TECHNICAL REPORT ON THE
PEAT FUEL PROJECT,
NORTHWESTERN ONTARIO
(NTS 52G/1, 52G/2, 52B/15, 52B/16)
FOR
PEAT RESOURCES LIMITED

prepared by

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December 3, 2004
Toronto, Canada

Watts, Griffis and McOuat Limited
Consulting Geologists and Engineers

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1. SUMMARY

Peat Resources Limited ("PET") is a Tier 3 **Toronto Venture Exchange** ("TSXV") listed company. The company is proposing to raise financing by way of a limited distribution Public Offering. The funds raised will be used to finance a program of geological exploration, process development, engineering test work, and environmental, market and financial studies for work leading to completion of a Prefeasibility Study. The transaction will also result in the listing of PET as a Tier 2 TSXV company.

Watts, Griffis and McOuat Limited ("WGM") was retained by PET to prepare an independent qualifying property report in accordance with National Instrument 43-101 ("NI 43-101") standards in support of the proposed transaction and change in stock exchange listing. PET is proposing to develop the various peat bogs on the Peat Resources Property ("the Property") for the production of fuel peat. The peat would be extracted from the bogs, processed and sold as fuel for electricity generation, initially to the **Ontario Power Generation** ("OPG") thermal power plants at Atikokan, Ontario and Thunder Bay, Ontario.

The subject Property covers an extensive area of ground centred on Upsala, Ontario, about 130 km northwest of Thunder Bay.

PET has been engaged since 1980 in the exploration for and development of peat as a fuel for use in thermal power generating stations. The company holds Land Use Permits ("LUPs") from the Ontario Ministry of Natural Resources for exploration of approximately 500,000 ha of land in a northwesterly trending corridor centred on the town of Upsala. The permit area has been explored by the company and the Ontario Geological Survey and extensive peatlands have been identified. Preliminary sampling and testing data over limited areas of the LUPs indicates significant volumes of high grade peat suitable for fuel use may be available.

PET conducted extensive research into peat mining and processing technologies from 1985 through 1994. This research resulted in the identification and testing of suitable technologies for mining and processing peat. Combustion test work at Ontario Hydro Research indicated a high density, high energy content peat fuel product could be successfully used in Ontario Hydro's thermal generating plants. Test data indicate the peat fuel will have an energy content of approximately 8,500 BTU/pound, which is equivalent to or better than the energy content of currently used lignite coal. OPG currently operates two such generating stations at Thunder Bay and Atikokan, Ontario. The proposed PET plant would be well positioned to supply fuel to the OPG plants. The project was put on hold in 1995 due to a decline in energy prices.

Recent changes in fuel prices have renewed interest in the concept. Cost estimates prepared by PET in the mid-1990s indicate the peat fuel product should be price competitive with lignite and coal on an energy content basis. PET is proposing to develop a peat mining and processing operation capable of producing 1.0 million tonnes fuel peat. PET is now proposing to undertake a comprehensive program of peat exploration and testing, engineering analysis and pilot plant testing, environmental studies and to prepare a comprehensive prefeasibility study. As a first step, substantial additional sampling and testing is required to fully delineate the extent of the available resources. PET is proposing to spend $4.1 million dollars on the program. WGM has reviewed the program budget and feels the proposed level of expenditure and the program as proposed outlined is warranted.

WGM makes the following conclusions and recommendations with respect to the resource potential of the property and PET's proposed project:

Conclusions

1. The lands held by Peat Resources Limited contain substantial resources of peat.
2. The highest potential area within the currently permitted area is the Goodfellow-Fallis-Gibbard Bog complex.

3. Historical preliminary estimates of available peat resources indicate sufficient material may be available to support planned production of 1 million tonnes/year dry peat fuel for a period in excess of 20 years.
4. Extensive engineering analysis and test work over the 1980 to 1994 period by Peat Resources has demonstrated the potential to produce a high density, high energy content peat fuel product from this material.
5. Mining methods have been proposed which appear capable of recovering fuel peat.
6. Processing methods have been evaluated. The engineering and test work to date has demonstrated that suitable processes and equipment are available for dewatering, drying and compacting the recovered peat.
7. Combustion tests on a fuel peat product have been conducted and demonstrate that a high calorific value, high solids content fuel peat product can be successfully utilized in a combustion boiler for thermal power generation.
8. A significant amount of exploration and sampling work will be required to measure the quantity and quality of the available peat resources on the property.
9. Once a potential resource has been confirmed, additional work will be required to more fully define the mining method(s) and to select the most suitable equipment and determine capital and operating costs.
10. Test work will also be required to more fully define the processes and determine final equipment selection, capital costs and operating costs.
11. Larger scale combustion tests to more fully evaluate the performance of the material in the burner and the materials handling characteristics of the material are also required.
12. Although historic economic analysis of the production of fuel peat indicates the project can be profitable, current and comprehensive financial analyses are required as part of a prefeasibility study.
13. Considerable environmental and stakeholder issues will need to be addressed in completing a prefeasibility study.

14. Sufficient time and financial resources will need to be committed to this phase of the work to ensure that all affected parties are satisfied sufficient consultation has taken place.

Recommendations

WGM recommend that PET proceed first with the exploration of the existing bog areas to establish sufficient resources for the 20 years of production which formed the basis of the prior feasibility study. This work must be in accordance with the specifications established by the Ontario Geological Survey.

Estimated Budget

Items	Cost ($)
Resource/Reserve Definition	**$1,000,000**
- Drill bogs at recommended intervals to establish resources/reserves sufficient for 20 years production	
- Identify depth, humification, biological composition of the peat and contours of the peat bottom	
- determine adequacy of the designated bogs for 20 years production	
Prepare Bulk Samples	**$500,000**
- Thermal value, chemical analysis, physical analysis	-
- Combustion tests	-
Engineering Testing	**$500,000**
- Bulk sample testing for mine equipment selection	-
- Bulk sample testing for dewatering and drying equipment selection	-
- Bulk sample testing of biomass conversion technologies at CANMET Energy Technology Centre	-
Process Engineering Design	**$1,000,000**
- Optimization of engineering design for mining and processing; equipment testing; selection of equipment suppliers	-
Preliminary Environmental Plan	$500,000
General and administration	$200,00
Contingency	$400,000
TOTAL	**$4,100,000**

1. WGM also recommends that a comprehensive stakeholder consultation process be initiated as soon as possible to identify critical issues affecting each party early in the

process to allow adequate time to develop agreed solutions to resolve potential conflicts and issues.

