Environmental Assessment Registration

Markland Resource Development Inc.

Advanced Exploration Program
Churchill Mineral Sands Project

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Prepared for: **Department of Environment and Conservation**
PO Box 8700
St. John's, Newfoundland
A1B 4J6

Prepared by: **Earth Tech Canada Inc.**
105 Commerce Valley Drive West, 7th Floor
Markham, Ontario
L3T 7W3

Date: **June 2005**

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PN 84531

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1.0 Name of Undertaking

Localized Mineral Sands Bulk Sample Collection Program in the Lower Churchill River.

2.0 Proponent:

2.1 Name of Corporate Body

Markland Resource Development Inc.

2.2 Address

Markland Resource Development Inc., 301 – 170 The Donway West, Toronto, Ontario, M3C 2G3

2.3 Chief Executive Officer

Mr. Fenton Scott, P.Eng.

2.4 Managing Director

Mr. Graeme Scott

2.5 Principal Contact Person for Purposes of Environmental Assessment

Linda Wrong, P.Geo. (BC)

Earth Tech Consultants Inc.

105 Commerce Valley Drive West

Telephone: 905-886-7022 ext. 2489

Fax: 905-886-9494

3.0 The Undertaking

3.1 Nature of the Undertaking

The purpose of the undertaking is to perform an assessment of the concentrations of heavy minerals in "bulk" samples of river sand from the Lower Churchill River. The results will be used to further determine the viability of proposed future suction-dredge mining in the central channel of the Lower Churchill River between Muskrat Island and the River mouth (Figure 1). This advanced exploration program is to be conducted during the summer of 2005. To achieve this objective, two methods will likely be used:

1) a small excavator will be used on the central portion of the larger shifting sandbars in the main river channel, or alternatively

2) a suction dredge will be used to collect samples within the submerged portions of the project area.

No permanent structures will be placed within the river area. There will be no in-water or on-land disposal of the sand. Furthermore, it is noted that this section of the river has been previously dredged for local navigational purposes.

Although no exploration tonnage threshold is identified in the Department of Mines legislation, an Environmental Assessment threshold trigger of 1000 m^3 is identified in Newfoundland and Labrador Regulation 54/03 Environmental *Assessment Regulations, 2003* under the *Environmental Protection Act*. Section 35 (4).

3.2 Purpose/Rationale/Need for the Undertaking

This undertaking will provide Markland Resource Development Inc. (Markland) with larger sample analytical data, an important next stage to evaluate the economic feasibility of the project. Benefits include:

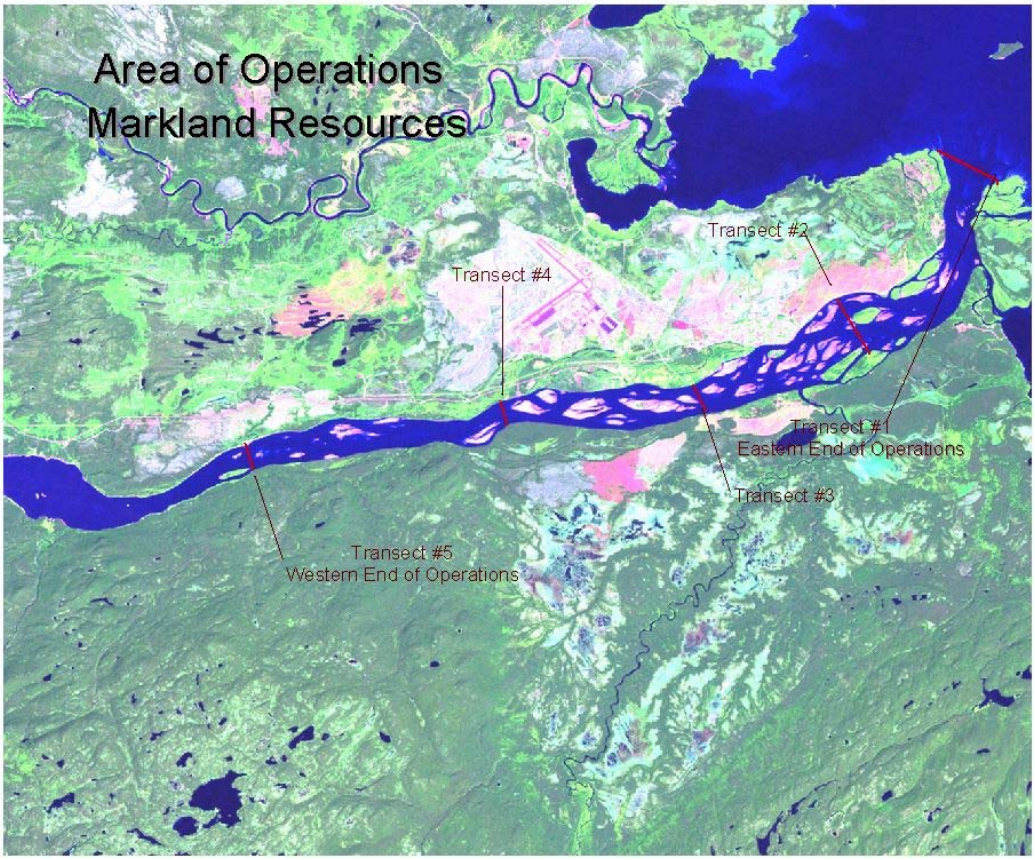
- provision of local exploration employment,
- local training and capacity-building, and,
- economic diversification in a safe and environmentally sustainable manner.

