrip lighting removal	each	70	#N/A	$42.47	$2,973	50%	$1,486	$1,486	
	DM-007 Dismantle helipad	m3	15	TMAC	$4.18	$63	50%	$31	$31	
	DM-027 Decommission Airstrip	each	2	TMAC	$325.00	$650	50%	$325	$325	
	DM-028 Decommission and Dismantle apron equipment	each	5	TMAC	$1,370.00	$6,850	50%	$3,425	$3,425	
	DM-007, DM-027 & DM-028 Load and Haul Debris to Landfill	m3	575.9	TMAC	$14.93	$8,598	50%	$4,299	$4,299	
Windy Development Area	Windry Development debris clean up	m2	40000	TMAC	$0.37	$14,800	50%	$7,400	$7,400	

1 **Building / Equip Name:** **Doris - Madrid** **Bldg / Equip #:** 1

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost	
Windy Development Area	Windy Disposal of demolition waste	m3	2580	TMAC	$13.64	$35,191	50%	$17,596	$17,596	
Emergency Shelters	Madrid North - decommission	each	5	TMAC	$679.52	$3,398	50%	$1,699	$1,699	
	Madrid North Demolish trailers	each	75	TMAC	$13.12	$984	50%	$492	$492	
	Madrid North - containerize and haul to landfill for disposal	m3	4	TMAC	$28.27	$113	50%	$57	$57	
	Madrid South - decommission	each	3	TMAC	$679.52	$2,039	50%	$1,019	$1,019	
	Madrid South Demolish trailers	m3	75	TMAC	$13.12	$984	50%	$492	$492	
	Madrid South - containerize and haul to landfill for disposal	m3	4	TMAC	$26.61	$106	50%	$53	$53	
Roberts Bay Overburden Pile	Debris clean up	m2	14205	TMAC	$0.57	$8,097	50%	$4,048	$4,048	
	Load and haul to landfill	m3	9	TMAC	$16.22	$146	50%	$73	$73	
Other	Decommission elec and mech from WTP at TIA	LS	1	TMAC	$1,370.00	$1,370	50%	$685	$685	Cost not carried in TMAC estimate for the WTP at the TIA
	Remove WTP at TIA for treatment of water (incl demo, containerization and haul)	m3	150	TMAC	$24.04	$3,606	50%	$1,803	$1,803	
LANDFILL FOR DEMOLITION WASTE										
Prepare debris for capping	Q3-003 Main Landfill	m3	27081	TMAC	$3.27	$88,555	50%	$44,277	$44,277	used regrading slope rate to account for slower production
Empty seacans	dump, grade, place and compact	m3	5280	TMAC	$86.72	$457,882	50%	$228,941	$228,941	
Place rock cover	Q3-003 Prepare Rock Cover for 300 mm cap	m3	8125	TMAC	$16.35	$132,844	50%	$66,422	$66,422	
Generate rock cover	Q3-003 Prepare Rock Cover for 300 mm cap	m3	8125	TMAC	$24.76	$201,175	50%	$100,588	$100,588	
Final grading of landfill cover	Q3-003 regrade cover	m2	27081	TMAC	$1.23	$33,310	50%	$16,655	$16,655	
Place soil cover		allow		#N/A		$0		$0	$0	
Vegetate		ha		#N/A	$0.00	$0		$0	$0	
GRADE AND CONTOUR PADS & QUARRIES										
Accomodation Complex	Windy Accommodation Camp Bldgs	m3	150	TMAC	$12.27	$1,841	50%	$920	$920	
Process Facilities		m2		AE	$8.47	$0	50%	$0	$0	
Landfarm		m2		AE	$8.47	$0	50%	$0	$0	
Q2 Sewage Discharge Area		m3	552	TMAC	$16.35	$9,025	50%	$4,513	$4,513	
Storage Pad		m2		AE	$8.47	$0	50%	$0	$0	
Power Plant		m2		AE	$8.47	$0	50%	$0	$0	
Communication Tower		m2		AE	$8.47	$0	50%	$0	$0	
U/G Heating Plant		m2		#N/A	$0.00	$0	50%	$0	$0	
Reagent Equipment and Material Laydown		m2		DRI	$1.05	$0	50%	$0	$0	
Waste Management & Land Farm		m3		DRI	$1.05	$0	50%	$0	$0	
Fuel tanks on site for bulk fuel storage		m3		TMAC	$2.75	$0	50%	$0	$0	
Vent Raise	Doris Vent Raises DM-030, DM-033 & DM-034	m2	4150	DSI	$0.95	$3,943	50%	$1,971	$1,971	
	Madrid North Vent Raises	m2	11435	DSI	$0.95	$10,863	50%	$5,432	$5,432	
	Madrid South Vent Raises	m2	11435	DSI	$0.95	$10,863	50%	$5,432	$5,432	Not in TMAC estimate so area from Madrid North used
Tailings Line	SR-001 Remove tailings line	m	5750	TMAC	$11.08	$63,710	50%	$31,855	$31,855	
	SR-001 relocate cut pieces of tailings line to landfill	m3	255	TMAC	$14.40	$3,672	50%	$1,836	$1,836	added cost for containerization
WTP & Fresh Water Pumping Station		m2		AE	$8.47	$0	50%	$0	$0	
General Site Grading	RB-011 & DM-032	ha	59.75	ACI	$1,230.00	$73,493	50%	$36,746	$36,746	
Grade Quarries		m2		TMAC	$1.23	$0	50%	$0	$0	
Other	Drill Holes at Windy Reclaim backfill	m3	100	TMAC	$16.35	$1,635	50%	$818	$818	
	Drill Holes at Windy cut tops of drill rods	each	889	TMAC	$13.11	$11,655	50%	$5,827	$5,827	
	Windy Winter Road to Patch lake	m3	225	TMAC	$12.27	$2,761	50%	$1,380	$1,380	
	Patch Lake Roads and Trails	m3	120	TMAC	$12.27	$1,472	50%	$736	$736	
REMOVE LINED CONTAINMENT STRUCTURES										
Cut Liner as part of removal - load and haul carried above under Remove Bldgs	Madrid North Diversion Berm and Contact Water Pond Berm, CaCl Laydown Area plus Fuel Storage Area	m2	805	TMAC	$0.57	$459		$0	$459	Used 550 m2 for the diversion berm as cubic metres stated did not make sense
	Doris Run-off berm, Sedimentation/Pollution Control Pond, Reagent Pads Storage Areas, Waste Management Landfarm and Primary Vent Raise plus Tanks Farms at Doris and Roberts Bay	m2	55570	TMAC	$0.57	$31,675		$0	$31,675	Used 300 m2 for the diversion berm as cubic metres stated did not make sense
	Madrid South CaCl laydown plus Fuel Storage Area	m2	395	TMAC	$0.57	$225		$0	$225	
RECLAIM ROADS										
Remove culverts	Q2 Quarry Overburden Pile culvert	lm	15	TMAC	$96.57	$1,449	50%	$724	$724	
	RB Fuel Storage Facility Road	lm	40	TMAC	$96.57	$3,863	50%	$1,931	$1,931	
	Madrid North TIA Road Culvert	lm	60	TMAC	$96.57	$5,794	50%	$2,897	$2,897	
	Cargo Dock Road Culvert	lm	30	TMAC	$96.57	$2,897	50%	$1,449	$1,449	
	Secondary Road Culvert	lm	20	TMAC	$96.57	$1,931	50%	$966	$966	
	Madrid North Vent Raise Road	lm	10	TMAC	$96.57	$966	50%	$483	$483	
	Madrid North Site Access Culverts	lm	48	TMAC	$96.57	$4,635	50%	$2,318	$2,318	
	Madrid South AWR Culvert	lm	30	TMAC	$96.57	$2,897	50%	$1,449	$1,449	Assumes two culverts at 15m each
	Doris Connector Vent Raise Culvert	lm	15	TMAC	$96.57	$1,449	50%	$724	$724	assumes a 15 m culvert
	Madrid Boston AWR Crossings -10,-11,-13,-14,-17,-18,-20	lm	262	TMAC	$96.57	$25,301	50%	$12,651	$12,651	
	Doris Central Vent Raise Culvert	lm	15	TMAC	$96.57	$1,449	50%	$724	$724	assumes a 15 m culvert
Remove bridges	CDR-003 Remove Bridge	each	1	TMAC	$50,000.00	$50,000	50%	$25,000	$25,000	
	CDR-003 Cut Bridge Piles	each	8	TMAC	$535.00	$4,280	50%	$2,140	$2,140	
	CDR-003 Regrade abutements	m2	225	TMAC	$3.27	$736	50%	$368	$368	
	SR-002 Remove Bridge from Secondary Road	each	1	TMAC	$50,000.00	$50,000	50%	$25,000	$25,000	
	Madrid Boston AWR Regrade Crossings MBR-22,-23,-24,-27,-30,-31 and -34	m2	1575	TMAC	$3.27	$5,150	50%	$2,575	$2,575	
	MNT-003 Madrid North to TIA Regrade bridge abutment	m2	225	TMAC	$3.27	$736	50%	$368	$368	
	MNT-003 Madrid North to TIA remove bridge	each	1	TMAC	$50,000.00	$50,000	50%	$25,000	$25,000	
	MNT-003 Cut Piles at ground surface	each	8	TMAC	$535.00	$4,280	50%	$2,140	$2,140	
	MNT-003 load and haul waste frrom demolition	m3	95	TMAC	$15.15	$1,439	50%	$720	$720	added haulage to landfillC4.59
	Doris-Windy AWR remove bridges	each	3	TMAC	$50,000.00	$150,000	50%	$75,000	$75,000	
	Doris-Windy AWR Load and Haul Waste to landfill	m3	140	TMAC	$15.15	$2,121	50%	$1,061	$1,061	
	Madrid-Boston AWR Bridge Removal -7,-8,-9,-12,-15,16 &-19	each	7	TMAC	$50,000.00	$350,000	50%	$175,000	$175,000	
	Madrid-Boston AWR Bridge -7,-8,-9,-12,-15,16 &-19 Pile Removal	each	56	TMAC	$535.00	$29,960	50%	$14,980	$14,980	
	Madrid-Boston AWR Bridge -7,-8,-9,-12,-15,16 &-19 Waste Load and Hau	m2	927	TMAC	$15.15	$14,044	50%	$7,022	$7,022	used an average haulage cost of $4.92/m3
Remove Arch Culverts	DW-005	each	1	TMAC	$100,000.00	$100,000		$0	$100,000	
	DW-005 load and haul waste to landfill	m3	180	TMAC	$13.49	$2,428	50%	$1,214	$1,214	
Remove Traffic Boulders	Madrid North -TIA Road Bridge Crossing	m3	24	TMAC	$2.75	$66	50%	$33	$33	
	Cargo Dock Access Road Bridge Crossing	m3	24	TMAC	$2.75	$66	50%	$33	$33	
	Madrid Boston AWR Crossings -7,-8,-9,-12,-15,-16 & -19	m3	168	TMAC	$2.75	$462	50%	$231	$231	
Doris Sump Removal	Remove pumps and culverts	each	2	TMAC	$2,500.00	$5,000	50%	$2,500	$2,500	
Scarify Roads	Madrid North - Fuel storage access & bypass roads, TIA AWR, Vent raise access	ha	7.228	ACI	$1,230.00	$8,890	50%	$4,445	$4,445	
	Madrid South - AWR, Vent Raise pad,	ha	5.429	ACI	$1,230.00	$6,678	50%	$3,339	$3,339	increased cost from 0.087 to 0.123/m2
	Madrid-Boston AWR	ha	52.948	ACI	$1,230.00	$65,126	50%	$32,563	$32,563	
	Doris-Windy AWR	ha	7.318	ACI	$1,230.00	$9,001	50%	$4,501	$4,501	
	Roberts Bay Jetty	m2	1045	TMAC	$1.23	$1,285	50%	$643	$643	
	Madrid-Boston AWR Quarry Roads (L,M,N,O,S,S,W,X,Z,AB)	ha	5.44	ACI	$1,230.00	$6,691	50%	$3,346	$3,346	increased cost from 0.087 to 0.123/m2
	Roberts Bay Access Roads	ha	3.32	ACI	$1,230.00	$4,084	50%	$2,042	$2,042	
	Doris Access Roads	ha	6.43	ACI	$1,230.00	$7,909	50%	$3,954	$3,954	
Scarify Laydown Area	Patch Lake Development Area	m2	291	TMAC	$1.23	$358	50%	$179	$179	
	Roberts Bay Development Area	ha	13.75	ACI	$1,230.00	$16,913	50%	$8,456	$8,456	
	Madrid North Development Area	ha	9.5	ACI	$1,230.00	$11,685	50%	$5,843	$5,843	increased cost from 0.01 to 0.123/m2
	Madrid South Development Area	ha	10.834	ACI	$1,230.00	$13,326	50%	$6,663	$6,663	
Grade Fuel Storage Roads	RB-014 & RB-008	ha	0.7	ACI	$1,230.00	$861	50%	$431	$431	
Grade Helipad, Airstrip and Aprons	DM-007, DM-027 & DM-028	ha	107000	TMAC	$1.23	$131,610	50%	$65,805	$65,805	
	Place X on airstrip each end	each	2	TMAC	$325.00	$650	50%	$325	$325	
Scarify ore piles laydown area		ha		scfyl	$4,300.00	$0		$0	$0	
Vegetate	Windy Tank Farm	m2	1400	TMAC	$0.92	$1,288	50%	$644	$644	
	Windy Accommodation Bldg	m2	1250	TMAC	$0.92	$1,150	50%	$575	$575	
	Windy Reclaim Drill Holes	m2	100	TMAC	$0.92	$92	50%	$46	$46	
	Windy Development Area (apply nutrient for soil bioremediation)	m3	115	TMAC	$260.00	$29,900	50%	$14,950	$14,950	
Other	DW-001, DM-31, CDR-001, SR-003 & Q3-002	ha	15.83	ACI	$1,230.00	$19,475		$0	$19,475	
SPECIALIZED ITEMS										
Remove Thermosyphons	TIA-003	each	12	TMAC	$535.00	$6,420	50%	$3,210	$3,210	
Dispose of misc. debris and laydown area refuse				#N/A	$0.00	$0		$0	$0	
					Total	$14,598,548		$7,220,857	$7,377,691	
					% of Total			49%	51%	

Note:

1 **Capital Expenditures and Short Term Water Treatment identified in 'Instructions' worksheet**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	
BREACH WATER PONDS & CONTAINMENT BERMS							
Remove/Level Berms (excavation)	MN-022, RB-013, RB-002, RB-003, RP-003, WM-001,DM-013, DM-014, DM-020	m3	1091.2	TMAC	$2.75	$3,001	
Remove/Level Berms (grading)	DM-015, DM-035, MN-003, MS-003 & MS-012	m3	7162	TMAC	$1.23	$8,809	
Contour water intake area		m3		#N/A	$0.00	$0	
STABILIZE SEDIMENT PONDS/WATER MANAGEMENT PONDS/SEWAGE DISCHARGE AREA							
Place soil cover	Q2-003	m3	552	TMAC	$16.35	$9,025	
Place erosion control blanket	Q2-002, Q2-003, PLA-001, WC-002	m2	4075	TMAC	$4.84	$19,723	
place ROQ	PLA-003	m3	552	TMAC	$12.69	$7,005	
Doze & spread excavated material		m3		#N/A	$0.00	$0	
Vegetate spread material		ha		#N/A	$0.00	$0	
Rip rap in channel base		each		#N/A	$0.00	$0	
Remove sediment from WRSF Pond		allow		AE	$10,000.00	$0	
REDIRECT RUNOFF/CONSTRUCT DIVERSION DITCHES							
Excavate ditches -soil		m3		sc3l	$8.90	$0	
Excavate ditches -rock		m3		#N/A	$0.00	$0	
Stabilize side slopes		m3		#N/A	$0.00	$0	
Rip rap in channel base		m3		rr2l	$14.20	$0	
BREACH DITCHES & TAILINGS IMPOUNDMENT AREA							
Excavate breaches	TIA-003, RB-013, RB-002	m3	31021.1	TMAC	$8.82	$273,606	
Drill and Blast Ice Core	TIA-003	m3	7028	TMAC	$24.76	$174,013	
Place borrow for core protection	TIA-003	m3	614.2	TMAC	$16.35	$10,042	
Install flow dissipation		m3		#N/A	$0.00	$0	
Vegetate remainder of ditch		m2		#N/A	$0.00	$0	
DECOMISSION FRESH WATER SUPPLY							
Breach embankment		m		#N/A	$0.00	$0	
Remove pump	Madrid North sump and Doris two sumps	each	3	TMAC	$2,500.00	$7,500	
Remove pipeline		LS		AE	$40,000.00	$0	
Backfill Sumps	DM-018, MN-023	m3	51	TMAC	$16.35	$834	
WATER CONTROL IN RECLAMATION QUARRY							
Install pumping system		LS		#N/A	$0.00	$0	
Remove pumping system		LS		#N/A	$0.00	$0	
REMOVE PIPELINES							
Remove pipes	Process water pipeline from Madrid North to Water Treatment Plant at TIA	m	9000	TMAC	$16.00	$144,000	Not included in TMAC security but required to address movement of water from concentrator to WTP
Concrete plug deep pipes		m3		#N/A	$0.00	$0	
Other	Remove pumps and cables	LS	1	TMAC	$2,500.00	$2,500	
GROUNDWATER COLLECTION SYSTEM							
Excavate/install sumps		m3		#N/A	$0.00	$0	
Install pumping wells		m3		#N/A	$0.00	$0	
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0	
CONSTRUCT CONTAMINATED WATER STORAGE POND							
Excavate pond		m3		#N/A	$0.00	$0	
Doze & spread excavated material		m3		#N/A	$0.00	$0	
Vegetate spread material		ha		#N/A	$0.00	$0	
Bedding layer		m3		#N/A	$0.00	$0	
Supply geomembrane		m2		#N/A	$0.00	$0	
Install geomembrane		m2		#N/A	$0.00	$0	
Erosion protection layer		m3		#N/A	$0.00	$0	
CONSTRUCT PASSIVE TREATMENT SYSTEM (e.g. Constructed Wetland)							
Construct access roads		km		#N/A	$0.00	$0	
Install HDPE piping system from collection pond		m		#N/A	$0.00	$0	
Inter-cell flow structures		allow		#N/A	$0.00	$0	
Install liners		m2		#N/A	$0.00	$0	
Install growth media		m3		#N/A	$0.00	$0	
Wetland vegetation		ha		#N/A	$0.00	$0	
CONSTRUCT WATER TREATMENT PLANT							
Build treatment plant		LS		#N/A	$0.00	$0	
Build sludge containment facility		LS		#N/A	$0.00	$0	
					Total	$660,059	

For cost of long-term/post-closure water treatment see "WATER TREATMENT" Worksheet"

1 **Post Closure Water Treatment - Identified as long term/post-closure in 'Instructions' worksheet**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
ADDITION OF REAGENTS TO WTP						
H2O2		kg		#N/A	$0.00	$0
lime		kg		#N/A	$0.00	$0
ferric sulphate		kg		#N/A	$0.00	$0
ferrous sulphate		kg		#N/A	$0.00	$0
flocculents		kg		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
LABOUR AND SUPPLIES						
Annual fuel		litres		#N/A	$0.00	$0
Annual power		kW-h		#N/A	$0.00	$0
Electrician/mechanic to maintain treatment plant	Closure Dam Reclaim Pond	days	170	TMAC	$1,190.00	$202,300
Equipment maintenance and parts		allow	1	TMAC	$50,000.00	$50,000
Misc. supplies, hoses, tools		allow	1	TMAC	$20,000.00	$20,000
Communications		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
WATER MANAGEMENT FROM LANDFARM						
Water Treatment (reagents, equip Op. labour)		m3		#N/A	$0.00	$0
Water pumping from sumps and ponds to treatment plant		allow		#N/A	$0.00	$0
Annual Treatment Plant Servicing		manhours		lab-ss	$120.00	$0
Treatment Plant Servicing Travel Allowance		visit		#N/A	$0.00	$0
Other		allow	1	TMAC	$5,000.00	$5,000
WTP WATER SAMPLING AND ANALYSES						
Sampling equipment		allow		#N/A	$0.00	$0
Analyses		allow		#N/A	$0.00	$0
Shipping to laboratory		allow		#N/A	$0.00	$0
Reporting		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
SITE ACCESS						
Road maintenance (incl. snow removal)		allow		#N/A	$0.00	$0
Winter road tariff		allow		#N/A	$0.00	$0
Truck rental		allow		#N/A	$0.00	$0
Air support		allow		#N/A	$0.00	$0
					Annual water treatment costs	$277,300
Number of years of water treatment		years	2			
					Total	$554,600

1 **Interim Care and Maintenance**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
INTERIM CARE & MAINTENANCE						
Operation and Maintenance	includes camp operations	allow	1	TMAC	2E+06	$1,570,000
Mobilization of ICM Equipment Fleet		allow	0.33	TMAC	3E+05	$85,800
SNP/AEMP water sampling & reporting		each	3	TMAC	60000	$180,000
Compliance Monitoring		each	1	TMAC	95000	$95,000
Regulatory reporting		each	3	TMAC	20000	$60,000
geotechnical assessment		each	3	TMAC	35000	$105,000
interim water treatment				#N/A		$277,300
other		allow				$0
			Annual	Interim C&M Cost		$2,373,100
Number of years of ICM		years	3		**Total**	$7,119,300

1 **Mobilization/Demobilization:**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MOBILIZE HEAVY EQUIPMENT						
MOBILIZE MISC. EQUIPMENT						
Other	Mobilize eqipment and materials	allow	1	#N/A	1090000	$1,090,000
MOBILIZE CAMP						
Maintain Camp Accomodations	Food	andays	19021	TMAC	110	$2,092,310
Camp Mobilization/Demobilization		LS	1	TMAC	208000	$208,000
Field Support Staff	mechanic	day	109	TMAC	1160	$126,440
Camp Rental		year	3	TMAC	495000	$1,485,000
Camp Operations		year	3	TMAC	816750	$2,450,250
MOBILIZE WORKERS						
Reclamation activities - transport		flight	78	TMAC	10625	$828,750
Reclamation activities - travel time		manhours	5434.6	ACI	80	$434,766
WORKER ACCOMODATIONS						
MOBILIZE FUEL						
WINTER ROAD						
DEMOBILIZE EQUIPMENT & MATERIALs						
Other	Demobilize eqipment and materials	allow	1	#N/A	1090000	$1,090,000
DEMOBILIZE CAMP						
DEMOBILIZE WORKERS						
WINTER ROAD						
					Total	**$9,805,516**

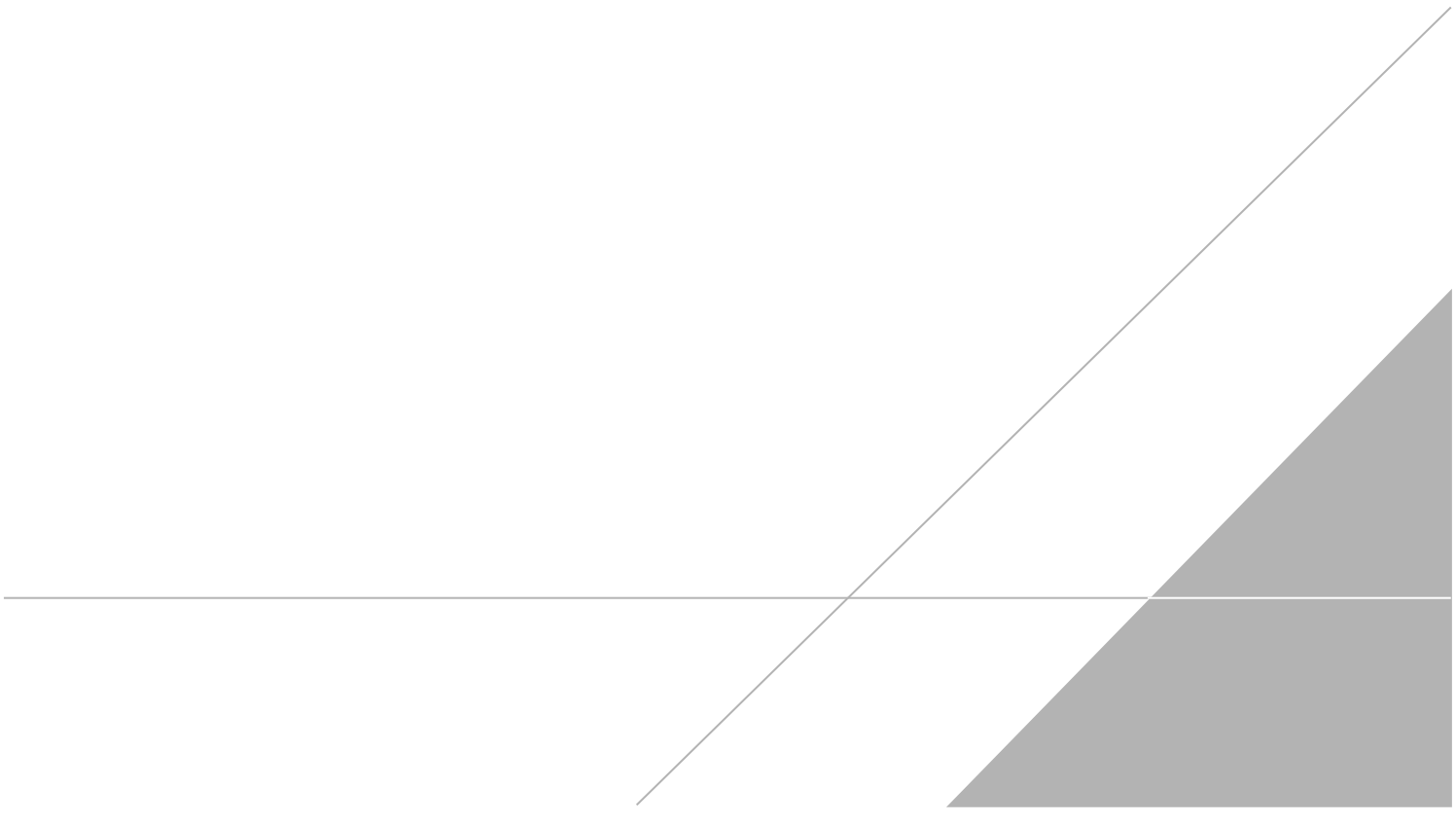
1 **Post-Closure Monitoring & Maintenance:**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	
MONITORING & INSPECTIONS							
Annual geotechnical inspection	Year 1, 2, 3, 6, 10, 15, 20, & 25	each	1	TMAC	$28,000.00	$28,000	8 inspections @$35,000 each = $280,000
Cover Monitoirng Inspections	Year 2, 4, 6, 8, 10, 15, 20 &25	each	1	TMAC	$28,000.00	$28,000	8 inspections @$35,000 each = $280,000
Surface water sampling	Year 1 - 5, 7, 10, 15, 20 & 25	each	1	TMAC	$60,000.00	$60,000	10 insepctions @$60,000 = $600,000
Groundwater sampling		each		wsh	$10,000.00	$0	
Receiving.downstream water sampling		each		wsh	$10,000.00	$0	
Monitoring program	initial confirmatory program	each	1	TMAC	$10,000.00	$10,000	1 time event prorated for 10 years total = $100,000
Survey inspection		each		#N/A	$0.00	$0	
Regulatory Monitoring*	Year 1 - 10, 15, 20 & 25	each	1	TMAC	$26,000.00	$26,000	13 insepctions @$20,000 = $260,000
Site water monitoring (AEMP and SNP)		each		#N/A	$25,000.00	$0	
- Active closure and flooding		each		#N/A	$0.00	$0	
- Post pit flooding		each		#N/A	$0.00	$0	
Air Quality Monitoring Program (AQMP)		each		#N/A	$0.00	$0	
Wildlife Effects Monitoring Program (WEMP)		each		#N/A	$0.00	$0	
Vegetation Monitoring		each		#N/A	$0.00	$0	
Other	Equipment mechanic for inspections	days	5	TMAC	$1,157.53	$5,788	approximately 50 days of mechanic time over ten years
COVER MAINTENANCE							
Repair erosion - infill gullies		allow		#N/A	$0.00	$0	
Repair erosion - upgrade diversion ditches		allow		#N/A	$0.00	$0	
Remove problem vegetation		allow		#N/A	$0.00	$0	
Repair animal damage		allow		#N/A	$0.00	$0	
Repair/upgrade access controls		allow		#N/A	$0.00	$0	
Other				#N/A	$0.00	$0	
SPILLWAY MAINTENANCE							
Repair erosion		m3		#N/A	$0.00	$0	
Clear spillway		each		#N/A	$0.00	$0	
CWTS MAINTENANCE							
Maintain flow, restore vegetation		allow		#N/A	$0.00	$0	
POST-CLOSURE WATER TREATMENT							
water treatment - refer to water treatment tab			1	wt tab	$277,300.00	$277,300	
Subtotal, Annual post-closure costs						$435,088	
Discount rate for calculation of net present value of post-closure cost, %				0.00%			
Number of years of post-closure activity				10	years		
Present Value of payment stream						$4,350,877	

*Regulatory costs - annual reporting, management plans, progress reports etc.

APPENDIX B

TMAC Summary Worksheets for Quantum of Security (2017 version)