2. Initial exploration efforts should be focussed on the Goodfellow-Fallis-Gibbard Bog area.
3. Environmental baseline data should be collected as part of this exploration activity.
4. WGM recommends that bulk samples be collected from several locations as soon as possible to allow for the (metallurgical) physical, chemical and thermal characteristic evaluation of the material.
5. Marketing of the fuel peat to local power plants will require the establishment of close relations with consumers. WGM recommends the potential consumers be identified and involved during the testing phase of the material.
6. Once the suitability of the material as a fuel has been confirmed and sufficient quality material identified engineering test work to select the most appropriate mining and processing methods should be undertaken.
7. WGM recommends that process engineering and design work begin as soon as possible to help define all the required costing parameters required for the feasibility study.

2. INTRODUCTION AND SCOPE OF WORK

2.1 INTRODUCTION

Watts, Griffis and McOuat Limited ("WGM") was retained by **Peat Resources Limited** ("PET") to prepare a qualifying property report in accordance with National Instrument 43-101 ("NI 43-101") standards for the Peat Resources Property ("the Property"). PET is proposing to develop the various peat bogs on the Property for the production of fuel peat. The peat would be extracted from the bogs, processed and sold as fuel for electricity generation, initially to the **Ontario Power Generation** ("OPG") thermal power plants at Atikokan, Ontario and Thunder Bay, Ontario.

The subject Property covers an extensive area of ground centred on Upsala, Ontario, about 130 km northwest of Thunder Bay (Figure 1).

PET is a Tier 3 **Toronto Venture Exchange** ("TSXV") listed company. The company is proposing to raise financing by way of a limited distribution Public Offering. The funds raised will be used to finance a program of geological exploration, process development, engineering test work, and environmental, market and financial studies required for the work leading up to and the completion of a Prefeasibility Study. The transaction will also result in the listing of PET as a Tier 2 TSXV company. TSXV regulations require submission of an Independent Qualifying Report prepared in accordance with NI 43-101 standards in support of the proposed transaction and change in stock exchange listing.

During a 12 year period, the Company completed the identification and field testing of suitable peat deposits, developed and tested engineering processes required to upgrade peat

PET REV / PET_02_Loc_Map
Last revision date: Thursday, 2 December 2004

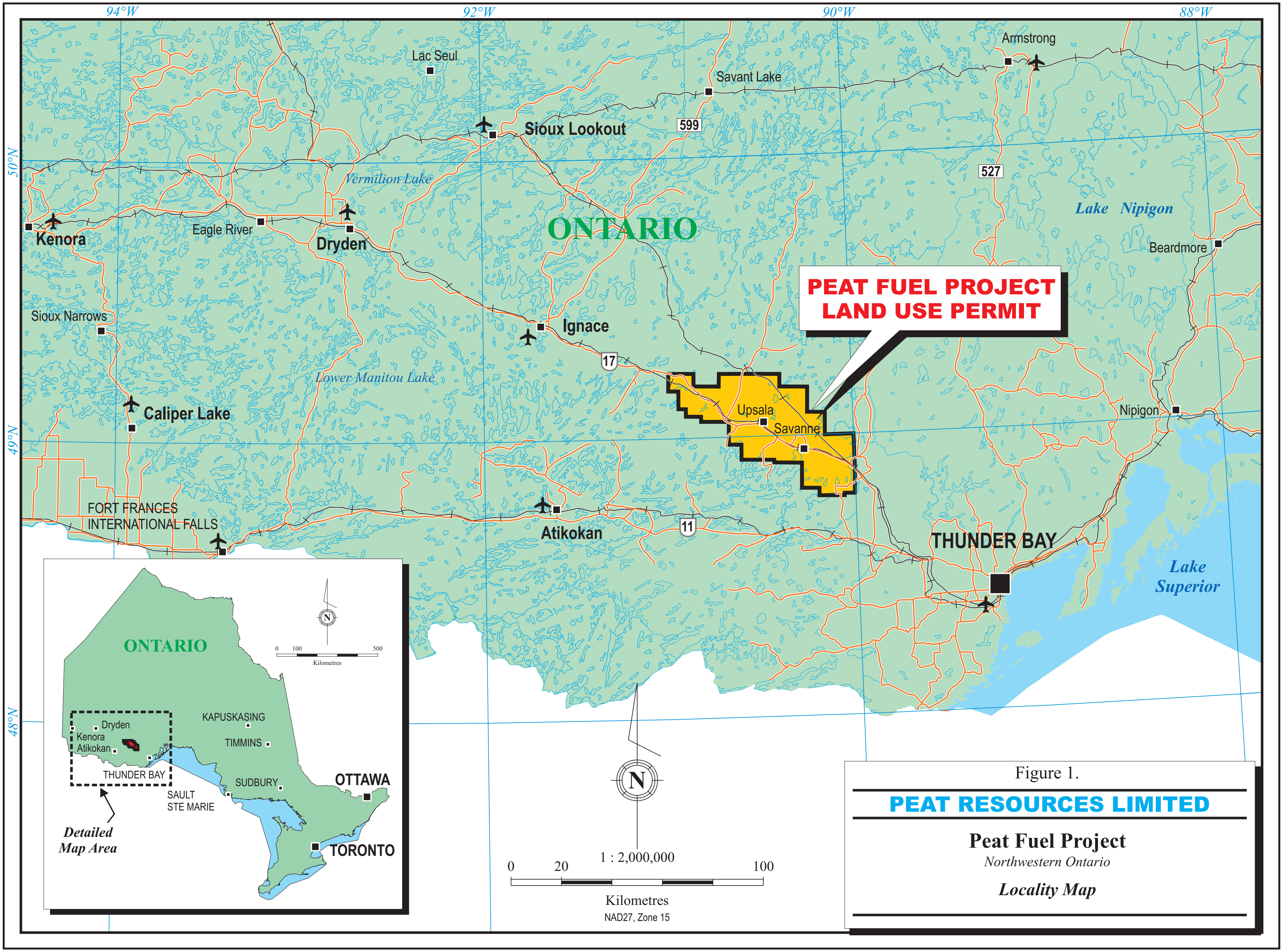


Figure 1.