4.0 Description of the Undertaking

4.1 Geographical Location

The 35 km of the lower Churchill River between Muskrat Island and the river mouth is shallow with a sand substrate and extensive sandbars. Within the project area, the lower Churchill River is a broad, shallow watercourse characterized by a uniformly sandy substrate and shifting sandbars. The current velocity varies across the channel. Flow is lowest in backwaters and side-channels, and highest in the main channel. Bulk samples will be collected intermittently within the main river channel, extending from the mouth of the Churchill River at Lake Melville upstream to Muskrat Island (Figure 1). Within the project area, the river flows past the town of Happy Valley-Goose Bay, the community of Mud Lake, and Goose Bay's military airport.

Figure 1: Area of Operations Happy Valley Goose Bay Labrador



4.2 Physical Features

The Lower Churchill River is a wide and shallow river characterized by the presence of shifting sandbars and scoured riverbanks composed of outwash glacial till. Frequent dredging is necessary throughout the Lower Churchill River because of the naturally shifting sands and sandbars, which impede access to the Town of Happy Valley-Goose Bay, Goose Bay's military airport, and numerous small communities up and down the river.

Development, including the community of Goose Bay-Happy Valley and the Goose Bay military base and an extensive road network, is observed along the banks of the river within the project area. This area is surrounded primarily by muskeg and low mountains.

The unique geology of the project area is responsible for the large resource of mineral sands of the Lower Churchill River. Approximately 60 million years ago, the climate in the project area shifted from a tropical environment to an Arctic climate, which produced continental glaciers in the Northern Hemisphere. Extensive erosion by glacial action, followed by melt water deposition resulted in extensive beds of sands with persistent layers of dark heavy minerals in front of the glacial retreat. In Labrador, the "outwash" sediments are the precursor of important mineral sand bodies that have been enriched by river currents and ocean wave action.

Based on a review of existing available data and Markland's collection of supplemental data (discussed in subsequent sections of this document), it is noted that the substrate is unable to maintain aquatic macrophytes, in general because of the shifting sands. As a result, fish cover is absent from most of the operations area. Where fish cover exists, it is characterized by the presence of fallen trees and overhanging vegetation along the banks and side-channels. Overall, the quality of fish habitat in the operations area is low, confirming previous observations that the Lower Churchill River between Muskrat Falls and the river mouth contains no salmonid spawning habitat and only low-quality salmonid rearing habitat (Lower Churchill River Downstream from Muskrat Island, Aquatic Baseline Study 2004, prepared by EVS Consultants Inc., November 2004).

4.3 Local Need for Dredging

The constantly shifting sandbars of the region have caused notable difficulties in the past in maintaining channels. The following excerpt, taken from "NAVIGATIONAL AIDS PROJECT", 2002, by Leander Baikie, Strategic Opportunities Officer, Central Labrador Economic Development Board (P.O. Box 2143, Stn "B" Happy Valley-Goose Bay Labrador, AOP 1MO), provides an example of such local concerns:

"The Churchill River is used extensively for navigational purposes and has a long history of dredging. The lack of funding for dredging in recent years is beginning to have implications for pleasure and commercial watercraft operators. A full summer's

work can be contracted out to provide better local navigation in the Upper Lake Melville marine area.