Work Area Code		Item	Task	Sub-task	Facility Name	Task	Quantity	Quantity	Unit	Cost Code	Unit Cost	Activity Total	Subtotals	Source / Comments
DIRECT COSTS														
Stockpiles and Waste Rock Dumps													$ 88,463.31	
RB_007	Y	1	7	1	Roberts Bay Overburden Pile	collect all debris	14205.0	14205.0	m2	C.3.10	$ 0.37	$ 5,326.00		
		1	7	2		load waste into containers	8.5	8.5	m3	C.4.01	$ 10.23	$ 87.17		
		1	7	3		haul containers to Quarry 3 landfill	8.5	8.5	m3	C.4.15	$ 5.99	$ 51.08		
		1	7	4		grade for positive drainage	14205.0	14205.0	m2	C.5.05	$ 1.23	$ 17,434.51		
Q2_002	Y	14	2	1	Quarry 2 Overburden Pile	reslope to 3H:1V	8781.3	8781.3	m2	C.5.06	$ 3.27	$ 28,740.72		Assumed 1/3 of footprint
		14	2	2		grade top for positive drainage	18440.8	18440.8	m2	C.5.05	$ 1.23	$ 22,633.32		Assumed 70% of footprint
		14	2	3		install erosion protection measures (coconut matting)	2634.4	2634.4	m2	C.5.08	$ 4.84	$ 12,741.99		Assumed 10% of footprint
		14	2	4		Remove Culvert	15.0	15.0	m	C.5.15	$ 96.57	$ 1,448.53		
DM_010	Y	2	10	1	Doris Ore Pile	activities are required for final closure, regrading addressed under DM_032								
		2	10	2		interim closure cover: regrade top surface for positive drainage	0.0	0.0	m2	C.5.05	$ 1.23	$ -		
		2	10	3		interim closure cover: cover entire dump with hdpe liner	0.0	0.0	m2	C.5.01	$ 33.85	$ -		
		2	10	4		interim closure cover: produce ROQ (quarry drill & blast)	0.0	0.0	m3	C.5.09	$ 24.76	$ -		
		2	10	5		interim closure cover: place 0.3 m thick liner protection layer of crushed rock	0.0	0.0	m3	C.5.02	$ 16.35	$ -		
DM_025	Y	2	25	1	Doris Waste Rock Pile	activities are required for final closure, regrading addressed under DM_032								
		2	25	2		interim closure cover: regrade top surface for positive drainage	0.0	0.0	m2	C.5.05	$ 1.23	$ -		
		2	25	3		interim closure cover: cover entire dump with hdpe liner	0.0	0.0	m2	C.5.01	$ 33.85	$ -		
		2	25	4		interim closure cover: produce ROQ (quarry drill & blast)	0.0	0.0	m3	C.5.09	$ 24.76	$ -		
		2	25	5		interim closure cover: place 0.3 m thick liner protection layer of crushed rock	0.0	0.0	m3	C.5.02	$ 16.35	$ -		
DW_009	Y	3	9	1	Doris-Windy All Weather Road Quarry D Overburden P	grade for positive drainage	0.0	0.0	m2	C.5.05	$ 1.23	$ -		
MN_001	Y	5	1	1	Madrid North Waste Rock Pile	activities are required for final closure, regrading addressed under MN_016								
		5	1	2		interim closure cover: regrade top surface for positive drainage	0.0	0.0	m2	C.5.05	$ 1.23	$ -		
		5	1	3		interim closure cover: cover entire dump with hdpe liner	0.0	0.0	m2	C.5.01	$ 33.85	$ -		
		5	1	4		interim closure cover: produce ROQ (quarry drill & blast)	0.0	0.0	m3	C.5.09	$ 24.76	$ -		
		5	1	5		interim closure cover: place 0.3 m thick liner protection layer of crushed rock	0.0	0.0	m3	C.5.02	$ 16.35	$ -		
MN_002	Y	5	2	1	Madrid North Ore Stockpile	no closure activities are required, regrading addressed under MN_016		0.0	m3	C.5.02	$ 16.35	$ -		No ore scheduled to be on surface at the end of each year, or at the end of production.
MS_001	Y	7	1	1	Madrid South Waste Rock Pile	activities are required for final closure, regrading addressed under MS_021								
		7	1	2		interim closure cover: regrade top surface for positive drainage	0.0	0.0	m3	C.5.05	$ 1.23	$ -		
		7	1	3		interim closure cover: cover entire dump with hdpe liner	0.0	0.0	m3	C.5.01	$ 33.85	$ -		
		7	1	4		interim closure cover: produce ROQ (quarry drill & blast)	0.0	0.0	m3	C.5.09	$ 24.76	$ -		
		7	1	5		interim closure cover: place 0.3 m thick liner protection layer of crushed rock	0.0	0.0	m3	C.5.02	$ 16.35	$ -		
MS_002	Y	7	2	1	Madrid South Ore Stockpile	no closure activities are required, regrading addressed under MS_021								
DC_001	Y	22	1	1	Doris Phase 1 Waste Rock Pile	no closure activities are required								
		22	1	2		interim closure cover: regrade top surface for positive drainage	0.0	0.0	m2	C.5.05	$ 1.23	$ -		
		22	1	3		interim closure cover: cover entire dump with hdpe liner	0.0	0.0	m2	C.5.01	$ 33.85	$ -		
		22	1	4		interim closure cover: produce ROQ (quarry drill & blast)	0.0	0.0	m3	C.5.09	$ 24.76	$ -		
		22	1	5		interim closure cover: place 0.3 m thick liner protection layer of crushed rock	0.0	0.0	m3	C.5.02	$ 16.35	$ -		
DC_002	Y	22	2	1	Doris Phase 1 Expanded Waste Rock Storage (Pad T)	no closure activities are required								
		22	2	2		interim closure cover: regrade top surface for positive drainage	0.0	0.0	m2	C.5.05	$ 1.23	$ -		
		22	2	3		interim closure cover: cover entire dump with hdpe liner	0.0	0.0	m2	C.5.01	$ 33.85	$ -		
		22	2	4		interim closure cover: produce ROQ (quarry drill & blast)	0.0	0.0	m3	C.5.09	$ 24.76	$ -		
		22	2	5		interim closure cover: place 0.3 m thick liner protection layer of crushed rock	0.0	0.0	m3	C.5.02	$ 16.35	$ -		
Fuel Storage Facilities													$ 3,078,418.23	
WC_001	Y	19	1	1	Windy Tank Farm	haul reusable materials to Doris camp	10.8	10.8	m3	C.4.60	$ 2.77	$ 29.81		
		19	1	2		unload container	10.8	10.8	m3	C.4.65	$ 34.08	$ 367.34		
		19	1	3		place rockfill buttress on slope near tank farm	600.0	600.0	m3	C.5.25	$ 12.27	$ 7,364.10		
		19	1	4		load debris into seacans for transport	12.0	12.0	m3	C.4.01	$ 10.23	$ 122.74		
		19	1	5		haul containers to Quarry 3 landfill	12.0	12.0	m3	C.4.25	$ 3.26	$ 39.12		
		19	1	6		revegetate area	1400.0	1400.0	m2	C.5.13	$ 0.92	$ 1,288.49		
PLA_001	Y	18	1	1	Patch Lake Tank Farm	stake out low-lying areas in summer to place fill	1.0	1.0	day	C.5.14	$ 7,186.44	$ 7,186.44		
		18	1	2		regrade spoil piles to ensure positive drainage	200.0	200.0	m2	C.5.05	$ 1.23	$ 245.47		
		18	1	3		regrade spoil piles to ensure positive drainage (with excavator)	3630.0	3630.0	m2	C.5.26	$ 5.50	$ 19,955.53		
		18	1	4		install erosion protection measures (coconut matting)	381.5	381.5	m2	C.5.08	$ 4.84	$ 1,845.23		
		18	1	5		cover area with 1 m thermal rock cover	3000.0	3000.0	m^3	C.5.03	$ 24.53	$ 73,587.95		
RB_013	Y	1	13	1	Roberts Bay 10ML Fuel Storage Facility	drain residual fuel	160000.0	160000.0	L	C.2.03	$ 0.02	$ 3,634.78		
		1	13	2		consolidate fuel in barge at Roberts Bay	160000.0	160000.0	L	C.4.69	$ 0.01	$ 986.66		
		1	13	3		decommission fuel transfer facilities	1.0	1.0	each	C.1.02	$ 476.06	$ 476.06		
		1	13	4		wash tanks	4.0	4.0	each	C.2.04	$ 1,186.71	$ 4,746.84		
		1	13	5		operate oil/water separator	4.5	4.5	m3	C.2.08	$ 32.80	$ 147.38		
		1	13	6		disconnect piping and controls	4.0	4.0	each	C.1.02	$ 476.06	$ 1,904.25		
		1	13	7		dismantle tanks and cut into manageable pieces	4.0	4.0	each	X.08	$ 100,000.00	$ 400,000.00		
		1	13	8		prepare pieces for transportation	51.7	51.7	m3	C.4.01	$ 10.23	$ 529.04		
		1	13	9		haul cut metal to quarry 3 landfill	51.7	51.7	m3	C.4.15	$ 5.99	$ 310.01		
		1	13	10		excavate and stockpile liner protection cover	10315.2	10315.2	m3	C.5.04	$ 2.75	$ 28,353.34		
		1	13	11		load contained contaminated soils into megabags for hauling	5157.6	5157.6	m3	C.4.12	$ 72.73	$ 375,117.27		assume 50% of liner protection cover is contaminated
		1	13	12		haul megabags to Doris	5157.6	5157.6	m3	C.4.04	$ 2.30	$ 11,848.95		
		1	13	13		haul megabags to Doris underground	5157.6	5157.6	m3	C.5.22	$ 15.37	$ 79,256.84		
		1	13	14		clean liner	8596.0	8596.0	m2	C.2.10	$ 0.41	$ 3,542.00		
		1	13	15		remove and cut liner into manageable pieces	8596.0	8596.0	m2	C.3.02	$ 0.17	$ 1,464.59		
		1	13	16		load waste into containers	128.9	128.9	m3	C.4.01	$ 10.23	$ 1,318.79		
		1	13	17		haul containers to Quarry 3 landfill	128.9	128.9	m3	C.4.15	$ 5.99	$ 772.78		
		1	13	18		breach containment berm	45.0	45.0	m3	C.5.04	$ 2.75	$ 123.69		
RB_002	Y	1	2	1	Roberts Bay 20 ML Tank Farm	drain residual fuel	160000.0	160000.0	L	C.2.03	$ 0.02	$ 3,634.78		
		1	2	2		consolidate fuel in barge at Roberts Bay	160000.0	160000.0	L	C.4.69	$ 0.01	$ 986.66		
		1	2	3		decommission fuel transfer facilities	1.0	1.0	each	C.1.02	$ 476.06	$ 476.06		
		1	2	4		wash tanks	4.0	4.0	each	C.2.04	$ 1,186.71	$ 4,746.84		
		1	2	5		operate oil/water separator	4.5	4.5	m3	C.2.08	$ 32.80	$ 147.38		
		1	2	6		disconnect piping and controls	4.0	4.0	each	C.1.02	$ 476.06	$ 1,904.25		
		1	2	7		dismantle tanks and cut into manageable pieces	4.0	4.0	each	X.08	$ 100,000.00	$ 400,000.00		
		1	2	8		prepare pieces for transportation	51.7	51.7	m3	C.4.01	$ 10.23	$ 529.04		
		1	2	9		haul cut metal to quarry 3 landfill	57.6	57.6	m3	C.4.15	$ 5.99	$ 344.96		
		1	2	10		excavate and stockpile liner protection cover	7923.6	7923.6	m3	C.5.04	$ 2.75	$ 21,779.56		
		1	2	11		load contained contaminated soils into megabags for hauling	3961.8	3961.8	m3	C.4.12	$ 72.73	$ 288,145.57		assume 50% of liner protection cover is contaminated
		1	2	12		haul megabags to Doris	3961.8	3961.8	m3	C.4.04	$ 2.30	$ 9,101.75		
		1	2	13		haul megabags to Doris underground	3961.8	3961.8	m3	C.5.22	$ 15.37	$ 60,880.98		
		1	2	14		clean liner	13206.0	13206.0	m2	C.2.10	$ 0.41	$ 5,441.56		
		1	2	15		remove and cut liner into manageable pieces	13206.0	13206.0	m2	C.3.02	$ 0.17	$ 2,250.04		
		1	2	16		load waste into containers	118.9	118.9	m3	C.4.01	$ 10.23	$ 1,215.63		
		1	2	17		haul containers to Quarry 3 landfill	118.9	118.9	m3	C.4.15	$ 5.99	$ 712.33		
		1	2	18		breach containment berm	154.0	154.0	m3	C.5.04	$ 2.75	$ 423.27		
RB_003	Y	1	3	1	Roberts Bay Quarry 1 - 5 ML Tank Farm	drain residual fuel	40000.0	40000.0	L	C.2.03	$ 0.02	$ 908.69		
		1	3	2		consolidate fuel in barge at Roberts Bay	40000.0	40000.0	L	C.4.69	$ 0.01	$ 246.66		
		1	3	3		decommission fuel transfer facilities	1.0	1.0	each	C.1.02	$ 476.06	$ 476.06		
		1	3	4		wash tanks	1.0	1.0	each	C.2.04	$ 1,186.71	$ 1,186.71		
		1	3	5		operate oil/water separator	1.1	1.1	m3	C.2.08	$ 32.80	$ 36.85		
		1	3	6		disconnect piping and controls	1.0	1.0	each	C.1.02	$ 476.06	$ 476.06		
		1	3	7		dismantle tanks and cut into manageable pieces	1.0	1.0	each	X.08	$ 100,000.00	$ 100,000.00		
		1	3	8		prepare pieces for transportation	16.9	16.9	m3	C.4.01	$ 10.23	$ 172.93		
		1	3	9		haul cut metal to quarry 3 landfill	16.9	16.9	m3	C.4.15	$ 5.99	$ 101.33		
		1	3	10		drain and wash empty fuel drums	150.0	150.0	each	C.2.05	$ 18.40	$ 2,760.11		
		1	3	11		crush empty fuel drums	150.0	150.0	each	C.3.01	$ 21.04	$ 3,155.42		
		1	3	12		excavate and stockpile liner protection cover	2979.9	2979.9	m3	C.5.04	$ 2.75	$ 8,190.84		
		1	3	13		load contained contaminated soils into megabags for hauling	1490.0	1490.0	m3	C.4.12	$ 72.73	$ 108,365.51		assume 50% of liner protection cover is contaminated
		1	3	14		haul megabags to Doris	745.0	745.0	m3	C.4.04	$ 2.30	$ 1,711.49		
		1	3	15		haul megabags to Doris underground	1490.0	1490.0	m3	C.5.22	$ 15.37	$ 22,896.06		
		1	3	16		clean liner	9933.0	9933.0	m2	C.2.10	$ 0.41	$ 4,092.91		
		1	3	17		remove and cut liner into manageable pieces	9933.0	9933.0	m2	C.3.02	$ 0.17	$ 1,692.39		
		1	3	18		load waste into containers	149.9	149.9	m3	C.4.01	$ 10.23	$ 1,533.66		Includes geotextile, liner, & fuel drums
		1	3	19		haul containers to Quarry 3 landfill	149.9	149.9	m3	C.4.15	$ 5.99	$ 898.69		
		1	3	20		breach containment berm	77.8	77.8	m3	C.5.04	$ 2.75	$ 213.74		
DM_020	Y	2	20	1	Doris Tank Farm	drain residual fuel	75000.0	75000.0	each	C.2.03	$ 0.02	$ 1,703.80		
		2	20	2		consolidate fuel in barge at Roberts Bay	75000.0	75000.0	L	C.4.70	$ 0.01	$ 546.55		
		2	20	3		decommission fuel transfer facilities	5.0	5.0	each	C.1.02	$ 476.06	$ 2,380.31		
		2	20	4		wash tanks	5.0	5.0	each	C.2.04	$ 1,186.71	$ 5,933.55		
		2	20	5		operate oil/water separator	3.9	3.9	m3	C.2.08	$ 32.80	$ 129.39		
		2	20	6		disconnect piping and controls	5.0	5.0	each	C.1.02	$ 476.06	$ 2,380.31		
		2	20	7		dismantle tanks and cut into manageable pieces	5.0	5.0	each	X.22	$ 74,211.74	$ 371,058.71		
		2	20	8		prepare pieces for transportation	25.3	25.3	m3	C.4.01	$ 10.23	$ 258.58		
		2	20	9		haul cut metal to quarry 3 landfill	25.3	25.3	m3	C.4.47	$ 4.92	$ 124.28		
		2	20	10		excavate and stockpile liner protection cover	3360.0	3360.0	m3	C.5.04	$ 2.75	$ 9,235.62		
		2	20	11		load contained contaminated soils into megabags for hauling	1680.0	1680.0	m3	C.4.12	$ 72.73	$ 122,188.03		assume 50% of liner protection cover is contaminated
		2	20	12		haul megabags to Doris underground	1680.0	1680.0	m3	C.5.22	$ 15.37	$ 25,816.56		
		2	20	13		clean liner	5500.0	5500.0	m2	C.2.10	$ 0.41	$ 2,266.29		
		2	20	14		remove and cut liner into manageable pieces	5500.0	5500.0	m2	C.3.02	$ 0.17	$ 937.09		
		2	20	15		load waste into containers	82.5	82.5	m3	C.4.01	$ 10.23	$ 843.80		
		2	20	16		haul containers to Quarry 3 landfill	82.5	82.5	m3	C.4.14	$ 4.70	$ 387.73		
		2	20	17		level containment berms	90.0	90.0	m3	C.5.04	$ 2.75	$ 247.38		
MN_011	Y	5	11	1	Madrid North Fuel Storage Facility	drain residual fuel	45000.0	45000.0	each	C.2.03	$ 0.02	$ 1,022.28		
		5	11	2		consolidate fuel in barge at Roberts Bay	45000.0	45000.0	L	C.4.71	$ 0.01	$ 426.42		
		5	11	3		decommission fuel transfer facilities	3.0	3.0	each	C.1.02	$ 476.06	$ 1,428.19		
		5	11	4		wash tanks	3.0	3.0	each	C.2.04	$ 1,186.71	$ 3,560.13		
		5	11	5		operate oil/water separator	2.6	2.6	m3	C.2.08	$ 32.80	$ 83.93		
		5	11	6		disconnect piping and controls	3.0	3.0	each	C.1.02	$ 476.06	$ 1,428.19		
		5	11	7		dismantle tanks and cut into manageable pieces	3.0	3.0	each	X.22	$ 74,211.74	$ 222,635.23		
		5	11	8		prepare pieces for transportation	16.3	16.3	m3	C.4.01	$ 10.23	$ 166.56		
		5	11	9		haul cut metal to quarry 3 landfill	16.3	16.3	m3	C.4.59	$ 4.92	$ 80.05		
		5	11	10		excavate and stockpile liner protection cover	2436.0	2436.0	m3	C.5.04	$ 2.75	$ 6,695.82		
		5	11	11		load contained contaminated soils into megabags for hauling	1218.0	1218.0	m3	C.4.12	$ 72.73	$ 88,586.33		assume 50% of liner protection cover is contaminated
		5	11	12		haul megabags to Madrid north underground	1218.0	1218.0	m3	C.5.22	$ 15.37	$ 18,717.01		
		5	11	13		clean liner	18.3	18.3	m2	C.2.10	$ 0.41	$ 7.53		
		5	11	14		remove and cut liner into manageable pieces	18.3	18.3	m2	C.3.02	$ 0.17	$ 3.11		
		5	11	15		load waste into containers	32.3	32.3	m3	C.4.01	$ 10.23	$ 330.55		
		5	11	16		haul containers to Quarry 3 landfill	32.3	32.3	m3	C.4.59	$ 4.92	$ 158.87		
		5	11	17		breach containment berm	90.0	90.0	m3	C.5.04	$ 2.75	$ 247.38		
MS_017	Y	7	17	1	Madrid South Fuel Storage Facility	drain residual fuel	2000.0	2000.0	L	C.2.03	$ 0.02	$ 45.43		
		7	17	2		consolidate fuel in barge at Roberts Bay	2000.0	2000.0	L	C.4.71	$ 0.01	$ 18.95		
		7	17	3		decommission fuel transfer facilities	1.0	1.0	each	C.1.02	$ 476.06	$ 476.06		
		7	17	4		wash tanks	1.0	1.0	each	C.2.04	$ 1,186.71	$ 1,186.71		
		7	17	5		operate oil/water separator	0.2	0.2	m3	C.2.08	$ 32.80	$ 5.04		
		7	17	6		disconnect piping and controls	1.0	1.0	each	C.1.02	$ 476.06	$ 476.06		
		7	17	7		dismantle tanks and cut into manageable pieces	1.0	1.0	each	X.22	$ 74,211.74	$ 74,211.74		
		7	17	8		prepare pieces for transportation	0.8	0.8	m3	C.4.01	$ 10.23	$ 7.71		
		7	17	9		haul cut metal to quarry 3 landfill	0.8	0.8	m3	C.4.25	$ 3.26	$ 2.46		
		7	17	10		excavate and stockpile liner protection cover	450.0	450.0	m3	C.5.04	$ 2.75	$ 1,236.91		
		7	17	11		load contained contaminated soils into megabags hauling	225.0	225.0	m3	C.4.12	$ 72.73	$ 16,364.47		assume 50% of liner protection cover is contaminated
		7	17	12		haul megabags to Madrid south underground	225.0	225.0	m3	C.5.22	$ 15.37	$ 3,457.58		
		7	17	13		clean liner	375.0	375.0	m2	C.2.10	$ 0.41	$ 154.52		
		7	17	14		remove and cut liner into manageable pieces	375.0	375.0	m2	C.3.02	$ 0.17	$ 63.89		
		7	17	15		load waste into containers	3.4	3.4	m3	C.4.01	$ 10.23	$ 34.52		
		7	17	16		haul containers to Quarry 3 landfill	3.4	3.4	m3	C.4.25	$ 3.26	$ 11.00		
		7	17	17		breach containment berm	90.0	90.0	m3	C.5.04	$ 2.75	$ 247.38		
Buildings and Facilities													$ 8,704,961.22	
MBR_041	Y	8	41	1	Madrid-Boston All Weather Road Turbine Pad #6	Dismantle wind turbine and prepare for shipping off-site	1.0	1.0	each	X.23	$ 500,000.00	$ 500,000.00		
		8	41	2		Demolish equipment housing shack	288.8	288.8	m3	C.3.05	$ 13.12	$ 3,788.60		
		8	41	3		Remove electrical and fiber optics cables	11949.0	11949.0	m	C.3.20	$ 14.04	$ 167,731.41		
		8	41	4		collect debris	5080.0	5080.0	m2	C.3.10	$ 0.37	$ 1,904.69		
		8	41	5		load waste into trucks for transport to landfill	580.5	580.5	m3	C.4.01	$ 10.23	$ 5,937.80		
		8	41	6		transport waste to landfill	580.5	580.5	m3	C.4.49	$ 3.21	$ 1,862.49		
		8	41	7		transport wind turbine parts to Roberts Bay	1.0	1.0	each	X.19	$ 20,000.00	$ 20,000.00		
MBR_040	Y	8	40	1	Madrid-Boston All Weather Road Turbine Pad #5	Dismantle wind turbine and prepare for shipping off-site	1.0	1.0	each	X.23	$ 500,000.00	$ 500,000.00		
		8	40	2		Demolish equipment housing shack	288.8	288.8	m3	C.3.05	$ 13.12	$ 3,788.60		
		8	40	3		Remove electrical and fiber optics cables	11949.0	11949.0	m	C.3.20	$ 14.04	$ 167,731.41		
		8	40	4		collect debris	5080.0	5080.0	m2	C.3.10	$ 0.37	$ 1,904.69		
		8	40	5		load waste into trucks for transport to landfill	580.5	580.5	m3	C.4.01	$ 10.23	$ 5,937.80		
		8	40	6		transport waste to landfill	580.5	580.5	m3	C.4.49	$ 3.21	$ 1,862.49		
		8	40	7		transport wind turbine parts to Roberts Bay	1.0	1.0	m3	X.19	$ 20,000.00	$ 20,000.00		
MBR_039	Y	8	39	1	Madrid-Boston All Weather Road Turbine Pad #4	Dismantle wind turbine and prepare for shipping off-site	1.0	1.0	each	X.23	$ 500,000.00	$ 500,000.00		
		8	39	2		Demolish equipment housing shack	288.8	288.8	m3	C.3.05	$ 13.12	$ 3,788.60		
		8	39	3		Remove electrical and fiber optics cables	3385.0	3385.0	m	C.3.20	$ 14.04	$ 47,516.18		
		8	39	4		collect debris	5080.0	5080.0	m2	C.3.10	$ 0.37	$ 1,904.69		
		8	39	5		load waste into trucks for transport to landfill	580.5	580.5	m3	C.4.01	$ 10.23	$ 5,937.80		
		8	39	6		transport waste to landfill	580.5	580.5	m3	C.4.49	$ 3.21	$ 1,862.49		
		8	39	7		transport wind turbine parts to Roberts Bay	1.0	1.0	m3	X.20	$ 15,000.00	$ 15,000.00		
MBR_038	Y	8	38	1	Madrid-Boston All Weather Road Turbine Pad #3	Dismantle wind turbine and prepare for shipping off-site	1.0	1.0	each	X.23	$ 500,000.00	$ 500,000.00		
		8	38	2		Demolish equipment housing shack	288.8	288.8	m3	C.3.05	$ 13.12	$ 3,788.60		
		8	38	3		Remove electrical and fiber optics cables	1692.0	1692.0	m	C.3.20	$ 14.04	$ 23,751.07		
		8	38	4		collect debris	5080.0	5080.0	m2	C.3.10	$ 0.37	$ 1,904.69		
		8	38	5		load waste into trucks for transport to landfill	580.5	580.5	m3	C.4.01	$ 10.23	$ 5,937.80		
		8	38	6		transport waste to landfill	580.5	580.5	m3	C.4.49	$ 3.21	$ 1,862.49		
		8	38	7		transport wind turbine parts to Roberts Bay	1.0	1.0	m3	X.20	$ 15,000.00	$ 15,000.00		
DW_012	Y	3	12	1	Doris-Windy All Weather Road Turbine Pad #2	Dismantle wind turbine and prepare for shipping off-site	1.0	1.0	each	X.23	$ 500,000.00	$ 500,000.00		
		3	12	2		Demolish equipment housing shack	288.8	288.8	m3	C.3.05	$ 13.12	$ 3,788.60		
		3	12	3		Remove electrical and fiber optics cables	405.0	405.0	m	C.3.20	$ 14.04	$ 5,685.10		
		3	12	4		collect debris	5080.0	5080.0	m2	C.3.10	$ 0.37	$ 1,904.69		
		3	12	5		load waste into trucks for transport to landfill	580.5	580.5	m3	C.4.01	$ 10.23	$ 5,937.80		
		3	12	6		transport waste to landfill	580.5	580.5	m3	C.4.49	$ 3.21	$ 1,862.49		
		3	12	7		transport wind turbine parts to Roberts Bay	1.0	1.0	m3	X.21	$ 10,000.00	$ 10,000.00		
DW_011	Y	3	11	1	Doris-Windy All Weather Road Turbine Pad #1	Dismantle wind turbine and prepare for shipping off-site	1.0	1.0	each	X.23	$ 500,000.00	$ 500,000.00		
		3	11	2		Demolish equipment housing shack	288.8	288.8	m3	C.3.05	$ 13.12	$ 3,788.60		
		3	11	3		Remove electrical and fiber optics cables	4261.0	4261.0	m	C.3.20	$ 14.04	$ 59,812.83		
		3	11	4		collect debris	5080.0	5080.0	m2	C.3.10	$ 0.37	$ 1,904.69		
		3	11	5		load waste into trucks for transport to landfill	580.5	580.5	m3	C.4.01	$ 10.23	$ 5,937.80		
		3	11	6		transport waste to landfill	580.5	580.5	m3	C.4.49	$ 3.21	$ 1,862.49		
		3	11	7		transport wind turbine parts to Roberts Bay	1.0	1.0	m3	X.21	$ 10,000.00	$ 10,000.00		
DW_010	Y	3	10	1	Doris-Windy All Weather Road Explosives Storage Faci	remove all explosives	2176.0	2176.0	m3	C.4.08	$ 2.91	$ 6,333.51		
		3	10	2		demolish entry gates	0.5	0.5	m3	C.3.05	$ 13.12	$ 5.90		
		3	10	3		collect all debris	2805.8	2805.8	m2	C.3.10	$ 0.37	$ 1,052.01		
		3	10	4		load waste into containers for transport to landfill	5.4	5.4	m3	C.4.01	$ 10.23	$ 55.23		
		3	10	5		haul waste to landfill	5.4	5.4	m3	C.4.18	$ 3.41	$ 18.39		
		3	10	6		regrade area for positive drainage	2805.8	2805.8	m2	C.5.18	$ 0.01	$ 27.72		Includes AWR
WC_007	Y	19	7	1	Windy Waste Incinerator	decommission waste incinerator (mechanical)	1.0	1.0	each	C.1.04	$ 1,322.22	$ 1,322.22		
		19	7	2		collect ashes and place in containers	1.0	1.0	m3	C.2.07	$ 763.55	$ 763.55		
		19	7	3		dismantle (welding crew)	1.0	1.0	each	C.3.08	$ 534.78	$ 534.78		
		19	7	4		load waste into containers	6.8	6.8	m3	C.4.64	$ 804.49	$ 5,430.29		
		19	7	5		haul reusable materials to Doris Camp	6.8	6.8	m3	C.4.60	$ 2.77	$ 18.67		
WC_006	Y	19	6	1	Windy Potable Water Supply System	decommission potable water supply system	1.0	1.0	LS	C.1.03	$ 1,327.71	$ 1,327.71		
		19	6	2		dismantle potable water supply system	1.0	1.0	LS	C.3.08	$ 534.78	$ 534.78		
		19	6	3		load treatment units and tanks on skids for transport	4.0	4.0	m3	C.4.64	$ 804.49	$ 3,217.95		
		19	6	4		haul reusable materials to Doris Camp	35.6	35.6	m3	C.4.60	$ 2.77	$ 98.59		
WC_002	Y	19	2	1	Windy Accomodation Camp Buildings	decommission (electrical, mechanical, plumbing)	1.0	1.0	LS	C.1.05	$ 679.52	$ 679.52		
		19	2	2		load reusable components into containers for transport to Doris Camp	29.0	29.0	m3	C.4.66	$ 136.30	$ 3,952.82		
		19	2	3		dismantle and package communication equipment	1.0	1.0	LS	C.1.07	$ 374.34	$ 374.34		
		19	2	4		haul all reusable materials to Doris Camp	31.6	31.6	m3	C.4.60	$ 2.77	$ 87.28		
		19	2	5		regrade area for positive drainage	1248.0	1248.0	m2	C.5.05	$ 1.23	$ 1,531.73		
		19	2	6		install erosion protection measures (coconut matting)	500.0	500.0	m2	C.5.08	$ 4.84	$ 2,418.38		
		19	2	7		revegetate area	1248.0	1248.0	m2	C.5.13	$ 0.92	$ 1,148.60		
		19	2	8		fill low-lying areas with soil to prevent ponding	150.0	150.0	m3	C.5.25	$ 12.27	$ 1,841.03		
		19	2	9		manual demolition beyond rock pads	886.2	886.2	m2	C.3.18	$ 154.86	$ 137,234.66		
		19	2	10		mechanical demolition on rock pads	3479.1	3479.1	m3	C.3.19	$ 11.23	$ 39,084.16		
		19	2	11		load waste into containers	1891.3	1891.3	m3	C.4.01	$ 10.23	$ 19,344.55		
		19	2	12		haul containers to Quarry 3 landfill	1891.3	1891.3	m3	C.4.59	$ 4.92	$ 9,297.33		
RB_004	Y	1	4	1	Roberts Bay Mechanical Shop Complex	chanical, heating (including connections to generator house & transformer)	7.0	7.0	each	C.1.05	$ 679.52	$ 4,756.61		
		1	4	2		demolish (steel modular structure)	2402.4	2402.4	m3	C.3.05	$ 13.12	$ 31,521.60		
		1	4	3		demolish wood structures (warehouse roof, crew lounge)	283.2	283.2	m3	C.3.05	$ 13.12	$ 3,715.78		
		1	4	4		demolish tent structure (light vehicle shop)	460.3	460.3	m3	C.3.05	$ 13.12	$ 6,039.52		
		1	4	5		collect debris	480.5	480.5	m2	C.3.10	$ 0.37	$ 180.15		
		1	4	6		load waste into containers	776.9	776.9	m3	C.4.01	$ 10.23	$ 7,946.30		
		1	4	7		haul containers to Quarry 3 landfill	776.9	776.9	m3	C.4.15	$ 5.99	$ 4,656.34		
RB_005	Y	1	5	1	Roberts Bay Waste Management Facility	collect ashes and place in containers	0.5	0.5	m3	C.2.07	$ 763.55	$ 381.77		
		1	5	2		dismantle (welding crew)	2.0	2.0	each	C.3.08	$ 534.78	$ 1,069.57		
		1	5	3		demolish wood structures (roof, entryway, etc.)	321.6	321.6	m3	C.3.05	$ 13.12	$ 4,220.25		
		1	5	4		disconnect containers and prep for shipping	11.0	11.0	each	C.1.08	$ 1,368.94	$ 15,058.31		
		1	5	5		collect all debris	128.7	128.7	m2	C.3.10	$ 0.37	$ 48.24		
		1	5	6		load waste into containers	189.8	189.8	m3	C.4.01	$ 10.23	$ 1,940.91		
		1	5	7		haul containers to Quarry 3 landfill	189.8	189.8	m3	C.4.15	$ 5.99	$ 1,137.33		
RB_009	Y	1	9	1	Roberts Bay Communications Tower	decommission tower	1.0	1.0	Each	C.1.05	$ 679.52	$ 679.52		
		1	9	2		remove communication equipment	4.0	4.0	each	C.1.07	$ 374.34	$ 1,497.34		
		1	9	3		dismantle towers	1.0	1.0	each	C.3.11	$ 15,749.71	$ 15,749.71		
		1	9	4		collect all debris	2.9	2.9	m2	C.3.10	$ 0.37	$ 1.08		
		1	9	5		load waste into containers	4.1	4.1	m3	C.4.01	$ 10.23	$ 41.50		
		1	9	6		haul containers to Quarry 3 landfill	4.1	4.1	m3	C.4.15	$ 5.99	$ 24.32		