PEAT RESOURCES LIMITED

Peat Fuel Project

Northwestern Ontario

Locality Map

Watts, Griffis and McOuat

into a high BTU fuel grade product comparable to good quality thermal goal, created a proposal to supply peat fuel to the Atikokan and Thunder Bay generating plants and proceeded with an environmental overview.

The project was put on standby in the early 1990s due to low energy prices. The Company is now revising the project as a result of the rebound in energy prices, the positive environmental qualities inherent in the peat fuel cycle and the provincial government's determination to replace coal in Ontario's fuel consumption.

2.2 SCOPE OF WORK

WGM reviewed:

- All land use permits and any restrictions or other pertinent factors affecting the Property;
- location maps, geological maps and other mapped topographic and geological information;
- all of the technical reports of work previously conducted on the Property;
- the previous expenditures on the Property;
- all of the information pertaining to any current environmental restrictions which would affect development of the Property;
- the historical resource estimates;
- the proposed work programs and budgets for the next stage of the exploration and development programs; and
- visited the Property.

Dr. Peter Telford was the Senior Associate Geologist assigned by WGM to this work. He is a demonstrated expert in peat development in Ontario and is the former manager of the Ontario Peatland Inventory Project (1981-1985). He also led or managed a number of initiatives by the Ontario Ministries of Natural Resources, Northern Development and Mines, and Energy aimed at encouragement of development of Ontario's peat resources.

2.3 CURRENCY

Unless otherwise specified all monetary references are to Canadian dollars (C$).

2.4 DEFINITIONS

The following definitions are used in this report:

Peat is partially carbonized organic matter originating from the decomposition of vegetation in bogs, marshes or heathlands under waterlogged (anaerobic) conditions. Peat is distinguished from peat moss by the degree of humification of the plant material. On complete humification the peat is a dark brown to black, plastic, amorphous, homogeneous material. Further burial and consolidation may eventually form coal (Graham, 1979). Fuel peat is generally regarded as peat material having a humification rating of H4 to H10 on the Lennant von Post (von Post) Humification scale. Peats in the H1 to H3 range are typically utilized as agricultural and horticultural peat (peat moss).

> **Mineral Property** means any right, title, or interest to property held or acquired in connection with the exploration, development, extraction or processing of minerals which may be located in, on or under the surface of the property, together with all plants, equipment and infrastructure owned or acquired for the exploration, development, extraction and processing of minerals in connection with such properties. Such properties shall include, but not be limited to, real property, unpatented mining claims, prospecting licenses, reconnaissance permits, reconnaissance licenses, exploration permits, exploration licenses, development permits, development licenses, mining licenses, mining leases, leasehold patents and patented claims.

> **Mineral Resources**. The terms Mineral Resource, Measured Mineral Resource, Indicated Mineral Resource and Inferred Mineral Resource and their usage have the meaning ascribed by the CIM Standards on Mineral Reserves and Reserve Definitions and Guidelines adopted on August 20, 2000 (CIM Bulletin, October 2000), as these definitions may be amended from time to time by the CIM, and as included by reference in NI 43-101.

Technical Report means a report prepared, filed and certified in accordance with NI 43-101 and form 43-101F (Technical Report (NI 43-101, Section 1.2, Definitions).

2.5 SITE VISIT

A site visit to the Property was made on November 15, 2004 by Dr. Peter G. Telford, Senior Associate Geologist and Mr. Donald Hains, P.Geo, Senior Associate Industrial Minerals Specialist, respectively, of WGM. Inspections were made of the Meinzinger Bog and the Goodfellow-Fallis Bog.

3. DISCLAIMER

The authors have relied on the truth and accuracy of the data produced by the personnel contracted by PET during prior fieldwork and technical and economic evaluation of the peat fuel program.

The authors have relied on the statement of expenditures by PET that summarizes the expenditures the company incurred on the peat fuel project to date. The authors have not reviewed any of the supporting data to this statement, but are of the opinion that the level of expenditures reported is reasonable considering the work completed.

The authors have used information and opinions from a number of reports and studies published by agencies of the Ontario provincial government. These are referenced in the text.

Peat is not classified as a metallic or industrial mineral under the Mining Act (RSO, 1990, Chapter M14) and the associated Regulations. Rights to exploit peat deposits in Ontario are regulated under the Public Lands Act by the Ministry of Natural Resources (MNR). Exploration and development of peat lands is controlled by MNR through the issuance of Land Use Permits. These permits confer many of the same rights and obligations as mining claims and mining leases regulated by the Mining Act. Accordingly, WGM considers Land Use Permits for peat exploration and development as "Mineral Property" rights for the purposes of NI 43-101.

