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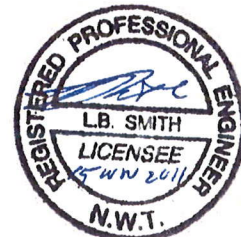
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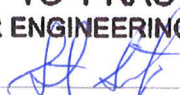
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**MARY RIVER PROJECT**  
**INITIAL GEOTECHNICAL RECOMMENDATIONS**  
**ROCK FILL EMBANKMENTS AND OVERBURDEN CUTS**  
**MARY RIVER RAILWAY**

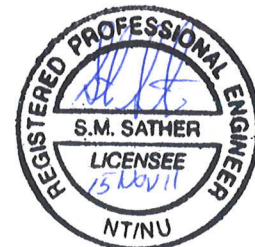
**Report**  
  
**to**  
  
**Hatch Ltd.**



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<b>PERMIT TO PRACTICE</b> <b>THURBER ENGINEERING LTD.</b>
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## **EXECUTIVE SUMMARY**

This report presents initial recommendations for the preliminary design of the rock fill embankments and cuts in overburden soils required for a proposed railway line, about 150 km long, that will carry iron ore between the Mary River Mine and Port Steensby on Baffin Island. Design recommendations for rock cuts and two tunnels, which are also required for the railway, are presented in a separate report prepared by EBA Engineering Consultants.

The entire alignment is underlain by permafrost which extends to depths of several hundred metres. The near surface soils consist primarily of sands and gravels, cobbles, boulders and frost shattered bedrock. Granite bedrock outcrops are common along the entire corridor. Ground ice and ice rich soils were encountered within the overburden soils, most frequently between the Mary River Mine and KP 86.

Experience on a number of earthworks construction projects, similar to that proposed for the Mary River Railway, has demonstrated that if the embankments are constructed of blasted granite rock, sideslopes of 1.5 horizontal to 1 vertical will remain stable, including under the design seismic loads, provided the embankment is constructed on a fairly level surface and the underlying soils consist of well drained sands and gravels, such as are present below most locations along the alignment.

The stability of cut slopes in ice rich overburden soils during the thaw season will depend on the fines (silt and clay) content of the material. A review of the available data found that the overburden soils consist primarily of coarse grained sands and gravels which have an average fines content of less than 20 percent. It is expected that these materials will drain faster than they thaw, so that while surface settlements will occur, mass movement or sloughing will be minimal and the slopes should become relatively stable after 2 to 3 thaw seasons.

A series of theoretical deformation analyses were undertaken to evaluate the effect that creep of ice and ice rich soils in the embankment foundations has on track settlements and the deformations of culverts installed near the base of embankments. The magnitude of creep deformations depends primarily on the height of the embankment and the thickness of the ice rich material in the underlying foundation.

The subsurface conditions along the proposed railway alignment were reviewed and an initial evaluation indicates that track and culvert settlements will likely be less than



0.5 metres after 25 years in most locations, primarily because the majority of embankment heights and ice thicknesses are moderate. In a few locations, where high embankments are underlain by thick deposits of ice or ice rich soil, it will be necessary to construct stabilization berms and take other measures to control embankment and culvert deformations.

The reliability of the geotechnical evaluation presented in this report is limited for a number of reasons, as described in the report. The primary concern however, is that because the majority of the boreholes were drilled with a diamond drill rig, without chilled brine, sample recovery of the overburden soils was often poor. There is therefore some uncertainty regarding the geotechnical properties of the overburden.

The report presents a number of recommendations which are intended to provide a more accurate assessment of the properties of the overburden soil and thereby improve the reliability of the geotechnical evaluation and design recommendations presented in the report.

It should be recognized that there are some deficiencies in the subsurface information currently available and in addition, the construction of high rock fill embankments on thick ice deposits is unprecedented. These uncertainties should be reflected in the cost estimate.

It is also recommended that railway operating cost estimates include an allowance for remedial and maintenance work of cut slopes, embankments and culverts, which is expected to be necessary, particularly during the first 5 to 10 years of railway operations.

It is recommended that the initial geotechnical recommendations presented in this report be reviewed and modified, based on site specific conditions, during detailed design by a geotechnical engineer who has practical experience in the design of major earthworks and other structures in permafrost regions.

## TABLE OF CONTENTS

EXECUTIVE SUMMARY	
1	INTRODUCTION .....1
1.1	Purpose .....1
1.2	Project Background .....1
1.3	Scope of Report.....2
1.4	Field Investigations .....3
2	SITE DESCRIPTION .....6
2.1	General .....6
2.2	Permafrost .....6
2.3	Ground Ice .....7
2.4	Mary River Mine Site to KP 35.....9
2.5	KP 35 to KP 86 .....9
2.6	KP 86 to KP 124 .....10
2.7	KP 124 to Port Steensby.....11
3	EMBANKMENT FILLS.....12
3.1	Embankment Sideslopes .....12
3.2	Seismic Loading .....13
4	CUTS ON OVERBURDEN .....15
4.1	General .....15
4.2	Fines Contents.....16
4.3	Cut Slope Angles .....17
5	COCKBURN LAKES SECTION.....19
5.1	General .....19
5.2	Site Conditions.....19
5.3	Possible Cross-Sections .....20
5.4	Recommended Cross-Section .....21
5.5	Stability of Cut and Fill Slopes .....22
5.6	Estimating Earthworks Volumes .....23

5.7	Recommendations .....	24
6	CREEP OF ICE RICH SOIL .....	26
6.1	General .....	26
6.2	Method of Analysis .....	26
6.3	Configurations Analysed .....	29
6.4	Calibration of Creep Parameters .....	30
6.5	Creep Deformation Patterns .....	31
6.6	Strength of Embankment Fill.....	32
6.7	Effect of Embankment Height .....	33
6.8	Effect of Stabilization Berms .....	33
6.9	Rate of Creep Settlement .....	34
7	TRACK SETTLEMENTS .....	36
7.1	Interpolation of Calculated Track Settlements .....	36
7.2	Estimated Settlements .....	36
7.3	Discussion .....	37
8	CULVERT DEFORMATIONS .....	39
8.1	Estimated Culvert Settlements.....	40
8.2	Discussion .....	42
9	DISCUSSION AND RECOMMENDATIONS.....	44
9.1	Limitations of the Evaluation .....	44
9.2	Summary of Recommendations.....	45
10	CLOSURE .....	48
REFERENCES		
STATEMENT OF GENERAL CONDITIONS		
APPENDIX A – TABLES		
APPENDIX B – FIGURES		
APPENDIX C – PHOTOS		
APPENDIX D – MAPS		