# List of Appendices and Supporting Letters



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Rescan Environmental Services Ltd., an ERM company

Suite 2050, West Tower 3300 Bloor Street Toronto, ON Canada M8X 2X2 +1 416 646 3608 www.erm.com



November 20, 2013

Gordon Morrison, President c/o TMAC Resources Inc. 372 Bay Street, Suite 901 Toronto, Ontario M5H 2W9, Canada

Subject: Review of Technical Reports in support of Water Licence Amendment Package

Dear Mr. Morrison:

#### **INTRODUCTION**

ERM Rescan is pleased to respond to TMAC Resources Inc.'s (TMAC) request to review the identified technical Reports described below (Reports) for the Doris Mine (Project), located in Nunavut, Canada. ERM Rescan understands that TMAC is preparing a documentation package in order to submit an amendment to the existing Water Licence (2AM-DOH1323) for the Project.

#### **SUMMARY**

ERM Rescan prepared the following technical Reports dated 2011 and 2013 with respect to the Project. This letter affirms that ERM Rescan has reviewed the Reports and determined that the conclusions remain valid. Therefore, it is ERM Rescan's opinion that the following Reports are suitable for inclusion in TMAC's Water Licence amendment package:

Appendix 3: Doris North Project: Mine Infrastructure Changes - Supporting Memo (Rescan, November 2013);

Appendix 4: Doris North Project: Roberts Bay Report - A Supporting Document for the Project Certificate and Type A Water Licence Amendment Package (Rescan, November 2013);

Appendix 5: Doris North Project: No Net Loss Plan for the Roberts Bay Subsea Pipeline and Diffuser (Rescan, November 2013); and

Appendix 23: Screening of Socio-economic Effects for Proposed Doris North Infrastructure Changes (Rescan, November 2011).



Gordon Morrison Reference: 0194098-0035 November 20, 2013 Page 2

#### ADDITIONAL INFORMATION

#### **Appendix 3: Supporting Memo**

ERM Rescan has prepared the Doris North Project: Mine Infrastructure Changes - Supporting Memo, identifying the proposed infrastructure changes to extend the mine life. ERM Rescan is of the opinion that the conclusions describing the identified measures to either avoid, minimize or mitigate the potential environmental effects of the proposed Project remain valid.

#### **Appendix 4: Roberts Bay Report**

The Doris North Gold Mine Project: Roberts Bay Report was produced in 2011 and the conclusions remain valid. The report was updated in November 2013 for TMAC. Additional physical oceanographic information was collected in Roberts Bay during 2011 and a numerical simulation of Roberts Bay circulation was conducted in 2012. Under a variety of scenarios (i.e., varying wind and freshwater inputs), the modeling results confirmed that Roberts Bay can become fully flushed within a week to a month's time during the open-water season. This falls within the conservative flushing model presented in the amendment and indicates that the treated Tailings Impoundment Area (TIA) water quality discharge targets presented in the amendment will meet the marine CCME receiving water criteria designed to be protective of marine life.

#### Appendix 5: No Net Loss Plan

The proposed TIA Water Management Plan involves discharging treated TIA water to Roberts Bay via a subsea pipeline and diffuser. The No Net Loss Plan provides mitigation of fish habitat potentially affected by the construction of the subsea pipeline and diffuser in Roberts Bay.

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#### **SOCIO-ECONOMIC EFFECTS**

The socio-economic effects assessment remain valid. The extension of the mine life and mining rate are predicted to increase the socio-economic benefits of the Project to Nunavut because of the increase in employment, income, and business activity. With respect to community services and infrastructure, minimal adverse effects are predicted on health care services, community well-being and delivery of social services, and public safety and protection services. As described in the Report's conclusion, mitigation measures were identified and remain appropriate to address adverse socio-economic effects and enhance the positive effects on employment and income, education and training, and business opportunities.