The channel at Terrington Basin narrows is beginning to fill in and is becoming a nuisance to commercial shipping and for the cruiseship industry, as much older cruiseship have a deep draft, thus restricting their access to the port of Goose Bay.

Channels leading into the community of Mud Lake are very shallow and difficult to navigate at low water levels and must be dredged. With no roads, the main channel is the main hi-way into the community. Realistically, the main channel should be considered as part of the provincial transportation system.

The north side of Lake Melville supports a high number of cabin owners, and also supports an unprecedented number of dangerous, rock/boulder shoals. A safe passage along Tickle Island near Bakeapple Island gradually filled in many years ago and has become impassable. Dredging in this area will reopen the once safe direct route and provide protection for boat operators from rough seas and other dangerous shoals in the area."

4.4 Overview of the Sampling Methods

Markland will collect bulk samples using suction dredging (described below) and/or a backhoe to facilitate sample collection from the unvegetated sandbars. All removed material will be assessed for mineralogical potential and there will be no on land or in water disposal of sediments. The following sections describe various aspects of the proposed process.

4.4.1 Suction Dredge Sampling

Suction dredges are used for two primary purposes – mining and the removal of contaminants from river/lacustrine sediments. Suction dredge mining is a relatively new method, wherein river sediments are literally vacuumed up into a spiral concentrator and heavy minerals are removed by gravitational methods.

Dredging will be conducted within the project area at selected locations to a depth of approximately 1 meter below river bottom, and will cover only an area of about 200 m^2 at each sample location. A small suction dredge for pilot scale operations will be used for this operation. These small units pump at a rate of approximately 6.31 litres per second. A maximum of 200 m^3 of sand material will be removed from each sample site.

It is considered superior to earlier dredging and placer methods, because the vacuum cleaner-like suction reduces the river turbidity, increasing the efficiency of sediment removal, while the gravitational extraction method removes heavy minerals without harmful chemical additives typically associated with exploration and mining ventures.

The U.S. Geological Survey (USGS) and the Alaska Department of Natural Resources have conducted an extensive research program on suction dredging at the Fortymile River drainage area in eastern Alaska (Gough, L., Day, W., Crock, J., Gamble, B., and Henning, M., 1997, Wanty, R.B., Wang, B., and Vohden, J., 1997, Yeend, W., 1996). Results indicate that:

1) There is no appreciable difference in the distribution of turbidity values between mined and unmined areas;
2) The data show similar water quality values for samples collected within and on either side of the dredge plumes (see appendix for complete article);
3) Immediately behind the dredge, turbidity values increase 19 NTU units (a very small amount, see below); however, within 30 m these temporarily increased values had returned to river background levels; and,
4) Results were invariant regardless of sediment size.

Following a literature review of pollution remediation technology, suction dredging was recently endorsed by the Sierra Club (2003) as an environmentally-friendly remediation method on the basis of its low impact on riverine and lacustrine systems.