Work Area Code		Item	Task	Sub-task	Facility Name	Task	Quantity	Quantity	Unit	Cost Code	Unit Cost	Activity Total	Subtotals	Source / Comments
RP_004	Y	12	4	1	Reagent Pads Exploration Drilling Support Shop	Decommission electrical, mechanical, heating	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
		12	4	2		demolish building (tent structure)	708.7	708.7	m3	C.3.05	$ 13.12	$ 9,298.10		
		12	4	3		prep sea-cans for moving	13.0	13.0	each	C.1.08	$ 1,368.94	$ 17,796.19		
		12	4	4		haul sea-cans Quarry 3 landfill	483.7	483.7	m3	C.4.17	$ 5.23	$ 2,529.95		
		12	4	5		collect all debris	1449.0	1449.0	m2	C.3.10	$ 0.37	$ 543.29		
		12	4	6		load waste into containers	12.4	12.4	m3	C.4.01	$ 10.23	$ 126.85		
		12	4	7		haul containers to Quarry 3 landfill	12.4	12.4	m3	C.4.17	$ 5.23	$ 64.87		
DM_001	Y	2	1	1	Doris Accommodation Complex	decommission (electrical, mechanical, plumbing)	103.0	103.0	each	C.1.05	$ 679.52	$ 69,990.15		
		2	1	2		demolish trailers	11184.8	11184.8	m3	C.3.05a	$ 13.32	$ 148,980.27		
		2	1	3		demolish cabins	319.1	319.1	m3	C.3.05	$ 13.12	$ 4,186.49		
		2	1	4		demolish cribbing, stairs, entryways, etc.	221.4	221.4	m3	C.3.05	$ 13.12	$ 2,904.92		
		2	1	5		demolish arctic corridor	132.5	132.5	m3	C.3.05	$ 13.12	$ 1,738.49		
		2	1	6		collect all debris	21050.0	21050.0	m2	C.3.10	$ 0.37	$ 7,892.45		
		2	1	7		load waste into containers	7426.1	7426.1	m3	C.4.01	$ 10.23	$ 75,953.37		
		2	1	8		haul containers to Quarry 3 landfill	7426.1	7426.1	m3	C.4.14	$ 4.70	$ 34,900.35		
DM_002	Y	2	2	1	Doris Backup Power generator	decommission (electrical)	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
		2	2	2		disconnect generator units and prep for shipping off-site	2.0	2.0	each	C.1.06	$ 784.27	$ 1,568.55		
		2	2	3		haul units to quarry 3 landfill	67.6	67.6	m3	C.4.14	$ 4.70	$ 317.70		
		2	2	4		demolish tent housing structure	1296.6	1296.6	m3	C.3.05	$ 13.12	$ 17,012.28		
		2	2	5		collect all debris	259.3	259.3	m2	C.3.10	$ 0.37	$ 97.23		
		2	2	6		load waste into containers	21.4	21.4	m3	C.4.01	$ 10.23	$ 218.68		
		2	2	7		haul containers to Quarry 3 landfill	21.4	21.4	m3	C.4.14	$ 4.70	$ 100.48		
DM_004	Y	2	4	1	Doris Communications Tower	Remove communications equipment	12.0	12.0	each	C.1.07	$ 374.34	$ 4,492.02		
		2	4	2		Dismantle the communications towers and prepare for shipping off-site	2.0	2.0	each	C.3.11	$ 15,749.71	$ 31,499.41		
		2	4	3		Demolish equipment housing shack	24.0	24.0	m3	C.3.05	$ 13.12	$ 315.06		
		2	4	4		Remove electrical and fiber optics cables	12.0	12.0	each	C.1.05	$ 679.52	$ 8,154.19		
		2	4	5		Remove all equipment, material, and waste from Doris Mountain,	9.0	9.0	m3	C.3.17	$ 2,509.33	$ 22,514.46		
		2	4	6		load waste into containers	9.0	9.0	m3	C.4.01	$ 10.23	$ 91.77		
		2	4	7		haul containers to Quarry 3 landfill	9.0	9.0	m3	C.4.14	$ 4.70	$ 42.17		
		2	4	8		Transport Communications tower equipment to Roberts Bay	37.2	37.2	m3	C.4.04	$ 2.30	$ 85.49		
DM_005	Y	2	5	1	Doris Fire Water Storage Tank	decommission and disconnect electrical and plumbing	3.0	3.0	each	C.1.03	$ 1,327.71	$ 3,983.12		
		2	5	2		disconnect and remove container housing the pumps and controls, and prep for shipping	1.0	1.0	each	C.1.08	$ 1,368.94	$ 1,368.94		
		2	5	3		haul container to Quarry 3 landfill	74.4	74.4	m3	C.4.14	$ 4.70	$ 349.75		
		2	5	4		remove tank insulation	1.0	1.0	each	C.3.15	$ 746.46	$ 746.46		
		2	5	5		dismantle tanks and cut into manageable pieces	1.0	1.0	LS	X.08	$ 100,000.00	$ 100,000.00		
		2	5	6		prepare pieces for transportation	1.5	1.5	m3	C.4.01	$ 10.23	$ 15.78		
		2	5	7		haul containers to Quarry 3 landfill	1.5	1.5	m3	C.4.14	$ 4.70	$ 7.25		
		2	5	8		collect debris	73.1	73.1	m2	C.3.10	$ 0.37	$ 27.42		
		2	5	9		load waste into containers	0.0	0.0	m3	C.4.01	$ 10.23	$ 0.45		
		2	5	10		haul containers to Quarry 3 landfill	0.0	0.0	m3	C.4.14	$ 4.70	$ 0.21		
DM_008	Y	2	8	1	Doris Muster Station	demolish tent structure	227.3	227.3	m3	C.3.05	$ 13.12	$ 2,982.38		
		2	8	2		dismantle wood flooring	27.3	27.3	m3	C.3.05	$ 13.12	$ 357.89		
		2	8	3		collect debris	90.9	90.9	m2	C.3.10	$ 0.37	$ 34.09		
		2	8	4		load debris into containers for transport	48.2	48.2	m3	C.4.01	$ 10.23	$ 493.38		
		2	8	5		haul debris to quarry 3 landfill	48.2	48.2	m3	C.4.14	$ 4.70	$ 226.71		
DM_009	Y	2	9	1	Doris Offices & Mine Dry Complex	decommission (electrical, mechanical, plumbing)	3.0	3.0	each	C.1.05	$ 679.52	$ 2,038.55		
		2	9	2		disconnect trailers and prep for moving (remove boards, cladding, etc.; wrap in plastic)	17.0	17.0	each	C.1.08	$ 1,368.94	$ 23,271.94		
		2	9	3		haul trailers to Quarry 3 landfill	145670.5	145670.5	m3	C.4.14	$ 4.70	$ 684,607.24		
		2	9	4		demolish arctic corridor	219.5	219.5	m3	C.3.05	$ 13.12	$ 2,879.68		
		2	9	5		demolish cribbing, stairs, entryways, etc.	45.9	45.9	m3	C.3.05	$ 13.12	$ 602.24		
		2	9	6		collect all debris	2034.9	2034.9	m2	C.3.10	$ 0.37	$ 762.97		
		2	9	7		load waste into containers	1.2	1.2	m3	C.4.01	$ 10.23	$ 12.49		
		2	9	8		haul containers to Quarry 3 landfill	1.2	1.2	m3	C.4.14	$ 4.70	$ 5.74		
DM_011	Y	2	11	1	Doris Permanent Power Generator	decommission (electrical)	8.0	8.0	each	C.1.06	$ 784.27	$ 6,274.19		
		2	11	2		disconnect containers and prep for shipping off-site	8.0	8.0	each	C.1.08	$ 1,368.94	$ 10,951.50		
		2	11	3		haul containers to Roberts bay laydown	264.8	264.8	m3	C.4.04	$ 2.30	$ 608.35		
		2	11	4		dismantle stacks	40.0	40.0	m	C.3.13	$ 136.30	$ 5,452.16		
		2	11	5		prep stacks for shipping	40.0	40.0	m	C.3.12	$ 627.24	$ 25,089.76		
		2	11	6		haul stack sections to Quarry 3 landfill	166.0	166.0	m3	C.4.14	$ 4.70	$ 780.15		
		2	11	7		collect all debris	2103.6	2103.6	m2	C.3.10	$ 0.37	$ 788.73		
		2	11	8		load waste into containers	1.3	1.3	m3	C.4.01	$ 10.23	$ 12.91		
		2	11	9		haul containers to Quarry 3 landfill	1.3	1.3	m3	C.4.14	$ 4.70	$ 5.93		
DM_017	Y	2	17	1	Doris Sewage Treatment Plant	ve sewage plumbing, collect sewage sludge/waste water in 55 gallon drums	9.0	9.0	each	C.2.06	$ 677.68	$ 6,099.16		
		2	17	2		decommission (electrical)	9.0	9.0	each	C.1.05	$ 679.52	$ 6,115.64		
		2	17	3		disconnect containers and prep for shipping	9.0	9.0	each	C.1.08	$ 1,368.94	$ 12,320.44		
		2	17	4		haul containers to Quarry 3 landfill	671.4	671.4	m3	C.4.14	$ 4.70	$ 3,155.50		
		2	17	5		collect debris	268.6	268.6	m2	C.3.10	$ 0.37	$ 100.70		
		2	17	6		load waste into containers	24.0	24.0	m3	C.4.01	$ 10.23	$ 245.05		
		2	17	7		haul containers to Quarry 3 landfill	24.0	24.0	m3	C.4.14	$ 4.70	$ 112.60		
DM_019	Y	2	19	1	Doris Swick Shop	demolish tent structure	859.2	859.2	m3	C.3.05	$ 13.12	$ 11,272.81		
		2	19	2		collect debris	229.1	229.1	m2	C.3.10	$ 0.37	$ 85.90		
		2	19	3		load waste into containers	18.3	18.3	m3	C.4.01	$ 10.23	$ 187.50		
		2	19	4		haul containers to Quarry 3 landfill	18.3	18.3	m3	C.4.14	$ 4.70	$ 86.15		
DM_021	Y	2	21	1	Doris Process Plant	decommission crusher, milling, and process plants	1.0	1.0	each	X.09	$ 100,000.00	$ 100,000.00		
		2	21	2		Drain chemicals and reagents into containers for shipping off site	8.3	8.3	m3	C.2.01	$ 2,699.56	$ 22,460.31		
		2	21	3		disassemble equipment	1.0	1.0	each	X.10	$ 200,000.00	$ 200,000.00		
		2	21	4		prepare equipment for shipping	1.0	1.0	each	X.11	$ 50,000.00	$ 50,000.00		
		2	21	5		demolish / dismantle mill building	123540.0	123540.0	m3	C.3.05a	$ 13.32	$ 1,645,538.85		
		2	21	6		Collect Debris	8700.0	8700.0	m2	C.3.10	$ 0.37	$ 3,261.96		
		2	21	7		load waste into containers	8522.2	8522.2	m3	C.4.01	$ 10.23	$ 87,163.94		
		2	21	8		haul containers to Quarry 3 landfill	8522.2	8522.2	m3	C.4.14	$ 4.70	$ 40,051.57		
		2	21	9		transport drums to Roberts Bay	8.3	8.3	m3	C.4.04	$ 2.30	$ 19.11		
DM_022	Y	2	22	1	Doris Underground Support Mechanical Shop	trical, mechanical (including connections to generator house & transformer)	3.0	3.0	each	C.1.05	$ 679.52	$ 2,038.55		
		2	22	2		demolish building	2281.6	2281.6	m3	C.3.05	$ 13.12	$ 29,935.55		
		2	22	3		collect debris	456.3	456.3	m2	C.3.10	$ 0.37	$ 171.09		
		2	22	4		load waste into containers	549.7	549.7	m3	C.4.01	$ 10.23	$ 5,622.39		
		2	22	5		haul containers to Quarry 3 landfill	549.7	549.7	m3	C.4.14	$ 4.70	$ 2,583.47		
DM_023	Y	2	23	1	Doris Underground Wash Bay	demolish tent structure	776.9	776.9	m3	C.3.05	$ 13.12	$ 10,193.20		
		2	23	2		collect debris	155.4	155.4	m2	C.3.10	$ 0.37	$ 58.26		
		2	23	3		load waste into containers	13.5	13.5	m3	C.4.01	$ 10.23	$ 138.24		
		2	23	4		haul containers to Quarry 3 landfill	13.5	13.5	m3	C.4.14	$ 4.70	$ 63.52		
DM_024	Y	2	24	1	Doris Warehouse / Core Shack	demolish tent structure	3422.2	3422.2	m3	C.3.05	$ 13.12	$ 44,901.62		
		2	24	2		dismantle wood flooring, shelving, and lofts	186.2	186.2	m3	C.3.05	$ 13.12	$ 2,443.18		
		2	24	3		collect debris	720.1	720.1	m2	C.3.10	$ 0.37	$ 269.98		
		2	24	4		load waste into containers	350.7	350.7	m3	C.4.01	$ 10.23	$ 3,587.41		
		2	24	5		haul containers to Quarry 3 landfill	350.7	350.7	m3	C.4.14	$ 4.70	$ 1,648.40		
		2	24	6		haul all warehouse containers to Quarry 3 landfill	796.8	796.8	m3	C.4.14	$ 4.70	$ 3,744.72		
MN_004	Y	5	4	1	Madrid North Emergency Shelter	decommission (electrical, mechanical, plumbing)	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
		5	4	2		demolish trailers	75.0	75.0	each	C.3.05	$ 13.12	$ 984.05		
		5	4	3		demolish cribbing, stairs, entryways, etc.	4.1	4.1	m3	C.3.05	$ 13.12	$ 53.14		
		5	4	4		collect all debris	30.0	30.0	m2	C.3.10	$ 0.37	$ 11.25		
		5	4	5		load waste into containers	4.1	4.1	m3	C.4.01	$ 10.23	$ 41.61		
		5	4	6		haul containers to Quarry 3 landfill	51.2	51.2	m3	C.4.59	$ 4.92	$ 251.53		
MN_005	Y	5	5	1	Madrid North Office Trailer	decommission (electrical, mechanical, plumbing)	3.0	3.0	each	C.1.05	$ 679.52	$ 2,038.55		
		5	5	2		demolish trailer	75.0	75.0	m3	C.3.05	$ 13.12	$ 984.05		
		5	5	3		demolish cribbing, stairs, entryways, etc.	4.1	4.1	m3	C.3.05	$ 13.12	$ 53.14		
		5	5	4		collect all debris	30.0	30.0	m2	C.3.10	$ 0.37	$ 11.25		
		5	5	5		load waste into containers	4.1	4.1	m3	C.4.01	$ 10.23	$ 41.61		
		5	5	6		haul containers to Quarry 3 landfill	51.2	51.2	m3	C.4.59	$ 4.92	$ 251.53		
MN_007	Y	5	7	1	Madrid North Mine Equipment Shop	decommission electrical, mechanical, heating	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
		5	7	2		demolish equipment shop	1125.0	1125.0	m3	C.3.05	$ 13.12	$ 14,760.77		
		5	7	3		collect all debris	450.0	450.0	m2	C.3.10	$ 0.37	$ 168.72		
		5	7	4		load waste into containers off-site	0.3	0.3	m3	C.4.01	$ 10.23	$ 2.76		
		5	7	5		haul containers to Quarry 3 landfill	481.8	481.8	m3	C.4.59	$ 4.92	$ 2,368.24		
MN_008	Y	5	8	1	Madrid North Compressor Building	decommission (electrical)	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
		5	8	2		disconnect compressor units and prep for shipping off-site	2.0	2.0	each	C.1.06	$ 784.27	$ 1,568.55		
		5	8	3		haul units to Roberts bay laydown	37.2	37.2	m3	C.4.22	$ 5.02	$ 186.76		
		5	8	4		demolish tent housing structure	62.5	62.5	m3	C.3.05	$ 13.12	$ 820.04		
		5	8	5		collect all debris	25.0	25.0	m2	C.3.10	$ 0.37	$ 9.37		
		5	8	6		load waste into containers off-site	5.9	5.9	m3	C.4.01	$ 10.23	$ 59.99		
		5	8	7		haul containers to Quarry 3 landfill	5.9	5.9	m3	C.4.59	$ 4.92	$ 28.83		
MN_009	Y	5	9	1	Madrid North Diesel Generator	decommission (electrical)	1.0	1.0	each	C.1.06	$ 784.27	$ 784.27		
		5	9	2		disconnect containers and prep for shipping off-site	1.0	1.0	each	C.1.08	$ 1,368.94	$ 1,368.94		
		5	9	3		haul containers to Roberts bay laydown	46.9	46.9	m3	C.4.22	$ 5.02	$ 235.28		
		5	9	4		demolish tent housing structure	46.9	46.9	m3	C.3.05	$ 13.12	$ 615.03		
		5	9	5		collect all debris	18.8	18.8	m2	C.3.10	$ 0.37	$ 7.03		
		5	9	6		load waste into containers	1.9	1.9	m3	C.4.01	$ 10.23	$ 19.23		
		5	9	7		haul containers to Quarry 3 landfill	1.9	1.9	m3	C.4.59	$ 4.92	$ 9.24		
MN_013	Y	5	13	1	Madrid North Water Storage Tank with Containment	drain tanks into portable storage (envirotanks)	1.0	1.0	each	C.2.03	$ 0.02	$ 0.02		
		5	13	2		wash tanks	1.0	1.0	each	C.2.04	$ 1,186.71	$ 1,186.71		
		5	13	3		disconnect piping and controls	1.0	1.0	each	C.1.02	$ 476.06	$ 476.06		
		5	13	4		dismantle tanks and cut into manageable pieces	1.0	1.0	each	X.08	$ 100,000.00	$ 100,000.00		
		5	13	5		prepare pieces for transportation	2.4	2.4	m3	C.4.01	$ 10.23	$ 24.55		
		5	13	6		haul cut metal to quarry 3 landfill	2.4	2.4	m3	C.4.59	$ 4.92	$ 11.80		
		5	13	7		excavate and stockpile liner protection cover	259.2	259.2	m3	C.5.04	$ 2.75	$ 712.46		
		5	13	8		clean liner	144.0	144.0	m2	C.2.10	$ 0.41	$ 59.34		
		5	13	9		remove and cut liner into manageable pieces	144.0	144.0	m2	C.3.02	$ 0.17	$ 24.53		
		5	13	10		load waste into containers	1.3	1.3	m3	C.4.01	$ 10.23	$ 13.26		
		5	13	11		haul containers to Quarry 3 landfill	1.3	1.3	m3	C.4.59	$ 4.92	$ 6.37		
MN_015	Y	5	15	1	Madrid North Brine Mixing Facility	load contained contaminated soils into megabags for hauling	5.6	5.6	m3	C.4.12	$ 72.73	$ 409.11		assume 50% of liner protection cover is contaminated
		5	15	2		haul megabags to Madrid north underground	5.6	5.6	m3	C.5.22	$ 15.37	$ 86.44		
		5	15	3		collect all debris	18.8	18.8	m2	C.3.10	$ 0.37	$ 7.03		
		5	15	4		clean liner	18.8	18.8	m2	C.2.10	$ 0.41	$ 7.73		
		5	15	5		remove and cut liner into manageable pieces	18.8	18.8	m2	C.3.02	$ 0.17	$ 3.19		
		5	15	6		load waste into containers	0.2	0.2	m3	C.4.01	$ 10.23	$ 1.82		
		5	15	7		haul containers to Quarry 3 landfill	0.2	0.2	m3	C.4.25	$ 3.26	$ 0.58		
MN_019	Y	5	19	1	Madrid North Power Plant	decommission (electrical)	4.0	4.0	each	C.1.06	$ 784.27	$ 3,137.10		
		5	19	2		demolish building	2375.0	2375.0	m3	C.3.05a	$ 13.32	$ 31,634.73		
		5	19	3		dismantle stacks	40.0	40.0	m	C.3.13	$ 136.30	$ 5,452.16		
		5	19	4		prep stacks for shipping	40.0	40.0	m	C.3.12	$ 627.24	$ 25,089.76		
		5	19	5		haul stack sections to Quarry 3 landfill	166.0	166.0	m3	C.4.59	$ 4.92	$ 816.01		
		5	19	6		collect all debris	950.0	950.0	m2	C.3.10	$ 0.37	$ 356.19		
		5	19	7		load waste into containers	738.0	738.0	m3	C.4.01	$ 10.23	$ 7,548.51		
		5	19	8		haul containers to Quarry 3 landfill	738.0	738.0	m3	C.4.59	$ 4.92	$ 3,627.95		
MN_021	Y	5	21	1	Madrid North Concentrator	decommission crusher, milling, and process plants	1.0	1.0	each	X.09	$ 100,000.00	$ 100,000.00		
		5	21	2		Drain chemicals and reagents into containers for shipping off site	4.2	4.2	m3	C.2.01	$ 2,699.56	$ 11,230.16		
		5	21	3		disassemble equipment	1.0	1.0	each	X.10	$ 200,000.00	$ 200,000.00		
		5	21	4		prepare equipment for shipping	1.0	1.0	each	X.11	$ 50,000.00	$ 50,000.00		
		5	21	5		demolish / dismantle mill building	23075.0	23075.0	m3	C.3.05a	$ 13.32	$ 307,356.39		
		5	21	6		Collect Debris	1625.0	1625.0	m2	C.3.10	$ 0.37	$ 609.28		
		5	21	7		load waste into containers	3691.8	3691.8	m3	C.4.01	$ 10.23	$ 37,759.42		
		5	21	8		haul containers to Quarry 3 landfill	3691.8	3691.8	m3	C.4.59	$ 4.92	$ 18,147.84		
		5	21	9		transport drums to Roberts Bay	4.2	4.2	m3	C.4.22	$ 5.02	$ 20.88		
MS_004	Y	7	4	1	Madrid South Mine Equipment Shop	decommission electrical, mechanical, heating	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
		7	4	2		demolish tent housing structure	2250.0	2250.0	m3	C.3.05	$ 13.12	$ 29,521.54		
		7	4	3		collect all debris	450.0	450.0	m2	C.3.10	$ 0.37	$ 168.72		
		7	4	4		load waste into containers	35.4	35.4	m3	C.4.01	$ 10.23	$ 361.76		
		7	4	5		haul containers to Quarry 3 landfill	35.4	35.4	m3	C.4.25	$ 3.26	$ 115.30		
MS_005	Y	7	5	1	Madrid South Emergency Shelter	decommission (electrical, mechanical, plumbing)	3.0	3.0	each	C.1.05	$ 679.52	$ 2,038.55		
		7	5	2		demolish structure	75.0	75.0	each	C.3.05	$ 13.12	$ 984.05		
		7	5	3		demolish cribbing, stairs, entryways, etc.	4.1	4.1	m3	C.3.05	$ 13.12	$ 53.14		
		7	5	4		collect all debris	30.0	30.0	m2	C.3.10	$ 0.37	$ 11.25		
		7	5	5		load waste into containers	51.2	51.2	m3	C.4.01	$ 10.23	$ 523.34		
		7	5	6		haul containers to Quarry 3 landfill	51.2	51.2	m3	C.4.25	$ 3.26	$ 166.80		
MS_006	Y	7	6	1	Madrid South Office Trailer	decommission (electrical, mechanical, plumbing)	3.0	3.0	each	C.1.05	$ 679.52	$ 2,038.55		
		7	6	2		demolish structure	75.0	75.0	each	C.3.05	$ 13.12	$ 984.05		
		7	6	3		demolish cribbing, stairs, entryways, etc.	4.1	4.1	m3	C.3.05	$ 13.12	$ 53.14		
		7	6	4		collect all debris	30.0	30.0	m2	C.3.10	$ 0.37	$ 11.25		
		7	6	5		load waste into containers	51.2	51.2	m3	C.4.01	$ 10.23	$ 523.34		
		7	6	6		haul containers to Quarry 3 landfill	51.2	51.2	m3	C.4.25	$ 3.26	$ 166.80		
MS_007	Y	7	7	1	Madrid South Diesel Generator	decommission (electrical)	1.0	1.0	each	C.1.06	$ 784.27	$ 784.27		
		7	7	2		demolish tent housing structure	46.9	46.9	m3	C.3.05	$ 13.12	$ 615.03		
		7	7	3		collect all debris	18.8	18.8	m2	C.3.10	$ 0.37	$ 7.03		
		7	7	4		load waste into containers	1.9	1.9	m3	C.4.01	$ 10.23	$ 19.23		
		7	7	5		haul containers to Quarry 3 landfill	1.9	1.9	m3	C.4.24	$ 1.86	$ 3.50		
MS_008	Y	7	8	1	Madrid South Compressor Building	decommission (electrical)	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
		7	8	2		disconnect compressor units and prep for shipping off-site	2.0	2.0	each	C.1.06	$ 784.27	$ 1,568.55		
		7	8	3		haul units to Quarry 3 landfill	37.2	37.2	m3	C.4.59	$ 4.92	$ 182.91		
		7	8	4		demolish tent housing structure	62.5	62.5	m3	C.3.05	$ 13.12	$ 820.04		
		7	8	5		collect all debris	25.0	25.0	m2	C.3.10	$ 0.37	$ 9.37		
		7	8	6		load waste into containers	2.3	2.3	m3	C.4.01	$ 10.23	$ 23.42		
		7	8	7		haul containers to Quarry 3 landfill	2.3	2.3	m3	C.4.25	$ 3.26	$ 7.47		
MS_019	Y	7	19	1	Madrid South Brine Mixing Facility	load contained contaminated soils into megabags for hauling	7.5	7.5	m3	C.4.12	$ 72.73	$ 545.48		assume 50% of liner protection cover is contaminated
		7	19	2		haul megabags to Madrid south underground	7.5	7.5	m3	C.5.22	$ 15.37	$ 115.25		
		7	19	3		collect all debris	25.0	25.0	m2	C.3.10	$ 0.37	$ 9.37		
		7	19	4		clean liner	25.0	25.0	m2	C.2.10	$ 0.41	$ 10.30		
		7	19	5		remove and cut liner into manageable pieces	25.0	25.0	m2	C.3.02	$ 0.17	$ 4.26		
		7	19	6		load waste into containers	0.2	0.2	m3	C.4.01	$ 10.23	$ 2.43		
		7	19	7		haul containers to Quarry 3 landfill	0.2	0.2	m3	C.4.25	$ 3.26	$ 0.77		
MS_020	Y	7	20	1	Madrid South Water Storage Tank with Containment	disconnect piping and controls	1.0	1.0	each	C.1.02	$ 476.06	$ 476.06		
		7	20	2		dismantle tanks and cut into manageable pieces	1.0	1.0	each	X.08	$ 100,000.00	$ 100,000.00		
		7	20	3		prepare pieces for transportation	2.4	2.4	m3	C.4.01	$ 10.23	$ 24.55		
		7	20	4		haul cut metal to quarry 3 landfill	2.4	2.4	m3	C.4.25	$ 3.26	$ 7.83		
		7	20	5		excavate and stockpile liner protection cover	259.2	259.2	m3	C.5.04	$ 2.75	$ 712.46		
		7	20	6		clean liner	144.0	144.0	m2	C.2.10	$ 0.41	$ 59.34		
		7	20	7		remove and cut liner into manageable pieces	144.0	144.0	m2	C.3.02	$ 0.17	$ 24.53		
		7	20	8		load waste into containers	0.1	0.1	m3	C.4.01	$ 10.23	$ 0.88		
		7	20	9		haul containers to Quarry 3 landfill	0.1	0.1	m3	C.4.25	$ 3.26	$ 0.28		
Water Management													$ 324,456.73	
MN_022	Y	5	22	1	Madrid North Diversion Berm	breach berm to original ground (one location) to restore natural flow paths	75.6	75.6	m3	C.5.04	$ 2.75	$ 207.80		
		5	22	2		remove cut liners and place in containers for disposal	0.6	0.6	m3	C.3.02	$ 0.17	$ 0.10		
		5	22	3		haul containers to Quarry 3 landfill	0.6	0.6	m3	C.4.59	$ 4.92	$ 2.79		
MN_023	Y	5	23	1	Madrid North Sump	decommission sump	1.0	1.0	each	C.1.05	$ 679.52	$ 679.52		
		5	23	2		remove pumps, pipes, cables, and culverts	1.0	1.0	each	X.05	$ 2,500.00	$ 2,500.00		
		5	23	3		backfill sump excavation	17.0	17.0	m3	C.5.02	$ 16.35	$ 277.42		
Q2_003	Y	14	3	1	Quarry 2 Treated Sewage Discharge Areas	Fill in low-lying areas (assumed sourced within 0.5km)	552.0	552.0	m3	C.5.02	$ 16.35	$ 9,026.79		
		14	3	2		erosion protection: Supply and place coconut matting	460.0	460.0	m2	C.5.08	$ 4.84	$ 2,224.91		
DM_013	Y	2	13	1	Doris Run-off Diversion Berm	original ground in several locations (4 locations) to restore natural flow path	453.6	453.6	m3	C.5.04	$ 2.75	$ 1,246.81		
		2	13	2		remove cut liners and place in containers for shipping off-site and disposal	0.3	0.3	m3	C.3.02	$ 0.17	$ 0.05		
		2	13	3		haul containers to Quarry 3 landfill	0.3	0.3	m3	C.4.14	$ 4.70	$ 1.42		
DM_014	Y	2	14	1	Doris Sedimentation Berm	breach the berm to restore a free drainage path	28.8	28.8	m3	C.5.04	$ 2.75	$ 79.16		
DM_015	Y	2	15	1	Doris Sedimentation/Pollution Control Pond	disconnect piping and electrical wiring, remove sump pumps	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
		2	15	2		remove and cut liner into manageable pieces	14110.0	14110.0	m2	C.3.02	$ 0.17	$ 2,404.06		
		2	15	3		load waste into containers for hauling to landfill	70.2	70.2	m3	C.4.01	$ 10.23	$ 717.69		
		2	15	4		haul containers to Quarry 3 landfill	70.2	70.2	m3	C.4.14	$ 4.70	$ 329.78		
		2	15	5		breach contact water containment berm	3129.8	3129.8	m3	C.5.05	$ 1.23	$ 3,841.41		
DM_018	Y	2	18	1	Doris Sumps	decommission sumps	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
		2	18	2		remove pumps, pipes, cables, culverts	2.0	2.0	LS	X.05	$ 2,500.00	$ 5,000.00		
		2	18	3		backfill sump excavation	33.9	33.9	m3	C.5.02	$ 16.35	$ 554.84		
DM_026	Y	2	26	1	Doris Water Intake Structure and Pumping Facility	remove water intake line from Doris lake	25.0	25.0	lm	C.3.03	$ 11.08	$ 277.11		
		2	26	2		decommission pumping facility (remove electrical)	2.0	2.0	each	C.1.03	$ 1,327.71	$ 2,655.41		
		2	26	3		prep containers for shipping off-site	2.0	2.0	each	C.1.08	$ 1,368.94	$ 2,737.88		
		2	26	4		disconnect and remove generator fuel tank (place in Doris tank farm for cleaning)	1.0	1.0	each	C.1.01	$ 95.44	$ 95.44		
		2	26	5		clean tidytank and prep for shipping	1.0	1.0	each	C.2.02	$ 24.72	$ 24.72		
		2	26	6		run oil-water separator	1.0	1.0	m3	C.2.08	$ 32.80	$ 32.80		
		2	26	7		prep generator container for shipping	1.0	1.0	each	C.1.08	$ 1,368.94	$ 1,368.94		
		2	26	8		haul containers to Roberts bay laydown	66.4	66.4	m3	C.4.04	$ 2.30	$ 152.55		
		2	26	9		collect debris	2226.2	2226.2	m2	C.3.10	$ 0.37	$ 834.68		
		2	26	10		load debris into containers for transport	21.3	21.3	m3	C.4.01	$ 10.23	$ 218.22		
		2	26	11		haul debris to quarry 3 landfill	21.3	21.3	m3	C.4.14	$ 4.70	$ 100.27		
DM_035	Y	2	35	1	Doris Pad U Sedimentation/Pollution Control Pond	disconnect piping and electrical wiring, remove sump pumps	1.0	1.0	each	C.1.05	$ 679.52	$ 679.52		
		2	35	2		load waste into containers	1.9	1.9	m3	C.4.01	$ 10.23	$ 19.33		
		2	35	3		haul containers to Quarry 3 landfill	1.9	1.9	m3	C.4.14	$ 4.70	$ 8.88		
		2	35	4		breach contact water containment berm	1008.0	1008.0	m3	C.5.05	$ 1.23	$ 1,237.17		
		2	35	5		remove and cut liner at breach into manageable pieces	210.0	210.0	m2	C.3.02	$ 0.17	$ 35.78		
MN_003	Y	5	3	1	Madrid North Contact Water Pond Berm	disconnect piping and electrical wiring, remove sump pumps	1.0	1.0	each	C.1.05	$ 679.52	$ 679.52		
		5	3	2		load waste into containers	1.9	1.9	m3	C.4.01	$ 10.23	$ 19.33		
		5	3	3		haul containers to Quarry 3 landfill	1.9	1.9	m3	C.4.59	$ 4.92	$ 9.29		
		5	3	4		breach contact water containment berm	1008.0	1008.0	m3	C.5.05	$ 1.23	$ 1,237.17		
		5	3	5		remove and cut liner at breach into manageable pieces	210.0	210.0	m2	C.3.02	$ 0.17	$ 35.78		
MS_003	Y	7	3	1	Madrid South Primary Contact Water Pond Berm	disconnect piping and electrical wiring, remove sump pumps	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
		7	3	2		load waste into containers	1.9	1.9	m3	C.4.01	$ 10.23	$ 19.33		
		7	3	3		haul containers to Quarry 3 landfill	1.9	1.9	m3	C.4.25	$ 3.26	$ 6.16		
		7	3	4		breach contact water containment berm	1008.0	1008.0	m3	C.5.05	$ 1.23	$ 1,237.17		
		7	3	5		remove and cut liner from breach into manageable pieces	210.0	210.0	m2	C.3.02	$ 0.17	$ 35.78		