#### **CONCLUSION**

In summary, ERM Rescan has reviewed the above noted Reports, confirmed that the effects assessment conclusions remain valid and affirm that the Reports are appropriate for inclusion in TMAC's Water Licence amendment submission.

Sincerely,

Rescan Environmental Services Ltd., an ERM Company

Per:

Jim Chan, MEP

Project Manager

(Impact Assessment and

Planning Practice)

Mike Henry, Ph.D.

Partner

(Freshwater and Marine Sciences)

Kerry Marchinko, Ph.D.

Principal Consultant (Fisheries)

Kent Gustavson, Ph.D., M.Sc.

Partner (Regional Consultant)

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- Appendix 6. Geochemical Characterization Program for Quarry I, Doris (SRK, November 2011)
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- Appendix 8. Geochemical Characterization Report for Waste Rock and Ore from the Doris Deposits, Hope Bay (SRK, November 2011)
- Appendix 9. Groundwater Inflows and Inflow Water Quality Used for the Revised Doris North Project Amendment Package No. 3 to Water Licence No. 2AM-DOH0713 (SRK, November 2011)
- Appendix 10. Water Quality Model, Hope Bay Project, Nunavut, Canada (SRK, November 2011)
- Appendix 14. Tail Lake Water Cover Design (SRK, November 2011)
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- Appendix 16. Engineering Drawings for the Doris Central Vent Raise Pad and Access Road (SRK, June 2011)
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- Appendix 18. Design Brief: Doris North Project Expanded Ore Storage Pad (T; SRK, August 2011)
- Appendix 19. Design Brief: Doris North Project Expanded Waste Rock Storage Pad (U; SRK, November 2013)
- Appendix 21. Doris-Windy All-Weather Access Road: Proposed Freshwater Intake Line (SRK, September 2010)
- Appendix 24. Footprint of Proposed Changes to Phase 1 Doris North Mine (SRK, October 2013)



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vancouver@srk.com www.srk.com

October 31, 2013 Project No: 1CT022.000

TMAC Resources Inc. Suite 700, 55 University Avenue Toronto, ON M5J 2H7

Attention: Mr. Gordon Morrison, President and Chief Technology Officer

Dear Gordon

Subject: Review of Technical Reports in support of Water Licence Amendment Package

SRK Consulting (Canada) Inc. is pleased to respond to TMAC Resources Inc.'s (TMAC) request to review previously prepared Technical submissions for the Doris North Project, located in Nunavut, Canada. SRK understands that TMAC is preparing a submission for an amendment to the existing Water Licence (2AM-DOH1323) for the Project to be filed in November 2013.

The following Technical Reports dated 2010 and 2011, and updated in 2013 were prepared by SRK with respect to this amendment, which was originally to be submitted in late 2011:

- Appendix 6: Geochemical Characterization Program for Quarry 1, Doris (SRK, November 2011);
- Appendix 7: Kinetic Testing of Waste Rock and Ore from the Doris Deposits, Hope Bay (SRK, November 2011);
- Appendix 8: Geochemical Characterization Report for Waste Rock and Ore from the Doris Deposits, Hope Bay (SRK, November 2011);
- Appendix 9: Groundwater Inflows and Inflow Water Quality Used for the Revised Doris North Project Amendment Package No. 03 to Water Licence No. 2AM-DOH0713 (SRK, November 2011);
- Appendix 10: Water Quality Model, Hope Bay Project, Nunavut, Canada (SRK, November 2011);
- Appendix 14: Tail Lake Water Cover Design: Motivation to Reduce Water Cover Thickness (SRK, November 2011);
- Appendix 15: Reclamation and Security Brief for Amendment to Doris North Type A Water Licence No. 2AM-DOH1323 (SRK, October 2013);
- Appendix 16: Engineering Drawings for the Doris Central Vent Raise Pad and Access Road (SRK, June 2011);