4. PROPERTY DESCRIPTION AND LOCATION

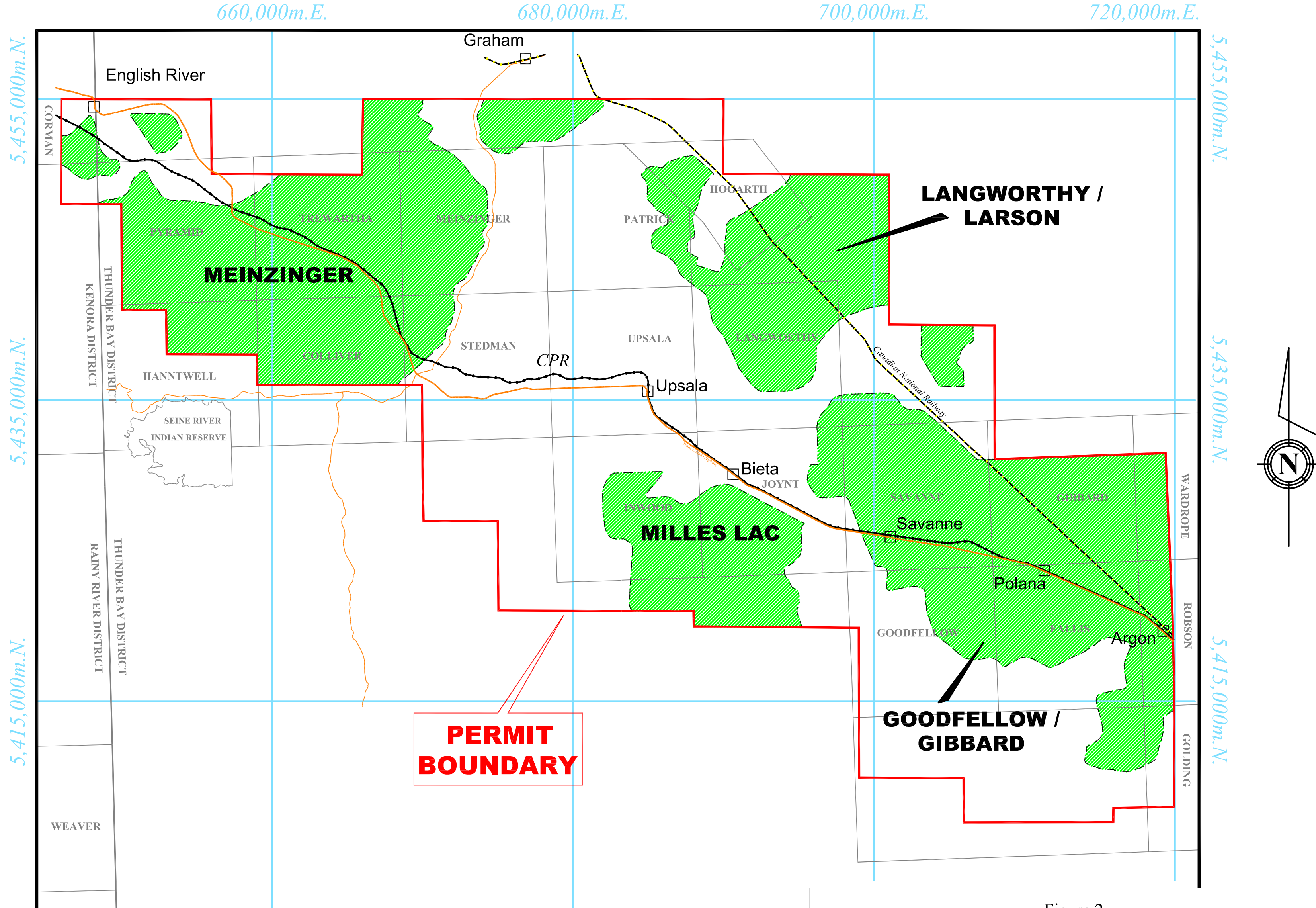
The subject property consists of peatlands within a corridor northwest of Thunder Bay, Ontario, centred on the town of Upsala. The corridor is serviced by the CN Railway, Canadian Pacific Railway and Highway 17, which roughly bisect the property. Thunder Bay lies approximately 130 km to the southeast of Upsala (Figure 1). Ontario Power generation operates coal-fired thermal generating stations at Thunder Bay and Atikokan. These plants are the initial primary target markets for the company's product.

The company has held rights to the property under a series of Land Use Permits (LUPs) issued by the Ontario Ministry of Natural Resources and is currently in the process of renewing the existing permit (LUP 1245-1000972). The LUPs have been issued under the Public Lands Act (File F4.01). The permits cover an area of approximately 500,000 hectares. Conditions imposed on the LUP for PET in the Upsala area are governed by the terms of Ministry of Natural Resources Policy Directive LM 8.17.01 (Peat and Peatland Disposition). Schedule C for LUP 1245-1000972 described the following conditions:

- The authorized area (which forms part of this LUP) is indicated on Figure 2;
- Exploration conditions include activities shall be limited to core sampling;
- No exploration to be conducted within 800 m of the Bald Eagle nests on Doats and Muskeg Lakes, Lac des Mille Lacs, as shown on the maps that form Schedule B of this LUP;
- This LUP authorizes Peat Exploration Activities only;
- Bulk sampling shall be limited to 500 m^3 per site; and
- Excavation created as a result of the exploratory work shall be rehabilitated to the satisfaction of MNR prior to the expiration of this land use.

The principal bogs within the permit area are (Table 1).

PET REV / PET_06_Permit_Map.dwg (Layout: Permit 400k SEDAR)
Last revision date: Friday, 3 December 2004



Scale 1 : 400,000

0 4 20

Kilometres

NAD27, Zone15

Figure 2.

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Peat Fuel Project

Northwestern Ontario

Property Map, Upsala Area

Watts, Griffis and McOuat

TABLE 1
PRINCIPAL BOGS WITHIN PROPERTY

Name	Township(s)	NTS	Approximate Size (ha)
Trewartha	Trewartha	52 G/2	1,500
Meinzinger	Trewartha, Meinzinger, Stedman & unsurveyed terr. north of Trewartha and Meinzinger Twps.	52 G/2	4,225
Inwood	Inwood, Joynt & unsurveyed terr.	52 B/15 & 52 B/16	1,461
Mille Lacs	Joynt & unsurveyed terr.	52 B/16	2,409
Langworthy	Langworthy & unsurveyed terr.	52 G/1	701
Goodfellow	Goodfellow & Savanne	52 B/16	2,384
Gibbard	Gibbard	52 B/16	1,496
Fallis	Fallis & Gibbard	52 B/16	2,471
Argon	Fallis, Robson, Golding & Block No. 2	52 B/16	1,005

Source: L.J. Rak Engineering (1983), Graham (1979)

The locations of these bogs are illustrated in Figures 3 through 6. It is to be noted that the Trewartha Bog and the Meinzinger Bog are currently designated as Areas of Natural and Scientific Interest ("ANSI") under the Living Lands legacy and thus may not be available for development.