Work Area Code		Item	Task	Sub-task	Facility Name	Task	Quantity	Quantity	Unit	Cost Code	Unit Cost	Activity Total	Subtotals	Source / Comments
MS_012	Y	7	12	1	Madrid South Haul Road / Secondary Contact Water Po	disconnect piping and electrical wiring, remove sump pumps	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
		7	12	2		load waste into containers for hauling	1.9	1.9	m3	C.4.01	$ 10.23	$ 19.33		
		7	12	3		haul containers to Quarry 3 landfill	1.9	1.9	m3	C.4.25	$ 3.26	$ 6.16		
		7	12	4		breach contact water containment berm	1008.0	1008.0	m3	C.5.05	$ 1.23	$ 1,237.17		
		7	12	5		remove and cut liner from breach into manageable pieces	210.0	210.0	m2	C.3.02	$ 0.17	$ 35.78		
CM_001	Y	17	1	1	Closure Drain Reclaim Pond	Pump technician	170.0	170.0	day	day rate	$ 1,189.13	$ 202,151.32		first 2 seasons of pumping occur while under C&M, only last season accounted here
		17	1	2		Support person (camp, etc.)	0.0	0.0	day	day rate	$ 2,000.00	$ -		camp costs are covered under general closure activities
		17	1	3		Site Services Support &Maintenance	1.0	1.0	-	LS	$ 50,000.00	$ 50,000.00		first 2 seasons of pumping occur while under C&M
		17	1	4		Spare Parts & Consumables	1.0	1.0	-	LS	$ 20,000.00	$ 20,000.00		first 2 seasons of pumping occur while under C&M
Rock Fill Pads													$ 1,052,105.17	
WC_010	Y	19	10	1	Windy Summer Debris Collection	collect misc. debris scattered around site and stockpile	40000.0	40000.0	m2	C.3.10	$ 0.37	$ 14,997.54		
		19	10	2		load stockpiled debris into container for transport (to landfill)	30.0	30.0	m3	C.4.01	$ 10.23	$ 306.84		
		19	10	3		haul materials to landfill	30.0	30.0	m3	C.4.63	$ 4.04	$ 121.34		
WC_012	Y	19	12	1	Windy Reclaim Drill Holes	cut top of drill pipes and cap	889.0	889.0	each	C.3.09	$ 13.11	$ 11,653.69		
		19	12	2		load debris into containers for disposal	10.0	10.0	m3	C.4.01	$ 10.23	$ 101.82		
		19	12	3		Fill in low-lying areas (assumed sourced within 0.5km)	100.0	100.0	m3	C.5.02	$ 16.35	$ 1,635.29		
		19	12	4		supply and place coconut matting	100.0	100.0	m2	C.5.08	$ 4.84	$ 483.68		
		19	12	5		revegetate area	100.0	100.0	m2	C.5.13	$ 0.92	$ 92.03		
WC_011	Y	19	11	1	Windy Developed Areas (for regrading)	stake-out low lying areas in summer to place fill	1.0	1.0	day	C.5.14	$ 7,186.44	$ 7,186.44		
		19	11	2		apply nutrients for soil bioremediation	113.5	113.5	m3	H.07	$ 260.00	$ 29,510.00		
		19	11	3		excavate hydrocarbon contaminated soil and place in megabags	717.2	717.2	m3	C.4.12	$ 72.73	$ 52,162.65		
		19	11	4		place megabags into containers	717.2	717.2	m3	C.4.61	$ 20.91	$ 14,995.32		
		19	11	5		haul containers to Madrid North Underground	717.2	717.2	m3	C.4.14	$ 4.70	$ 3,370.62		
		19	11	6		excavate and place soil in megabags (for transport to Doris OVB dump)	60.0	60.0	m3	C.4.12	$ 72.73	$ 4,363.86		
		19	11	7		place megabags into containers	60.0	60.0	m3	C.5.02	$ 16.35	$ 981.17		
		19	11	8		empty megabags	60.0	60.0	m3	C.4.62	$ 34.30	$ 2,058.13		
		19	11	9		haul containers to Doris OVB Dump	60.0	60.0	m3	C.4.60	$ 2.77	$ 165.94		
		19	11	10		Load, Haul, Dump, Place from Quarry D (less than 1 km)	662.0	662.0	m3	C.5.12	$ 12.69	$ 8,398.25		
PLA_003	Y	18	3	1	Patch Lake Developed Areas (for regrading)	excavate impacted soil and place in megabags	243.6	243.6	m3	C.4.12	$ 72.73	$ 17,717.27		
		18	3	2		haul containers to Madrid North Underground	243.6	243.6	m3	C.4.14	$ 4.70	$ 1,144.85		
		18	3	3		backfill area with ROQ	243.6	243.6	m3	C.5.12	$ 12.69	$ 3,090.21		
		18	3	4		regrade for positive drainage	291.0	291.0	m2	C.5.05	$ 1.23	$ 357.16		
		18	3	5		in-situ bioremediation	39.0	39.0	m3	H.07	$ 260.00	$ 10,140.00		
		18	3	6		install silt fencing	1.0	1.0	LS	X.18	$ 2,500.00	$ 2,500.00		
RB_006	Y	1	6	1	Roberts Bay Laydown Area	decommission vehicle plug system	1.0	1.0	each	C.1.05	$ 679.52	$ 679.52		
		1	6	2		remove cables and posts	8.0	8.0	each	C.3.14	$ 411.17	$ 3,289.39		
		1	6	3		collect all debris	63291.6	63291.6	m2	C.3.10	$ 0.37	$ 23,730.46		
		1	6	4		load waste into containers	20.0	20.0	m3	C.4.01	$ 10.23	$ 204.56		
		1	6	5		haul debris to quarry 3 landfill	20.0	20.0	m3	C.4.15	$ 5.99	$ 119.87		
		1	6	6		regrade area for positive drainage	63291.6	63291.6	m2	C.5.18	$ 0.01	$ 625.29		
RB_011	Y	1	11	1	Roberts Bay Developed Areas (for regrading)	regrade for positive drainage	137500.0	137500.0	m2	C.5.18	$ 0.01	$ 1,358.43		
RP_001	Y	12	1	1	Reagent Pads Equipment Laydown Area	collect all debris	35244.0	35244.0	m2	C.3.10	$ 0.37	$ 13,214.33		
		12	1	2		load waste for transport to landfill	20.0	20.0	m3	C.4.01	$ 10.23	$ 204.56		
		12	1	3		regrade area for positive drainage	35244.0	35244.0	m2	C.5.18	$ 0.01	$ 348.19		
		12	1	4		haul waste to Quarry 3 Landfill	20.0	20.0	m3	C.4.17	$ 5.23	$ 104.60		
RP_002	Y	12	2	1	Reagent Pads Materials Laydown Area	collect all debris	25421.0	25421.0	m2	C.3.10	$ 0.37	$ 9,531.31		
		12	2	2		load waste to ship to Landfill	20.0	20.0	m3	C.4.01	$ 10.23	$ 204.56		
		12	2	3		regrade area for positive drainage	25421.0	25421.0	m2	C.5.18	$ 0.01	$ 251.15		
		12	2	4		haul waste to Quarry 3 Landfill	20.0	20.0	m3	C.4.17	$ 5.23	$ 104.60		
RP_003	Y	12	3	1	Reagent Pads Ammonium Nitrate Storage Area	remove and stockpile liner protection cover	893.2	893.2	m3	C.5.04	$ 2.75	$ 2,455.02		
		12	3	2		clean liner	2481.0	2481.0	m2	C.2.10	$ 0.41	$ 1,022.30		
		12	3	3		remove and cut liner into manageable pieces	2481.0	2481.0	m2	C.3.02	$ 0.17	$ 422.71		
		12	3	4		load waste for transport to landfill	22.3	22.3	m3	C.4.01	$ 10.23	$ 228.38		
		12	3	5		Haul waste to Quarry 3 Landfill	22.3	22.3	m3	C.4.17	$ 5.23	$ 116.78		
		12	3	6		level containment berms	31.7	31.7	m2	C.5.05	$ 1.23	$ 38.91		
		12	3	7		regrade area for positive drainage	2481.0	2481.0	m2	C.5.18	$ 0.01	$ 24.51		
WM_001	Y	13	1	1	Waste Management Area Land Farm	load contained contaminated soils into megabags for hauling	100.0	100.0	m3	C.4.12	$ 72.73	$ 7,273.10		
		13	1	2		haul megabags to Doris underground	100.0	100.0	m3	C.5.22	$ 15.37	$ 1,536.70		
		13	1	3		treat contained water and discharge	1.0	1.0	LS	X.03	$ 5,000.00	$ 5,000.00		
		13	1	4		remove and stockpile liner protection cover	2591.0	2591.0	m3	C.5.04	$ 2.75	$ 7,121.87		
		13	1	5		clean liner	4384.0	4384.0	m2	C.2.10	$ 0.41	$ 1,806.44		
		13	1	6		remove and cut liner into manageable pieces	4384.0	4384.0	m2	C.3.02	$ 0.17	$ 746.95		
		13	1	7		load waste for transport to landfill	118.4	118.4	m3	C.4.01	$ 10.23	$ 1,210.66		
		13	1	8		Haul Material to Quarry 3 Landfill	118.4	118.4	m3	C.4.14	$ 4.70	$ 556.29		
		13	1	9		breach contact water containment berm	90.0	90.0	m3	C.5.04	$ 2.75	$ 247.38		
		13	1	10		regrade area for positive drainage	4384.0	4384.0	m2	C.5.18	$ 0.01	$ 43.31		
WM_002	Y	13	2	1	Waste Management Area Batch Plant Pad	demolish tent structure	3701.7	3701.7	m3	C.3.05	$ 13.12	$ 48,568.17		
		13	2	2		collect all debris	740.3	740.3	m2	C.3.10	$ 0.37	$ 277.58		
		13	2	3		load waste for transport to landfill	55.9	55.9	m3	C.4.01	$ 10.23	$ 571.56		
		13	2	4		haul waste to Quarry 3 Landfill	55.9	55.9	m3	C.4.17	$ 5.23	$ 292.27		
		13	2	5		regrade area for positive drainage	740.3	740.3	m2	C.5.18	$ 0.01	$ 7.31		
WM_003	Y	13	3	1	Waste Management Area Burn Pan	Collect ashes and place in containers	0.1	0.1	m3	C.2.07	$ 763.55	$ 76.35		
		13	3	2		Dismantle (welding crew)	1.0	1.0	each	C.3.08	$ 534.78	$ 534.78		
		13	3	3		load waste into containers	0.2	0.2	m3	C.4.01	$ 10.23	$ 2.52		
		13	3	4		haul containers to Boston landfill	0.2	0.2	m3	C.4.44	$ 3.26	$ 0.80		
		13	3	5		regrade area for positive drainage	400.0	400.0	m2	C.5.18	$ 0.01	$ 3.95		
WM_004	Y	13	4	1	Waste Management Area Core Storage Area	load core boxes into containers for shipping	500.0	500.0	each	C.6.02	$ 11.36	$ 5,679.34		
		13	4	2		collect all debris	10000.0	10000.0	m2	C.3.10	$ 0.37	$ 3,749.38		
		13	4	3		load waste into containers	6.0	6.0	m3	C.4.01	$ 10.23	$ 61.37		
		13	4	4		haul debris to Boston landfill	6.0	6.0	m3	C.4.44	$ 3.26	$ 19.56		
DM_032	Y	2	32	1	Doris Developed Areas (for regrading)	regrade for positive drainage	460000.0	460000.0	m2	C.5.18	$ 0.01	$ 4,544.58		
DW_008	Y	3	8	1	Doris-Windy All Weather Road Core Storage Area	load core boxes into containers for shipping	1665.0	1665.0	m3	C.4.01	$ 10.23	$ 17,029.48		
		3	8	2		haul containers to Quarry 3 landfill	1665.0	1665.0	m3	C.4.44	$ 3.26	$ 5,427.73		
		3	8	3		collect all debris	10000.0	10000.0	m2	C.3.10	$ 0.37	$ 3,749.38		
		3	8	4		load waste into containers	6.0	6.0	m3	C.4.01	$ 10.23	$ 61.37		
		3	8	5		haul debris to Quarry 3 landfill	6.0	6.0	m3	C.4.44	$ 3.26	$ 19.56		
MN_006	Y	5	6	1	Madrid North Portal Pad	load contained contaminated soils into megabags for hauling	7635.0	7635.0	m3	C.4.12	$ 72.73	$ 555,300.98		assume 50% of liner protection cover is contaminated
		5	6	2		haul megabags to Roberts bay laydown	7635.0	7635.0	m3	C.5.22	$ 15.37	$ 117,327.05		
MN_010	Y	5	10	1	Madrid North Laydown Area	decommission vehicle plug system	5.0	5.0	each	C.1.05	$ 679.52	$ 3,397.58		
		5	10	2		remove cables and posts	5.0	5.0	each	C.3.14	$ 411.17	$ 2,055.87		
		5	10	3		collect all debris	1473.0	1473.0	m2	C.3.10	$ 0.37	$ 552.28		
		5	10	4		load waste into containers	0.9	0.9	m3	C.4.01	$ 10.23	$ 9.04		
		5	10	5		haul debris to quarry 3 landfill	0.9	0.9	m3	C.4.59	$ 4.92	$ 4.34		
MN_014	Y	5	14	1	Madrid North Calcium Chloride Laydown	load contained contaminated soils into megabags for hauling	6.3	6.3	m3	C.4.12	$ 72.73	$ 454.57		assume 50% of liner protection cover is contaminated
		5	14	2		haul megabags to Madrid north underground	6.3	6.3	m3	C.4.23	$ 6.29	$ 39.29		
		5	14	3		collect all debris	25.0	25.0	m2	C.3.10	$ 0.37	$ 9.37		
		5	14	4		clean liner	25.0	25.0	m2	C.2.10	$ 0.41	$ 10.30		
		5	14	5		remove and cut liner into manageable pieces	25.0	25.0	m2	C.3.02	$ 0.17	$ 4.26		
		5	14	6		load waste into containers	0.2	0.2	m3	C.4.01	$ 10.23	$ 2.30		
		5	14	7		haul containers to Quarry 3 landfill	0.2	0.2	m3	C.4.25	$ 3.26	$ 0.73		
MN_016	Y	5	16	1	Madrid North Developed Areas (for regrading)	regrade for positive drainage	95000.0	95000.0	m2	C.5.18	$ 0.01	$ 938.55		
MS_009	Y	7	9	1	Madrid South Laydown Pad	decommission vehicle plug system	5.0	5.0	each	C.1.05	$ 679.52	$ 3,397.58		
		7	9	2		remove cables and posts	5.0	5.0	each	C.3.14	$ 411.17	$ 2,055.87		
		7	9	3		collect all debris	5967.0	5967.0	m2	C.3.10	$ 0.37	$ 2,237.26		
		7	9	4		load waste into containers off-site	3.6	3.6	m3	C.4.01	$ 10.23	$ 36.62		
		7	9	5		haul debris to quarry 3 landfill	3.6	3.6	m3	C.4.25	$ 3.26	$ 11.67		
MS_018	Y	7	18	1	Madrid South Calcium Chloride Laydown	load contained contaminated soils into megabags for hauling	5.6	5.6	m3	C.4.12	$ 72.73	$ 409.11		assume 50% of liner protection cover is contaminated
		7	18	2		haul megabags to Madrid south underground	5.6	5.6	m3	C.5.22	$ 15.37	$ 86.44		
		7	18	3		collect all debris	18.8	18.8	m2	C.3.10	$ 0.37	$ 7.03		
		7	18	4		clean liner	18.8	18.8	m2	C.2.10	$ 0.41	$ 7.73		
		7	18	5		remove and cut liner into manageable pieces	18.8	18.8	m2	C.3.02	$ 0.17	$ 3.19		
		7	18	6		demolish tent structure	46.9	46.9	m3	C.3.05	$ 13.12	$ 615.03		
		7	18	7		load waste into containers	2.0	2.0	m3	C.4.01	$ 10.23	$ 20.84		
		7	18	8		haul containers to Quarry 3 landfill	2.0	2.0	m3	C.4.25	$ 3.26	$ 6.64		
MS_021	Y	7	21	1	Madrid South Developed Areas (for regrading)	regrade for positive drainage	108340.0	108340.0	m2	C.5.18	$ 0.01	$ 1,070.35		
Roads and Transportation													$ 1,288,880.53	
MN_024	Y	5	24	1	Madrid North Fuel Storage Facility Access Road	crown road for positive drainage	0.6	0.6	km	C.5.17	$ 866.22	$ 501.54		
MN_025	Y	5	25	1	Madrid North Fuel Storage Facility Bypass Road	crown road for positive drainage	0.1	0.1	km	C.5.17	$ 866.22	$ 100.48		
WC_004	Y	19	4	1	Windy Winter Road to Patch	Fill in low-lying areas with rock fill (to prevent ponding)	225.0	225.0	m	C.5.25	$ 12.27	$ 2,761.54		
PLA_002	Y	18	2	1	Patch Lake Roads and Trails	Fill in low-lying areas	119.4	119.4	m3	C.5.25	$ 12.27	$ 1,465.46		
RB_015	Y	1	15	1	Roberts Bay 10ML Fuel Storage Facility Access Road (	remove culvert and create swale	40.0	40.0	lm	C.5.15	$ 96.57	$ 3,862.74		
RB_014	Y	1	14	1	Roberts Bay 10ML Fuel Storage Facility Access Road	crown road for positive drainage	0.2	0.2	km	C.5.17	$ 866.22	$ 159.38		
RB_012	Y	1	12	1	Roberts Bay Cargo Dock	remove rock fill to 0.3 m below llwl	24867.6	24867.6	m3	C.5.04	$ 2.75	$ 68,353.45		
		1	12	2		remove on-shore mooring points	2.0	2.0	LS	X.01	$ 1,200.00	$ 2,400.00		
		1	12	2		cut sheet piles to 0.3 m below llwl	1.0	1.0	each	X.15	$ 50,000.00	$ 50,000.00		
		1	12	2		haul cut metal to quarry 3 landfill	15.9	15.9	m3	C.4.15	$ 5.99	$ 95.11		
RB_001	Y	1	1	1	Roberts Bay Jetty	remove rock fill to 0.3 m below llwl	1216.6	1216.6	m3	C.5.04	$ 2.75	$ 3,344.10		
		1	1	3		remove on-shore mooring points	1.0	1.0	LS	X.01	$ 1,200.00	$ 1,200.00		
		1	1	3		remove mooring buoy	1.0	1.0	LS	X.02	$ 2,500.00	$ 2,500.00		
		1	1	2		crown jetty for positive drainage	1045.2	1045.2	m2	C.5.05	$ 1.23	$ 1,282.83		
MNT_003	Y	4	3	1	Madrid North - TIA Road Bridge crossing	remove bridge (timber deck and steel girders)	1.0	1.0	each	X.06	$ 50,000.00	$ 50,000.00		
		4	3	4		cut piles to ground surface	8.0	8.0	each	C.3.08	$ 534.78	$ 4,278.27		
		4	3	3		load waste materials into containers for shipping	92.0	92.0	m3	C.4.01	$ 10.23	$ 941.08		
		4	3	2		haul container to Boston landfill	92.0	92.0	m3	C.4.45	$ 9.18	$ 845.08		
		4	3	5		remove traffic barriers (boulders)	24.0	24.0	m3	C.5.04	$ 2.75	$ 65.97		
		4	3	4		reslope abutments	225.0	225.0	m2	C.5.06	$ 3.27	$ 736.41		
MNT_002	Y	4	2	1	Madrid North - TIA Road Culvert crossings	remove culvert and create swale	60.0	60.0	lm	C.5.15	$ 96.57	$ 5,794.11		
MNT_001	Y	4	1	1	Madrid North - TIA Road All-Weather Road	crown road for positive drainage	5.4	5.4	km	C.5.17	$ 866.22	$ 4,681.92		
CDR_003	Y	21	3	1	Cargo Dock Access Road Bridge Crossing	remove bridge (timber deck and steel girders)	1.0	1.0	each	X.06	$ 50,000.00	$ 50,000.00		
		21	3	2		cut piles to ground surface	8.0	8.0	each	C.3.08	$ 534.78	$ 4,278.27		
		21	3	2		load waste materials into containers for shipping	110.0	110.0	m3	C.4.01	$ 10.23	$ 1,125.18		
		21	3	2		haul container to quarry 3 landfill	110.0	110.0	m3	C.4.45	$ 9.18	$ 1,010.41		
		21	3	3		remove traffic barriers (boulders)	24.0	24.0	m3	C.5.04	$ 2.75	$ 65.97		
		21	3	3		reslope abutments	225.0	225.0	m2	C.5.06	$ 3.27	$ 736.41		
CDR_002	Y	21	2	1	Cargo Dock Access Road Culverts	remove culvert and create swale	30.0	30.0	lm	C.5.15	$ 96.57	$ 2,897.05		
CDR_001	Y	21	1	1	Cargo Dock Access Road All-Weather Road	crown road for positive drainage	2.8	2.8	km	C.5.17	$ 866.22	$ 2,425.42		
RB_008	Y	1	8	1	Roberts Bay Fuel Transfer Access Road	crown road for positive drainage	0.3	0.3	km	C.5.17	$ 866.22	$ 291.05		
SR_001	Y	15	1	1	Secondary Road Secondary Road	Remove Doris Creek bridge	1.0	1.0	LS	X.06	$ 50,000.00	$ 50,000.00		
		15	1	2		Cut tailings line running alongside the road into manageable pieces	5750.0	5750.0	m	C.3.03	$ 11.08	$ 63,735.57		
		15	1	3		Strap together or load pipe sections in containers for transport to landfill	2167.7	2167.7	m3	C.4.01	$ 10.23	$ 22,171.04		
		15	1	4		crown road for positive drainage	3.5	3.5	km	C.5.17	$ 866.22	$ 3,014.45		
		15	1	5		Haul waste to the landfill	2167.7	2167.7	m3	C.4.19	$ 4.17	$ 9,048.34		
		15	1	6		Remove pipe culvert east of the bridge	18.8	18.8	lm	C.5.15	$ 96.57	$ 1,815.49		
SR_003	Y	15	3	1	Secondary Road Tail Lake Access Road	Crown road for positive drainage	0.3	0.3	km	C.5.17	$ 866.22	$ 259.87		
Q3_002	Y	16	2	1	Quarry 3 Access Road	Crown road for positive drainage	0.2	0.2	km	C.5.17	$ 866.22	$ 199.23		
DM_007	Y	2	7	1	Doris Helicopter Support Facilities	dismantle helicopter pads and walkway	15.0	15.0	m3	C.3.06	$ 4.18	$ 62.78		
		2	7	2		demolish helishack	19.3	19.3	m3	C.3.05	$ 13.12	$ 253.75		
		2	7	3		decommission washcar and other facilities	70.8	70.8	m3	C.3.05	$ 13.12	$ 928.38		
		2	7	4		collect debris	180.2	180.2	m2	C.3.10	$ 0.37	$ 67.55		
		2	7	5		load debris into containers for transport	213.3	213.3	m3	C.4.01	$ 10.23	$ 2,181.62		
		2	7	6		haul debris to quarry 3 landfill	213.3	213.3	m3	C.4.14	$ 4.70	$ 1,002.45		
DM_027	Y	2	27	1	Doris Airstrip	decommission airstrip	2.0	2.0	Each	C.1.09	$ 322.61	$ 645.22		
		2	27	2		collect all debris	67722.0	67722.0	m2	C.3.10	$ 0.37	$ 25,391.58		
		2	27	3		load waste into containers	40.6	40.6	m3	C.4.01	$ 10.23	$ 415.59		
		2	27	4		haul containers to Quarry 3 landfill	40.6	40.6	m3	C.4.16	$ 3.48	$ 141.61		
		2	27	5		crown airstrip and airstrip expansion for positive drainage	67722.0	67722.0	m2	C.5.05	$ 1.23	$ 83,118.60		
DM_028	Y	2	28	1	Doris Airstrip Aprons	crown for positive drainage	15500.0	15500.0	m2	C.5.05	$ 1.23	$ 19,023.93		
		2	28	2		decommission electrical, and heating from traffic control tower	1.0	1.0	each	C.1.07	$ 374.34	$ 374.34		
		2	28	3		demolish control tower structure (wood shack)	30.5	30.5	m3	C.3.05	$ 13.12	$ 400.18		
		2	28	4		disconnect containers and prep for shipping	5.0	5.0	each	C.1.08	$ 1,368.94	$ 6,844.69		
		2	28	5		haul trailers to Quarry 3 landfill	235.6	235.6	m3	C.4.14	$ 4.70	$ 1,107.39		
		2	28	6		collect all debris	15500.0	15500.0	m2	C.3.10	$ 0.37	$ 5,811.55		
		2	28	7		load waste into containers	29.6	29.6	m3	C.4.01	$ 10.23	$ 302.51		
		2	28	8		haul containers to Quarry 3 landfill	29.6	29.6	m3	C.4.14	$ 4.70	$ 139.00		
DM_029	Y	2	29	1	Doris Airstrip Lighting	remove lighting fixtures (airstrip lighting, approach lights)	70.0	70.0	each	C.1.10	$ 42.47	$ 2,972.88		
DM_031	Y	2	31	1	Doris Primary Road	Crown road for positive drainage	2.4	2.4	km	C.5.17	$ 866.22	$ 2,096.25		
DW_001	Y	3	1	1	Doris-Windy All Weather Road All weather road	crown road for positive drainage	7.3	7.3	km	C.5.17	$ 866.22	$ 6,338.82		
DW_004	Y	3	4	1	Doris-Windy All Weather Road Clear-span crossings	remove bridge (timber deck and steel girders)	3.0	3.0	each	X.06	$ 50,000.00	$ 150,000.00		
		3	4	2		load waste materials into containers	138.0	138.0	m3	C.4.01	$ 10.23	$ 1,410.96		
		3	4	3		haul container to quarry 3 landfill	138.0	138.0	m3	C.4.59	$ 4.92	$ 678.13		
DW_005	Y	3	5	1	Doris-Windy All Weather Road Arched Culvert Crossing	remove arched culvert	1.0	1.0	each	X.12	$ 100,000.00	$ 100,000.00		
		3	5	2		load waste into containers	180.0	180.0	m3	C.4.01	$ 10.23	$ 1,841.03		
		3	5	3		haul container to quarry 3 landfill	180.0	180.0	m3	C.4.25	$ 3.26	$ 586.78		
MN_017	Y	5	17	1	Madrid North Vent Raise Access Road	crown road for positive drainage	1.1	1.1	km	C.5.17	$ 866.22	$ 977.10		
		5	17	2		remove culvert and create swale	10.0	10.0	lm	C.5.15	$ 96.57	$ 965.68		
MN_020	Y	5	20	1	Madrid North Culverts	remove culvert and create swale	48.0	48.0	lm	C.5.15	$ 96.57	$ 4,635.29		
MSR_001	Y	6	1	1	Madrid South All Weather Road All-Weather Road	crown road for positive drainage	4.9	4.9	km	C.5.17	$ 866.22	$ 4,281.73		
MSR_002	Y	6	2	1	Madrid South All Weather Road Culvert crossings	remove culvert and create swale	2.0	2.0	lm	C.5.15	$ 96.57	$ 193.14		
MS_010	Y	7	10	1	Madrid South Infrastructure Access Road	sure activities are required, addressed under Madrid South developed areas								
MS_011	Y	7	11	1	Madrid South Portal Haul Road	sure activities are required, addressed under Madrid South developed areas								
MS_013	Y	7	13	1	Madrid South Vent Raise Pad Access Road	crown road for positive drainage	0.5	0.5	km	C.5.17	$ 866.22	$ 420.98		
MBR_001	Y	8	1	1	Madrid-Boston All Weather Road All-Weather Road	crown road for positive drainage	52.9	52.9	km	C.5.17	$ 866.22	$ 45,864.62		
MBR_022	Y	8	22	1	Madrid-Boston All Weather Road Crossing C-MBR-7	remove bridge (timber deck and steel girders)	1.0	1.0	each	X.06	$ 50,000.00	$ 50,000.00		
		8	22	2		cut piles to ground surface	8.0	8.0	each	C.3.08	$ 534.78	$ 4,278.27		
		8	22	3		load waste materials into containers for shipping	135.0	135.0	m3	C.4.01	$ 10.23	$ 1,380.77		
		8	22	4		haul container to Quarry 3 landfill	135.0	135.0	m3	C.4.45	$ 9.18	$ 1,239.92		
		8	22	5		remove traffic barriers (boulders)	24.0	24.0	m3	C.5.04	$ 2.75	$ 65.97		
		8	22	6		reslope abutments	225.0	225.0	m2	C.5.06	$ 3.27	$ 736.41		
MBR_023	Y	8	23	1	Madrid-Boston All Weather Road Crossing C-MBR-8	remove bridge (timber deck and steel girders)	1.0	1.0	each	X.06	$ 50,000.00	$ 50,000.00		
		8	23	2		cut piles to ground surface	8.0	8.0	each	C.3.09	$ 13.11	$ 104.87		
		8	23	3		load waste materials into containers for shipping	126.0	126.0	m3	C.4.01	$ 10.23	$ 1,288.72		
		8	23	4		haul container to Boston landfill	126.0	126.0	m3	C.4.46	$ 7.09	$ 893.21		
		8	23	5		remove traffic barriers (boulders)	24.0	24.0	m3	C.5.04	$ 2.75	$ 65.97		
		8	23	6		reslope abutments	225.0	225.0	m2	C.5.06	$ 3.27	$ 736.41		
MBR_024	Y	8	24	1	Madrid-Boston All Weather Road Crossing C-MBR-9	remove bridge (timber deck and steel girders)	1.0	1.0	each	X.06	$ 50,000.00	$ 50,000.00		
		8	24	2		cut piles to ground surface	8.0	8.0	each	C.3.09	$ 13.11	$ 104.87		
		8	24	3		load waste materials into containers for shipping	180.0	180.0	m3	C.4.01	$ 10.23	$ 1,841.03		
		8	24	4		haul container to Boston landfill	180.0	180.0	m3	C.4.47	$ 4.92	$ 884.83		
		8	24	5		remove traffic barriers (boulders)	24.0	24.0	m3	C.5.04	$ 2.75	$ 65.97		
		8	24	6		reslope abutments	225.0	225.0	m2	C.5.05	$ 1.23	$ 276.15		
MBR_025	Y	8	25	1	Madrid-Boston All Weather Road Crossing C-MBR-10	remove culvert and create swale	34.0	34.0	lm	C.5.15	$ 96.57	$ 3,283.33		
MBR_026	Y	8	26	1	Madrid-Boston All Weather Road Crossing C-MBR-11	remove culvert and create swale	34.0	34.0	lm	C.5.15	$ 96.57	$ 3,283.33		
MBR_027	Y	8	27	1	Madrid-Boston All Weather Road Crossing C-MBR-12	remove bridge (timber deck and steel girders)	1.0	1.0	each	X.06	$ 50,000.00	$ 50,000.00		
		8	27	2		cut piles to ground surface	8.0	8.0	each	C.3.09	$ 13.11	$ 104.87		
		8	27	3		load waste materials into containers for shipping	180.0	180.0	m3	C.4.01	$ 10.23	$ 1,841.03		
		8	27	4		haul container to Boston landfill	180.0	180.0	m3	C.4.50	$ 2.28	$ 409.82		
		8	27	5		remove traffic barriers (boulders)	24.0	24.0	m3	C.5.04	$ 2.75	$ 65.97		
		8	27	6		reslope abutments	225.0	225.0	m2	C.5.06	$ 3.27	$ 736.41		
MBR_028	Y	8	28	1	Madrid-Boston All Weather Road Crossing C-MBR-13	remove culvert and create swale	36.0	36.0	lm	C.5.15	$ 96.57	$ 3,476.46		
MBR_029	Y	8	29	1	Madrid-Boston All Weather Road Crossing C-MBR-14	remove culvert and create swale	34.0	34.0	lm	C.5.15	$ 96.57	$ 3,283.33		
MBR_030	Y	8	30	1	Madrid-Boston All Weather Road Crossing C-MBR-15	remove bridge (timber deck and steel girders)	1.0	1.0	each	X.06	$ 50,000.00	$ 50,000.00		
		8	30	2		cut piles to ground surface	8.0	8.0	each	C.3.09	$ 13.11	$ 104.87		
		8	30	3		load waste materials into containers for shipping	108.0	108.0	m3	C.4.01	$ 10.23	$ 1,104.62		
		8	30	4		haul container to Boston landfill	108.0	108.0	m3	C.4.53	$ 1.79	$ 192.80		
		8	30	5		remove traffic barriers (boulders)	24.0	24.0	m3	C.5.04	$ 2.75	$ 65.97		
		8	30	6		reslope abutments	225.0	225.0	m2	C.5.06	$ 3.27	$ 736.41		
MBR_031	Y	8	31	1	Madrid-Boston All Weather Road Crossing C-MBR-16	remove bridge (timber deck and steel girders)	1.0	1.0	each	X.06	$ 50,000.00	$ 50,000.00		
		8	31	2		cut piles to ground surface	8.0	8.0	each	C.3.09	$ 13.11	$ 104.87		
		8	31	3		load waste materials into containers for shipping	90.0	90.0	m3	C.4.01	$ 10.23	$ 920.51		
		8	31	4		haul container to Boston landfill	90.0	90.0	m3	C.4.54	$ 2.17	$ 195.59		
		8	31	5		remove traffic barriers (boulders)	24.0	24.0	m3	C.5.04	$ 2.75	$ 65.97		
		8	31	6		reslope abutments	225.0	225.0	m2	C.5.06	$ 3.27	$ 736.41		
MBR_032	Y	8	32	1	Madrid-Boston All Weather Road Crossing C-MBR-17	remove culvert and create swale	50.0	50.0	lm	C.5.15	$ 96.57	$ 4,828.42		
MBR_033	Y	8	33	1	Madrid-Boston All Weather Road Crossing C-MBR-18	remove culvert and create swale	34.0	34.0	lm	C.5.15	$ 96.57	$ 3,283.33		
MBR_034	Y	8	34	1	Madrid-Boston All Weather Road Crossing C-MBR-19	remove bridge (timber deck and steel girders)	1.0	1.0	each	X.06	$ 50,000.00	$ 50,000.00		
		8	34	2		cut piles to ground surface	8.0	8.0	each	C.3.09	$ 13.11	$ 104.87		
		8	34	3		load waste materials into containers for shipping	108.0	108.0	m3	C.4.01	$ 10.23	$ 1,104.62		
		8	34	4		haul container to Boston landfill	108.0	108.0	m3	C.4.57	$ 2.77	$ 298.98		
		8	34	5		remove traffic barriers (boulders)	24.0	24.0	m3	C.5.04	$ 2.75	$ 65.97		
		8	34	6		reslope abutments	225.0	225.0	m2	C.5.06	$ 3.27	$ 736.41		
MBR_035	Y	8	35	1	Madrid-Boston All Weather Road Crossing C-MBR-20	remove culvert and create swale	40.0	40.0	lm	C.5.15	$ 96.57	$ 3,862.74		
Underground Workings													$ 341,870.12	
DM_012	Y	2	12	1	Doris Portal and Underground Works	remove ducts, pipes, electrical cables	100.0	100.0	lm	C.3.16	$ 119.02	$ 11,901.55		
		2	12	2		construct portal plug	706.8	706.8	m3	C.5.03	$ 24.53	$ 17,337.32		
DM_030	Y	2	30	1	Doris Primary Vent Raise	Remove ducts, pipes, and cables	100.0	100.0	lm	C.3.16	$ 119.02	$ 11,901.55		
		2	30	2		Construct a concrete cap (0.5 m thick reinforced concrete) to seal the top	1.0	1.0	each	C.6.03	$ 14,292.68	$ 14,292.68		
		2	30	3		Decommission and dismantle all ventilation and heating facilities	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
		2	30	4		Prepare units for shipping	1.0	1.0	each	C.1.08	$ 1,368.94	$ 1,368.94		
		2	30	5		haul units to quarry 3 landfill	33.2	33.2	m3	C.4.14	$ 4.70	$ 156.03		
		2	30	6		Regrade pads for positive drainage	4150.0	4150.0	m2	C.5.18	$ 0.01	$ 41.00		
		2	30	7		Drain and decommission Enviro Tank	1.0	1.0	each	C.2.03	$ 0.02	$ 0.02		
		2	30	8		Haul Enviro Tank to Roberts Bay	33.2	33.2	m3	C.4.04	$ 2.30	$ 76.27		
		2	30	9		Remove liner and cut into manageable pieces	1230.0	1230.0	m2	C.3.02	$ 0.17	$ 209.57		
		2	30	10		Load waste for transport to landfill	11.1	11.1	m3	C.4.01	$ 10.23	$ 113.22		
		2	30	11		Haul waste to landfill	11.1	11.1	m3	C.4.14	$ 4.70	$ 52.03		
		2	30	12		Backfill area to prevent permanent ponding	4150.0	4150.0	m2	C.5.05	$ 1.23	$ 5,093.50		

