

JWEL PROJECT NO. NFS09737

PRELIMINARY HYDROGEOLOGICAL STUDY
PROPOSED WASTE MANAGEMENT FACILITY
NORRIS ARM, NL

NOVEMBER 2003

W.M.
03/12/01



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REPORT ON

**PRELIMINARY HYDROGEOLOGICAL STUDY
PROPOSED WASTE MANAGEMENT FACILITY
NORRIS ARM NORTH, NL**

PREPARED FOR

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PREPARED BY

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November 27, 2003





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Project No. NFS09737

November 27, 2003

Mr. Wayne Manuel
BAE Newplan Group Limited
1133 Topsail Road
Mount Pearl, NL A1N 5G2

**Re: Preliminary Hydrogeological Study
Proposed Waste Management Facility
Norris Arm North, Newfoundland and Labrador**

1.0 INTRODUCTION

Acting at your request, Jacques Whitford Environment Limited (JWEL) has carried out a preliminary hydrogeological evaluation of the proposed Central Newfoundland Waste Management Facility Norris Arm Site. The main objective of the study was to evaluate the hydrogeological conditions underlying the proposed site, and assess the potential for impacts on local groundwater resources resulting from the proposed disposal facility. This study involved a review of published hydrogeological and geological maps and reports, as well as topographic maps and aerial photographs for the area, and includes recommendations for future work to further assess hydrogeological conditions at the site.

2.0 SITE DESCRIPTION

The proposed site covers an area of approximately 368.9 ha and is located along the Trans Canada Highway, approximately 3 km west of the intersection with Highway 340 and 10 km east of the community of Norris Arm North, refer to Drawing NFS09737-EE-01 provided in **Attachment A**. The Trans Canada Highway is located approximately 200 m south of the proposed site at its closest point.

The topography of the site gently slopes towards the northwest at a gradient of approximately 0.04, with elevations ranging from about 90 to 110 m along the southern portion of the property to less than 45 m along the northern boundary. The land cover is forested with interspersed cut-over and wetland areas. Several small brooks transect the site flowing in a northerly direction towards an unnamed east-west-trending brook and pond system, located in a lowland area approximately 250 m north of the site, that in turn flows towards Norris Arm North, located approximately 4 km west of the site.



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The climate within the Norris Arm area is generally cool and humid, with a mean annual temperature of about 4.5°C and a mean annual precipitation of about 1124 mm. Based on a calculated annual evaporation of 530 mm, it is estimated that approximately one half of the annual precipitation is available as runoff and ground infiltration¹. There is reportedly no groundwater use in the vicinity of the proposed landfill.

3.0 SOURCES OF INFORMATION

The following data sources were reviewed as part of the evaluation:

- Hydrogeology of the Notre Dame Bay Area, Newfoundland Department of Environment and Lands, Water Resources Division, Groundwater Branch, Water Resources Report 2-2, Groundwater Series. Prepared by Hydrology Consultants Limited, 1980.
- Water Well Data for Newfoundland and Labrador, 1950-2002, Newfoundland Department of Environment, Water Resources Division, Groundwater Branch.
- Geology of the Island of Newfoundland, Newfoundland Department Mines and Energy, Map90-01.
- Surficial Geology of Insular Newfoundland, Newfoundland Department Mines and Energy, Map90-08.
- Topographic map of the Botwood area, 2E/3 (1:50,000 scale), 1981.
- Aerial photographs of the Norris Arm area, photograph nos. 99022-40 and 42 (1:12,500), Newfoundland Department of Natural Resources, 1999.

4.0 GEOLOGY AND HYDROGEOLOGY

Based on a review of surficial and bedrock geology maps, the proposed site is predominantly covered by unconsolidated glacial drift material largely consisting of sandy silt till with occasional discontinuous granular layers. While no subsurface data is available for the proposed site, information contained in water well records for the Notre Dame Junction area, which is underlain by similar geological strata and located approximately 3 km east of the site, indicates till overburden thickness ranging from 7 m to 53 m, and an average thickness of 40 m. Organic-rich marsh and bog deposits underlain by sand and gravel outwash material occur within the lowland area along the northern boundary of the proposed site. The thickness of the glacial outwash material in this area is unknown, however regional overburden thickness data for this material indicates thickness ranging from 9 m to 27 m, and an average thickness of 14 m. Aquifer testing would be required in order to determine various hydraulic parameters associated with glacial till and outwash overburden in the area, however permeabilities can be expected to be low to moderate for the sandy silt till material, with typical permeability values ranging from 10^{-8} to 10^{-6} m/s, while glacial outwash material can be expected to be somewhat higher with typical permeability values ranging from 10^{-5} to 10^{-3} m/s.

¹ Hydrology Consultants Ltd., 1980.