Conditions of a new LUP also require the following:

- Schedule B maps must now be provided at 1:50,000 scale (these will covers parts of 1:250,000 scale NTS maps 52G and 52B);
- Inclusion of a summary of exploration conducted under the previous LUP (2003 field season);
- Identification of areas where core sampling took place, the quantity of bulk sampling, areas of excavation (rehabilitation completed), proposed work schedule; and
- Understanding that the intent of the LUP is for peat exploration activities, not for development or for holding property.

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Last revision date: Friday, 3 December 2004

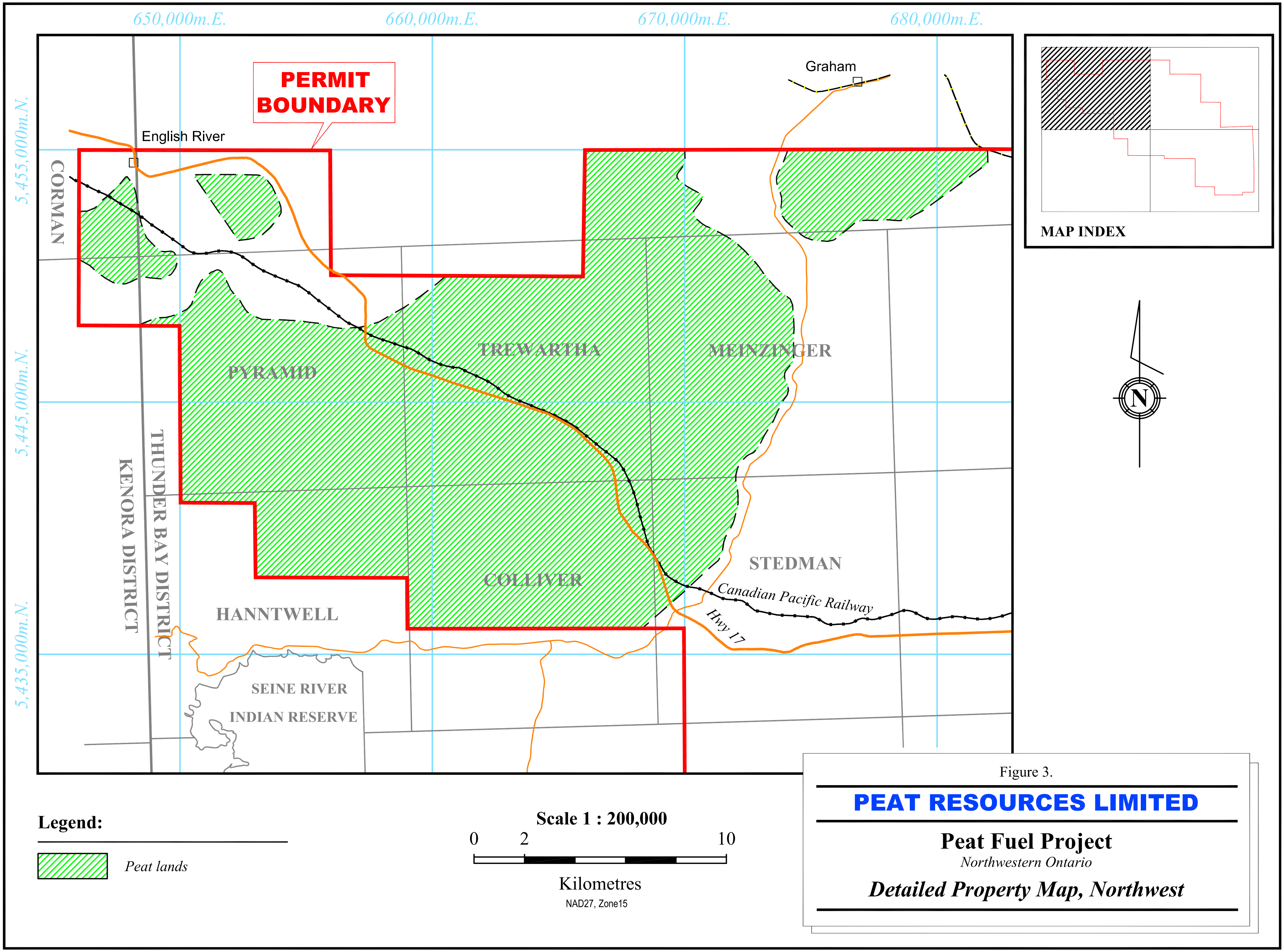

Figure 3.