U.S. Offices:		Mexico Office:	Canadian Offices:		Group Offices:
Anchorage	907.677.3520	Hermosillo	Saskatoon	306.955.4778	Africa
Denver	303.985.1333	52.662.215.1050	Sudbury	705.682.3270	Asia
Elko	775.753.4151	Queretaro	Toronto	416.601.1445	Australia
Fort Collins	970.407.8302	52.442.218.1030	Vancouver	604.681.4196	Europe
Reno	775.828.6800	Zacatecas	Yellowknife	867.873.8670	North America
Tucson	520.544.3688	52.492.927.8982			South America

SRK Consulting Page 2

 Appendix 17: Design Brief: Doris North Project, Roberts Bay Expanded Laydown Pads (SRK, August 2011);

- Appendix 18: Design Brief: Doris North Project Expanded Ore Storage Pad (Pad T) (SRK, August 2011);
- Appendix 19: Design Brief: Doris North Project Expanded Waste Rock Storage Pad (Pad U) (SRK, November 2013); and
- Appendix 21: Doris-Windy All-Weather Access Road: Proposed Freshwater Intake Line (SRK, September 2010).

SRK understands that no project changes are being proposed that would result in changes to the conclusions in the listed documents, and therefore SRK can confirm that these documents remain valid.

Sincerely, SRK Consulting (Canada) Inc.

any other use is not authorize

This signature was scanned with the author's

clusive use in this document;

Maritz Rykaart, PhD, PEng Principal Consultant

**Disclaimer**—SRK Consulting (Canada) Inc. has prepared this document for <Client Name>. Any use or decisions by which a third party makes of this document are the responsibility of such third parties. In no circumstance does SRK accept any consequential liability arising from commercial decisions or actions resulting from the use of this report by a third party.

The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

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Appendix 11. Tailings Impoundment Area - Excess Water Transfer System (Hatch, September 2011)

Appendix 20. Revised Waste Management Facility Drawings (Hatch, October 2011)

Appendix 22. Camp Layout Revision (Hatch, October 2011)





Project Memo

20 September, 2013

TO: Chris Hanks, Director, Environment and

Social Responsibility

FROM: Bruce Rustad, Project Manager, Hatch

cc: Gerry Schwab,

Christine Kowbel,

TMAC Resources Hope Bay Project

# Tailings Impoundment Area - Excess Water Transfer System

#### 1. Introduction

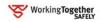
This memo is written to advise of the preferred engineering solution for the Tailings Impoundment Area (TIA) excess water management transfer system. This system has five components:

- 1. Tailings slurry pre-treatment in the process plant to remove zinc;
- 2. A pipeline through which treated tailings are pumped from the process plant to the TIA;
- 3. A pipeline through which excess water is pumped from the TIA to a treatment plant located beside the process plant;
- 4. A treatment plant that removes suspended solids from the excess TIA water; and
- 5. A pipeline through which treated TIA water is discharged to a subsea diffuser located in Roberts Bay.

This memo provides a technical summary of the five components. The diffuser system to be installed in Roberts Bay is described in detail in two separate reports prepared by Rescan ("Roberts Bay Report: A Supporting Document for the Water Licence Amendment Package No. 3" and "No Net Loss Plan for the Roberts Bay Subsea Pipeline and Diffuser"). This memo only summarizes the characteristics of the outfall pipeline.

The TIA water management system concept was designed to ensure that the treated TIA water that is discharged to the receiving environment of Roberts Bay, meets all regulatory limits and hence will not significantly impact any component of the marine aquatic ecosystem. The discharge criteria for the treated TIA water are listed in Tables 4-1 and 4-2 of the water balance modelling report prepared by SRK Consultants ("Water Quality Model, Hope Bay Project, Nunavut, Canada").

This memo describes Newmont's preliminary design for TIA water management. Newmont will periodically monitor the water quality in the TIA during the first few years and revise as appropriate any treatment scheme implemented during the initial construction phase.