Work Area Code		Item	Task	Sub-task	Facility Name	Task	Quantity	Quantity	Unit	Cost Code	Unit Cost	Activity Total	Subtotals	Source / Comments
DM_033	Y	2	33	1	Doris Connector Vent Raise	Remove ducts, pipes, and cables	100.0	100.0	lm	C.3.16	$ 119.02	$ 11,901.55		
		2	33	2		Decommission and dismantle all ventilation facilities	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
		2	33	3		Prepare units for shipping	1.0	1.0	each	C.1.08	$ 1,368.94	$ 1,368.94		
		2	33	4		haul units to quarry 3 landfill	33.2	33.2	each	C.4.14	$ 4.70	$ 156.03		
		2	33	5		Construct a concrete cap (0.5 m thick reinforced concrete) to seal the top	1.0	1.0	each	C.6.03	$ 14,292.68	$ 14,292.68		
		2	33	6		Remove culvert	1.0	1.0	each	C.5.15	$ 96.57	$ 96.57		
		2	33	7		Crown road for positive drainage	0.2	0.2	km	C.5.17	$ 866.22	$ 181.04		
DM_034	Y	2	34	1	Doris Central Vent Raise	Remove ducts, pipes, and cables	100.0	100.0	lm	C.3.16	$ 119.02	$ 11,901.55		
		2	34	2		Decommission and dismantle all ventilation facilities	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
		2	34	3		Prepare units for shipping off-site	1.0	1.0	each	C.1.08	$ 1,368.94	$ 1,368.94		
		2	34	4		haul units to quarry 3 landfill	33.2	33.2	each	C.4.14	$ 4.70	$ 156.03		
		2	34	5		Construct a concrete cap (0.5 m thick reinforced concrete) to seal the top	1.0	1.0	each	C.6.03	$ 14,292.68	$ 14,292.68		
		2	34	6		Remove culvert	1.0	1.0	each	C.5.15	$ 96.57	$ 96.57		
		2	34	7		Crown road for positive drainage	0.7	0.7	km	C.5.17	$ 866.22	$ 613.28		
MN_012	Y	5	12	1	Madrid North Portal and Underground Works	remove ducts, pipes, electrical cables	100.0	100.0	lm	C.3.16	$ 119.02	$ 11,901.55		
		5	12	2		construct portal plug	706.8	706.8	m3	C.5.03	$ 24.53	$ 17,337.32		
MN_018	Y	5	18	1	Madrid North Vent Raises	remove ducts, pipes, and cables	300.0	300.0	lm	C.3.16	$ 119.02	$ 35,704.66		
		5	18	2		construct a concrete cap (0.5 m thick reinforced concrete) to seal the top	3.0	3.0	each	C.6.03	$ 14,292.68	$ 42,878.04		
		5	18	3		decommission and dismantle all ventilation and heating facilities	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
		5	18	4		prepare units for shipping	1.0	1.0	each	C.1.08	$ 1,368.94	$ 1,368.94		
		5	18	5		haul units to quarry 3 landfill	37.2	37.2	m3	C.4.25	$ 3.26	$ 121.30		
		5	18	6		regrade pads for positive drainage	11435.0	11435.0	m2	C.5.05	$ 1.23	$ 14,034.75		
MS_014	Y	7	14	1	Madrid South Air Heating Facility	Decommission and dismantle all ventilation and heating facilities	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
		7	14	2		Prepare units for shipping	1.0	1.0	each	C.1.08	$ 1,368.94	$ 1,368.94		
		7	14	3		haul units to quarry 3 landfill	33.2	33.2	m3	C.4.25	$ 3.26	$ 108.23		
MS_015	Y	7	15	1	Madrid South Vent Raises	remove ducts, pipes, and cables	200.0	200.0	lm	C.3.16	$ 119.02	$ 23,803.11		
		7	15	2		construct a concrete cap (0.5 m thick reinforced concrete) to seal the top	2.0	2.0	each	C.6.03	$ 14,292.68	$ 28,585.36		
		7	15	3		decommission and dismantle all ventilation and heating facilities	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
		7	15	4		prepare units for shipping	2.0	2.0	each	C.1.08	$ 1,368.94	$ 2,737.88		
		7	15	5		haul units to quarry 3 landfill	37.2	37.2	m3	C.4.25	$ 3.26	$ 121.30		
MS_016	Y	7	16	1	Madrid South Madrid South Portal and Underground W	remove ducts, pipes, electrical cables	100.0	100.0	lm	C.3.16	$ 119.02	$ 11,901.55		
		7	16	2		construct portal plug	706.8	706.8	m3	C.5.03	$ 24.53	$ 17,337.32		
Quarry													**$ 11,965.67**	
MBR_037	Y	8	37	1	Madrid-Boston All Weather Road Quarry AJ	no closure activities are required								
Q2_001	Y	14	1	1	Quarry 2 Quarry	no closure activities are required								
Q3_001	Y	16	1	1	Quarry 3 Quarry # 3	no closure activities are required								
DW_002	Y	3	2	1	Doris-Windy All Weather Road Quarry A	no closure activities are required								
DW_003	Y	3	3	1	Doris-Windy All Weather Road Quarry B	no closure activities are required								
MNT_004	Y	4	4	1	Madrid North - TIA Road Quarry AG	no closure activities are required								
DW_007	Y	3	7	1	Doris-Windy All Weather Road Quarry D	no closure activities are required								
MBR_002	Y	8	2	1	Madrid-Boston All Weather Road Quarry G	no closure activities are required								
MBR_003	Y	8	3	1	Madrid-Boston All Weather Road Quarry H	no closure activities are required								
MBR_004	Y	8	4	1	Madrid-Boston All Weather Road Quarry J	no closure activities are required								
MBR_005	Y	8	5	1	Madrid-Boston All Weather Road Quarry L	crown access road for positive drainage	0.3	0.3	Km	C.5.17	$ 866.22	$ 233.88		
MBR_006	Y	8	6	1	Madrid-Boston All Weather Road Quarry M	crown access road for positive drainage	0.7	0.7	Km	C.5.17	$ 866.22	$ 647.93		
MBR_007	Y	8	7	1	Madrid-Boston All Weather Road Quarry N	crown access road for positive drainage	0.3	0.3	Km	C.5.17	$ 866.22	$ 224.35		
MBR_008	Y	8	8	1	Madrid-Boston All Weather Road Quarry O	crown access road for positive drainage	0.1	0.1	Km	C.5.17	$ 866.22	$ 76.23		
MBR_009	Y	8	9	1	Madrid-Boston All Weather Road Quarry P	no closure activities are required								
MBR_010	Y	8	10	1	Madrid-Boston All Weather Road Quarry Q	no closure activities are required								
MBR_011	Y	8	11	1	Madrid-Boston All Weather Road Quarry R	no closure activities are required								
MBR_012	Y	8	12	1	Madrid-Boston All Weather Road Quarry S	crown access road for positive drainage	1.2	1.2	Km	C.5.17	$ 866.22	$ 1,010.88		
MBR_013	Y	8	13	1	Madrid-Boston All Weather Road Quarry T	no closure activities are required								
MBR_014	Y	8	14	1	Madrid-Boston All Weather Road Quarry U	crown access road for positive drainage	0.5	0.5	Km	C.5.17	$ 866.22	$ 392.40		
MBR_015	Y	8	15	1	Madrid-Boston All Weather Road Quarry V	no closure activities are required								
MBR_016	Y	8	16	1	Madrid-Boston All Weather Road Quarry W	crown access road for positive drainage	1.2	1.2	Km	C.5.17	$ 866.22	$ 1,024.74		
MBR_017	Y	8	17	1	Madrid-Boston All Weather Road Quarry X	crown access road for positive drainage	0.0	0.0	Km	C.5.17	$ 866.22	$ 34.65		
MBR_018	Y	8	18	1	Madrid-Boston All Weather Road Quarry Z	crown access road for positive drainage	0.5	0.5	Km	C.5.17	$ 866.22	$ 424.45		
MBR_019	Y	8	19	1	Madrid-Boston All Weather Road Quarry AA	no closure activities are required								
MBR_020	Y	8	20	1	Madrid-Boston All Weather Road Quarry AB	crown access road for positive drainage	1.2	1.2	Km	C.5.17	$ 866.22	$ 1,024.74		
MBR_021	Y	8	21	1	Madrid-Boston All Weather Road Quarry AD	no closure activities are required								
MNT_004	Y	4	4	1	Madrid North - TIA Road Quarry AG	no closure activities are required								
MBR_036	Y	8	36	1	Madrid-Boston All Weather Road Crusher	dismantle hopper/crusher parts for transport	2.0	2.0	each	C.1.11	$ 3,397.58	$ 6,795.16		
		8	36	2		load equipment into containers for transport (to Roberts bay)	33.2	33.2	m3	C.4.04	$ 2.30	$ 76.27		
Tailings													**$ 19,266,674.76**	
TIA_001	Y	10	1	1	TIA Subaerial Tailings Area	Produce ROQ (quarry drill&blast)	510000.0	510000.0	m3	C.5.24	$ 23.16	$ 11,811,727.84		
		10	1	2		LHDP ROQ to construct 0.3 m cover	510000.0	510000.0	m3	C.5.23	$ 8.94	$ 4,558,821.31		
		10	1	3		Produce additional ROQ for drainage channel armoring	18150.0	18150.0	m3	C.5.24	$ 23.16	$ 420,358.55		
		10	1	3		LHDP ROQ to construct 0.3 m drainage channel armoring	18150.0	18150.0	m3	C.5.23	$ 8.94	$ 162,240.41		
TIA_002	Y	10	2	1	TIA South Dam	no closure activities are required								
TIA_003	Y	10	3	1	TIA North Dam	each the dam by cutting a 20 m slot down to original ground (drill and blast)	7028.0	7028.0	m3	C.5.09	$ 24.76	$ 174,033.99		
		10	3	2		Load and haul material	31021.1	31021.1	m3	C.5.16	$ 8.82	$ 273,741.45		
		10	3	3		Remove thermosyphon radiators and superstructure	12.0	12.0	each	C.3.08	$ 534.78	$ 6,417.40		
		10	3	4		Clad the cut core faces for thermal protection	614.2	614.2	m3	C.5.02	$ 16.35	$ 10,044.59		
TIA_004	Y	10	4	1	TIA West Dam	no closure activities are required								
TIA_005	Y	10	5	1	TIA Shoreline Protection	Install separation geotextile	54340.0	54340.0	m2	M.02	$ 30.02	$ 1,631,327.29		
		10	5	2		Haul and place riprap to prevent erosion	24700.0	24700.0	m3	C.5.16	$ 8.82	$ 217,961.91		
TIA_006		10	6	1	TIA Interim Dyke	recontour dike crest	0.0	0.0	m3	C.5.04	$ 2.75	$ -		
		10	6	2		crown access road for positive drainage	0.0	0.0	km	C.5.17	$ 866.22	$ -		
Waste and Landfills													**$ 1,013,273.56**	
WC_009	Y	19	9	1	Windy Hazardous Waste Disposal Cost	hazardous waste one time flat fee	0.0	0.0	LS	M.09	$ 11,273.28	$ -		accounted for under W.002
		19	9	2		Haul hazardous waste to Roberts Bay	2.8	2.8	m3	C.4.23	$ 6.29	$ 17.60		
		19	9	3		disposal fees at Hay River	0.0	0.0	m3	H.05	$ 116.16	$ -		accounted for under W.002
WC_008	Y	19	8	1	Windy Disposal of demolition waste	Load debris for transport to landfill	2579.4	2579.4	m3	C.4.01	$ 10.23	$ 26,382.14		
		19	8	2		haul debris to landfill	2579.4	2579.4	m3	C.4.22	$ 5.02	$ 12,946.66		
		19	8	3		hydrocarbon contaminated soils to Madrid underground	4263.0	4263.0	m3	C.4.60	$ 2.77	$ 11,790.16		
PLA_004	Y	18	4	1	Patch Lake Disposal of demolition waste	hydrocarbon contaminated soil to Madrid underground	243.6	243.6	m3	C.4.60	$ 2.77	$ 673.72		
Q3_003	Y	16	3	1	Quarry 3 Landfill	empty seacan of debris, place and track pack	5278.4	5278.4	each	C.4.02	$ 86.72	$ 457,763.97		
		16	3	2		regrade top surface for positive drainage	27081.0	27081.0	m2	C.5.05	$ 1.23	$ 33,237.87		
		16	3	3		Produce ROQ (quarry drill&blast)	8124.3	8124.3	m3	C.5.09	$ 24.76	$ 201,180.70		
		16	3	4		place 0.3 m thick liner protection layer of crushed rock	8124.3	8124.3	m3	C.5.02	$ 16.35	$ 132,855.69		
W_001	Y	16	1	1	Waste Ship Off-Site	Hazardous waste	118.3	118.3	m3	S.02	$ 232.32	$ 27,492.96		
		16	1	2		Hazardous solid waste	38.4	38.4	m3	S.02	$ 232.32	$ 8,932.11		
W_002	Y	16	2	1	Waste Disposal Off-Site	Hazardous waste	1.0	1.0	LS	X.07	$ 50,000.00	$ 50,000.00		
		16	2	2		disposal fees at Hay River	0.0	0.0	t	H.05	$ 116.16	$ -		
W_003	Y	16	3	1	Waste Contaminated Material	hydrocarbon contamination survey	1.0	1.0	ls	X.13	$ 25,000.00	$ 25,000.00		
		16	3	2		metal contamination survey	1.0	1.0	ls	X.13	$ 25,000.00	$ 25,000.00		
Pipelines													**$ 609,308.02**	
PL_003	Y	11	3	1	Pipeline Madrid South Groundwater Pipeline	Cut pipelines into manageable pieces	14309.0	14309.0	lm	C.3.03	$ 11.08	$ 158,607.36		
		11	3	2		decommission electrical (heat tracing)	25.0	25.0	each	C.1.05	$ 679.52	$ 16,987.90		
		11	3	3		collect electrical cables and controllers and prep for shipping off-site	2861.8	2861.8	m2	C.3.10	$ 0.37	$ 1,073.00		
		11	3	4		Load debris for transport to landfill	3349.1	3349.1	m3	C.4.01	$ 10.23	$ 34,254.61		
		11	3	5		haul debris to landfill	3349.1	3349.1	m3	C.4.22	$ 5.02	$ 16,809.96		
PL_002	Y	11	2	1	Pipeline Madrid North Reclaim Pipeline	Cut pipelines into manageable pieces	13392.0	13392.0	lm	C.3.03	$ 11.08	$ 148,442.92		
		11	2	2		decommission electrical (heat tracing)	25.0	25.0	each	C.1.05	$ 679.52	$ 16,987.90		
		11	2	3		collect electrical cables and controllers and prep for shipping off-site	2678.4	2678.4	m2	C.3.10	$ 0.37	$ 1,004.24		
		11	2	4		Load debris for transport to landfill	3134.5	3134.5	m3	C.4.01	$ 10.23	$ 32,059.39		
		11	2	5		haul debris to landfill	3134.5	3134.5	m3	C.4.22	$ 5.02	$ 15,732.69		
CDR_004	Y	21	4	1	Cargo Dock Access Road Fuel Transfer Pipeline	flush pipeline prior to decommissioning	1.0	1.0	Each	C.2.06	$ 677.68	$ 677.68		
		21	4	2		cut pipelines into manageable pieces and place in containers for hauling to landfill	3250.0	3250.0	m	C.3.03	$ 11.08	$ 36,024.45		
		21	4	3		remove electrical cables and controllers	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
		21	4	4		load debris into containers for hauling to landfill	159.5	159.5	m3	C.4.01	$ 10.23	$ 1,631.70		
		21	4	5		haul containers to Quarry 3 landfill	159.5	159.5	m3	C.4.17	$ 5.23	$ 834.38		
DM_006	Y	2	6	1	Doris Fresh Water Pipelines	cut pipelines into manageable pieces	830.0	830.0	lm	C.3.03	$ 11.08	$ 9,200.09		
		2	6	2		decommission electrical (heat tracing)	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
		2	6	3		collect electrical cables and controllers and prep for shipping off-site	1600.0	1600.0	m2	C.3.10	$ 0.37	$ 599.90		
		2	6	4		load debris into containers for transport	28.2	28.2	m3	C.4.01	$ 10.23	$ 288.03		
		2	6	5		haul debris to quarry 3 landfill	28.2	28.2	m3	C.4.14	$ 4.70	$ 132.35		
DM_016	Y	2	16	1	Doris Sewage Discharge Line	flush pipeline prior to decommissioning	1.0	1.0	Each	C.2.06	$ 677.68	$ 677.68		
		2	16	2		cut pipelines into manageable pieces and place in containers for hauling to landfill	1190.0	1190.0	m	C.3.03	$ 11.08	$ 13,190.49		
		2	16	3		remove electrical cables and controllers	1.0	1.0	each	C.1.05	$ 679.52	$ 679.52		
		2	16	4		load debris into containers for hauling to landfill	90.8	90.8	m3	C.4.01	$ 10.23	$ 929.16		
		2	16	5		haul containers to Quarry 3 landfill	90.8	90.8	m3	C.4.14	$ 4.70	$ 426.95		
SR_002	Y	15	2	1	Secondary Road Tailings and Reclaim Water Pipelines	Cut pipelines into manageable pieces	8125.0	8125.0	lm	C.3.03	$ 11.08	$ 90,061.14		
		15	2	2		decommission electrical (heat tracing)	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
		15	2	3		collect electrical cables and controllers and prep for shipping off-site	4062.5	4062.5	m2	C.3.10	$ 0.37	$ 1,523.19		
		15	2	4		Load debris for transport to landfill	255.3	255.3	m3	C.4.01	$ 10.23	$ 2,610.72		
		15	2	5		Haul waste to the landfill	255.3	255.3	m3	C.4.19	$ 4.17	$ 1,065.47		
Marine Environment Reclamation													**$ 136,659.13**	
PL_001	Y	11	1	1	Pipeline Roberts Bay Discharge System	Cut pipelines into manageable pieces	5470.0	5470.0	lm	C.3.03	$ 11.08	$ 60,631.93		
		11	1	2		decommission electrical (heat tracing)	11.0	11.0	each	C.1.05	$ 679.52	$ 7,474.68		
		11	1	3		collect electrical cables and controllers and prep for shipping off-site	5470.0	5470.0	m2	C.3.10	$ 0.37	$ 2,050.91		
		11	1	4		Load debris for transport to landfill	1160.0	1160.0	m3	C.4.01	$ 10.23	$ 11,863.92		
		11	1	5		haul debris to landfill	1160.0	1160.0	m3	C.4.16	$ 3.48	$ 4,042.43		
		11	1	6		Remove rock fill to 0.3 m below LLWL	485.0	485.0	m3	C.5.05	$ 1.23	$ 595.26		
		11	1	7		conduct survey of submerged section of pipeline	1.0	1.0	ls	X.14	$ 50,000.00	$ 50,000.00		
Closure Monitoring													**$ 345,000.00**	
CM_002	Y	24	1	1	Closure Compliance	Annual Geotechical Inspection	3	3	each	LS	$ 35,000.00	$ 105,000.00		yearly during closure activities
		24	1	2		Water Sampling and Testing	3	3	each	LS	$ 60,000.00	$ 180,000.00		yearly during closure activities
		24	1	3		Regulatory Costs	3	3	each	LS	$ 20,000.00	$ 60,000.00		yearly during closure activities
Interim Care and Maintenance													**$ 2,753,608.67**	
ICM_001	Y	23	1	1	Interim Care and Maintenance - Annual ICM	water management and camp care and maintenance	1.5	1.5	year	LS	$ 1,569,603.11	$ 2,354,404.67		2 years of ICM
		23	1	2		compliance monitoring	1.5	1.5	year	LS	$ 95,000.00	$ 142,500.00		compliance monitoring extended into closure duration
		23	1	3		mob/demob ICM fleet	1	1	-	LS	$ 256,704.00	$ 256,704.00		equipment required at 2 camp(s) based on number of work areas
Total Direct Costs													**$ 39,015,645.11**	
Contingency													$ 7,803,129.02	
-					Contingency	20% of direct costs	0.2	0.2	%	x	$ 39,015,645.11	$ 7,803,129.02		
Mobilization & Demobilization													$ 2,178,405.71	
-					Mobilization - all work areas	Mob/Demob	1	1	ls		$ 1,089,202.85	$ 1,089,202.85		equipment on site for 2 years while all closure completed
					Demobilization - all work areas	Mob/Demob	1	1	ls		$ 1,089,202.85	$ 1,089,202.85		
General and Administration costs													$ 6,873,522.09	
-					Travel allowance		0	0				$ -		
-					Camp Management & Operations		3	3.00	yr	OC.11	$ 816,750.00	$ 2,450,250.00		
-					Camp Mobilization/Demobilization		1	1	LS	OC.12	$ 208,000.00	$ 208,000.00		
					Crew charters (by-weekly)		78	78	each	OC.05	$ 10,617.57	$ 828,170.49		
					Groceries		19,021	19,021	person-day	OC.13	$ 100.00	$ 1,902,101.60		
-					Camp Rental		3	3	yr	OC.10	$ 495,000.00	$ 1,485,000.00		
Field support													$ 2,025,598.64	
-					Supervision		1,085.00	1,085.00	days	x	$ 1,750.63	$ 1,899,428.14		
-					Equipment maintenance support - Mechanic		109.00	109.00	days	x	$ 1,157.53	$ 126,170.50		
-					Helicopter Support		0	0	hours	E.08	$ 2,367.39	$ -		
Hydrocarbon decontamination													$ 100,000.00	
-					Confirmatory Sampling and Analysis		1	1	LS		$ 100,000.00	$ 100,000.00		Minimum cost $25,000 maximum cost $100,000, each work area = $20,000
Post-closure Monitoring													$ 970,000.00	
					Annual geotechnical inspection	Annual for first 3 years, the years 6 and 10	5	5	LS		$ 35,000.00	$ 175,000.00		
					Cover monitoring	Every 2 years for a 10 year period	5	5	LS		$ 35,000.00	$ 175,000.00		
					Regulatory costs	Yearly for 10 years	10	10	LS		$ 20,000.00	$ 200,000.00		
					Water sampling and testing	Annual for 5 consecutive years, they year 7 and 10	7	7	LS		$ 60,000.00	$ 420,000.00		
Other														
-					Contractor profit	% of direct and other indirect costs (excluding contingency)	0	0	%	of	$ -	$ -	$ -	this is included in the hourly rates for the equipment
-					Contractor Bonding	% of direct cost	0	0	%	of	$ -	$ -		
Total Indirect Costs													**$ 19,950,655.46**	
Total Closure and Reclamation Cost													**$ 58,966,300.57**	

Mobilization

No. of units (from schedule)	Manual Override	Equipment already on site from ICM	Final No. Units	Description	Units	Quantity	Unit cost	Task cost	Notes
All Project Areas				Construction equipment					
1			1	Helicopter	ea	1.0	$ 10,000.00	$ 10,000.00	Flight from Yellowknife
3			3	Dozer - CAT D8	m^2	38.9	$ 470.00	$ 54,905.40	From Hay River to Roberts Bay; NT Marine Rates 2017
3		2	1	Excavator - Cat 330	m^2	36.7	$ 470.00	$ 17,237.04	From Hay River to Roberts Bay; NT Marine Rates 2017
5		2	3	Loader - CAT 980	m^2	46.4	$ 470.00	$ 65,441.58	From Hay River to Roberts Bay; NT Marine Rates 2017
1	2		2	Motor grader CAT 14H	m^2	28.5	$ 470.00	$ 26,798.00	From Hay River to Roberts Bay; NT Marine Rates 2017
2	2		2	Skidder CAT 242	m^2	5.8	$ 470.00	$ 5,470.44	From Hay River to Roberts Bay; NT Marine Rates 2017
5	5	2	3	Truck - CAT 740	m^3	69.3	$ 470.00	$ 97,713.00	From Hay River to Roberts Bay; NT Marine Rates 2017
4	4		4	Tractor Trailer	m^2	1.0	$ 14,216.00	$ 56,864.00	From Hay River to Roberts Bay; NT Marine Rates 2017
4	4		4	Flatbed truck (5 tonne)	ea	1.0	$ 5,358.00	$ 21,432.00	From Hay River to Roberts Bay; NT Marine Rates 2017
6			6	Drill	m^2	25.9	$ 470.00	$ 73,094.40	From Hay River to Roberts Bay; NT Marine Rates 2017
1			1	Drum crusher	kg	0.2	$ 470.00	$ 70.50	From Hay River to Roberts Bay; NT Marine Rates 2017
1			1	Power washer	kg	0.1	$ 470.00	$ 47.00	From Hay River to Roberts Bay; NT Marine Rates 2017
2			2	Welding Equipment	kg	0.3	$ 470.00	$ 235.00	From Hay River to Roberts Bay; NT Marine Rates 2017
2	2		2	Crane	m^2	28.4	$ 470.00	$ 26,720.06	From Hay River to Roberts Bay; NT Marine Rates 2017
6		4	2	Pickup trucks - F150	ea	1.0	$ 3,925.00	$ 7,850.00	From Hay River to Roberts Bay; NT Marine Rates 2017
30		4	26	20 ft containers	ea	1.0	$ 6,896.00	$ 179,296.00	tires, spare parts, and lubricants; from Hay River to Roberts Bay; NT Marine Ra
41			41	Highway Trailers Hauling	LS	1.0	$ 456,028.43	$ 456,028.43	double up the barging cost, as per INAC& TMAC agreed upon cost
							Subtotal Mobilisation	**$ 1,089,203**	
							Subtotal Demobilisation	**$ 1,089,203**	Assumes same cost as mobilisation
							Total	***$ 2,178,406***	

Task	Unit	Quantity	Tonnage	Unit Cost	Activity Total	Subtotals	Notes
INTERIM CARE & MAINTENANCE						**$ 1,332,182**	
on-site caretaker	person months	6		$35,674	$214,043		on-site caretaker in the summer months only
extra personnel	person months						extra personnel
-electrician	person months	3		$36,622	$109,865		half the time, for opening and closing the camp + maintenance
-mechanic	person months	3		$34,726	$104,177		half the time, for opening and closing the camp + maintenance
annual fuel	litre	22500		$1.05	$23,625		annual fuel
misc. supplies	allow	6		$1,500	$9,000		misc. supplies
pick-up truck	month	12	2	$3,999	$95,986.72		one pickup for each crew - Doris and Madrid
small dozer	month	12		$36,215	$217,287.39		yearly stand-by rate at 50% of active rate
small excavator	month	12		$10,000	$120,000		small excavator
snow machine	month	0		$7,103	$0		summer caretaker only
articulated dump truck	month	12		$10,000	$120,000		articulated dump truck
communications	month	6		$2,500	$15,000		communications
mobile camp rental	allow	0		$80,000	$0		existing Doris camp will be used as it transitions to C&M
camp operations (up to 10 persons)	month	6		$20,625	$123,750		includes manager and cook/first aid
groceries	person/month	182	6	$130	$141,960.00		based on 6 person average occupancy
flights (Yellowknife - cambridge bay - Doris)	each	26		$1,442	$37,488		two person-crews shift change monthly commercial flight to Cambridge Bay + 1 hr helicopter charter
COMPLIANCE MONITORING AND REPORTING						**$ 95,000**	
SNP/AEMP water sampling & reporting	each	1		$60,000	$60,000		SNP/AEMP water sampling & reporting
geotechnical assessment	each	1		$35,000	$35,000		geotechnical assessment
WATER MANAGEMENT						**$ 237,421**	
Operate / maintain pumping system							
technician (camp support incl under Mob)	days	182		$1,189	$216,421		120 days pumping down Doris TIA Reclaim Pond (June to September)
site support, consumables	month	6		$3,500	$21,000		site support, consumables
Annual Interim C&M Cost						**$ 1,664,603.11**	
EQUIPMENT MOBILIZATION						**$ 256,704.00**	
Number of ICM crews required:		2					Based on number of areas requiring reclamation, linked to schedule
Excavators							
mobilize		2	20	$ 470.00	$ 18,800.00		Edmonton to Hay River (1 x 36.1 tonnes)
demobilize		2	20	$ 470.00	$ 18,800.00		Hay River to Roberts Bay (1 x 36.1 tonnes)
Dump trucks							
mobilize		2	34.4	$ 470.00	$ 32,336.00		Edmonton to Hay River (1 x 34.4 tonnes)
demobilize		2	34.4	$ 470.00	$ 32,336.00		Hay River to Roberts Bay (1 x 34.4 tonnes)
Loaders							
mobilize		2	30	$ 470.00	$ 28,200.00		Edmonton to Hay River (1 x 30 tonnes)
demobilize		2	30	$ 470.00	$ 28,200.00		Hay River to Roberts Bay (1 x 30 tonnes)
Light duty vehicles							
mobilize		4	-	$ 5,358.00	$ 21,432.00		Edmonton to Hay River
demobilize		4	-	$ 5,358.00	$ 21,432.00		Hay River to Roberts Bay
Standard 20' containers							
mobilize		4	-	$ 6,896.00	$ 27,584.00		Edmonton to Hay River
demobilize		4	-	$ 6,896.00	$ 27,584.00		Hay River to Roberts Bay
Mob/Demob cost for ICM						**$ 256,704.00**	

Item_Task	Duration (weeks)	Crew Size	Start Week	End Week
Doris TIA Produce ROQ	64	10	0	63
Doris TIA Construct Cover	58	5	4	61
Doris camp and mill facilities Decommission	13	4	0	12
Doris camp and mill facilities Decontamination	2	4	13	14
Doris camp and mill facilities Demolition	22	10	62	83
Doris camp and mill facilities Earthworks	7	4	84	90
Doris camp and mill facilities Misc.	9	6	84	92
Doris camp and mill facilities Vent Raise Seal	2	5	84	85
Doris Fuel Storage Decommission	1	3	62	62
Doris Fuel Storage Decontamination	1	3	63	63
Doris Fuel Storage Demolition	1	3	64	64
Doris Fuel Storage Earthworks	2	2	65	66
Doris Fuel Storage Misc.	10	3	67	76
Doris Pads Collect Debris	1	4	77	77
Doris Pads Earthworks	5	6	78	82
Doris Water Management Structures Demolition	1	3	65	65
Doris Water Management Structures Earthworks	1	6	66	66
Construct Quarry 3 Landfill Cover Produce ROQ	4	4	67	70
Construct Quarry 3 Landfill Cover Construct Cover	3	3	71	73
Roberts Bay facilities Decommission	2	4	93	94
Roberts Bay facilities Decontamination	1	2	95	95
Roberts Bay facilities Demolition	2	5	96	97
Roberts Bay facilities Earthworks	5	4	93	97
Roberts Bay facilities Misc.	2	6	98	99
Roberts Bay Fuel Storage Decommission	1	3	93	93
Roberts Bay Fuel Storage Decontamination	4	3	94	97
Roberts Bay Fuel Storage Demolition	1	3	98	98
Roberts Bay Fuel Storage Earthworks	9	2	99	107
Roberts Bay Fuel Storage Misc.	18	5	108	125
Roberts Bay Pads Collect Debris	1	4	93	93
Roberts Bay Pads Earthworks	2	1	94	95
Roberts Bay Water Management Structures Demolition	0	0	96	95
Roberts Bay Water Management Structures Earthworks	0	0	96	95
All Roads Collect Debris	1	4	93	93
All Roads Earthworks	6	4	94	99
Patch Lake Earthworks	1	1	126	126
Patch Lake Fuel Storage Earthworks	3	6	127	129
Patch lake Developed Areas Earthworks	1	4	130	130
Windy Decommission	1	3	126	126
Windy Decontamination	1	2	127	127
Windy Demolition	6	4	128	133
Windy Earthworks	1	6	126	126
Windy Misc.	0	0	127	126
Windy Earthworks	1	6	127	127
Windy Fuel Storage Earthworks	1	3	126	126
Windy Pads Decontamination	0	0	127	126
Windy Pads Demolition	2	1	127	128
Windy Pads Earthworks	1	6	129	129
Madrid Camp and Mill Facilities Decommission	3	4	130	132
Madrid Camp and Mill Facilities Decontamination	1	4	133	133
Madrid Camp and Mill Facilities Demolition	11	10	134	144
Madrid Camp and Mill Facilities Earthworks	3	4	145	147
Madrid Camp and Mill Facilities Misc.	11	6	145	155
Madrid Camp and Mill Facilities Earthworks	3	4	130	132
Madrid Fuel Storage Decommission	1	3	130	130
Madrid Fuel Storage Decontamination	1	3	131	131
Madrid Fuel Storage Demolition	1	3	132	132
Madrid Fuel Storage Earthworks	2	2	133	134
Madrid Fuel Storage Misc.	8	3	135	142
Madrid Pads Collect Debris	1	4	130	130
Madrid Pads Earthworks	4	5	131	134
Madrid Water Management Structures Demolition	1	3	135	135
Madrid Water Management Structures Earthworks	1	1	136	136

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Appendix B

Reclamation cost estimate for water licence application
2AM-BOS---- (Boston)
prepared by Arcadis Canada Inc.

ARCADIS Design & Consultancy for natural and built assets

INDIGENOUS AND NORTHERN AFFAIRS CANADA

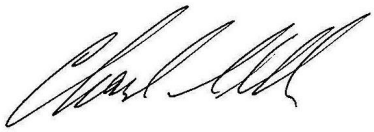
RECLAIM ESTIMATE FOR BOSTON MINE SITE PROJECT

Water Licence Application

2AM-BOS----

27 March 2018

702774-000



Charles Gravelle, M.Sc.E., P.Eng.

Principal

Gerd Wiatzka, P.Eng.

Vice-President Mining

RECLAIM ESTIMATE FOR BOSTON MINE SITE PROJECT

Water Licence Application

2AM-BOS----

Prepared for:

INAC – Nunavut Region

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Our Ref.:

702774-000

Date:

27 March, 2018

VERSION CONTROL

Issue	Revision No	Date Issued	Page No	Description	Reviewed by
Draft	0	12 March 2018	23	Quantum of Security Estimate for Boston Mine Site Project	
Final	1	27 March 2018	42	Quantum of Security Estimate for Boston Mine Site Project	Gerd Wiatzka

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APPENDICES

ACRONYMS AND ABBREVIATIONS

Arcadis	Arcadis Canada Inc.
CCRP	Conceptual Closure and Reclamation Plan
ESA	Environmental Site Assessment
INAC	Indigenous and Northern Affairs Canada
IOL	Inuit Owned Lands
NIRB	Nunavut Impact Review Board
NPAG	Non-Potentially Acid Generating
NWB	Nunavut Water Board
PAG	Potential Acid Generating
TMAC	TMAC Resources Inc.
TSF	Tailings Storage Facility
WRSF	Waste Rock Storage Facility

EXECUTIVE SUMMARY

Further to the request of INAC, Arcadis was retained to complete an independent quantum of security estimate for the proposed Boston mine development project as part of a water licence application request set forth by TMAC. TMAC has applied to the NWB for a new Type A Water Licence (No. 2AM-BOS----) to include mining of the Boston underground and milling operations including the construction/operation of associated infrastructure. Of note the Boston mine site is currently operating under a Type B Water Licence No. 2BB-BOS1727. This Water Licence is independent of the Hope Bay Phase 2 Type A Water Licence for the Doris-Madrid properties which have been evaluated separately and a quantum of security provided under separate letterhead. For the purposes of this quantum of security review it is assumed that the infrastructure to the Boston site will still come through the Hope Bay mine infrastructure and that economies of scale will be realized as a result of this synergy.

In order to prepare the quantum of security estimate, Arcadis reviewed the following documents;

- TMAC Resources, Hope Bay Project Boston Conceptual Closure and Reclamation Plan, November 2017;
- SRK Consulting Inc., Hope Bay Project Boston Conceptual Closure and Reclamation Plan, Detailed Cost Estimate, November 2017;
- TMAC Resources, Hope Bay Project, Phase 2 Conceptual Closure and Reclamation Plan, November 2016;
- SRK Consulting Inc., Hope Bay Project – phase 2 Conceptual Closure and Reclamation Plan, Detailed Cost Estimate, December 2016; and
- RECLAIM ESTIMATE for the Boston Project, as prepared by SRK Consulting and provided to INAC on 26 February 2018.

In preparing the estimate, Arcadis used the latest version of the RECLAIM model as provided by INAC. In general, the material, equipment and labour quantities, and reclamation activities outlined in the Conceptual Closure and Reclamation Plan, as prepared by TMAC and SRK Consulting, were used in preparing this quantum of security estimate.

A summary of the direct and indirect costs with a comparison to the 26 February 2018 TMAC RECLAIM estimate is provided in Table 1. Based on the outcome of the Arcadis review, it is recommended that the quantum of security estimate for the Boston project should be set at $41,934,353.

The split of the security amount between Land and Water based liabilities is $16,927,500 and $25,006,854 respectively. More details on the distribution are provided on the worksheets in Appendix A.

TABLE 1: SUMMARY OF COSTS

Cost Items	TMAC Security	Arcadis RECLAIM
CAPITAL COSTS		
Open Pit	$0	$0
Underground Mine	$55,433	$63,094
Tailings Facility	$10,314,105	$15,267,745
Rock Pile	$5,394,323	$73,985
Building and Equipment	$4,929,817	$6,144,260
Chemicals and Contaminated Soil Management	$488,231	$636,123
Surface and Groundwater Management	$47,872	$46,772
Water Treatment	$0	$0
Interim Care and Maintenance	$2,427,027	$4,786,320
SUB-TOTAL	$23,656,809	$27,018,298
INDIRECT COSTS		
Mobilization/Demobilization	$2,142,246	$5,464,605
Post-Closure Monitoring and Maintenance	$4,121,425	$1,345,961
Engineering (5%)	$0	$1,350,915
Project Management (5%)	$833,298	$1,350,915
Health and Safety Plans/Monitoring & QA/QC (1%)	$0	$0
Bonding/Insurance (1%)	$0	$0
Contingency (20%)	$4,731,362	$5,403,660
Market Price Factor Adjustment	$0	$0
SUB-TOTAL	$11,828,330	$14,916,055
TOTAL COSTS	$35,485,139	$41,934,353

1 INTRODUCTION

1.1 General

Arcadis was retained by INAC to complete a quantum of security evaluation for the Boston Mine Project. The security estimate was to be prepared based on the existing information provided by the proponent as part of their annual update to the quantum of security as allowed under water licence amendment application process for the Hope Bay project.

1.2 Background

TMAC Resources Inc. (TMAC) is proposing to develop an underground mine with some milling operations at the Boston mine property. Originally the development of this property was being consider as part of the overall Hope Bay project, however, in February 2018 TMAC made a separate application to have a new Type A Water licence (2AM-BOS---) for the Boston mine property and amend the existing Type A Water Licence (2AM-DOH1323) for the balance of the Hope Bay project.