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Peat Fuel Project

Northwestern Ontario

Detailed Property Map, Northwest

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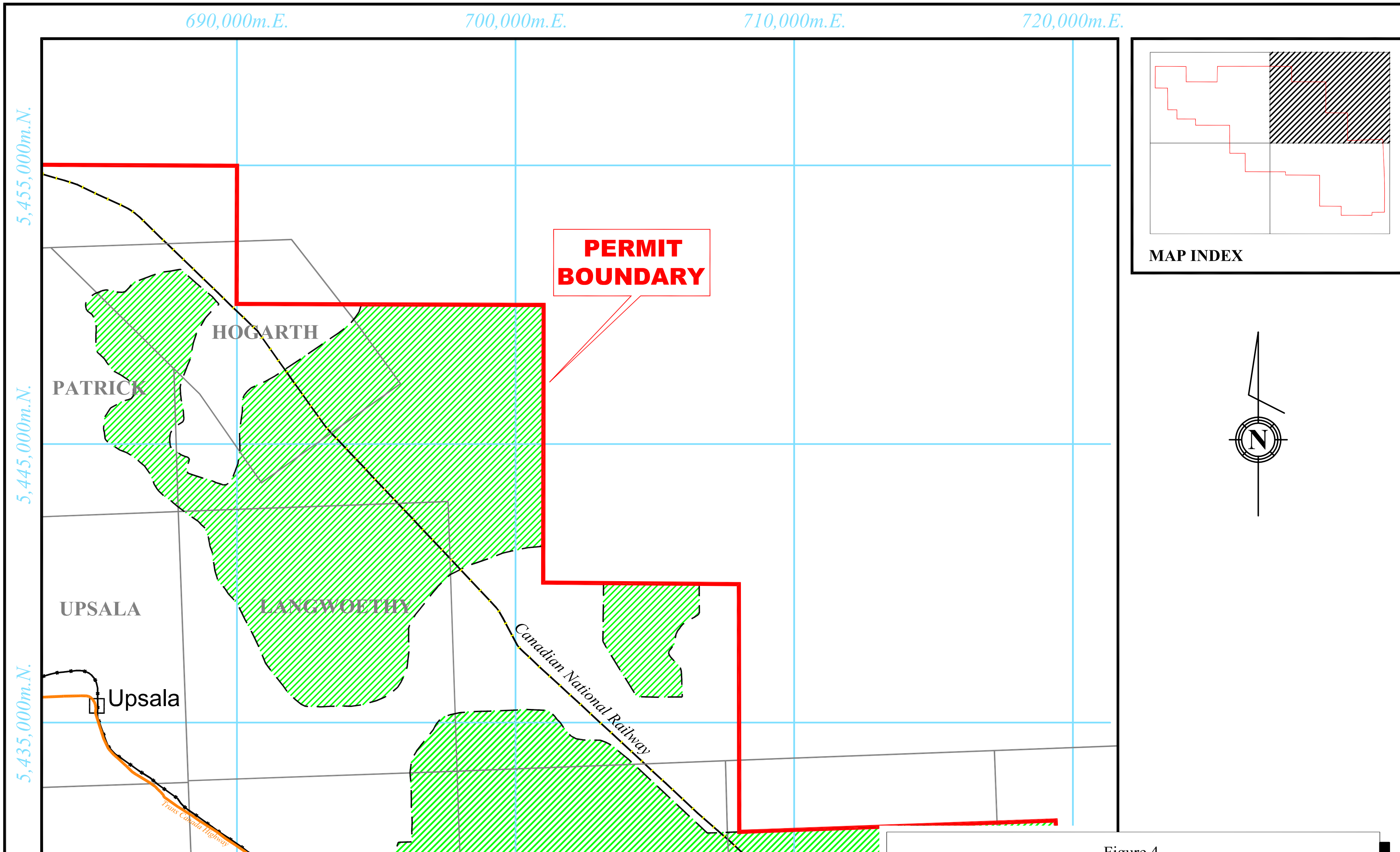
PET REV / PET_01_Property_Map.dwg (Layout: Sheet 2 200k SEDAR)
Last revision date: Friday, 3 December 2004



Legend:

Peat lands

Scale 1 : 200,000

0 2 10

Kilometres

NAD27, Zone15

Figure 4.