## 2. Tailings Water Management Planning

These five components are based on a site water management plan that has taken into consideration all aspects of site water management. The plan incorporates water recycle, fresh water make up, proper effluent disposal, and energy conservation to minimize the impact to the local environment. The plan is supported by a water balance model that predicts TIA discharge water quality.

Although all efforts will be made to recycle as much of the process water from inside the milling/grinding and gold recovery areas of the plant as possible, a portion of the process water will leave with the tailings as a slurry to be deposited in the TIA.

The water and overall mass balance will be managed inside the process facility using recycle water through the use of thickeners etc. to reduce the amount of water being pumped from the mill to the TIA. All efforts will be made to select the optimum balance between recycle, process effluent treatment and fresh water make up to balance metals and other contaminants within the plant. Make up water from Doris Lake will continue to be used to offset the water consumed in the process.

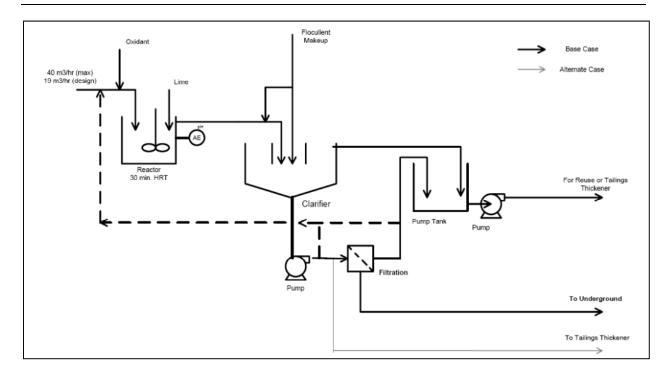
Excess water from the TIA will need to start being pumped out of the TIA within two years of mill operation. This excess water will be pumped from the impoundment via pumps to a treatment plant, located at the Doris Camp site, where the water will be treated to meet the discharge standards. The line pressure will then be boosted inside the water treatment facility, via centrifugal pump, to allow the treated water to transfer the 5 km to Roberts Bay for discharge via the subsea outfall and diffuser system.

## 3. Tailings Pre-treatment

The expected water quality in the TIA, based on modeling by SRK, indicates that treatment to remove one or more metals is required prior to discharge of process water to the TIA. Zinc is the main metal of concern because it is used as a dosing agent in the Merrill-Crowe process, but copper and cadmium are also metals of concern. The following flow sheet and process description provides the details for an effluent treatment plant (ETP) for removal of zinc from the mill effluent. The process for zinc removal will also remove other metals such as copper, if required.







Review of the mill effluent water quality suggests that only zinc will require treatment prior to discharging the tailings to the TIA. The water quality model assumed a zinc concentration of 0.5 mg/L following lime pre-treatment and that is the target for the ETP. The following is a description of the process and includes a secondary process that is necessary until it can be determined that the zinc hydroxide precipitate produced does not re-solubilise back into solution as the pH drops to near neutral during initial plant operation.

A portion of the mill effluent, specifically the cyanide detoxified barren (so-called because the cyanide has been destroyed and the gold has been extracted), will be directed to the primary pH adjustment tank and potassium permanganate will be injected with an in-line mixer in order that any complexes formed between the cyanide and zinc are eliminated. Provision will be made to inject additional reagents prior to the lime tank if other metals besides zinc need to be controlled, such as cadmium or copper introduced through Merrill-Crowe and cyanide detoxification. The pH of the reactor is critical to the precipitation of the zinc hydroxide as it is amphoteric in nature. This means it will readily dissolve in a dilute solution of a strong acid, and also in a solution of an alkali such as sodium hydroxide. To minimize the zinc in solution the optimal pH must be adjusted in the field, however, it is anticipated based on test work to be around 10 – 10.5. A lime solution will be fed to the agitated primary pH adjustment tank to increase the pH of the solution. The reactor will be sized for a 30 minute retention and the flow will then be directed by gravity to a clarifier where flocculent will be added to enhance liquid-solid separation. The settled solids will be periodically pumped through a bag filter or a recessed plate filter to collect the precipitate, while the filtrate will be recycled back to the primary pH adjustment tank, if necessary. Provisions will be in place to recycle the underflow solids as required to the primary pH adjustment tank to aid in producing denser floc. Tailings will be transported from the plant site to the TIA and deposited during both summer and winter months.