Figure 2: Turbidity Survey Results using an Operating Suction Dredge

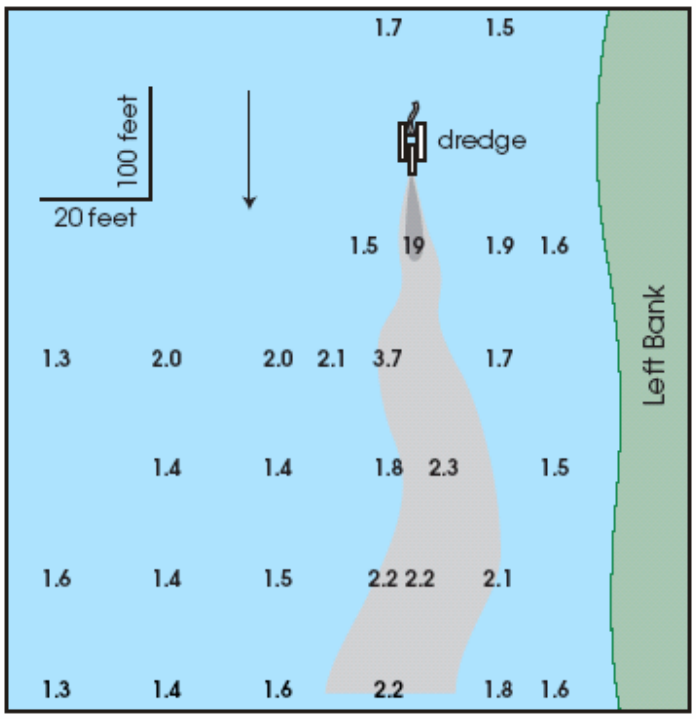


Figure 2. Results of turbidity survey behind an operating 10-inch suction dredge (site #1 on fig. 1). All numbers shown are in NTU, or nephelometric turbidity units; the standard unit of turbidity. The right bank of the river is off the edge of the figure. The approximate shape of the plume is shown in gray. Note that the figure is exaggerated 5x horizontally, so the plume is actually much narrower than it appears in the figure. To comply with State regulations, dredges may not increase the turbidity of the river by more than 5 NTU, 500 feet behind the dredge.

USGS Fact Sheet FS–154–97
October 1997

Figure 3: Example of a Suction Dredge

4.4.2 Excavator Sample Collection

The use of a small excavator is proposed to collect samples from unvegetated sand bars within the main channel of the Churchill River. Ease of access and minimizing cultural and environmental impact are the main factors in sample site selection, as the geology appears to be similar throughout the project area. Excavation will be conducted to a depth of approximately 1 meter below the surface of the bar, and disturbance will cover only an area of about 200 square meters (in each location). A back hoe or small front-end loader will be used to conduct this operation, and will be transported and stored on the barge (LST). All excavation areas will be graded and sloped after sample collection.

4.5 Operation

The operation section is not applicable as all disturbances will occur during the bulk sample collection period only and will not affect post bulk sample collection navigational uses or habitat.

4.6 Potential Source of Pollutants

No chemicals or reagents are used during the bulk sample collection process. All activities will be strictly monitored to assure regulatory compliance. Monitoring will include prevention of:

- Fuel and lubricant release from pumps and motors – low potential, as all of these are self-contained units constructed to prevent releases.
- Airborne emissions from dredging equipment – low potential, as this is a wet operation with no dust generation.
- Silt and sediment from dredging – low potential, as all material is sand-sized or larger.

- Noise pollution from dredging activities – low potential, as these are small, pilot-scale machines, properly equipped with mufflers and safety equipment.

4.6.1 Mitigation Measures

Mitigation measures to reduce the potential environmental concerns associated with the proposed bulk-sampling project include:

- Establishment of a 100 m buffer to be observed around identified tributaries, streams, river mouths, wetlands, vegetative islands, delta's, fish spawning areas, and water/sewage works. These areas will be excluded from the area of operations, and as such, will not be dredged.
- Work will be scheduled to avoid periods of heavy precipitation and inclement weather.
- Solid waste disposal practices will be in compliance the Environmental Protection Act and associated regulations. Sampling-generated material, other than spiral-dredge silica river sand, is not anticipated.
- All machinery will be routinely inspected for leakage of lubricants or fuel. An emergency response document will be prepared and an emergency response-training program will be conducted with employees prior to the start of operations. All fuel handling and storage will be in compliance with *The Storage and Handling of Gasoline and Associated Products Regulations.* Basic petroleum spill clean-up equipment and an emergency response program will be onsite and made accessible to all workers.
- Equipment exhaust systems will be maintained to provide emissions to the standard designed for by the equipment manufacturer.

4.6.2 Potential Ecosystem Interactions and Mitigation

4.6.2.1 Soil, Surface Water, and Groundwater Resources

Dredging activities have the potential to contaminate and/or disturb sediment, surface water, and groundwater resources. A sediment-sampling program was conducted during the Summer 2004 to determine the environmental quality of the Lower Churchill River sediments and no contamination has been identified in the project area. Bulk samples will be handled in accordance with regulatory agency requirements. If offsite disposal is required, the dredge spoils will be transported to an approved disposal facility using approved containers. All machinery will be inspected for leakage of lubricants or fuel and must be in good working order. Work will be scheduled to avoid periods of heavy precipitation. Erosion control structures are to be used, if necessary, to prevent erosion and silty runoff during the dredging program.