As part of the Boston mine project, ore would be mined from the underground via a single portal, the ore crushed and sent a floatation tailings facility on site. For the first year of operations cyanide leaching of the concentrate will be done at the Doris facility with the concentrate hauled to the Doris mill facility via an all-weather road to be constructed between the two mine properties. Once the mill at Boston is constructed and operational, TMAC will operate both a floatation and cyanide leaching system and detoxified tailings from the cyanide leaching stream will be placed underground. Other tailings from the Boston mill will be managed in a drystack tailings management area that will include several contact water channeling berms and ponds. A camp will be constructed at the mine site along with a gravel airstrip. Numerous quarries will be developed and used in the development of the all-weather road (AWR) between the Madrid (part of the Hope bay project) and the Boston mine workings. The construction of the all-weather road will also involve the construction of numerous bridge and installation of culverts to facilitate overland surface water flow to Aimaokatalok Lake.

TMAC expects to begin construction of the AWR and mine infrastructure this year (Year 2 - 2018) and ultimately have full production by 2021. The operational phase of the mine will span up to ten years. Mining activities, including milling operations, are expected to end in Year 14 or 2031. The 2016 Phase 2 Conceptual Closure Plan states there would be a three-year reclamation phase for this mine property while the more recent security estimate prepared by SRK Consulting (SRK, November 2017), for TMAC, states there would be a sixteen-month reclamation phase beginning in Year 15 or 2032. At this point, the post-closure monitoring will begin with the long-term monitoring expected to extend to Year 25 or 2042. More details on the mine life cycle are provided in the CCRP.

1.3 Scope of Work

The scope of work (SOW) developed by INAC for the quantum of security evaluation is outlined in Section 2 of this report. In general, the SOW for this task was to review existing documentation on the closure and reclamation of the Boston Mine Project and prepare a quantum of security estimate based on the RECLAIM Version 7.0 model for the costing of mine reclamation programs.

2 METHODOLOGY

2.1 General Approach

Arcadis' approach to this quantum of security review consisted of the following:

- A review of the Hope Bay Phase 2 CCRP and Project Description as prepared by TMAC with their consultant SRK Consulting (November 2016 which included the Boston Mine property);
- A review of the Hope Bay Project Boston CCRP as prepare by SRK Consulting for TMAC (November 2017);
- A review of the Hope Bay Project Boston Conceptual Closure and Reclamation Plan, Detailed Cost Estimate, as prepared by SRK Consulting (November 2017);
- A review of the latest TMAC quantum of security estimates, as prepared by SRK Consulting, (February 2018) for the Boston Mine;
- A review of the TMAC quantum of security estimates, as prepared by SRK Consulting, (December 2016) for the entire Hope Bay Project (including Boston Mine); and
- A review of the RECLAIM Version 7.0 Manual.

The security review was completed considering the application of the financial security provisions of the Mine Site Reclamation Policy for Nunavut (INAC, 2002) summarized as follows:

- Total financial security for final reclamation should be equal to the total outstanding reclamation liability for land and water combined. The financial security should be sufficient to cover the highest liability over the applicable time period.
- Reclamation cost estimates for financial security purposes should be based on the cost of having the reclamation work completed by a third-party contractor if the operator defaults.
- Estimates should include a contingency that is appropriate to the particular work to be undertaken.
- A recognized methodology such as RECLAIM or some other appropriate model should be used to calculate reclamation costs.

- Consideration should be given to alternate or innovative forms of security.
- Financial security requirements should be clearly set out in water licences, land leases and other regulatory instruments. Alternatively, the security requirements can be specified within a separate agreement if this approach is more applicable.
- Mine operators should be credited for approved progressive reclamation, and the value of financial security required should be adjusted in a timely fashion.

Arcadis initially completed its quantum of security estimate using the TMAC security estimates (not done using the RECLAIM model but summarized in a manner similar to the RECLAIM summary output) and reviewed the differences between the two to make sure the Arcadis assumptions were reasonable and consistent with other security estimates done on mine properties in Nunavut.

2.2 Limitations

The quantum of security estimate is based on the information provided by INAC to Arcadis and, as such, the assessment is primarily based on the CCRP prepared by TMAC for the Hope Bay Phase 2 program which included the Boston Mine property. A copy of the 2017 CCRP for the Boston property was obtained late and only a cursory review of this document was undertaken to confirm assumptions made by TMAC in this updated document.

Should any of the underlying assumptions outlined in the CCRP change over the lifetime of the mine site, then the quantum of security estimate should be reviewed in light of any new information. Under the existing Water Licence the proponent will have the opportunity to amend the quantum of security based on progressive reclamation works. It is assumed that this provision will remain in the new Type A Water Licence.

Furthermore, given the water licence currently held on the Hope Bay properties, it may be more expedient to have one single security held for both the amended 2AM-DOH-1323 and new 2AM-BOS---- water licences as their operations have some linkages thus avoiding any potential confusion with respect to which security would be pulled in the event that only part of the Hope Bay/Boston mine sites were abandoned.

3 FINDINGS

3.1 General

The RECLAIM worksheets detailing the direct and indirect costs used to develop the Arcadis quantum of security estimate are provided in Appendix A. A copy of the security estimate as prepared by SRK Consulting for TMAC (i.e. version provided to Arcadis February 2018) is provided in Appendix B. Further discussion on each major cost item is provided herein, organized based on the RECALIM 7.0 layout developed and used by INAC.

3.2 Direct Costs

The Direct Costs for the Arcadis RECLAIM estimate are provided in the worksheets found in Appendix A. The Land and Water Liability costs are presented in these worksheets. In summary, the Land Liability has been calculated to be $16,927,500 while the Water Liability has been calculated to be $25,006,854. Given that the site is completely contained within IOL lands, we have not provided a breakdown of the costs into IOL versus Crown land.

3.2.1 Open Pit

Not applicable to this water licence application.

3.2.2 Underground Mine

On the basis of the information provided by TMAC this work will entail decommissioning the infrastructure associated with the two mine openings (a vent raise and a portal), transferring the demolition waste to the local non-hazardous landfill, sealing a vent raise with a concrete cap, grading vent raise location and using local waste rock/quarry material to construct the portal seal. The quantities and rates provided by TMAC are reasonable for the nature of the work and have been used by Arcadis in this RECLAIM estimate. The main difference between the two estimates relates to an additional cost to relocate some underground equipment to Roberts Bay for subsequent disposal off-site as outlined in the original December 2016 cost estimate provided by SRK. Arcadis has elected to retain this $4,700 worth of work in the RECLAIM estimate. Other than this difference the TMAC and Arcadis estimates are not materially different for this work activity.

3.2.3 Tailings Facility

On the basis of the information provided by TMAC (February 2018 SRK Security Estimate) the design of the tailings cover has changed from a 300 mm to 1,000 mm thick rock cover placed over top a HDPE liner. The cost included in the TMAC estimate includes for the liner and aggregate however their costs for site grading prior to the installation of the liner have not been included and the costs associated with the preparation of the rock to be used in the cover is carried under the Waste Rock Pile costs. The $5M difference in the two security estimate amounts is primarily the result of how the costs were reported.

3.2.4 Waste Rock Pile

According to the CCRP all waste rock will be returned to the underground during the course of the mine development and reclamation phases. The quantities and rates used by TMAC in their estimate have been adopted by Arcadis as they are representative and reasonable. The primary difference between the two security estimates relates to how TMAC carried approximately $5M of work under this line item in their estimate that was carried under Tailings in the Arcadis estimate. Other differences between the two estimates are immaterial given the overall security.

3.2.5 Buildings and Equipment

For the purposes of the Arcadis estimate, the building footprint areas and facility layouts provided by TMAC in the 2016 Phase 2 CCRP were used to estimate the building removal costs and grading/contouring of the various waste rock pads underlying the buildings. In addition to these cost items, costs were also included for; an assumed area of the laydown area that were part of common areas not included in the building area footprints.

In general, the costs for the decommissioning and dismantling of buildings and equipment as well as management of the associated wastes are higher in the Arcadis estimate as higher of the rates provided by SRK were used when two rates existed as the aggregate of cost for some work items were determined to be too low in the opinion of Arcadis.

For the purposes of this exercise, Arcadis has followed the work flow provided in the CCRP November 2017 security estimate rather than the previously prepared 2016 CCRP as the assumptions made in preparing the estimate are reasonable and consistent with industry practice in remote locations.

More details are provided in the RECLAIM worksheet in Appendix A.

3.2.6 Chemicals and Contaminated Soil Management

The work under this task includes; completing a Phase I/II ESA; decontaminating the various facilities on site including power house and fuel storage facilities; removal of hazardous wastes (i.e. batteries, waste fuel/oil, glycol, etc.); management of petroleum hydrocarbons and reagents as well as de-icing impacts. For the purposes of this estimate we have assumed that there will be 75,000 L of residual fuel on site that will have to be managed as part of the reclamation works. This quantity was provided by TMAC and is equivalent to approximately 1% of the total fuel storage capacity within the large tanks planned for the Boston mine site.

Given the methods used to prepare the respective security estimates it is not possible to complete a direct comparison of the two however in general the quantities and rates provided by TMAC are reasonable for the level of effort required to decommission the infrastructure and manage the anticipated volume of contaminated soils.

The main difference in the two estimates relates to the costs assigned for the management of impacted soils from the de-icing pad which is to be disposed of below ground. TMAC has two different rates for the haulage and disposal of mega bags underground however for the Arcadis estimate only the higher unit rate of $15.37/m^3 was used. In addition, the rate to manage residual fuel is too low at $0.02/L and as such a rate of $0.43/L as used by TMAC in its earlier estimate has been applied in the Arcadis estimate.

More details are provided in the RECLAIM worksheet in Appendix A.

3.2.7 Surface and Groundwater Management

The work included under this task entailed; the breaching of the contact water berms (Berm #1 and #2, overburden, and TMA contact ponds), decommissioning the water discharge line from the treatment plant and the sewage treatment plant discharge line, and removal of equipment (pumps) and liners associated with the contact ponds. The material quantities used by Arcadis in its estimate for the removal and/or relocation of on-site material are the same as those presented by TMAC in their estimate however in some instances the rates have been increased to reflect additional effort required to complete a task or to account for missing work such as haulage of waste to the landfill.

The treatment and management of water during the Closure and Post-Closure phases is covered under the Post-Closure and Interim Care and Maintenance Costs, as applicable.

As with other portions of the security estimate TMAC has included work items herein that are normally provided in other sections of the RECLAIM estimate and as such a direct comparison is not feasible. More details on the Arcadis RECLAIM estimate are provided in Appendix A.

3.2.8 Interim Care and Maintenance (ICM)

Normally INAC would ask for a five-year care and maintenance period to be included in a security estimate as part of the water licence process, however for this estimate Arcadis has applied a three-year ICM period using TMAC's unit rates to derive a quantum of security that would be reasonable to cover five years of care and maintenance on this property. The unit rates used by TMAC in their 1.3 year care and maintenance schedule are, in the opinion of Arcadis, conservative and as such ensure there would be sufficient security in place if a five year ICM period were required.

More details on the Arcadis RECLAIM estimate are provided in Appendix A.

3.2.9 Summary of Direct Cost Review

The net result of the Arcadis assessment was a total capital or direct cost of $27,018,298 as compared to a cost of $23,656,809 reported by TMAC. The $3,361,489 difference was primarily the result of higher costs calculated by Arcadis for the liabilities associated with residual petroleum hydrocarbon disposal, minor differences in waste containerization and disposal costs and interim care and maintenance costs.

3.3 Indirect Costs

The Indirect Costs for the Arcadis RECLAIM estimate are provided in the RECLAIM worksheets found in Appendix A. The Land and Water Liability costs are presented in these worksheets. In summary, the Land Liability has been calculated to be $6,021,114 while the Water Liability has been calculated to be $8,894,941. Given that the site is completely contained within IOL lands there is no division of liabilities between the IOL and Crown held lands.

3.3.1 Mobilization and Demobilization

For the purposes of the Arcadis security assessment, it was assumed that equipment would need to be mobilized to site in order to complete the site closure and reclamation works. The equipment for the reclamation work would be sourced from Southern Canada. The costs provided by TMAC are reasonable and have been used herein.

In general, the costs for the movement and housing of staff during the closure and reclamation works were consistent with those used by TMAC. Small differences were calculated where TMAC had not considered the cost that would be incurred mobilizing works to and from the site.

3.3.2 Post-Closure Monitoring and Maintenance

The Post-Closure Monitoring and Maintenance costs are based on 25 years of monitoring for geotechnical and environmental concerns. The 25 years is based on current INAC practice and has been set to protect against uncertainties related to the long-term water quality of the site. Those uncertainties include but are not limited to the effectiveness of the proposed waste rock cover and the potential for metal loadings to surface water receivers to be higher than currently predicted. There is insufficient information available to state for certain whether or not there will be an issue with seepage water quality from the TMA and as such no security has been assisted for this potential outcome other than to extend out the monitoring period from the ten years proposed by TMAC to the 25 years included herein.

More details on this are provided in the worksheet in Appendix A.

3.3.3 Engineering

Consistent with other quantum of security estimates provided by Arcadis for a mine such as the proposed Boston mine development, Arcadis has use a rate of 5% of direct costs for this security estimate. TMAC has incorporated engineering costs into other components of the work and as such there is not direct comparison of the liability item provided in the TMAC estimate.

3.3.4 Project Management

TMAC has provided a security estimate based on the number of days of field supervision required to complete the reclamation work (i.e $833,297.51). Given the relatively minimal amount of work required to reclaim this site Arcadis has assigned a project management percentage of 5% in the Arcadis RECLAIM estimate.

3.3.5 Health and Safety Plans/Monitoring and QA/QC

No cost was assigned to these items as they are considered to be part of the Engineering and Project Management costs.

3.3.6 Bonding/Insurance

No cost was assigned to these items as they are considered to be part of the Engineering and Project Management costs.

3.3.7 Contingency

Given the level of mine development, a 20% contingency is appropriate. This is consistent with the approach used by TMAC.

3.3.8 Market Factor Adjustment

No market factor adjustment was used in the Arcadis estimate. This is consistent with the approach used by TMAC.

3.3.9 Summary of Indirect Cost Review

The net result of the Arcadis assessment was a total indirect cost of $14,916,055 as compared to a cost of $11,828,330 reported by TMAC. The $3,087,725 difference was largely due to the difference in costs associated with aggregate of the Mobilization and Post-Closure costs (longer period than that assumed by TMAC – 25 yrs vs 10 yrs) and

to a lesser extent the direct costs which increased the costs that were calculated on the basis of percentage of direct cost.

4 CONCLUSIONS AND RECOMMENDATIONS

On the basis of the review completed by Arcadis, the quantum of security has assessed to be $41,934,353. The difference of approximately $6.45M is based primarily on increased costs for the management of residual petroleum hydrocarbons, variances in the costs to manage onsite debris related to decommissioning and demolition works, interim care and maintenance costs, post-closure monitoring, and indirect costs linked to direct costs not carried directly by TMAC (e.g. health and safety or engineering). A comparison of the two security estimates is tabulated below.

Table 2: SUMMARY OF COSTS

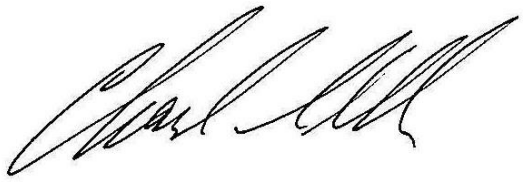
Cost Items	TMAC Security	Arcadis RECLAIM
CAPITAL COSTS		
Open Pit	$0	$0
Underground Mine	$55,433	$63,094
Tailings Facility	$10,314,105	$15,267,745
Rock Pile	$5,394,323	$73,985
Building and Equipment	$4,929,817	$6,144,260
Chemicals and Contaminated Soil Management	$488,231	$636,123
Surface and Groundwater Management	$47,872	$46,772
Water Treatment	$0	$0
Interim Care and Maintenance	$2,427,027	$4,786,320
SUB-TOTAL	$23,656,809	$27,018,298
INDIRECT COSTS		
Mobilization/Demobilization	$2,142,246	$5,464,605
Post-Closure Monitoring and Maintenance	$4,121,425	$1,345,961
Engineering (5%)	$0	$1,350,915
Project Management (5%)	$833,298	$1,350,915
Health and Safety Plans/Monitoring & QA/QC (1%)	$0	$0

Bonding/Insurance (1%)	$0	$0
Contingency (20%)	$4,731,362	$5,403,660
Market Price Factor Adjustment	$0	$0
SUB-TOTAL	$11,828,330	$14,916,055
TOTAL COSTS	$35,485,139	$41,934,353

The split in the Arcadis estimate between Land and Water liabilities is $16,927,500 for Land based liabilities and $25,006,854 for Water based liabilities. The entire property is on IOL lands and as such there is no split in the security holding between IOL and Crown lands.

5 CLOSURE

We trust the information provided herein meets your current needs. Should you require any additional information please do not hesitate to contact us.



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Charles F. Gravelle, M.Sc.E., P.Eng. (NWT/NU)

Principal Engineer

6 REFERENCES

Hope Bay Project, Phase 2 Boston Conceptual Closure and Reclamation Plan, TMAC Resources, prepared by SRK Consulting, November 2017.

Hope Bay Project – Phase 2 Conceptual Closure and Reclamation Plan, Detailed Cost Estimate, SRK Consulting, November 2017.

Hope Bay Project, Phase 2 Conceptual Closure and Reclamation Plan, TMAC Resources, prepared by SRK Consulting, November 2016.

Hope Bay Project – Phase 2 Conceptual Closure and Reclamation Plan, Detailed Cost Estimate, SRK Consulting, December 2016.

Hope Bay Project – Phase 2 Boston Conceptual Closure and Reclamation Plan, Detailed Cost Estimate (EXCEL tables only), SRK Consulting, February 2018.

Indian and Northern Affairs Canada (INAC), 2002. Mine Site Reclamation Policy for Nunavut. ISBN 0-662-32073-5. Copyright: Minister of Public Works and Government Services Canada.

Mackenzie Valley Land and Water Board, 2014. Guidelines for Closure and Reclamation Cost Estimates for Mines.

APPENDIX A

ARCADIS RECLAIM Worksheets

SUMMARY OF COSTS

CAPITAL COSTS	COMPONENT NAME	COST	LAND LIABILITY	WATER LIABILITY
OPEN PIT		$0	$0	$0
UNDERGROUND MINE		$63,094	$63,094	$0
TAILINGS FACILITY		$15,267,745	$7,484,491	$7,783,254
ROCK PILE	Overburden Dump	$73,985	$36,992	$36,992
BUILDINGS AND EQUIPMENT	Boston Mine	$6,144,260	$3,072,130	$3,072,130
CHEMICALS AND CONTAMINATED SOIL MANAGEMEI		$636,123	$249,679	$386,444
SURFACE AND GROUNDWATER MANAGEMENT		$46,772	-	$46,772
INTERIM CARE AND MAINTENANCE		$4,786,320	-	$4,786,320
SUBTOTAL: Capital Costs		**$27,018,298**	**$10,906,386**	**$16,111,912**
PERCENT OF SUBTOTAL			**40%**	**60%**

INDIRECT COSTS		COST	LAND LIABILITY	WATER LIABILITY
MOBILIZATION/DEMOBILIZATION		$5,464,605	$2,205,879	$3,258,726
POST-CLOSURE MONITORING AND MAINTENANCE		$1,345,961	$543,319	$802,641
ENGINEERING	5%	$1,350,915	$545,319	$805,596
PROJECT MANAGEMENT	5%	$1,350,915	$545,319	$805,596
HEALTH AND SAFETY PLANS/MONITORING & QA/QC	0%	$0	$0	$0
BONDING/INSURANCE	0%	$0	$0	$0
CONTINGENCY	20%	$5,403,660	$2,181,277	$3,222,382
MARKET PRICE FACTOR ADJUSTMENT	0%	$0	$0	$0
SUBTOTAL: Indirect Costs		**$14,916,055**	**$6,021,114**	**$8,894,941**

TOTAL COSTS	**$41,934,353**	**$16,927,500**	**$25,006,854**

1 **Underground Mine Name** **UG Mine # 1**

ACTIVITY/MATERIAL	Notes	Unit	Qty	Code	Unit Cost	Cost	Land	Land Cost	Water Cost
CONTROL ACCESS									
Fence		m		#N/A	$0.00	$0		$0	$0
Signs		each	2	SH	$37.08	$74	100%	$74	$0
Block roads		m3		#N/A	$0.00	$0		$0	$0
Berm		m3		#N/A	$0.00	$0		$0	$0
Concrete wall in portals		m3		#N/A	$0.00	$0		$0	$0
Backfill portal #1	BM-033	m3	710	TMAC	$24.53	$17,416	100%	$17,416	$0
Backfill portal #2		m3		#N/A	$0.00	$0		$0	$0
Cap Vent Raise	BM-028	each	1	TMAC	$14,293.00	$14,293	100%	$14,293	$0
Cap raise #2		m3		#N/A	$0.00	$0		$0	$0
Cap shaft #1		m3		#N/A	$0.00	$0		$0	$0
Cap shaft #2		m3		#N/A	$0.00	$0		$0	$0
Grading at Vent Raise		m2	2270	TMAC	$1.23	$2,792	100%	$2,792	$0
Backfill open stope		m3		sc3h	$14.20	$0		$0	$0
Concrete cap over open stope		m3		#N/A	$0.00	$0		$0	$0
Other - crown pillar study		LS		#N/A	$25,000.00	$0		$0	$0
REMOVE HAZARDOUS MATERIALS									
Remove hazardous materials, U/G labor		mandays		#N/A	$500.00	$0		$0	$0
Remove/decontam. stationary & elect. equip		lm	200	TMAC	$119.02	$23,804	100%	$23,804	$0
Remove/decontam. mobile equipment		each		#N/A	$0.00	$0		$0	$0
Remove misc. haz. mat & explosives		kg		#N/A	$0.00	$0		$0	$0
Other	BM-028 & BM-033 Relocate debris and equipment to Roberts Bay	LS	1	TMAC	$4,714.29	$4,714	100%	$4,714	$0
INSTALL BULKHEADS									
Bulkheads to control water flow		each		#N/A	$0.00	$0		$0	$0
Grout bulkhead		m3		#N/A	$0.00	$0		$0	$0
FLOOD MINE									
Supply/install pump		each		#N/A	$0.00	$0		$0	$0
Supply/install piping system		each		#N/A	$0.00	$0		$0	$0
Operate pumps to flood workings		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
INSTALL GROUNDWATER COLLECTION SYSTEM									
Excavate/install sumps		m2		#N/A	$0.00	$0		$0	$0
Install pumping wells		m3		#N/A	$0.00	$0		$0	$0
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0		$0	$0
SPECIALIZED ITEMS									
Install water quality monitoring pipes		each		#N/A	$0.00	$0		$0	$0
Install permanent pumping system		each		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
					Total	$63,094		$63,094	$0
					% of Total			100%	0%

1 **Tailings Impoundment Name:** **Pond # 1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
CONTROL ACCESS									
Fence		m		#N/A	$0.00	$0		$0	$0
Signs		each		#N/A	$0.00	$0		$0	$0
Berm		m3		#N/A	$0.00	$0		$0	$0
Block roads		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
STABILIZE EMBANKMENT(S)									
Toe buttress, drainage layer		m3		#N/A	$0.00	$0		$0	$0
Toe buttress, bulk fill		m3		#N/A	$0.00	$0		$0	$0
Rip rap		m3		RB2	$17.80	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Raise crest		m3		#N/A	$0.00	$0		$0	$0
Flatten slopes		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
COVER TAILINGS									
Grade/shape tailings surface	BM-031	m2	72900	TMAC	$1.23	$89,667	50%	$44,834	$44,834
Liner bedding		m3		#N/A	$0.00	$0		$0	$0
Subgrade preparation - compact		m2		#N/A	$0.00	$0		$0	$0
Supply geotextile/geosynthetic		m2		#N/A	$0.00	$0		$0	$0
Supply & Install geotextile/geosynthetic	BM-031	m2	202826	TMAC	$33.85	$6,865,660	50%	$3,432,830	$3,432,830
Soil cover		m3		SC4L	$9.30	$0		$0	$0
Rock cover	Based on 1000 mm cap	m3	202826	#N/A	$16.35	$3,316,205	50%	$1,658,103	$1,658,103
Other	Rock Crushing	m3	60847.8	TMAC	$4.91	$298,763		$0	$298,763
Other	Drill and Blast rock for cover BM-031	m3	202826	TMAC	$23.16	$4,697,450	50%	$2,348,725	$2,348,725
BURY PAG ROCK									
Relocate PAG rock		m3		#N/A	$0.00	$0		$0	$0
Place cover over PAG rock		m3		#N/A	$0.00	$0		$0	$0
Raise crest of dam		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
STABILIZE DECANT SYSTEM									
Excavate and replace		m3		#N/A	$0.00	$0		$0	$0
Plug/backfill with concrete or clay		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
REMOVE TAILINGS DISCHARGE									
Cyclones		m3		#N/A	$0.00	$0		$0	$0
Pipe		m		ppls	$57.33	$0		$0	$0
Remove reclaim barge		allow		#N/A	$0.00	$0		$0	$0
CONSTRUCT DIVERSION DITCHES									
Excavate ditches -soil		m3		#N/A	$0.00	$0		$0	$0
Excavate ditches -rock		m3		#N/A	$0.00	$0		$0	$0
Rip rap in channel base		m3		#N/A	$0.00	$0		$0	$0

1 **Tailings Impoundment Name:** **Pond # 1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	% Cost Land	Land Cost	Water Cost
FLOOD TAILINGS								
Doze tailings to final contour		m3		#N/A	$0.00	$0	$0	$0
Raise crest of dam		m3		#N/A	$0.00	$0	$0	$0
Other				#N/A	$0.00	$0	$0	$0
UPGRADE SPILLWAY								
Excavate channel, rock		m3		#N/A	$0.00	$0	$0	$0
Excavate channel, soil		m3		SC3H	$14.20	$0	$0	$0
Concrete		m3		#N/A	$0.00	$0	$0	$0
Rip rap		m3		RB4H	$30.75	$0	$0	$0
Geotextile		m2		GSTL	$3.44	$0	$0	$0
CONSTRUCT SEEPAGE COLLECTION POND								
Excavate seepage collection pond		m3		#N/A	$0.00	$0	$0	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0	$0	$0
Vegetate spread material		ha		#N/A	$0.00	$0	$0	$0
Bedding layer		m3		#N/A	$0.00	$0	$0	$0
Supply geomembrane		m2		#N/A	$0.00	$0	$0	$0
Install geomembrane		m2		#N/A	$0.00	$0	$0	$0
Erosion protection layer		m3		#N/A	$0.00	$0	$0	$0
INSTALL GROUNDWATER COLLECTION SYSTEM								
Excavate/install sumps		m3		#N/A	$0.00	$0	$0	$0
Install pumping wells		m3		#N/A	$0.00	$0	$0	$0
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0	$0	$0
SPECIALIZED ITEMS								
Install permanent instrumentation, supply & technican		each		#N/A	$30,000.00	$0	$0	$0
Install permanent instrumentation, drilling		each		#N/A	$30,000.00	$0		$0
TREAT SEEPAGE - see "Water Management" and "Water Treatment"								
TREAT SUPERNATANT								
Pump water (to pit, U/G)		m3		#N/A	$0.00	$0	$0	$0
Equipment maintenance and parts		allow		#N/A	$100,000.00	$0	$0	$0
Supply reagents		tonne		#N/A	$0.00	$0	$0	$0
				Annual treatment costs		$0		
Number of years of treatment		years						
				Total treatment costs		$0		$0
					Total	$15,267,745	$7,484,491	$7,783,254
					% of Total		49%	51%

* for construction of passive treatment system refer to "Water Management"

1 **Rock Pile Name:** **Waste Rock and Overburden Dump**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
STABILIZE SLOPES									
Grade Waste Rock Pile	BM-024	m3	40778	TMAC	$1.23	$50,157	50%	$25,078	$25,078
Grade Overburden Pile	BM-026	m3	17860	TMAC	$1.23	$21,968	50%	$10,984	$10,984
Grade Old Camp Ore Pile	BM-040	m3	1512	TMAC	$1.23	$1,860	50%	$930	$930
Grade Ore Stockpile	BM-001 in BM-036 Bldg & Equip	m3		#N/A	$0.00	$0		$0	$0
Toe buttress, drain mat'l		m3		#N/A	$0.00	$0		$0	$0
Toe buttress, fill mat'l A		m3		#N/A	$0.00	$0		$0	$0
Toe buttress, fill mat'l B		m3		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
COVER ROCK PILE									
Subgrade preparation - doze surface		m3		#N/A	$0.00	$0		$0	$0
Soil cover - excavate,haul,spread&compact		m3		SB1L	$4.30	$0		$0	$0
Rock cover - excavate,haul & spread		m3		#N/A	$0.00	$0		$0	$0
Excavate downslope drainage channel & chute		m3		#N/A	$0.00	$0		$0	$0
Rip rap drainage channel and chute		m3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
VERY LOW PERMEABILITY COVER (in addition to above)									
Liner subgrade preparation - compact		m2		#N/A	$0.00	$0		$0	$0
Supply geomembrame		m2		#N/A	$0.00	$0		$0	$0
Install geomembrane		m2		#N/A	$0.00	$0		$0	$0
Protective cover - excavate,haul,spread&compact		m3		#N/A	$0.00	$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0
CONSTRUCT DIVERSION DITCHES									
Excavate ditches -soil		m3		#N/A	$0.00	$0		$0	$0
Excavate ditches -rock		m3		#N/A	$0.00	$0		$0	$0
Rip rap in channel base		m3		#N/A	$0.00	$0		$0	$0
CONSTRUCT SEEPAGE COLLECTION POND									
Excavate seepage collection pond		m3		#N/A	$0.00	$0		$0	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0		$0	$0
Vegetate spread material		ha		#N/A	$0.00	$0		$0	$0
Bedding layer		m3		#N/A	$0.00	$0		$0	$0
Supply geomembrane		m2		#N/A	$0.00	$0		$0	$0
Install geomembrane		m2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0
INSTALL GROUNDWATER COLLECTION SYSTEM									
Excavate/install sumps		m3		#N/A	$0.00	$0		$0	$0
Install pumping wells		m3		#N/A	$0.00	$0		$0	$0
Install pumps/pipelines/power supply		allow		#N/A	$0.00	$0		$0	$0
RELOCATE DUMPS									
Load, haul, dump or doze		m3		SC3L	$8.90	$0		$0	$0
Add lime		tonne		#N/A	$0.00	$0		$0	$0
Contour reclaimed area		ha		#N/A	$0.00	$0		$0	$0
Other		allow		#N/A	$20,000.00	$0		$0	$0
SPECIALIZED ITEMS									
Install permanent instrumentation		allow		Ea	$50,000.00	$0		$0	$0
Install permanent instrumentation, drilling		each		#N/A	$0.00	$0		$0	$0
TREAT ROCK PILE SEEPAGE - see "Water Management"									
HEAP LEACH SEEPAGE TREATMENT - Cyanide Detox									
Cyanide destruction water treatment pumping		m3		#N/A	$0.00	$0		$0	$0
Reagents		tonnes		#N/A	$0.00	$0		$0	$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	$0.00	$0		$0	$0
Equipment maintenance and parts		allow		#N/A	$0.00	$0		$0	$0
					Annual treatment costs	$0			
Number of years of treatment		years							
					Total treatment costs	$0			$0
HEAP LEACH SEEPAGE TREATMENT - ARD/ML**									
Upgrade/modify pumping system - report to WTP		allow		#N/A	$0.00	$0			$0
					Total	$73,985		$36,992	$36,992
					% of Total			50%	50%

* For construction of passive treatment system refer to "Water Management". ARD/ML seepage treatment becomes post-closure water treatment cost

**Heap leach ARD/ML seepage treatment becomes post-closure water treatment cost

1 **Chemicals/Soil Area Name:**

Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
HAZARDOUS MATERIALS AUDIT									
Hazardous materials audit	Not required	allow		#N/A	$25,000.00	$0		$0	$0
BUILDING DECONTAMINATION & CONSOLIDATION OF HAZARDOUS MATERIALS									
Environmental technician/coordinator		mandays		#N/A	$0.00	$0		$0	$0
Drain residual fuel from tanks	BM-010	each	6	TMAC	$265.00	$1,590	50%	$795	$795
Clean containment liners	BM-010, BM -013 & BM -030	m2	10706	TMAC	$0.41	$4,389	50%	$2,195	$2,195
Decontaminate maintenance shop		mandays		#N/A	$0.00	$0		$0	$0
Decontaminate sewage treatment plant	BM-015	LS	1	TMAC	$667.63	$668	50%	$334	$334
Decontaminate Water Discharge Line	BM-043	LS	1	TMAC	$667.63	$668	50%	$334	$334
Decontaminate bulk fuel storage	BM-010	each	6	TMAC	$1,186.71	$7,120	50%	$3,560	$3,560
Decontaminate Process Plant	BM-002	M3	4.16	TMAC	$2,699.56	$11,230	50%	$5,615	$5,615
Decontaminate offices/warehouse/accom		m2		BDAL	$25.60	$0		$0	$0
Removal of asbestos siding on buildings		m2		BDAL	$25.60	$0		$0	$0
Removal of friable asbestos on equipment		m2		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
HAZARDOUS MATERIALS REMOVAL									
Waste oils		litre		orl	$0.43	$0		$0	$0
Waste fuel	BM-010	litre	75000	orl	$0.43	$32,250	50%	$16,125	$16,125
Waste batteries		allow		AE	$3,000.00	$0		$0	$0
Assay & environmental lab reagents		kg		#N/A	$25.00	$0		$0	$0
Machine shop paints, solvents etc		litre		AE	$10,000.00	$0		$0	$0
Glycol		litre		AE	$20,000.00	$0		$0	$0
Process reagents	BM-002	m3	5.4	TMAC	$88.10	$476	50%	$238	$238
Nuclear sources		allow		#N/A	$0.00	$0		$0	$0
Other hazardous materials		allow		AE	$20,000.00	$0		$0	$0
HAZARDOUS MATERIALS									
Transportation to disposal facility		allow		ea	$10,000.00	$0	50%	$0	$0
Disposal fees		allow		ea	$20,000.00	$0	50%	$0	$0
Other		allow		ea	$40,000.00	$0	50%	$0	$0
CONTAMINATED SOILS									
Contam. soil investigation - Phase 1		each	1	CS1L	$7,500.00	$7,500	50%	$3,750	$3,750
Contam. soil investigation - Phase 2	More money required for INAC to complete an ESA program	allow	1	EA	$100,000.00	$100,000	50%	$50,000	$50,000
CONTAMINATED SOIL REMOVAL									
Excavate and transport to Underground	BM-010 & BM-013	m3	3783.6	TMAC	$72.73	$275,181	50%	$137,591	$137,591
Place hydrocarbon underground	BM-010 & BM-013	m3	3783.6	TMAC	$15.37	$58,154	50%	$29,077	$29,077
Reagents/stabilizing agent	BM-030 de-icier impacted soil to underground (consolidate liner cover, containerize and haul)	m3	1505.4	TMAC	$90.85	$136,766		$0	$136,766
Excavate and transport to offsite facility		m3		est.	$1,000.00	$0	50%	$0	$0
Sludge from Oil/Water Separator		m3	4	TMAC	$32.80	$131	50%	$66	$66
CONTAMINATED SOIL VERY LOW PERMEABILITY COVER									
Supply geomembrane, HDPE, ES3, GCL		m2		#N/A	$0.00	$0		$0	$0
Upper and lower bedding layers		m3		#N/A	$0.00	$0		$0	$0
Install geomembrane, HDPE, ES3, GCL		m2		#N/A	$0.00	$0		$0	$0
Erosion protection layer		m3		#N/A	$0.00	$0		$0	$0
Vegetate		m2		#N/A	$0.00	$0		$0	$0
Install infiltration/seepage instrumentation		allow		#N/A	$0.00	$0		$0	$0
Other				#N/A	$0.00	$0		$0	$0
OTHER									
				#N/A	$0.00	$0		$0	$0
					Total	$636,123		$249,679	$386,444
					% of Total			39%	61%