If future investigation reveals that the zinc will not become soluble again at the pH anticipated in the tailings thickener, then the clarifier underflow filtration process could be eliminated. The clarifier



underflow will then report to the tailings thickener for final solids liquid separation prior to TIA disposal.

## 4. Mill Tailings Pipeline to the TIA

The mill processing plant waste streams will be combined into a tailing thickener where the overflow water will be reused in the process and the underflow will be transferred to a tails box and pumped to the TIA through a double-walled pipeline. The pipeline will be equipped with heat tracing, insulation and low point drains to HDPE containment and recovery tanks.

The pressure required to overcome the friction and head requires that the initial 1.1 km section of the line be rubber lined carbon steel. After 1.1 km, the piping material will be changed to HDPE.

The piping will be routed the most convenient way across the plant-site and then follow the tailings road to the TIA. The pipeline route has been designed to minimize low points. Two low point drainage points have been designed to accommodate the pipeline contents in the event of an emergency. The low point drains will transfer the pipeline contents into a HDPE containment / recovery tanks. The tailing will be discharged into the TIA in accordance with the SRK tailings deposition plan.

For pipeline plan and elevation please refer to Hatch drawings D2000-10-035-0001 and D2000-10-035-0002.

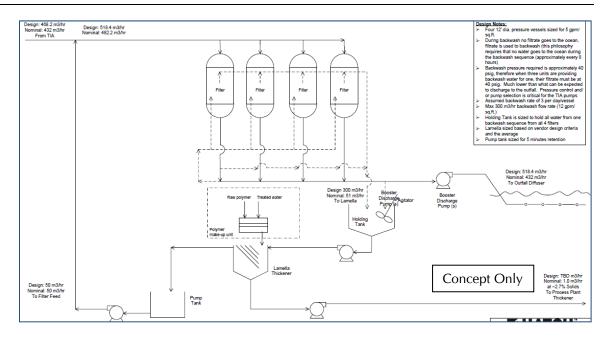
## 5. Pipeline from the TIA to the Water Treatment Facility

Excess water cover will be removed from the TIA through a single point of discharge. Based on modelling, it is expected that a nominal flow rate of 120 L/s will be discharged from the TIA to the ocean. To ensure that the effluent treatment plant is sized adequately for the operation, the maximum rate is designed to operate throughout the year. In years requiring lower volumes of discharge the discharge pumps may simply be shut down for periods of time. The HDPE pipeline from the TIA to the discharge treatment plant will also be double-walled, heat-traced and insulated.

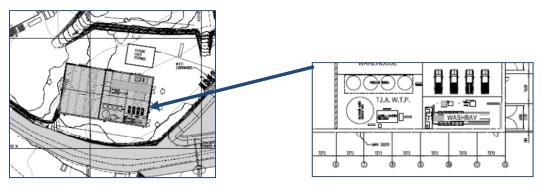
## 6. TIA Discharge Treatment

The expected water quality in the TIA, based on modeling by SRK suggests that a final filtration stage for the discharge of the TIA will be required to meet an acceptable discharge standard. Since effluent discharge from the TIA is not expected for the first two years of mill operation, it will be possible to closely monitor the water cover quality over that time to determine if any additional treatment is required. It is, however, predicted from water balance modelling that effluent to be discharged from the TIA will require only filtration with the backwash solids recycled back into the tailings thickener underflow in the process plant. This is required to ensure that the potential salinity from the TIA does not enter the process plant. If deemed required, additional equipment may be added to the treatment facility, such as mixed media filtration and pH adjustment. All thickened backwash underflow would be returned to the mill tails thickener underflow.