Overburden strata at the proposed site is underlain by Silurian-aged sedimentary and minor bimodal volcanic rocks of the Botwood Group. Sedimentary rocks in the area comprise red, brown and green micaceous sandstone, siltstone and quartzite, and the volcanic rocks comprise unseparated felsic pyroclastic rocks and vesicular basalt. These rocks can be expected to have low permeabilities ranging from 10^{-2} to 10^{-8} m/s, except in areas where secondary porosity has developed within joint, fracture or fault zones, and permeabilities may be somewhat higher.

Shallow groundwater at the proposed site is assumed to occur as an unconfined aquifer system within the unconsolidated glacial till overburden and shallow levels of the underlying bedrock. Based on regional water table level data and the abundance of standing water bodies in the area, groundwater levels are assumed to be a subdued reflection of topography occurring at shallow depths of less than 10 m. The average aquifer thickness is estimated to be approximately 40 m. Regionally, groundwater is thought to be recharging along the topographic highs and discharging along the coastal area, in the vicinity of Norris Arm North, NL. The proposed site occurs within a recharge area with groundwater movement occurring vertically downward and horizontally through the overburden sediments towards the unnamed brook and pond system to the north. It is unknown whether a deep groundwater flow system is present at the proposed site. However, due to the relative impermeability of the underlying bedrock, it is interpreted that groundwater flow at the proposed site is confined to a shallow flow system with groundwater discharge occurring as baseflow to local water bodies rather than contributing to a regional groundwater flow system.²

Water quality data for groundwater at the proposed site is not available, however regional studies indicate that groundwater in the area is generally acceptable for consumption³.

5.0 DISCUSSION

The potential for impacts on local groundwater resources resulting from the proposed disposal facility largely depends on the permeability and thickness of the overburden materials, as well as groundwater levels at the proposed site. A thorough evaluation of groundwater contamination susceptibility at the proposed site would require field study including subsurface investigation and aquifer testing in order to determine local hydrogeological conditions. However based on available data, groundwater contamination susceptibility ranging from moderate to high is inferred for the proposed site, depending on the amount of granular till material present and the depth to groundwater. Highest levels of groundwater contamination susceptibility can be expected to be associated with granular overburden material and shallow water table levels (i.e., <10 m), while lower potential for groundwater impacts can be expected in areas characterized by less permeable sandy silt till and deeper water tables. Also potential for groundwater impacts may be lower in wetland areas where higher soil attenuation can be expected associated with organic soils.

² Hydrology Consultants Ltd., 1980.

³ Hydrology Consultants Ltd., 1980.



6.0 CONCLUSION AND RECOMMENDATIONS

This study comprised a preliminary evaluation of the hydrogeological conditions in the area of the proposed Central Newfoundland Waste Management Facility Norris Arm North Site, including an assessment of the potential for impacts on local groundwater resources resulting from the proposed disposal facility. Based on regional data, the proposed site is interpreted to have moderate to high contamination susceptibility due to the nature of the inferred underlying glacial till material and shallow water table depths. It is recommended that local hydrogeological conditions at the site be confirmed through a Phase II field investigation involving the installation of test wells, stratigraphic analysis and aquifer testing. Hydrogeological, soil, and water quality data obtained during this work would allow for a detailed site-specific groundwater susceptibility study of the proposed site that could be used in determining proper placement of the proposed disposal facility and appropriate method(s) for leachate and run-off management at the proposed disposal site.

7.0 CLOSURE

This report has been prepared for the sole benefit of BAE Newplan Group Limited. The report may not be relied upon by any other person or entity without the express written consent of Jacques Whitford Environment Limited and BAE Newplan Group Ltd.

Any use which a third party makes of this report, or any reliance on decisions made based on it, are the responsibility of such third parties. JWEL accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

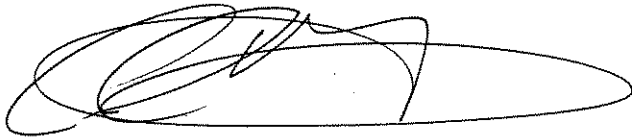
The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Conclusions presented in this report should not be construed as legal advice.



The conclusions presented represent the best judgement of JWEL based on the data obtained during this desktop study. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein. This report was prepared by Carolyn Anstey-Moore, M.A.Sc., M.Sc., P.Geo., and reviewed by Jim Slade, P.Eng., P.Geo and Robert MacLeod, M.Sc., P.Geo. We would be pleased to provide work scope and cost information for a Phase II component of the project. If you have any questions, please contact us at your convenience.