1 **Building / Equip Name:** **Boston Mine** **Bldg / Equip #:** **1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
DISPOSE MOBILE EQUIPMENT									
Decontaminate and ship off-site		allow		#N/A	$0.00	$0		$0	$0
Decontaminate and dispose on-site		manhours		mechl	$49.00	$0	50%	$0	$0
Relocate Containers to Roberts Bay	BM-034 (3)	ea	3	TMAC	$1,345.00	$4,035	50%	$2,018	$2,018
Relocate Trailers to Roberts Bay	BM-034	m3	112	TMAC	$19.15	$2,145	50%	$1,072	$1,072
Other				#N/A	$0.00	$0		$0	$0
REMOVE BUILDINGS									
Accomodation Complex	BM-018 Demolition	m3	14843	TMAC	$13.12	$194,740	50%	$97,370	$97,370
	BM-018 elec/mech discommissioning	each	300	TMAC	$679.52	$203,856	50%	$101,928	$101,928
	BM-018 - Containerization and disposal	m3	24230	TMAC	$13.49	$326,863	50%	$163,431	$163,431
Process Facilities	BM-002 includes Dismantling and Demolition of Mill, Crusher and Process Plant	LS	1	TMAC	$300,000.00	$300,000	50%	$150,000	$150,000
	BM-020 demolition only	m3	198800	TMAC	$13.12	$2,608,256	50%	$1,304,128	$1,304,128
	BM-020 office decommissioning	each	2	TMAC	$679.52	$1,359	50%	$680	$680
	Bm-020 Collect surface debris	m2	14000	TMAC	$0.37	$5,180	50%	$2,590	$2,590
	BM-020 transfer to landfill	m3	207145	TMAC	$3.26	$675,293	50%	$337,646	$337,646
Offices, Repair, Lab, Warehouse	BM-004, BM-005,BM-006, BM-007 demo, load, haul and tip at landfill	m3	570	TMAC	$26.61	$15,168	50%	$7,584	$7,584
	decommission equipment	each	6	TMAC	$679.52	$4,077	50%	$2,039	$2,039
Storage Facilites		m2				$0	$0	$0	$0
Water and Wastewater Treatment Facilities	BM-011 dismantle equipment	ea	1	TMAC	$1,369.00	$1,369	50%	$685	$685
	BM-011 dismantle and haul to landfill	m3	150	TMAC	$59.95	$8,993	50%	$4,496	$4,496
Fire Water Tank	BM-017 demolition	m3	74.42	TMAC	$13.12	$976	50%	$488	$488
	BM-017 dismantle into cut for haulage	each	1	TMAC	$74,212.00	$74,212	50%	$37,106	$37,106
	BM-017 elec/mech discommissioning	each	2	TMAC	$1,328.00	$2,656	50%	$1,328	$1,328
	BM-017 consolidate and haul to landfill	m3	39.2	TMAC	$13.49	$529	50%	$264	$264
Power Plant	BM-003 includes dismantling/demolition and haulage to Landfill	m3	3151	TMAC	$26.61	$83,848	50%	$41,924	$41,924
	BM-003 dismantle equipment	ea	4	TMAC	$784.27	$3,137	50%	$1,569	$1,569
	BM-003 Prep equipment for offsite shipment	LS	1	TMAC	$50,000.00	$50,000	50%	$25,000	$25,000
	Dismantle, prep and haul stacks for offsite disposal	lm	40	TMAC	$879.54	$35,182	50%	$17,591	$17,591
Communication Tower		m2		brs1h	$65.00	$0	50%	$0	$0
U/G Heating Plant		m2		#N/A	$0.00	$0		$0	$0
Emulsion Plant		m2		#N/A	$0.00	$0		$0	$0
AN Storage Facility		m2		brs1s	$128.00	$0	50%	$0	$0
Warehouse, Shops and Other	BM-009, BM-012 dismantle and transfer to Landfill	m3	2400	TMAC	$26.61	$63,864	50%	$31,932	$31,932
	BM-014 & BM-019 surface clean up	m2	19300	TMAC	$0.37	$7,141	50%	$3,571	$3,571
Laydown area and Core Pad	Post removals	ea	10	TMAC	$411.17	$4,112	50%	$2,056	$2,056
	BM-019 demolition	m3	1000	TMAC	$13.12	$13,120	50%	$6,560	$6,560
	BM-014 & BM-019 debris haul and dispose of at landf	m3	1011.6	TMAC	$12.59	$12,736	50%	$6,368	$6,368
Fuel tanks	BM-010	ea	6	TMAC	$76,000.00	$456,000	50%	$228,000	$228,000
Remove containment liner	BM-010, BM-030 & BM-013	m2	29001.6	TMAC	$0.57	$16,531	50%	$8,265	$8,265
Excavate containment area	BM-010 & BM-013	m3	7567.2	TMAC	$2.75	$20,810	50%	$10,405	$10,405
Fuel tank piping and containment structure	BM-010 includes load and transport to landfill	m3	87.13	TMAC	$24.31	$2,118	50%	$1,059	$1,059
Water Discharge Line	BM-043	m	282	TMAC	$10.79	$3,043	50%	$1,521	$1,521
Water Discharge Line -electrical	BM-43	ea	2	TMAC	$679.52	$1,359	50%	$680	$680

1 **Building / Equip Name:** **Boston Mine** **Bldg / Equip #:** **1**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
Water Discharge	BM-043 demo and landfill	m3	13.8	TMAC	$13.49	$186	50%	$93	$93
Contact Ponds decommissioning	BM-021, BM-025, BM-027 & BM-032	m3	184	TMAC	$13.49	$2,482	50%	$1,241	$1,241
Airstrip lighting, navigation, electrician	Tower fixtures	ea	10	TMAC	$68.15	$682	50%	$341	$341
Airstrip lighting, navigation, mechanical	Tower fixtures and equipment	ea	2	TMAC	$374.34	$749	50%	$374	$374
Break foundation slabs		m2		brcs	$6.00	$0	50%	$0	$0
Consolidate & dump boneyard debris		allow		brs1l	$45.00	$0		$0	$0
Worker Dry	BM-008 Demo, prep and haul waste to landfill	m3	682	TMAC	$26.61	$18,148	50%	$9,074	$9,074
	BM-008 decommission equipment	ea	3	TMAC	$679.52	$2,039	50%	$1,019	$1,019
Potable WTP & STP	BM-015 & BM-016 Decon electrical	ea	107	TMAC	$679.52	$72,709	50%	$36,354	$36,354
	BM-015 & BM -016 demo and landfill	m3	82.5	TMAC	$26.61	$2,195	50%	$1,098	$1,098
WTP Mine Water		m2		brs1l	$45.00	$0	50%	$0	$0
Water Intake		m2		brcs	$6.00	$0		$0	$0
Airstrip/Apron and Helipad	BM-029, BM-030 and BM-034 clean up	m2	68500	TMAC	$0.37	$25,345	50%	$12,673	$12,673
	demo heli shack includes containerization and haul to landfill	m3	45	TMAC	$26.61	$1,197	50%	$599	$599
	Remove lighting	ea	70	TMAC	$42.47	$2,973	50%	$1,486	$1,486
	BM-029, BM-030 and BM-034 includes disposal in landfill	m2	68500	TMAC	$0.15	$10,275	50%	$5,138	$5,138
Other	clean up general areas	m2	1100	TMAC	$0.37	$407	50%	$204	$204
	General Area debris haulage and disposal in landfill	m2	1100	TMAC	$0.15	$165	50%	$83	$83
	Seacan landfill placement (double SRK volume)	m3	2259	TMAC	$86.72	$195,900	50%	$97,950	$97,950
LANDFILL FOR DEMOLITION WASTE									
Place rock cover	BM-038	m3	8112	TMAC	$16.35	$132,631	50%	$66,316	$66,316
Generate rock cover	BM-038 assumes 300 mm cover	m3	8112	TMAC	$24.76	$200,853	50%	$100,427	$100,427
Final grading of landfill cover	BM-038	m2	27040	TMAC	$1.23	$33,259	50%	$16,630	$16,630
Place soil cover		allow		#N/A		$0		$0	$0
Vegetate		ha		#N/A	$0.00	$0		$0	$0
GRADE AND CONTOUR PADS									
Other	BM-036 Developed Areas	m2	122000	TMAC	$1.23	$150,060	50%	$75,030	$75,030
REMOVE LINED CONTAINMENT STRUCTURES									
Decontaminate/Remove/Dispose of Liner	see Chemicals or Water Treatment	m3		#N/A	$0.00	$0		$0	$0
RECLAIM ROADS									
Remove culverts		lm		TMAC	$95.76	$0		$0	$0
Remove bridges		each		#N/A	$0.00	$0		$0	$0
Grade roads	BM-023, BM-037, BM-039 and BM-045 (assumes 4.1 km of road at 10 m width)	ha	0.41	TMAC	$12,300.00	$5,043	50%	$2,522	$2,522
Grade Helipad, Airstrip and Aprons	BM-029, BM-030 and BM-034	ha	6.85	TMAC	$12,300.00	$84,255	50%	$42,128	$42,128
Scarify ore piles laydown area		ha		scfyl	$4,300.00	$0		$0	$0
Vegetate		allow		ea	$20,000.00	$0		$0	$0
Other		ha		scfyh	$6,030.00	$0		$0	$0
SPECIALIZED ITEMS									
Dispose of misc. debris and laydown area refuse				#N/A	$0.00	$0		$0	$0
					Total	$6,144,260		$3,072,130	$3,072,130
					% of Total			50%	50%

Note:

1 **Interim Care and Maintenance**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
INTERIM CARE & MAINTENANCE						
on-site caretaker	supervisor	manmonths		superh	91.84	$0
extra personnel	one skilled labourer	manmonths		lab-sl	41	$0
-electrician	assumes water treatment still required	manmonths		elech	95	$0
-mechanic	assumes water treatment still required	manmonths		mechh	72.85	$0
annual fuel		litre		fcdh	1.39	$0
misc. supplies		allow		accmh	175	$0
pick-up truck		each		#N/A	0	$0
small dozer		allow		#N/A	0	$0
small excavator		allow		#N/A	0	$0
snow machine		allow		#N/A	0	$0
Operation and Maintenance	includes camp operations	allow	1	TMAC	1440000	$1,440,000
Mobilization of ICM equipment fleet		allow	0.33	TMAC	118000	$38,940
communications		allow	1	ACI	1500	$1,500
SNP/AEMP water sampling & reporting		each	1	TMAC	60000	$60,000
Regulatory Reporting		each	1	TMAC	20000	$20,000
geotechnical assessment		each	1	TMAC	35000	$35,000
interim water treatment				#N/A		$0
other		each		#N/A	0	$0
				Annual Interim C&M Cost		$1,595,440
Number of years of ICM		years	3		**Total**	$4,786,320

1 **Post-Closure Monitoring & Maintenance:**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost	
MONITORING & INSPECTIONS							
Annual geotechnical inspection	Year 1, 2, 3, 6, 10, 15, 20, & 25	each	1	TMAC	$28,000.00	$28,000	8 inspections @$35,000 each = $280,000
Cover Monitoirng Inspections	Year 2, 4, 6, 8, 10, 15, 20 &25	each	1	TMAC	$28,000.00	$28,000	8 inspections @$35,000 each = $280,000
Surface water sampling	Year 1 - 5, 7, 10, 15, 20 & 25	each	1	TMAC	$60,000.00	$60,000	10 insepctions @$60,000 = $600,000
Groundwater sampling		each		wsh	$10,000.00	$0	
Receiving.downstream water sampling		each		wsh	$10,000.00	$0	
Monitoring program	initial confirmatory program	each	1	TMAC	$10,000.00	$10,000	1 time event prorated for 10 years total = $100,000
Survey inspection		each		#N/A	$0.00	$0	
Regulatory Monitoring*	Year 1 - 10, 15, 20 & 25	each	1	TMAC	$26,000.00	$26,000	13 insepctions @$20,000 = $260,000
Site water monitoring (AEMP and SNP)		each		#N/A	$25,000.00	$0	
- Active closure and flooding		each		#N/A	$0.00	$0	
- Post pit flooding		each		#N/A	$0.00	$0	
Air Quality Monitoring Program (AQMP)		each		#N/A	$0.00	$0	
Wildlife Effects Monitoring Program (WEMP)		each		#N/A	$0.00	$0	
Vegetation Monitoring		each		#N/A	$0.00	$0	
Other	Equipment mechanic for inspections	days	5	TMAC	$1,157.53	$5,788	approximately 50 days of mechanic time over ten years
COVER MAINTENANCE							
Repair erosion - infill gullies		allow		#N/A	$0.00	$0	
Repair erosion - upgrade diversion ditches		allow		#N/A	$0.00	$0	
Remove problem vegetation		allow		#N/A	$0.00	$0	
Repair animal damage		allow		#N/A	$0.00	$0	
Repair/upgrade access controls		allow		#N/A	$0.00	$0	
Other				#N/A	$0.00	$0	
SPILLWAY MAINTENANCE							
Repair erosion		m3		#N/A	$0.00	$0	
Clear spillway		each		#N/A	$0.00	$0	
CWTS MAINTENANCE							
Maintain flow, restore vegetation		allow		#N/A	$0.00	$0	
POST-CLOSURE WATER TREATMENT							
water treatment - refer to water treatment tab			1	wt tab	$0.00	$0	
Subtotal, Annual post-closure costs						$157,788	
Discount rate for calculation of net present value of post-closure cost, %				3.00%			
Number of years of post-closure activity				10	years		
Present Value of payment stream						$1,345,961	

*Regulatory costs - annual reporting, management plans, progress reports etc.

1 Mobilization/Demobilization:

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
MOBILIZE HEAVY EQUIPMENT						
Excavators		km		mherh	10.25	$0
Dump trucks		km		mherl	3.4	$0
Dozers		km		mherh	10.25	$0
Demolition shears		km		mherh	10.25	$0
Crane		km		mherh	10.25	$0
Loader		km		mherh	10.25	$0
Compactor		km		#N/A	0	$0
Light duty vehicles		km		mherl	3.4	$0
MOBILIZE MISC. EQUIPMENT						
Pump shipping		each		#N/A	0	$0
Pipe shipping		m		#N/A	0	$0
Minor tools and equipment		allow		#N/A	100000	$0
Truck tires		allow		#N/A	0	$0
Other	Mobilization of equipment and material	allow	1	TMAC	1071125	$1,071,125
MOBILIZE CAMP						
Maintain Camp Accomodations	Food	andays	9720	TMAC	110	$1,069,200
Camp Mobilization/Demobilization		LS	1	TMAC	170450	$170,450
Camp Rental		year	1.3	TMAC	668250	$868,725
Camp Operations		year	1.3	TMAC	405000	$526,500
Reclamation activities		allow		#N/A	0	$0
Long term reclamation activities (eg pump flooding)		allow		#N/A	0	$0
MOBILIZE WORKERS						
Reclamation activities - transport	air charter only	flights	34	TMAC	10620	$361,080
Reclamation activities - travel time	twenty workers three hours per shift	ınhours	4080	ACI	80	$326,400
Long term reclamation activities (eg pump flooding) - transport		each		AE	3500	$0
Long term reclamation activities (eg pump flooding) - travel time		manhours		AE	80	$0
Monitoring Airfare		each		mwl	4500	$0
WORKER ACCOMODATIONS						
Reclamation activities		manmonths		#N/A	2225	$0
Long term reclamation activities (eg pump flooding)		manmonths		#N/A	0	$0
MOBILIZE FUEL						
Fuel freight - reclamation activities	assumes sufficient fuel is on site to complete the work	litre		fcdh	1.39	$0
Fuel freight - long term reclamation activities	assumes sufficient fuel is on site to complete the work	litre		#N/A	0	$0
Fuel freight accomodations		litre		#N/A	0	$0
WINTER ROAD						
Construction and operation		km		#N/A	0	$0
Limited winter use		km		#N/A	0	$0
Winter road tarriff		km		#N/A	0	$0
DEMOBILIZE HEAVY EQUIPMENT						
Excavators	assume two excavators	km		mherh	10.25	$0
Dump trucks	assume four dump trucks	km		mherl	3.4	$0
Dozers	assume two dozers	km		mherh	10.25	$0
Demolition shears	assume one set of shears	km		mherh	10.25	$0
Crane	assume one crane	km		mherh	10.25	$0
Loader	assume one loader	km		mherh	10.25	$0
Compactor		each		#N/A	0	$0
Light duty vehicles	assume three trucks	km		mherl	3.4	$0
Other	Demobilization of equipment and material	allow	1	TMAC	1071125	$1,071,125
DEMOBILIZE CAMP						
		allow		#N/A	0	$0
DEMOBILIZE WORKERS						
crew travel time		andays		#N/A	0	$0
crew transportation	cost in mobilization of workers.	each		#N/A	0	$0
WINTER ROAD						
Construction and operation		km		wrcl	2000	$0
Limited winter use		km		#N/A	0	$0
Winter road tarriff		tonnekm		wrul	0.29	$0
					Total	**$5,464,605**

1 **Capital Expenditures and Short Term Water Treatment identified in 'Instructions' worksheet**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
BREACH DYKE EMBANKMENT						
breach contact ponds	TMA contact water BM-032	m3	2124	TMAC	$3.26	$6,924
breach contact ponds	Berm 1 and 2 and Overburden pile	m3	1944	TMAC	$1.23	$2,391
Remove Liner	all ponds (BM-021, BM-025, BM-027 and BM-032	m2	494	TMAC	$0.47	$232
de-icing containment	BM-030 excavate containment sump	m3	17	TMAC	$16.35	$278
Contour water intake area		m3		#N/A	$0.00	$0
STABILIZE SEDIMENT PONDS/WATER MANAGEMENT PONDS						
Place soil cover		m3		#N/A	$0.00	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0
Vegetate spread material		ha		#N/A	$0.00	$0
Rip rap in channel base		each		#N/A	$0.00	$0
Remove sediment from WRSF Pond		allow		AE	$10,000.00	$0
REDIRECT RUNOFF/CONSTRUCT DIVERSION DITCHES						
Excavate ditches -soil		m3		sc3l	$8.90	$0
Excavate ditches -rock		m3		#N/A	$0.00	$0
Stabilize side slopes		m3		#N/A	$0.00	$0
Rip rap in channel base		m3		rr2l	$14.20	$0
BREACH DITCHES						
Excavate breaches		m3		#N/A	$0.00	$0
Backfill/recontour		m3		SB3l	$5.10	$0
Install flow dissipation		m3		#N/A	$0.00	$0
Vegetate remainder of ditch		m2		#N/A	$0.00	$0
DECOMISSION FRESH WATER SUPPLY and OTHER EQUIPMENT						
Breach embankment		m		#N/A	$0.00	$0
Remove pumps	De-icing sump and contact water area pumps	LS	19	TMAC	$679.52	$12,911
Remove pipeline		LS		AE	$40,000.00	$0
WATER CONTROL IN RECLAMATION QUARRY						
Install pumping system		LS		#N/A	$0.00	$0
Remove pumping system		LS		#N/A	$0.00	$0
REMOVE PIPELINES						
Remove pipes	Water discharge line decommission	m	2000	TMAC	$11.08	$22,160
	Water discharge line load and haul to landfill	m3	98	TMAC	$13.49	$1,322
Decomission STP Pipe		m	50	TMAC	$11.08	$554
Concrete plug deep pipes		m3		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
GROUNDWATER COLLECTION SYSTEM						
Excavate/install sumps		m3		#N/A	$0.00	$0
Install pumping wells		m3		#N/A	$0.00	$0
Install pumps/pipelines/power supply		LS		#N/A	$0.00	$0
CONSTRUCT CONTAMINATED WATER STORAGE POND						
Excavate pond		m3		#N/A	$0.00	$0
Doze & spread excavated material		m3		#N/A	$0.00	$0
Vegetate spread material		ha		#N/A	$0.00	$0
Bedding layer		m3		#N/A	$0.00	$0
Supply geomembrane		m2		#N/A	$0.00	$0
Install geomembrane		m2		#N/A	$0.00	$0
Erosion protection layer		m3		#N/A	$0.00	$0
CONSTRUCT PASSIVE TREATMENT SYSTEM (e.g. Constructed Wetland)						
Construct access roads		km		#N/A	$0.00	$0
Install HDPE piping system from collection pond		m		#N/A	$0.00	$0
Inter-cell flow structures		allow		#N/A	$0.00	$0
Install liners		m2		#N/A	$0.00	$0
Install growth media		m3		#N/A	$0.00	$0
Wetland vegetation		ha		#N/A	$0.00	$0
CONSTRUCT WATER TREATMENT PLANT						
Build treatment plant		LS		#N/A	$0.00	$0
Build sludge containment facility		LS		#N/A	$0.00	$0
					Total	$46,772

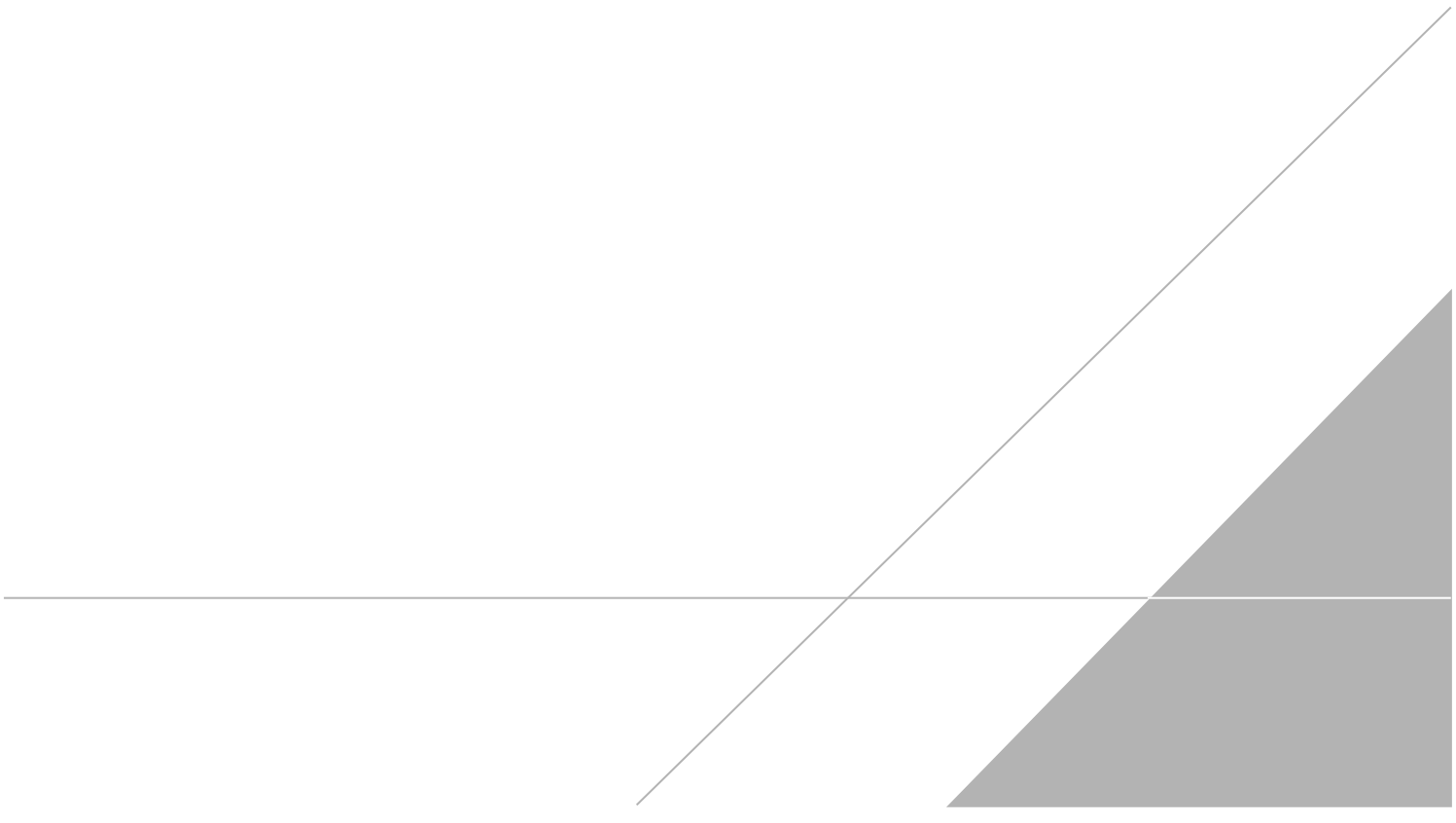
For cost of long-term/post-closure water treatment see "WATER TREATMENT" Worksheet"

1 **Post Closure Water Treatment - Identified as long term/post-closure in 'Instructions' worksheet**

ACTIVITY/MATERIAL	Notes	Units	Quantity	Cost Code	Unit Cost	Cost
ADDITION OF REAGENTS TO WTP						
H2O2		kg		#N/A	$0.00	$0
lime		kg		#N/A	$0.00	$0
ferric sulphate		kg		#N/A	$0.00	$0
ferrous sulphate		kg		#N/A	$0.00	$0
flocculents		kg		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
LABOUR AND SUPPLIES						
Annual fuel		litres		#N/A	$0.00	$0
Annual power		kW-h		#N/A	$0.00	$0
Electrician/mechanic to maintain treatment plant		allow		#N/A	$0.00	$0
Equipment maintenance and parts		allow		#N/A	$0.00	$0
Misc. supplies, hoses, tools		allow		#N/A	$0.00	$0
Communications		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
WATER MANAGEMENT						
Water Treatment (reagents, equip Op. labour)		m3		AE	$0.62	$0
Water pumping from sumps and ponds to treatment plant		allow		AE	$29,367.83	$0
Annual Treatment Plant Servicing		manhours		lab-ss	$120.00	$0
Treatment Plant Servicing Travel Allowance		visit		AE	$4,000.00	$0
Other				#N/A	$0.00	$0
WTP WATER SAMPLING AND ANALYSES						
Sampling equipment		allow		#N/A	$0.00	$0
Analyses		allow		#N/A	$0.00	$0
Shipping to laboratory		allow		#N/A	$0.00	$0
Reporting		allow		#N/A	$0.00	$0
Other				#N/A	$0.00	$0
SITE ACCESS						
Road maintenance (incl. snow removal)		allow		AE	$50,000.00	$0
Winter road tariff		allow		#N/A	$0.00	$0
Truck rental		allow		#N/A	$0.00	$0
Air support		allow		#N/A	$0.00	$0
					Annual water treatment costs	$0
Number of years of water treatment		years	25			
					Total	$0

APPENDIX B

TMAC Summary Worksheets for Quantum of Security (2017 version)



Work Area Code	Item	Task	Sub-task	Facility Name	Task	Quantity	Quantity	Unit	Cost Code	Unit Cost	Activity Total	Subtotals	Source / Comments
DIRECT COSTS													
Stockpiles and Waste Rock Dumps												**$ 71,969.35**	
BM_001	9	1	1	Boston Ore Stockpile	no closure activities are required, regrading addressed under BM_036								
BM_024	9	24	1	Boston Waste Rock Pile	grade for positive drainage	40778.0	40778.0	m2	C.5.05	$ 1.23	$ 50,048.88		
BM_026	9	26	1	Boston Overburden Pile	grade for positive drainage	17860.0	17860.0	m2	C.5.05	$ 1.23	$ 21,920.47		
BM_040	9	40	1	Boston Old Camp Ore Stockpile	grade for positive drainage	0.0	0.0	m2	C.5.05	$ 1.23	$ -		facility reclaimed as part of Phase 2 construction
Fuel Storage Facilities												**$ 712,873.00**	
BM_010	9	10	1	Boston Fuel Facility	drain residual fuel	75000.0	75000.0	L	C.2.03	$ 0.02	$ 1,703.80		
	9	10	2		consolidate fuel in barge at Roberts Bay	75000.0	75000.0	L	C.4.73	$ 0.02	$ 1,731.66		
	9	10	3		decommission fuel transfer facilities	6.0	6.0	each	C.1.02	$ 476.06	$ 2,856.37		
	9	10	4		wash tanks	6.0	6.0	each	C.2.04	$ 1,186.71	$ 7,120.26		
	9	10	5		operate oil/water separator	3.9	3.9	m3	C.2.08	$ 32.80	$ 129.09		
	9	10	6		disconnect piping and controls	6.0	6.0	each	C.1.02	$ 476.06	$ 2,856.37		
	9	10	7		dismantle tanks and cut into manageable pieces	6.0	6.0	each	X.22	$ 74,211.74	$ 445,270.46		
	9	10	8		prepare pieces for transportation - load into container	23.7	23.7	m3	C.4.01	$ 10.23	$ 242.75		
	9	10	9		haul cut metal to Boston landfill laydown	23.7	23.7	m3	C.4.48	$ 4.73	$ 112.37		
	9	10	10		excavate and stockpile liner protection cover	5287.2	5287.2	m3	C.5.04	$ 2.75	$ 14,532.90		
	9	10	11		load contained contaminated soils into megabags for hauling	2643.6	2643.6	m3	C.4.12	$ 72.73	$ 192,271.60		assume 50% of liner protection cover is contaminated
	9	10	12		haul megabags to Boston underground	2643.6	2643.6	m3	C.5.22	$ 15.37	$ 40,624.20		
	9	10	13		clean liner	4406.0	4406.0	m2	C.2.10	$ 0.41	$ 1,815.50		
	9	10	14		remove and cut liner into manageable pieces	4406.0	4406.0	m2	C.3.02	$ 0.17	$ 750.69		
	9	10	15		load waste into containers	63.4	63.4	m3	C.4.01	$ 10.23	$ 648.33		
	9	10	16		haul containers to Boston landfill	63.4	63.4	m3	C.4.44	$ 3.26	$ 206.64		
Buildings and Facilities												**$ 4,238,929.35**	
BM_002	9	2	1	Boston Process Plant	decommission crusher, milling, and process plants	1.0	1.0	each	X.09	$ 100,000.00	$ 100,000.00		
	9	2	2		Drain chemicals and reagents into containers for shipping off site	4.2	4.2	m3	C.2.01	$ 2,699.56	$ 11,230.16		
	9	2	3		disassemble equipment	1.0	1.0	each	X.10	$ 200,000.00	$ 200,000.00		
	9	2	4		prepare equipment for shipping off-site	1.0	1.0	each	X.11	$ 50,000.00	$ 50,000.00		
	9	2	5		demolish / dismantle mill building	198800.0	198800.0	m3	C.3.05a	$ 13.32	$ 2,647,993.55		
	9	2	6		Collect Debris	14000.0	14000.0	m2	C.3.10	$ 0.37	$ 5,249.14		
	9	2	7		load waste for transport to Landfill	8344.8	8344.8	m3	C.4.01	$ 10.23	$ 85,349.92		
	9	2	8		Haul debris to landfill	8344.8	8344.8	m3	C.4.14	$ 4.70	$ 39,218.03		
	9	2	9		transport drums to Roberts Bay	4.2	4.2	m3	C.4.04	$ 2.30	$ 9.56		
BM_003	9	3	1	Boston Power Plant	decommission (electrical)	4.0	4.0	each	C.1.06	$ 784.27	$ 3,137.10		
	9	3	2		demolish building	3125.0	3125.0	m3	C.3.05a	$ 13.32	$ 41,624.65		
	9	3	3		dismantle stacks	40.0	40.0	m	C.3.13	$ 136.30	$ 5,452.16		
	9	3	4		prep stacks for shipping	40.0	40.0	m	C.3.12	$ 627.24	$ 25,089.76		
	9	3	5		haul stack sections to Boston landfill	166.0	166.0	m3	C.4.44	$ 3.26	$ 541.14		
	9	3	6		collect all debris	1250.0	1250.0	m2	C.3.10	$ 0.37	$ 468.67		
	9	3	7		load waste into containers	3150.8	3150.8	m3	C.4.01	$ 10.23	$ 32,225.61		
	9	3	8		haul containers to Boston landfill	3150.8	3150.8	m3	C.4.44	$ 3.26	$ 10,271.12		
BM_004	9	4	1	Boston Warehouse	demolish tent structure	300.0	300.0	m3	C.3.05	$ 13.12	$ 3,936.20		
	9	4	2		dismantle wood flooring, shelving, and lofts	9.0	9.0	m3	C.3.05	$ 13.12	$ 118.09		
	9	4	3		collect debris	60.0	60.0	m2	C.3.10	$ 0.37	$ 22.50		
	9	4	4		load debris into containers for transport	18.1	18.1	m3	C.4.01	$ 10.23	$ 185.53		
	9	4	5		haul debris to Boston landfill	18.1	18.1	m3	C.4.44	$ 3.26	$ 59.13		
BM_005	9	5	1	Boston Mill Office	decommission (electrical, mechanical, plumbing)	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
	9	5	2		demolish trailers	90.0	90.0	m3	C.3.05	$ 13.12	$ 1,180.86		
	9	5	3		collect all debris	36.0	36.0	m2	C.3.10	$ 0.37	$ 13.50		
	9	5	4		load waste into containers	59.7	59.7	m3	C.4.01	$ 10.23	$ 610.48		
	9	5	5		haul containers to Boston landfill	59.7	59.7	m3	C.4.44	$ 3.26	$ 194.58		
BM_006	9	6	1	Boston Mine Office	decommission (electrical, mechanical, plumbing)	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
	9	6	2		demolish trailer	90.0	90.0	m3	C.3.05	$ 13.12	$ 1,180.86		
	9	6	3		demolish cribbing, stairs, entryways, etc.	18.0	18.0	m3	C.3.05	$ 13.12	$ 236.17		
	9	6	4		collect all debris	36.0	36.0	m2	C.3.10	$ 0.37	$ 13.50		
	9	6	5		load waste into containers	59.7	59.7	m3	C.4.01	$ 10.23	$ 610.48		
	9	6	6		haul containers to Boston landfill	59.7	59.7	m3	C.4.44	$ 3.26	$ 194.58		
BM_007	9	7	1	Boston Exploration Office	decommission (electrical, mechanical, plumbing)	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
	9	7	2		demolish trailer	90.0	90.0	m3	C.3.05	$ 13.12	$ 1,180.86		
	9	7	3		demolish cribbing, stairs, entryways, etc.	18.0	18.0	m3	C.3.05	$ 13.12	$ 236.17		
	9	7	4		collect all debris	36.0	36.0	m2	C.3.10	$ 0.37	$ 13.50		
	9	7	5		load waste into containers	59.7	59.7	m3	C.4.01	$ 10.23	$ 610.48		
	9	7	6		haul containers to Boston landfill	59.7	59.7	m3	C.4.44	$ 3.26	$ 194.58		
BM_008	9	8	1	Boston Mine Dry	decommission (electrical, mechanical, plumbing)	3.0	3.0	each	C.1.05	$ 679.52	$ 2,038.55		
	9	8	2		demolish trailer	1485.0	1485.0	m3	C.3.05a	$ 13.32	$ 19,780.03		
	9	8	3		demolish cribbing, stairs, entryways, etc.	18.0	18.0	m3	C.3.05	$ 13.12	$ 236.17		
	9	8	4		collect all debris	198.0	198.0	m2	C.3.10	$ 0.37	$ 74.24		
	9	8	5		load waste into containers off-site	681.1	681.1	m3	C.4.01	$ 10.23	$ 6,966.53		
	9	8	6		haul containers to Boston landfill	681.1	681.1	m3	C.4.44	$ 3.26	$ 2,220.41		
BM_009	9	9	1	Boston Mobile Equipment Workshop	decommission (electrical, mechanical, plumbing)	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
	9	9	2		demolish tent structure	2250.0	2250.0	m3	C.3.05	$ 13.12	$ 29,521.54		
	9	9	3		collect debris	450.0	450.0	m2	C.3.10	$ 0.37	$ 168.72		
	9	9	4		load debris into containers for transport	35.3	35.3	m3	C.4.01	$ 10.23	$ 361.30		
	9	9	5		haul debris to Boston landfill	35.3	35.3	m3	C.4.44	$ 3.26	$ 115.16		
BM_011	9	11	1	Boston Mill Effluent Discharge Water Treatment Plant	decommission (electrical, mechanical, plumbing)	3.0	3.0	each	C.1.05	$ 679.52	$ 2,038.55		
	9	11	2		disconnect containers and prep for shipping off-site	1.0	1.0	each	C.1.08	$ 1,368.94	$ 1,368.94		
	9	11	3		haul containers to Boston landfill	150.0	150.0	m3	C.4.44	$ 3.26	$ 488.98		
	9	11	4		collect debris	30.0	30.0	m2	C.3.10	$ 0.37	$ 11.25		
	9	11	5		load debris into containers for transport	0.018	0.0	m3	C.4.01	$ 10.23	$ 0.18		
	9	11	6		haul debris to Boston landfill	0.018	0.0	m3	C.4.04	$ 2.30	$ 0.04		
BM_012	9	12	1	Boston Reagent Storage	load contained contaminated soils into megabags for hauling	5.4	5.4	m3	C.4.12	$ 72.73	$ 392.75		assume 50% of liner protection cover is contaminated
	9	12	2		haul megabags to Boston underground	5.4	5.4	m3	C.4.16	$ 3.48	$ 18.82		
	9	12	3		collect all debris	30.0	30.0	m2	C.3.10	$ 0.37	$ 11.25		
	9	12	4		clean liner	18.0	18.0	m2	C.2.10	$ 0.41	$ 7.42		
	9	12	5		remove and cut liner into manageable pieces	18.0	18.0	m2	C.3.02	$ 0.17	$ 3.07		
	9	12	6		demolish tent structure	36.0	36.0	m3	C.3.05	$ 13.12	$ 472.34		
	9	12	7		load waste into containers	3.7	3.7	m3	C.4.01	$ 10.23	$ 37.52		
	9	12	8		haul containers to Boston landfill	3.7	3.7	m3	C.4.44	$ 3.26	$ 11.96		
BM_015	9	15	1	Boston Sewage Treatment Plant	flush and remove sewage plumbing, collect sewage sludge/waste water in 55 gallon drums	1.0	1.0	each	C.2.06	$ 677.68	$ 677.68		
	9	15	2		decommission (electrical and plumbing)	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
	9	15	3		Decommission sewage pipes	50.0	50.0	lm	C.3.16	$ 119.02	$ 5,950.78		
	9	15	4		disconnect containers and prep for shipping	1.0	1.0	each	C.1.08	$ 1,368.94	$ 1,368.94		
	9	15	5		haul containers to landfill	74.7	74.7	m3	C.4.44	$ 3.26	$ 243.60		
	9	15	6		collect debris	29.9	29.9	m2	C.3.10	$ 0.37	$ 11.21		
	9	15	7		load debris into containers for transport	2.7	2.7	m3	C.4.01	$ 10.23	$ 27.29		
	9	15	8		haul debris to Boston landfill	2.7	2.7	m3	C.4.44	$ 3.26	$ 8.70		
BM_016	9	16	1	Boston Potable Water Treatment Plant	decommission (electrical)	105.0	105.0	each	C.1.05	$ 679.52	$ 71,349.18		
	9	16	2		demolish structure	105.0	105.0	m3	C.3.05	$ 13.12	$ 1,377.67		
	9	16	3		collect debris	42.0	42.0	m2	C.3.10	$ 0.37	$ 15.75		
	9	16	4		load debris into containers for transport	7.6	7.6	m3	C.4.01	$ 10.23	$ 77.38		