4.6.2.2 Fish and Fish Habitat

Dredging activities have the potential to introduce sediment and pollutants to the marine environment that may have a negative impact on fish resources and habitat. Dredging will be carried out during low wind/wave conditions and be suspended whenever conditions cause sediment to be visible outside the immediate project area. An aquatic assessment of the area was conducted on behalf of the proponent by EVS-Golder during the Summer 2004 (Section 7.0). As reported by EVS-Golder fish cover is absent from most of the study area, and where it exists, consists of fallen trees and overhanging vegetation along the banks and side-channels. To protect fish habitat, there will be a 100 m buffer established around identified fish cover areas, tributaries, streams, river mouths, wetlands, vegetative islands, and delta's. These areas will be excluded from the area of operations, and as such, will not be dredged.

4.6.2.3 Air Quality

Equipment exhaust systems will be maintained to provide emissions and noise levels to the standard designed for by the equipment manufacturer. If necessary, equipment will be fitted with noise suppression devices and air filters to reduce noise and exhaust emissions.

4.6.2.4 Navigation

All attempts will be made to minimize any disruption to the navigation of marine vessels within the project area in compliance with *The Navigable Waters Protection Act* and the associated *Navigable Waters Works Regulations.*

4.6.2.5 Public Safety

Access to the work area will be controlled and restricted to project personnel.

5.0 Occupations/Employment:

The following list outlines occupations, which will be employed during the advanced exploration program

Employees	
Administrative	2
Dredge/Excavator Operators	2
Concentrator Barge/Facility	4
Professional Engineers	3
Environmental Scientists	1
Environmental Technicians	2
Labourers	2
Truckdrivers	2
Draftsperson	1
Transport, ship loading	4
Quality Control	2
TOTAL	**25**

6.0 Approval Required for the Undertaking

The permits, approvals, and authorizations that may be necessary for the undertaking include:

PERMIT, APPROVAL OR AUTHORIZATION	**ISSUING AGENCY**
Application for Exploration Approval & Notice of Planned Mineral Exploration Work	Department of Mines & Energy
Release for the Undertaking	Department of Environment and Conservation, Environmental Assessment Division
Certificate of Approval for Construction (Alter a Body of Water)	Department of Environment and Conservation, Water Resources Division

7.0 Background Information

7.1 Project-Related Documents

Markland Resources commissioned an assessment of available bio-physical data of the Lower Churchill River to identify current and available sources of ecological data for the project area and to define the key potential significant ecosystem components. Upon completion of this desktop data review, Markland Resources commissioned a supplemental baseline data gap collection program, including the completion of four relevant studies, to supplement information on the potential significant ecosystem components identified in the project area, with the understanding that numerous baseline programs have already been conducted recently within the same area, and to investigate the effects of suction dredging on this section of the Lower Churchill River. Copies of these studies will be made available at www.marklandresource.com. Additional resources reviewed during the preparation of this document are presented in Section 13.0. The following section presents a summary of the recently completed 2004/2005 baseline programs conducted on behalf of Markland Resource Development Inc.

7.1.1 Lower Churchill River Downstream from Muskrat Island, Aquatic Baseline Study 2004, *prepared by EVS Consultants Inc., November 2004*

This report provides a baseline assessment of the aquatic environment in the lower Churchill River downstream of Muskrat Island that characterizes the biota and aquatic habitats in those areas where Markland proposes to collect bulk samples. Habitat observations and invertebrate sampling were completed at fifteen sites; three on each of five transects located 2, 8, 15, 22, and 32 km upstream from the river mouth. These transects were situated in river sections deemed representative of the range of conditions throughout the study area as a whole. Fish were collected at three sites on each transect using three gillnets and six Gee minnow traps. Gillnets were usually placed in back-eddies downstream from sand bars, in side-channels, or in similar areas with reduced current. Baited Gee-traps were placed in a group, approximately 20 m apart, in shallow area near the riverbank.

Within the study area, the lower Churchill River is a broad, shallow watercourse characterized by a uniformly sandy substrate and shifting sand bars. The current velocity varies across the channel; flow is lowest in backwaters and side-channels, and highest in the main channel. Fish cover is absent from most of the study area, and where it exists, consists of fallen trees and overhanging vegetation along the banks and side-channels. Overall, the quality of fish habitat in the study area is low, confirming previous observations that Churchill River between Muskrat Falls and the river mouth contains no salmonid spawning habitat and only low-quality salmonid rearing habitat.