PEAT RESOURCES LIMITED

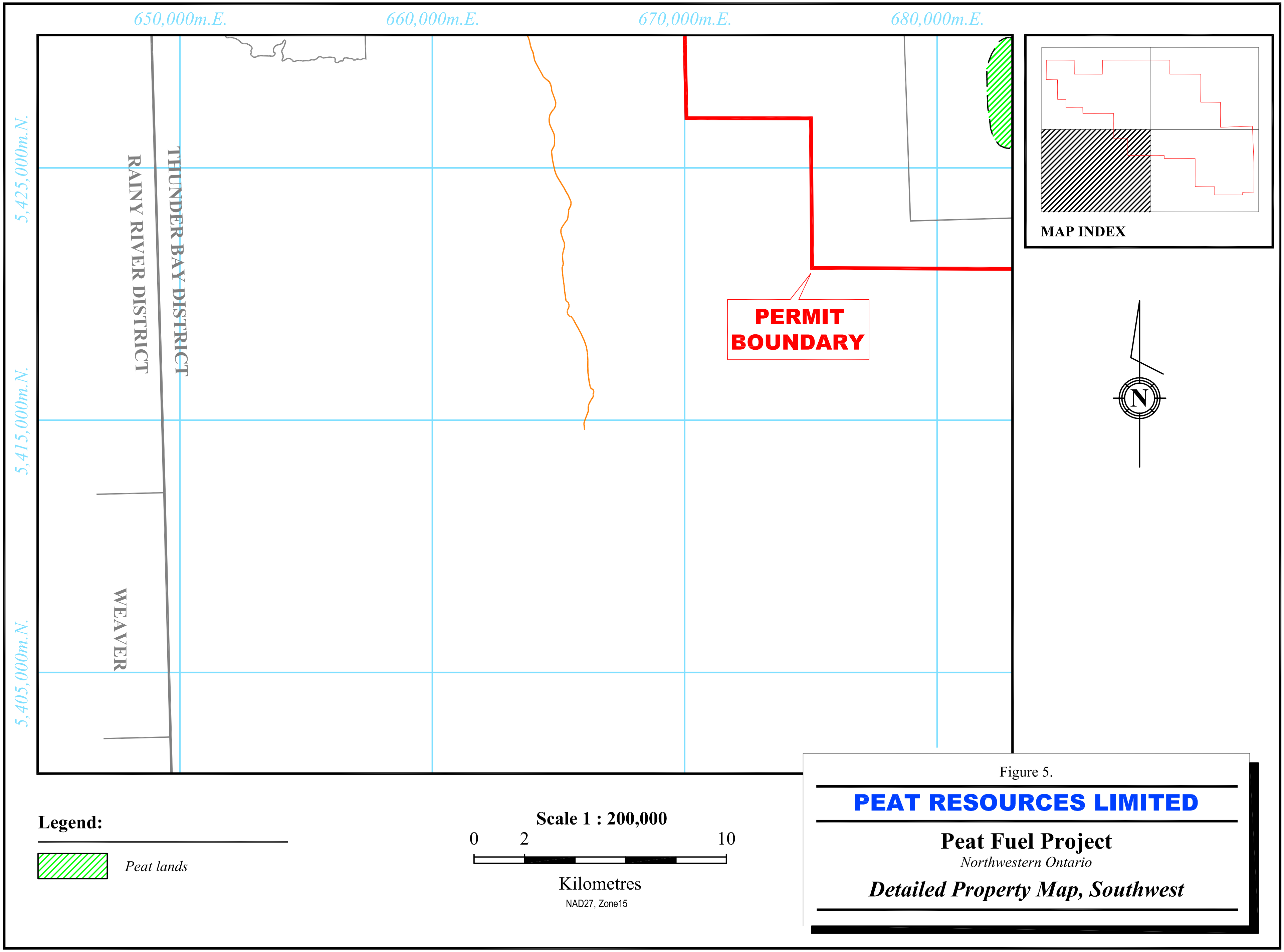
Peat Fuel Project

Northwestern Ontario

Detailed Property Map, Northeast

Watts, Griffis and McOuat

PET REV / PET_01_Property_Map.dwg (Layout: Sheet 3 200k SEDAR)
Last revision date: Friday, 3 December 2004



Watts, Griffis and McOuat

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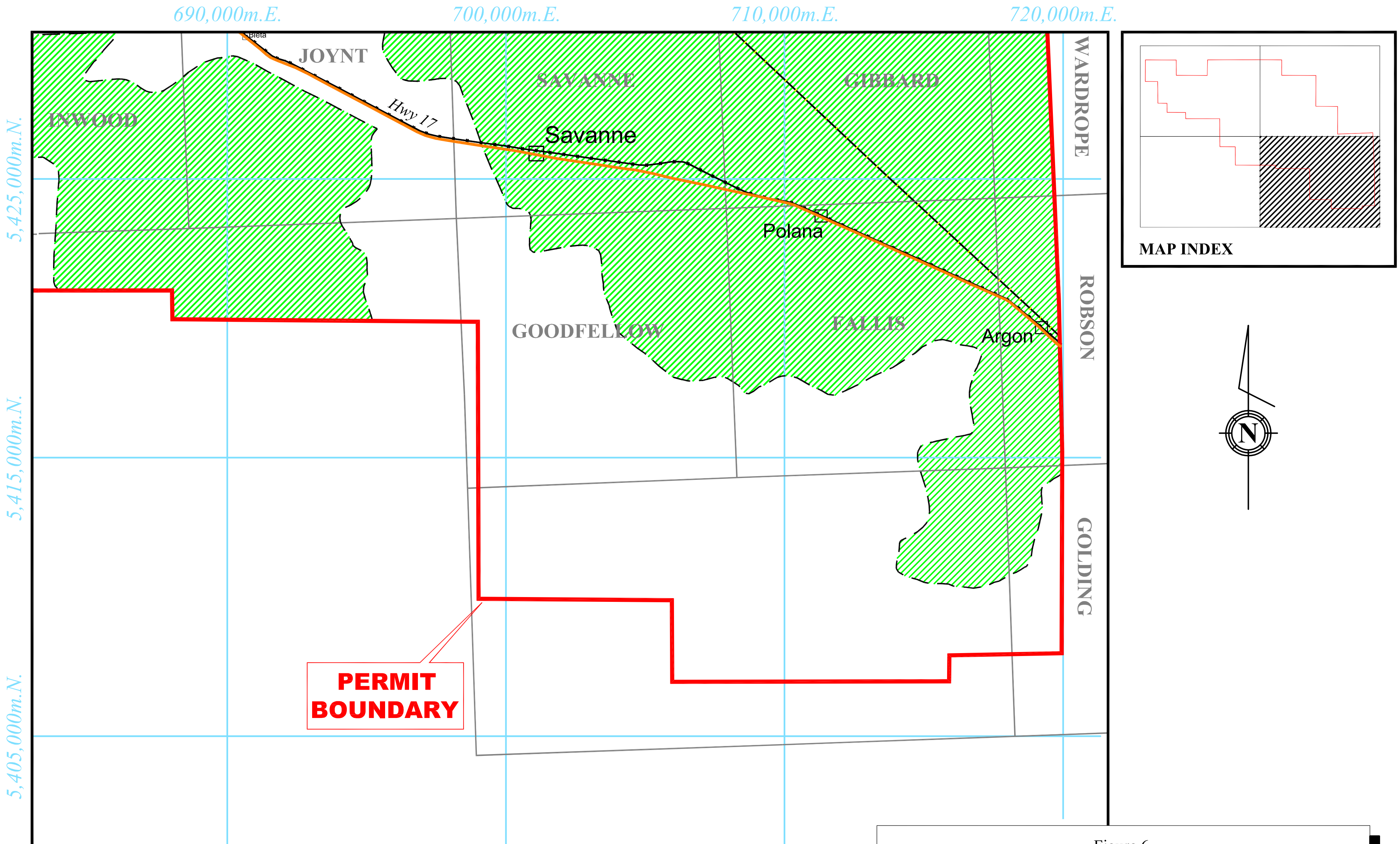
Last revision date: Friday, 3 December 2004



Legend:

Peat lands

Scale 1 : 200,000

0 2 10

Kilometres

NAD27, Zone15

Figure 6.

PEAT RESOURCES LIMITED

Peat Fuel Project

Northwestern Ontario

Detailed Property Map, Southeast

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This final condition reflects the fact that the current Peat and Peatland Disposition policy of the Ministry of Natural Resources recognizes Crown peatland disposition as two stages. Stage 1 is the exploration and evaluation of resources. Stage 2 is development and production under a combination of Land Use Permit for the production fields and Crown Lease for the processing plant etc. Successful completion of Stage 1 is a mandatory precursor to Stage 2. The granting of a Work Permit under Stage 1 confers on the proponent a first right of refusal to develop a peat extraction site, as allowed under Stage 2, on the area covered by the Work Permit.