Respectfully submitted,

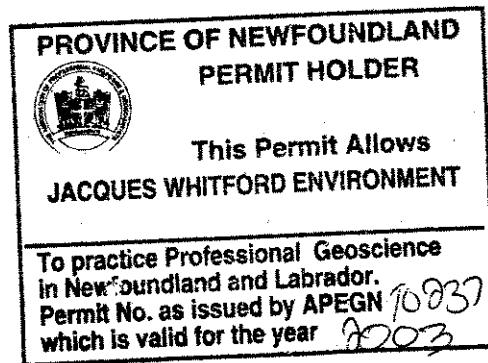
JACQUES WHITFORD ENVIRONMENT LIMITED



Carolyn Anstey-Moore, M.Sc., M.A.Sc., P.Geo.
Environmental Geoscientist

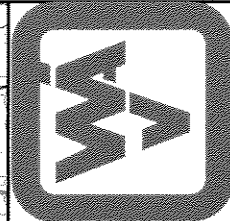
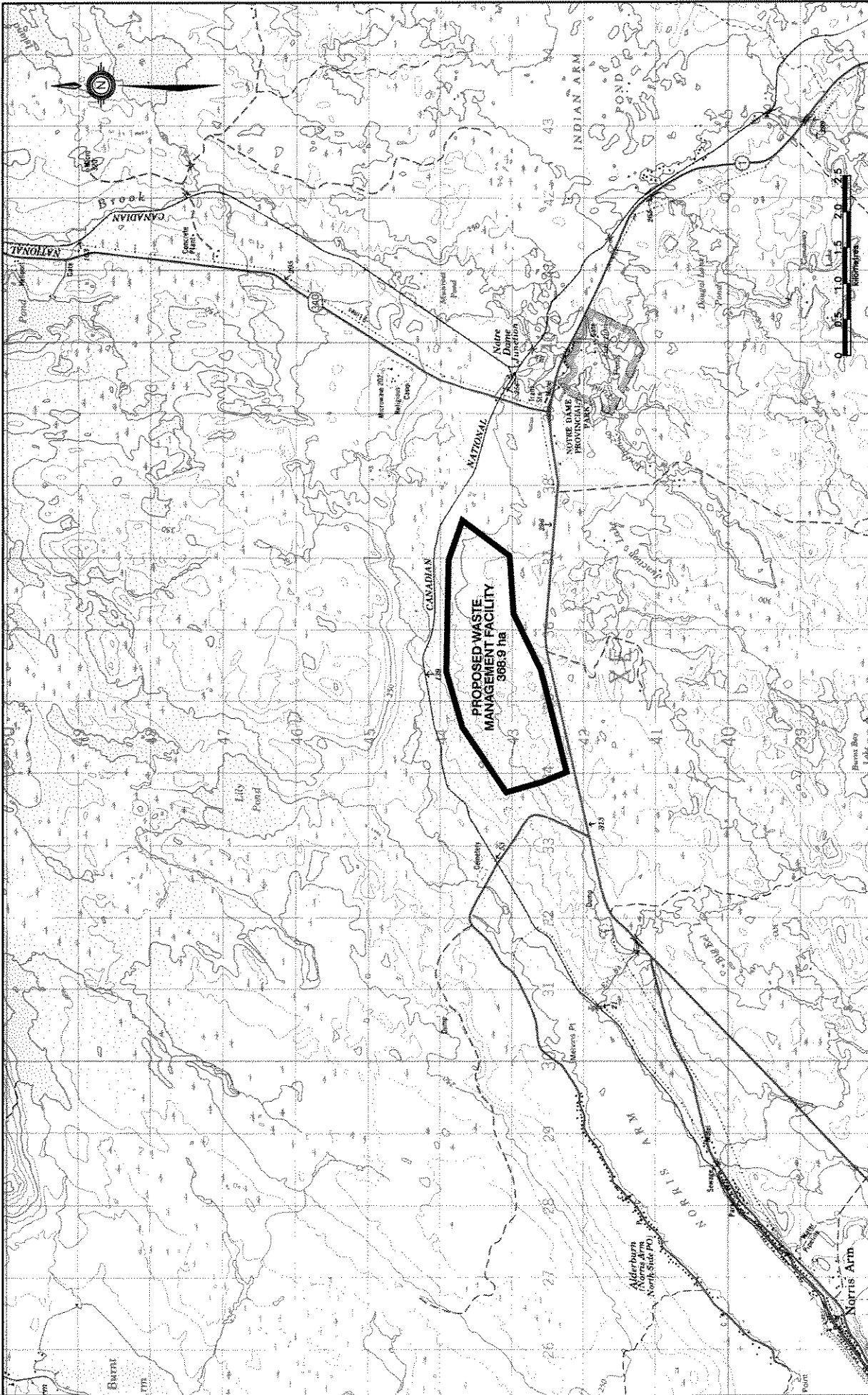


Jim Slade, P.Eng., P.Geo.
Environmental Engineer



ATTACHMENT A

Site Location Map



SCALE:	1:75 000	DATE:	NOV 26, 2003
DRAWN BY:	D.R.	CHECKED BY:	[Signature]
EDITED BY:		REVISED:	0
DRAWING NO.:	NFS09737-EE-01		
CAD FILE:	NFS09737-EE-01.DWG		

CLIENT:	BAE NEWPLAN
PROJECT TITLE:	PROPOSED WASTE MANAGEMENT FACILITY NORRIS ARM, NL
DRAWING TITLE:	SITE LOCATION PLAN