During the sampling, EVS collected eight fish species. In order of relative abundance, these were: pearl dace (n=81), brook trout (n=12), longnose sucker (n=8),

threespine stickleback (n=8), northern pike (n=3), white sucker (n=2), Atlantic salmon (n=1), and burbot (n=1). Threespine stickleback and pearl dace were only collected in Gee-traps, whereas all other species were only collected in gillnets. Lake whitefish and round whitefish, two species previously collected in the study area, were not present in our samples. Gillnet catch-per-unit-effort (CPUE) varied from 0.3 to 3.0 fish/net/24 hours, depending on species Our CPUE values were comparable to those previously recorded in the study area, and are relatively low compared to values recorded from other locations in the lower Churchill River and elsewhere.

The benthic macroinvertebrate fauna of the unstable sandy substrate is composed almost entirely of larval midges (Diptera: Chironomidae), although a single worm (Haplotaxida: Tubificidae) was collected. Chironomid densities in our samples were generally very low, ranging from 0-144 organsisms/m^2.

Overall, the study area does not support large resident fish populations, likely due to the lack of cover, relatively poor-quality spawning and rearing habitat, and low density of aquatic invertebrates. However, the study area provides an important migration corridor for runs of anadromous species (e.g., Atlantic salmon, brook trout) that spawn in major tributaries below Muskrat Falls.

7.1.2 Sediment and Surface Water Characterisation Program, *prepared by Earth Tech, April 2005*

The Sediment and Surface Water Characterization program, undertaken during the Summer 2004, was conducted to supplement existing information and to document existing surface water and sediment conditions prior to the initiation of the bulk sampling program. The program consisted of the collection of sediment and surface water samples along five transects, extending from the river's mouth at Lake Melville to Muskrat Island. Multimeter sampling was also conducted using a Horiba U22 Multimeter. Measurements of pH, conductivity, turbidity, velocity, salinity, dissolved oxygen, salinity, TDS, TSS, and oxygen-reduction potential (ORP) were recorded at specific locations along the river. Analysis of sediment and surface water for the following parameters was undertaken:

- Surface Water: metals, COD, BOD5, general chemistry parameters, TDS, TOC, BTEX, CCME F1-F3;
- Sediment: metals, grain size, general nutrients, BTEX, CCME F1-F3

The results of the program identified the presence of naturally elevated iron and aluminum and cadmium in surface water. All other parameters analysed in surface water were less than CCME freshwater aquatic life standards. All parameters analysed in sediment were less than applicable standards.

Previous studies on suction-dredge mining report maximum turbidity levels immediately behind the dredge of 19 NTU nephelometric units, dropping to a river average of 2.2 NTU within 30 m of the dredge (see Figure 2). The Churchill River has a much higher background NTU level (8.1 averages), and coarser sediments as a

result of the stronger current and mixing of the depositional sands (Beak Consultants *et. al*. 1977). Indeed, selected Multimeter turbidity levels (collected during Markland's summer 2004 program) range into the 100's NTU level. Considering these existing naturally-elevated turbidity levels, the small size and duration of the potential plume associated with the proposed operation, and the average width of this river (> 1km), it seems unlikely that using a suction dredge will result in a measurable change in the river turbidity levels.

The aquatic resources of the Lower Churchill River have been documented over the past thirty years in environmental assessments for proposed hydroelectric developments (Beak Consultants, 1980; Ryan, 1980; Jacques Whitford, 1999). More recent studies include the recent program undertaken by Markland, and a proposed bridge crossing which forms part of Phase III of the Trans-Labrador Highway Project (Jacques Whitford, 2003).

As part of the above study Jacques Whitford Environment limited and Innu Environmental Limited Partnership (2003) assessed fish habitats and surface water quality in Markland's proposed area of operations. Generally, most of the water quality values are typical for the region and in agreement with Markland Study. Parameters such as aluminum and iron were found at levels above the Canadian Council of Ministers of the Environment (CCME) Guideline for the Protection of Aquatic Life. Other parameters such as cadmium, selenium and silver had values that were either below the CCME guidelines, or, at levels that could not be compared to the guidelines, because of the level of quantification attained by the analytical laboratory. For example, although the quantified levels of cadmium are below measurement (<0.3 µg/L), the guideline is actually (.017 µg/L).