Work Area Code	Item	Task	Sub-task	Facility Name	Task	Quantity	Quantity	Unit	Cost Code	Unit Cost	Activity Total	Subtotals	Source / Comments
	9	16	5		haul debris to Boston landfill	7.6	7.6	m3	C.4.44	$ 3.26	$ 24.66		
BM_017	9	17	1	Boston Fire Water Tank	decommission and disconnect electrical and plumbing	2.0	2.0	each	C.1.03	$ 1,327.71	$ 2,655.41		
	9	17	2		demolish structure	74.4	74.4	m3	C.3.05	$ 13.12	$ 976.44		
	9	17	3		remove tank insulation	1.0	1.0	each	C.3.15	$ 746.46	$ 746.46		
	9	17	4		dismantle tanks and cut into manageable pieces	1.0	1.0	each	X.22	$ 74,211.74	$ 74,211.74		
	9	17	5		prepare pieces for transportation	2.2	2.2	m3	C.4.01	$ 10.23	$ 22.55		
	9	17	6		haul cut metal to Boston landfill	2.2	2.2	m3	C.4.44	$ 3.26	$ 7.19		
	9	17	7		collect debris	73.1	73.1	m2	C.3.10	$ 0.37	$ 27.42		
	9	17	8		load debris into containers for transport	37.1	37.1	m3	C.4.01	$ 10.23	$ 378.98		
	9	17	9		haul debris to Boston landfill	37.1	37.1	m3	C.4.44	$ 3.26	$ 120.79		
BM_018	9	18	1	Boston Accomodation Camp Buildings	decommission (electrical, mechanical, plumbing)	300.0	300.0	each	C.1.05	$ 679.52	$ 203,854.80		
	9	18	2		demolish accommodation trailers	13640.0	13640.0	m3	C.3.05	$ 13.12	$ 178,966.11		
	9	18	3		demolish cribbing, stairs, entryways, etc.	202.5	202.5	m3	C.3.05	$ 13.12	$ 2,656.94		
	9	18	4		demolish arctic corridor	1000.0	1000.0	m3	C.3.05	$ 13.12	$ 13,120.68		
	9	18	5		collect all debris	4140.0	4140.0	m2	C.3.10	$ 0.37	$ 1,552.25		
	9	18	6		load waste into containers	23329.7	23329.7	m3	C.4.01	$ 10.23	$ 238,614.64		
	9	18	7		haul containers to Boston landfill	23329.7	23329.7	m3	C.4.44	$ 3.26	$ 76,052.51		
BM_020	9	20	1	Boston Core Shack	decommission (electrical, heating)	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
	9	20	2		demolish tent structure	781.3	781.3	m3	C.3.05	$ 13.12	$ 10,250.53		
	9	20	3		dismantle wood flooring, shelving, and lofts	390.6	390.6	m3	C.3.05	$ 13.12	$ 5,125.27		
	9	20	4		collect debris	312.5	312.5	m2	C.3.10	$ 0.37	$ 117.17		
	9	20	5		load debris into containers for transport	113.6	113.6	m3	C.4.01	$ 10.23	$ 1,161.51		
	9	20	6		haul debris to Boston landfill	113.6	113.6	m3	C.4.44	$ 3.26	$ 370.20		
BM_035	9	35	1	Boston Airstrip Lighting	remove ground lighting fixtures (airstrip lighting, approach lights)	70.0	70.0	each	C.1.10	$ 42.47	$ 2,972.88		
	9	35	2		remove floating lighting fixtures (airstrip lighting, approach lights)	10.0	10.0	each	C.1.12	$ 68.15	$ 681.52		
Water Management												**$ 19,567.82**	
CM_001	17	1	1	Closure - Drain Reclaim Pond									
	17	1	2										
	17	1	3										
	17	1	4										
	17	1	5										
BM_021	9	21	1	Boston Contact Water Pond #2	disconnect piping and electrical wiring, remove sump pumps	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
	9	21	2		load waste into containers	1.6	1.6	m3	C.4.01	$ 10.23	$ 16.57		
	9	21	3		haul containers to Boston landfill	1.6	1.6	m3	C.4.44	$ 3.26	$ 5.28		
	9	21	4		breach contact water containment berm	648.0	648.0	m3	C.5.05	$ 1.23	$ 795.32		
	9	21	5		remove and cut liner from breach into manageable pieces	90.0	90.0	m2	C.3.02	$ 0.17	$ 15.33		
BM_025	9	25	1	Boston Contact Water Pond #1	disconnect piping and electrical wiring, remove sump pumps	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
	9	25	2		load waste into containers	1.2	1.2	m3	C.4.01	$ 10.23	$ 12.27		
	9	25	3		haul containers to Boston landfill	1.2	1.2	m3	C.4.44	$ 3.26	$ 3.91		
	9	25	4		breach contact water containment berm	648.0	648.0	m3	C.5.05	$ 1.23	$ 795.32		
	9	25	5		remove and cut liner from breach into manageable pieces	66.6	66.6	m2	C.3.02	$ 0.17	$ 11.35		
BM_027	9	27	1	Boston Overburden Pile Sedimentation Pond	disconnect piping and electrical wiring, remove sump pumps	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
	9	27	2		loat waste into containers off-site	1.2	1.2	m3	C.4.01	$ 10.23	$ 12.27		
	9	27	3		haul containers to Boston landfill	1.2	1.2	m3	C.4.44	$ 3.26	$ 3.91		
	9	27	4		breach contact water containment berm	648.0	648.0	m3	C.5.05	$ 1.23	$ 795.32		
	9	27	5		remove and cut liner from breach into manageable pieces	66.6	66.6	m2	C.3.02	$ 0.17	$ 11.35		
BM_032	9	32	1	Boston TMA Contact Water Pond Berms	disconnect piping and electrical wiring, remove sump pumps	6.0	6.0	each	C.1.05	$ 679.52	$ 4,077.10		
	9	32	3		remove and cut liner from breach into manageable pieces	270.0	270.0	m2	C.3.02	$ 0.17	$ 46.00		
	9	32	4		load waste into containers for hauling to landfill	179.9	179.9	m3	C.4.01	$ 10.23	$ 1,839.92		
	9	32	5		haul containers to Boston landfill	179.9	179.9	m3	C.4.44	$ 3.26	$ 586.43		
	9	32	2		breach contact water containment berm	1944.0	1944.0	m3	C.5.05	$ 1.23	$ 2,385.97		
Rock Fill Pads												**$ 121,930.78**	
	18	3	2		haul containers to Madrid North Underground	243.6	243.6	m3	C.4.14	$ 4.70	$ 1,144.85		
BM_014	9	14	1	Boston Laydown Area	decommission vehicle plug system	10.0	10.0	each	C.1.05	$ 679.52	$ 6,795.16		
	9	14	2		remove cables and posts	10.0	10.0	each	C.3.14	$ 411.17	$ 4,111.74		
	9	14	3		collect all debris	9300.0	9300.0	m2	C.3.10	$ 0.37	$ 3,486.93		
	9	14	4		load waste into containers	5.6	5.6	m3	C.4.01	$ 10.23	$ 57.07		
	9	14	5		haul debris to Boston landfill	5.6	5.6	m3	C.4.44	$ 3.26	$ 18.19		
BM_013	9	13	1	Boston Land Farm	excavate and stockpile liner protection cover	2280.0	2280.0	m3	C.5.04	$ 2.75	$ 6,267.02		
	9	13	2		load contained contaminated soils into megabags for shipping off-site	1140.0	1140.0	m3	C.4.12	$ 72.73	$ 82,913.31		assume 50% of liner protection cover is contaminated
	9	13	3		haul megabags to Boston underground	1140.0	1140.0	m3	C.4.44	$ 3.26	$ 3,716.28		
	9	13	4		clean liner	3800.0	3800.0	m2	C.2.10	$ 0.41	$ 1,565.80		
	9	13	5		remove and cut liner into manageable pieces	3800.0	3800.0	m2	C.3.02	$ 0.17	$ 647.44		
	9	13	6		load waste into containers	36.5	36.5	m3	C.4.01	$ 10.23	$ 373.11		
	9	13	7		haul containers to Boston landfill	36.5	36.5	m3	C.4.44	$ 3.26	$ 118.92		
BM_019	9	19	1	Boston Core Storage Pad	band together core boxes	500.0	500.0	each	C.6.02	$ 11.36	$ 5,679.34		
	9	19	2		collect all debris	10000.0	10000.0	m2	C.3.10	$ 0.37	$ 3,749.38		
	9	19	3		load waste into containers	6.0	6.0	m3	C.4.01	$ 10.23	$ 61.37		
	9	19	4		haul debris to Boston landfill	6.0	6.0	m3	C.4.44	$ 3.26	$ 19.56		
BM_036	9	36	1	Boston Developed Areas (for regrading)	regrade for positive drainage	122000.0	122000.0	m2	C.5.18	$ 0.01	$ 1,205.30		
Roads and Transportation												**$ 244,926.85**	
BM_050	9	50	1	Boston Airstrip De-icing Facility	decommission sump	1.0	1.0	each	C.1.05	$ 679.52	$ 679.52		
	9	50	2		remove pumps, pipes, cables, and culverts	1.0	1.0	each	X.05	$ 2,500.00	$ 2,500.00		
	9	50	3		backfill sump excavation	17.0	17.0	m3	C.5.02	$ 16.35	$ 277.42		
	9	50	4		excavate and stockpile liner protection cover	1500.0	1500.0	m3	C.5.04	$ 2.75	$ 4,123.04		
	9	50	5		load contained contaminated soils into megabags for hauling	1500.0	1500.0	m3	C.4.12	$ 72.73	$ 109,096.46		
	9	50	6		haul megabags to Boston underground	1500.0	1500.0	m3	C.4.44	$ 3.26	$ 4,889.84		
	9	50	7		clean liner	2500.0	2500.0	m2	C.2.10	$ 0.41	$ 1,030.13		
	9	50	8		remove and cut liner into manageable pieces	2500.0	2500.0	m2	C.3.02	$ 0.17	$ 425.95		
	9	50	9		load waste into containers	22.5	22.5	m3	C.4.01	$ 10.23	$ 230.13		
	9	50	10		haul containers to Boston landfill	22.5	22.5	m3	C.4.43	$ 3.26	$ 73.35		
BM_044	9	44	1	Boston Water Discharge Access Road	crown road for positive drainage	0.2	0.2	km	C.5.17	$ 866.22	$ 185.37		
BM_042	9	42	1	Boston Vent Raise Access Road	crown road for positive drainage	1.2	1.2	km	C.5.17	$ 866.22	$ 1,013.48		
BM_023	9	23	1	Boston Mill Haul Road	crown road for positive drainage	0.3	0.3	km	C.5.17	$ 866.22	$ 253.80		
BM_022	9	22	1	Boston Camp Ring Road	no closure activities are required, addressed under Boston developed areas								
BM_029	9	29	1	Boston Heliport	dismantle helicopter pads and walkway	15.0	15.0	m3	C.3.06	$ 4.18	$ 62.72		
	9	29	2		demolish helishack	45.0	45.0	m3	C.3.05	$ 13.12	$ 590.43		
	9	29	3		collect debris	1165.0	1165.0	m2	C.3.10	$ 0.37	$ 436.80		
	9	29	4		load debris into containers for transport	51.5	51.5	m3	C.4.01	$ 10.23	$ 526.93		
	9	29	5		haul debris to Boston landfill	51.5	51.5	m3	C.4.44	$ 3.26	$ 167.95		
BM_030	9	30	1	Boston Airstrip	decommission airstrip	2.0	2.0	Each	C.1.09	$ 322.61	$ 645.22		
	9	30	2		collect all debris	60960.0	60960.0	m2	C.3.10	$ 0.37	$ 22,856.25		
	9	30	3		load waste into containers	36.6	36.6	m3	C.4.01	$ 10.23	$ 374.10		
	9	30	4		haul containers to Boston landfill	36.6	36.6	m3	C.4.44	$ 3.26	$ 119.23		
	9	30	5		crown airstrip and airstrip expansion for positive drainage	60960.0	60960.0	m2	C.5.05	$ 1.23	$ 74,819.26		
BM_034	9	34	1	Boston South Apron	regrade for positive drainage	6000.0	6000.0	m2	C.5.05	$ 1.23	$ 7,364.10		
	9	34	2		decommission electrical, and heating from traffic control tower	2.0	2.0	each	C.1.07	$ 374.34	$ 748.67		
	9	34	3		demolish control tower structure (wood shack)	30.5	30.5	m3	C.3.05	$ 13.12	$ 400.18		
	9	34	4		disconnect containers and prep for shipping	3.0	3.0	each	C.1.08	$ 1,368.94	$ 4,106.81		
	9	34	5		haul trailers to Roberts bay for shipping	111.6	111.6	m3	C.4.26	$ 19.15	$ 2,137.20		

Work Area Code	Item	Task	Sub-task	Facility Name	Task	Quantity	Quantity	Unit	Cost Code	Unit Cost	Activity Total	Subtotals	Source / Comments
	9	34	6		collect all debris	6000.0	6000.0	m2	C.3.10	$ 0.37	$ 2,249.63		
	9	34	7		load waste into containers	26.0	26.0	m3	C.4.01	$ 10.23	$ 265.76		
	9	34	8		haul containers to Boston landfill	26.0	26.0	m3	C.4.43	$ 3.26	$ 84.71		
BM_037	9	37	1	Boston Airstrip Access Road	crown road for positive drainage	1.0	1.0	km	C.5.17	$ 866.22	$ 887.01		
BM_039	9	39	1	Boston Landfill Access Road	crown road for positive drainage	1.3	1.3	km	C.5.17	$ 866.22	$ 1,092.30		
BM_045	9	45	1	Boston Water Intake Access Road	crown road for positive drainage	0.2	0.2	km	C.5.17	$ 866.22	$ 213.09		
Underground Workings												**$ 62,427.49**	
BM_028	9	28	1	Boston Vent Raise	remove ducts, pipes, and cables	100.0	100.0	lm	C.3.16	$ 119.02	$ 11,901.55		
	9	28	2		construct a concrete cap (0.5 m thick reinforced concrete) to seal the top	1.0	1.0	each	C.6.03	$ 14,292.68	$ 14,292.68		
	9	28	3		decommission and dismantle all ventilation and heating facilities	4.0	4.0	each	C.1.05	$ 679.52	$ 2,718.06		
	9	28	4		prepare units for shipping	1.0	1.0	each	C.1.08	$ 1,368.94	$ 1,368.94		
	9	28	5		haul units to Boston landfill	37.2	37.2	m3	C.4.44	$ 3.26	$ 121.30		
	9	28	6		regrade pads for positive drainage	2270.0	2270.0	m2	C.5.05	$ 1.23	$ 2,786.08		
BM_033	9	33	1	Boston Portal and Underground Works	remove ducts, pipes, electrical cables	100.0	100.0	lm	C.3.16	$ 119.02	$ 11,901.55		
	9	33	2		construct portal plug	706.8	706.8	m3	C.5.03	$ 24.53	$ 17,337.32		
Tailings												**$ 15,266,954.47**	
BM_031	9	31	1	Boston TMA Tailings	regrade top surface for positive drainage	72900.0	72900.0	m2	C.5.05	$ 1.23	$ 89,473.82		
	9	31	2		cover entire dump with hdpe liner,	202826.0	202826.0	m2	C.5.01	$ 33.85	$ 6,864,661.28		
	9	31	3		Produce ROQ (quarry drill&blast)	202826.0	202826.0	m3	C.5.24	$ 23.16	$ 4,697,501.00		
	9	31	4		Produce Crush	60847.8	60847.8	m3	C.5.27	$ 4.91	$ 298,529.54		
	9	31	5		place 1 m thick liner protection layer of crushed rock & ROQ	202826.0	202826.0	m2	C.5.02	$ 16.35	$ 3,316,788.83		
Waste and Landfills												**$ 464,672.36**	
BM_038	9	38	1	Boston Landfill	empty seacan of debris, place and track pack (all site waste to Boston landfill)	1129.5	1129.5	each	C.4.02	$ 86.72	$ 97,954.15		
	9	38	2		regrade top surface for positive drainage	27040.0	27040.0	m2	C.5.05	$ 1.23	$ 33,187.54		
	9	38	3		Produce ROQ (quarry drill&blast)	8112.0	8112.0	m3	C.5.09	$ 24.76	$ 200,876.11		
	9	38	4		place 0.3 m crushed gravel + 0.7 m ROQ liner protection layer	8112.0	8112.0	m3	C.5.02	$ 16.35	$ 132,654.55		
Pipelines												**$ 25,529.77**	
BM_043	9	43	1	Boston Water Discharge Line	flush pipeline prior to decommissioning	1.0	1.0	Each	C.2.06	$ 677.68	$ 677.68		
	9	43	2		cut pipelines into manageable pieces and place in containers for hauling to landfill	2000.0	2000.0	m	C.3.03	$ 11.08	$ 22,168.89		
	9	43	3		remove electrical cables and controllers	2.0	2.0	each	C.1.05	$ 679.52	$ 1,359.03		
	9	43	4		load debris into containers for hauling to landfill	98.2	98.2	m3	C.4.01	$ 10.23	$ 1,004.12		
	9	43	5		haul containers to Boston landfill	98.2	98.2	m3	C.4.44	$ 3.26	$ 320.04		
DO NOT MODIFY THIS ROW													
Closure Monitoring												**$ 149,500.00**	
CM_002	24	1	1	Closure Compliance	Annual Geotechical Inspection	1	1	each	LS	$ 35,000.00	$ 45,500.00		
	24	1	2		Water Sampling and Testing	1	1	each	LS	$ 60,000.00	$ 78,000.00		
	24	1	3		Regulatory Costs	1	1	each	LS	$ 20,000.00	$ 26,000.00		
Interim Care and Maintenance												**$ 2,277,527.38**	
ICM_001	23	1	1	Interim Care and Maintenance - Annual ICM	water management and camp care and maintenance	1.5	1.5	year	LS	$ 1,439,927.58	$ 2,159,891.38		18 months of ICM
	23	1	2		compliance monitoring	1.5	1.5	year	LS	$ -	$ -		compliance monitoring extended into closure duration
	23	1	3		mob/demob ICM fleet	1.0	1.0	-	LS	$ 117,636.00	$ 117,636.00		equipment required at 1 camp(s) based on number of work areas
Total Direct Costs												**$ 23,656,808.62**	
Contingency												$ 4,731,361.72	
-			Contingency		20% of direct costs	0.2	0.2	%	x	$ 23,656,808.62	$ 4,731,361.72		
Mobilization & Demobilization												$ 2,142,246.33	
-			Mobilization - all work areas		Mob/Demob	1	1	each	LS	$ 1,071,123.17	$ 1,071,123.17		equipment on site for 2 years while all closure completed
			Demobilization - all work areas		Mob/Demob	1	1	each	LS	$ 1,071,123.17	$ 1,071,123.17		
General and Administration costs												$ 2,995,863.42	
-			Camp Management & Operations			1.3	1.3	yr	OC.11	$ 668,250.00	$ 868,725.00		includes cook, first aid, housekeeping, manager
-			Camp Mobilization/Demobilization			1	1	LS	OC.12	$ 170,437.50	$ 170,437.50		includes mob/demob + one-time setup cost
			Crew charters (by-weekly)			34	34	each	OC.05	$ 10,617.57	$ 360,997.40		
			Groceries			9,720	9,720	person-day	OC.13	$ 110.00	$ 1,069,203.52		
-			Camp Rental			1.3	1.3	yr	OC.10	$ 405,000.00	$ 526,500.00		
Field support												$ 888,858.83	
-			Supervision			476.00	476.00	days	x	$ 1,750.63	$ 833,297.51		
-			Equipment maintenance support - Mechanic			48.00	48.00	days	x	$ 1,157.53	$ 55,561.32		
-			Helicopter Support			0	0	hours	E.08	$ 2,367.39	$ -		
Hydrocarbon decontamination												$ 100,000.00	
-			Confirmatory Sampling and Analysis			1	1	LS		$ 100,000.00	$ 100,000.00		Minimum cost $25,000 maximum cost $100,000, each work area = $20,000
Post-closure Monitoring												$ 970,000.00	
			Annual geotechnical inspection		Annual for first 3 years, the years 6 and 10	5	5	LS		$ 35,000.00	$ 175,000.00		
			Cover monitoring		Every 2 years for a 10 year period	5	5	LS		$ 35,000.00	$ 175,000.00		
			Regulatory costs		Yearly for 10 years	10	10	LS		$ 20,000.00	$ 200,000.00		
			Water sampling and testing		Annual for 5 consecutive years, they year 7 and 10	7	7	LS		$ 60,000.00	$ 420,000.00		
Total Indirect Costs												**$ 11,828,330.30**	
Total Closure and Reclamation Cost												**$ 35,485,138.92**	

Mobilization

No. of units (from schedule)	Manual Override	Equipment already on site from ICM	Final No. Units	Description	Units	Quantity	Unit cost	Task cost	Notes
All Project Areas				Construction equipment					
0			0	Helicopter	ea	1.0	$ 10,000.00	$ -	Flight from Yellowknife
3			3	Dozer - CAT D8	m^2	38.9	$ 470.00	$ 54,905.40	From Hay River to Roberts Bay; NT Marine Rates 2017
5		1	4	Excavator - Cat 330	m^2	36.7	$ 470.00	$ 68,948.17	From Hay River to Roberts Bay; NT Marine Rates 2017
2		1	1	Loader - CAT 980	m^2	46.4	$ 470.00	$ 21,813.86	From Hay River to Roberts Bay; NT Marine Rates 2017
2			2	Motor grader CAT 14H	m^2	28.5	$ 470.00	$ 26,798.00	From Hay River to Roberts Bay; NT Marine Rates 2017
1			1	Skidder CAT 242	m^2	5.8	$ 470.00	$ 2,735.22	From Hay River to Roberts Bay; NT Marine Rates 2017
4	4	1	3	Truck - CAT 740	m^3	69.3	$ 470.00	$ 97,713.00	From Hay River to Roberts Bay; NT Marine Rates 2017
4	4		4	Tractor Trailer	m^2	1.0	$ 14,216.00	$ 56,864.00	From Hay River to Roberts Bay; NT Marine Rates 2017
4	4		4	Flatbed truck (5 tonne)	ea	1.0	$ 5,358.00	$ 21,432.00	From Hay River to Roberts Bay; NT Marine Rates 2017
6			6	Drill	m^2	25.9	$ 470.00	$ 73,094.40	From Hay River to Roberts Bay; NT Marine Rates 2017
1	1		1	Drum crusher	kg	0.2	$ 470.00	$ 70.50	From Hay River to Roberts Bay; NT Marine Rates 2017
2			2	Power washer	kg	0.1	$ 470.00	$ 94.00	From Hay River to Roberts Bay; NT Marine Rates 2017
2			2	Welding Equipment	kg	0.3	$ 470.00	$ 235.00	From Hay River to Roberts Bay; NT Marine Rates 2017
1			1	Crane	m^2	28.4	$ 470.00	$ 13,360.03	From Hay River to Roberts Bay; NT Marine Rates 2017
5		1	4	Pickup trucks - F150	ea	1.0	$ 3,925.00	$ 15,700.00	From Hay River to Roberts Bay; NT Marine Rates 2017
28		2	26	20 ft containers	ea	1.0	$ 6,896.00	$ 179,296.00	tires, spare parts, and lubricants; from Hay River to Roberts Bay; NT Ma
37			37	Highway Trailers Hauling	LS	1.0	$ 438,063.58	$ 438,063.58	double up the barging cost, as per INAC& TMAC agreed upon cost
Subtotal Mobilisation								**$ 1,071,123**	
Subtotal Demobilisation								**$ 1,071,123**	Assumes same cost as mobilisation
Total								***$ 2,142,246***	

Task	Unit	Quantity	Tonnage	Unit Cost	Activity Total	Subtotals	Notes
INTERIM CARE & MAINTENANCE						**$ 1,202,507**	
on-site caretaker	person-months	6		$35,674	$214,043		on-site caretaker in the summer months only
extra personnel	person-months						extra personnel
-electrician	person-months	3		$36,622	$109,865		half the time, for opening and closing the camp + maintenance
-mechanic	person-months	3		$34,726	$104,177		half the time, for opening and closing the camp + maintenance
annual fuel	litre	22500		$1.05	$23,625		annual fuel
misc. supplies	allow	6		$1,500	$9,000		misc. supplies
pick-up truck	month	12	2	$3,999	$95,986.72		one pickup for each crew - Doris and Madrid
small dozer	month	12		$36,215	$217,287.39		yearly stand-by rate at 50% of active rate
small excavator	month	12		$10,000	$120,000		small excavator
snow machine	month	0		$7,103	$0		summer caretaker only
articulated dump truck	month	12		$10,000	$120,000		articulated dump truck
communications	month	6		$2,500	$15,000		communications
mobile camp rental	allow	0		$80,000	$0		existing Doris camp will be used as it transitions to C&M
camp operations (up to 10 persons)	month	6		$5,260	$31,563		includes manager and cook/first aid
groceries	person/month	182	6	$130	$141,960.00		based on 6 person average occupancy
flights (Yellowknife - cambridge bay - Dc	each	26		$11,209	$291,445		two person-crews shift change monthly commercial flight to Cambridge Bay + 1 hr helicopter charter
COMPLIANCE MONITORING AND REPORTING						**$ 95,000**	
SNP/AEMP water sampling & reporting	each	1		$60,000	$60,000		SNP/AEMP water sampling & reporting
geotechnical assessment	each	1		$35,000	$35,000		geotechnical assessment
WATER MANAGEMENT						**$ 237,421**	
Operate / maintain pumping system							
technician (camp support incl under Mob)	days	182		$1,189	$216,421		manage contact water ponds
site support, consumables	month	6		$3,500	$21,000		site support, consumables
Annual Interim C&M Cost						**$ 1,534,927.58**	
EQUIPMENT MOBILIZATION						**$ 117,636.00**	
Number of ICM crews required:		1					Based on number of areas requiring reclamation, linked to schedule
Excavators							
mobilize		1	20	$ 470.00	$ 9,400.00		Edmonton to Hay River (1 x 36.1 tonnes)
demobilize		1	20	$ 470.00	$ 9,400.00		Hay River to Roberts Bay (1 x 36.1 tonnes)
Dump trucks							
mobilize		1	34.4	$ 470.00	$ 16,168.00		Edmonton to Hay River (1 x 34.4 tonnes)
demobilize		1	34.4	$ 470.00	$ 16,168.00		Hay River to Roberts Bay (1 x 34.4 tonnes)
Loaders							
mobilize		1	30	$ 470.00	$ 14,100.00		Edmonton to Hay River (1 x 30 tonnes)
demobilize		1	30	$ 470.00	$ 14,100.00		Hay River to Roberts Bay (1 x 30 tonnes)
Light duty vehicles							
mobilize		1	-	$ 5,358.00	$ 5,358.00		Edmonton to Hay River
demobilize		1	-	$ 5,358.00	$ 5,358.00		Hay River to Roberts Bay
Standard 20' containers							
mobilize		2	-	$ 6,896.00	$ 13,792.00		Edmonton to Hay River
demobilize		2	-	$ 6,896.00	$ 13,792.00		Hay River to Roberts Bay
Mob/Demob cost for ICM						**$ 117,636.00**	

Item_Task	Duration (weeks)	Crew Size	Start Week	End Week
Boston TMA Produce ROQ	26	10.0	1.0	26.0
Boston TMA Produce crush	25	2.0	3.0	27.0
Boston TMA Construct Cover	33	3.0	6.0	38.0
Boston Landfill Produce ROQ	4	4.0	28.0	31.0
Boston camp and mill facilities Decommission	26	4.0	1.0	26.0
Boston camp and mill facilities Decontamination	1	4.0	27.0	27.0
Boston camp and mill facilities Demolition	29	10.0	27.0	55.0
Boston camp and mill facilities Earthworks	6	3.0	56.0	61.0
Boston camp and mill facilities Misc.	9	6.0	56.0	64.0
Boston camp and mill facilities Vent Raise Seal	1	4.5	62.0	62.0
Boston Fuel Storage Decommission	1	3.0	56.0	56.0
Boston Fuel Storage Decontamination	2	3.0	57.0	58.0
Boston Fuel Storage Demolition	1	3.0	59.0	59.0
Boston Fuel Storage Earthworks	3	2.0	54.0	56.0
Boston Fuel Storage Misc.	12	3.0	57.0	68.0
Boston Pads Collect Debris	1	4.0	52.0	52.0
Boston Pads Earthworks	5	1.0	54.0	58.0
Boston Water Management Structures Demolition	1	3.0	54.0	54.0
Boston Water Management Structures Earthworks	1	1.0	55.0	55.0
Construct Boston Landfill Cover Construct Cover	3	3.0	56.0	58.0
Construct Boston Landfill Cover Produce ROQ	4	4.0	59.0	62.0

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