Based on the initial test work and modelling, direct filtration is expected to be sufficient to remove TSS to below the MMER limits. It is expected that the equipment will be installed at the Doris Camp Site in a new multi-purpose building.

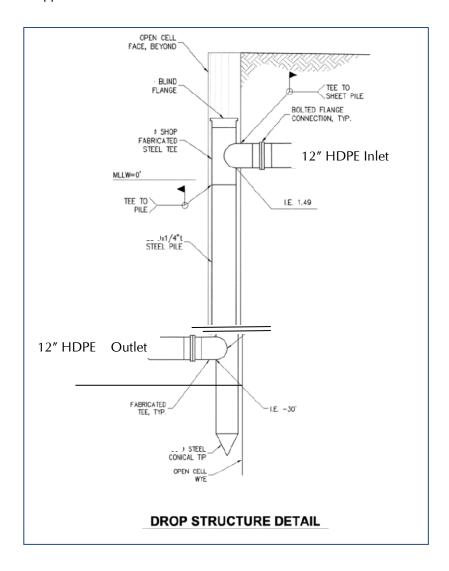




## 7. Subsea Outfall System

The subsea outfall system consists in general of an overland pipe made of HDPE pipe from the effluent filter plant to Roberts Bay then connecting to a subsea pipeline and diffuser installed on the sea floor within Roberts Bay. The pipeline will be heat-traced and insulated. A critical component of the outfall, both in terms of environmental impacts and constructability, is the shoreline crossing traversing the riparian zone adjacent to Roberts Bay to a point below the expected depth of freezing (approximately the 3 m isobath).

Hatch considers that the transition from the overland pipe to the subsea pipe could be achieved within the jetty footprint and should be installed during the future sheetpile work. The plan would be to install a pipe spool during the sheetpile installation incorporating the pipe protection into the sheet pile design. The pipe drop structure would be installed to penetrate the edge of the jetty below the lowest ice level. This early work would be installed and the piping would be blind flanged until approval is received for the subsea outfall.



# List of Appendices and Supporting Letter by Points West

Appendix 13. Archaeological Review (Points West, October 2011)

## POINTS WEST HERITAGE CONSULTING LTD.



23531 – 8<sup>th</sup> Street, Langley, B.C. V2Z 2X9 604-534-5054 50041 HWY 814, Leduc County, AB. T4X 0K2 780-980-2079

October 9, 2013

TO: Gordon Morrison, President TMAC Resources Inc. Toronto, Ontario

### **RE:** Doris North Amendment Application 2013

I have reviewed the November, 2011 amendment application and re-evaluated my assessment of the amendments. Assuming no changes in the proposed footprint and extent of associated ground disturbance as discussed in the amendment application, I re-affirm the conclusions in my original assessment.

#### Additional Information RE: Use of Quarries A, B, D

These three quarries were found to contain seven archaeological sites: Quarry A: NaNh-49, 60, 61; Quarry B: NaNh-62, 63, 64; Quarry D: NaNh-58. These sites were fully mitigated in 2010 and no longer present any archaeological concerns relative to quarrying activities conducted within the boundaries as originally identified.

#### **Doris Connector Vent Raise**

A Doris Central vent raise was assessed in 2011. The addition of a Doris Connector vent raise does not change the previous assessment. That is, this vent raise is proposed in an area that was subjected to one series of ground reconnaissance surveys and there are no known archaeological resources; thus, conflicts are considered unlikely. As originally recommended for the Doris Central developments, a final intensive ground inspection is recommended for both vent raises and associated access roads.

Gabriella Prager, MA

A Proses

Senior Archaeologist

Points West Heritage Consulting Ltd.