7.1.3 An Archaeological Assessment of Churchill Sediments, Churchill River, Central Labrador, *prepared by Black Spruce Heritage Services, March 23, 2005*

This study was undertaken in March 2005 to assess the archaeological potential of the project area. Since no primary archaeological contexts will be impacted, the assessment of potential archaeological impacts focussed on potential secondary deposits in the river sediment. Existing archaeological resources were reviewed and available studies accessed to assist in the assessment.

The report recommended the development of a simple protocol to deal with any potential discoveries during the sampling program. The report also concluded that, with appropriate protocols to ensure the effective collection of potential archaeological materials, the proposed bulk sampling and potential future mineral sandsdevelopment not only pose no threat to historic resources but, in fact, represent an opportunity to collect archaeological specimens from an otherwise inaccessible secondary context.

7.1.4 Community Consultation Assessment and Communications Plan For Mineral Sands Exploration Project Lower Churchill River Happy Valley-Goose Bay, Labrador, Canada, prepared by MCA in conjunction with HEG, April 2005

Melinda Clendenan and Associates (MCA) Environmental Management, in conjunction with the Human Environment Group (HEG), was retained by Markland to undertake a preliminary assessment of community-related issues and stakeholders in the subject area and to complete a comprehensive stakeholder communication plan. The purpose of the plan is to assist Markland in the development of a strategy to effectively identify and communicate with local stakeholders who may have an interest in the proposed mineral sands project.

Through the early identification of, and communication with, the various stakeholders, Markland has demonstrated an ongoing commitment to anticipate and develop successful approaches in addressing community concerns. The report also observed that Markland has maintained compliance with current legislation and guidelines, as well as interacting with stakeholders prior to the initiation of advanced exploration, and has recognized that this is essential to the sustainable undertaking of the project. Markland has taken steps to foster cooperation with the local community and ensure that mechanisms are in place to address stakeholder concerns, participation, and issues.

The primary objectives of the completed preliminary community consultation program were as follows.

- Reinforced and/or introduced Markland Resources' presence in the area
- Obtained contacts with a range of community members who use the land
- Requested advice on suitable consultation and involvement approaches from each of the communities so that they can determine how they want to be included
- Obtained direction on communication protocols
- Identified community issues, challenges, and aspirations
- Expanded familiarity with local politics and community priorities
- Reviewed existing community communication processes
- Assessed current resource use in the area
- Requested advice on the most effective manner of consulting with Elders

Markland has undertaken effective early and continuous communication with stakeholders to maintain positive relationships and reduce potential impacts associated with the program. Various communication approaches to disseminating information, relating to the identified potential issues, such as newsletters, meetings, or other forms of communication, will be undertaken by Markland, as appropriate, during the duration of the program.

8.0 Conclusions

In summary, the bulk sample collection program is a short-term activity that is expected to have minimal impacts to the natural or socio-cultural environment of the area. To date, Markland has initiated communication with, and provided employment and training opportunities to, numerous members of the community including members of the Innu, Inuit and Metis Nations, as well as to members of the non-aboriginal community. Markland, and representatives of Markland, have communicated with regulators and are committed to undertaking the work in an environmentally sustainable manner in accordance with all applicable legislation. There is no indication in the completed studies to suggest that these sediments pose either a threat to the environment, or, that dredging will release further contaminants. The shifting nature of the sediments, the naturally high turbidity, the long history of dredging, and the temporary nature of the project, indicate that that the minimal disturbance associated with this project will not have long-term impacts on the natural background conditions of the river. Mitigation measures, as outlined in this document, will be undertaken to reduce potential impacts and increase the sustainability of the program.

9.0 Schedule

The bulk sampling is planned for the Summer 2005.

10.0 Funding

Privately funded through Markland Resource Development Inc.

Signature of Chief Executive Officer — Date: June 16, 05

Signature of Managing Director — Date: June 16/05

11.0 References

"A Sediment and Surface Water Characterisation Program", prepared by Earth Tech, April 2005.

"An Archaeological Assessment of Churchill Sediments, Churchill River, Central Labrador", prepared by Black Spruce Heritage Services, May, 2005;

"Community Consultation Assessment and Communications Plan For Mineral Sands Exploration Project Lower Churchill River Happy Valley-Goose Bay, Labrador, Canada", prepared by Melinda Clendenan and Associates (MCA) Environmental Management, in conjunction with the Human Environment Group (HEG), April 2005

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Note: all Markland Resource Studies are available at *www.marklandresources.com*