5. ACCESSIBILITY, PHYSIOGRAPHY, CLIMATE, LOCAL RESOURCES AND INFRASTRUCTURE

5.1 ACCESSIBILITY

The property is centred on the town of Upsala, approximately 130 km northwest of Thunder Bay. The Property is roughly bisected by Highway 17 and the Canadian Pacific Railway main line from Thunder Bay to Winnipeg, which parallels Highway 17. The Trans Canada Pipe Lines natural gas pipeline also largely parallels the highway. The Canadian National Railway line from Thunder Bay to Winnipeg bounds the northern perimeter of the property, crossing the Gibbard Bog. Access to Highway 11 and Atikokan is provided by the Sapawe Road, or from the junction of Highway 17 and Highway 11 at Shabaqua Corners, approximately 30 km west of Thunder Bay.

The most significant bogs: Goodfellow, Gibbard, Fallis, Argon, Meinzinger and Trewartha, are accessible from Highway 17, although transit across either or both of the rights of way of CP rail and Trans Canada Pipelines is required. The CN rail line provides access to the Gibbard Bog and the Langworthy Bog. Various public access forestry roads also provide access to some of the bogs. These include the following:

- Graham Road: access to east side of Meinzinger Bog;
- Trewartha Road: access to northwest side of Meinzinger Bog and east side of Trewartha Bog;
- Rush Creek Road: access to west side of Trewartha Bog; and
- Langworthy Road: access to west side of Langworthy Bog.

5.2 PHYSIOGRAPHY

The property is partly within the Ignace study area as defined by the Ontario Geological Survey (Riley and Michaud, 1989). It is on the drainage divide between the Hudson Bay (English River) and Great Lakes Basin, with the rivers within the property boundary eventually draining into Hudson Bay. The property is characterized as low valley bedrock hills overlain by ground and hummocky moraine. Ground moraines predominate in association with extensive glaciolacustrine plains and organic or peatland terrain. The peatlands are found on the fine sandy outwash channels draining southwest from these moraines, occupying channels that would have drained the ice-front melt-out waters westward toward the former glacial Lake Agassiz. These sloping peatlands are characterized by distinctive central open fen drainways flanked by treed bogs and fens. The peatlands are classified as bog or poor fen or string mire. The poor fen areas are shallower than muskeg and have more humified peat with a lower fibre content.

The two most significant watercourses are the Firesteel River in the western portion of the property draining the Meinzinger and Trewartha bogs, and the Savanne and Little Savanne Rivers, draining the Goodfellow, Fallis, Gibbard and Inwood bogs. These rivers drain into Lac des Mille Lacs.

5.3 CLIMATE

The property is within Kappen’s "Dt6" climatic region and is classified as a continental climate. Historic weather data for Upsala (49°3’N, 90°28’W) show average daily temperatures of minus 18.9°C in January and 17.1°C in July. Precipitation is generally lowest in February (31.0 mm) and highest in June (107.1 mm) with a yearly average precipitation of 798.2 mm. On average, Upsala receives 136 days of precipitation per year. The Property area has a water surplus with most of the precipitation falling during the growing season. The overall climatic factors are conducive to the development and growth of many peatland plant species (Proctor and Redfern, 1984).

5.4 VEGETATION

The property is located within the Boreal Forest Region, and specifically within the Upper English River forest subdivision (Riley and Michaud, 1989). The dominant boreal forest species are black spruce, jack pine, trembling aspen and white birch. Tamarack accompanies black spruce in wetland areas. Jack pine, white birch, trembling aspen, balsam fir, balsam poplar and white spruce are found on sand and gravel deposits and low rocky outcrops. The forest landscape of the whole region has been historically modified by lumbering and clearing activities, extensive fires, blowdowns and forest pathogens.

Within the bogs themselves, vegetation generally consists of a surficial layer of sphagnum and Labrador tea (ledum), often complemented by scrub tamarack and/or black spruce. Other shrubs primarily consist of ericaceous species such as Leatherleaf, and Blueberry (v*accinum* sp.) Willows and speckled alder may be present in minerotropic areas, with some mixed forest (aspen, white birch, black spruce) in elevated areas.

5.5 WILDLIFE

Bogs have low biological potential and are poor habitat for large mammals. Moose and bear are the largest mammals in the property area, but typically are restricted to the margins of the bog areas where conditions are better suited for browse and berries. Beavers, voles, shrews and rabbits may be present in the more central portion of the bogs and where open water is available. Bird species tend to be limited, with the most common being gray jays, boreal chickadees and spruce grouse. Reptiles and amphibians are not significant in the property area.

Fish are present in the Savanne River and some of the larger streams discharging into the Savanne River and Lac des Mille Lacs. The Savanne River is a shallow river averaging about 2.5m depth, with a maximum depth of approximately 4.5 m. Walleye may travel up river as far as Argon, where rapids and gravel beds provide spawning habitat. Northern Pike spawn in reed beds along the river channel. Beaver dams may inhibit fish movement in some streams.

Coarse fish such as white sucker, longnose sucker, yellow perch, burbot, trout perch, darters and minnow (cyprinid) species may be present.

5.6 LOCAL RESOURCES AND INFRASTRUCTURE

The major communities near the property include the town of Upsala (population approximately 350), and Savanne, a fishing resort. Upsala is a sawmilling centre and local services such as fuel, food store, school, police station, etc. are available. Savanne is a year-round fishing resort with fuel supply, accommodation and small grocery store. Two First Nations reserves, Lacs des Mille Lac (Reserve 22A-1) and Seine River (Reserve 22A-2) are located on the southern perimeter of the property. These reserves form the Lacs des Mille Lacs First Nation, which in turn is represented by the Bimose Tribal Council of Treaty 3. The reserves are not occupied, with the band members living in the adjacent area. As previously mentioned, the nearest large communities are Thunder Bay, approximately 130 km to the east of Upsala, and Atikokan, approximately 70 km to the southwest of Upsala.

The most important transportation links on the property are Highway 17 and the CP Rail line, which roughly bisect the property in a northwest-southeast direction; the CN Rail line which largely bounds the northern edge of the property, and the Trans-Canada Pipe Line, which largely parallels Highway 17 and the CP Rail line. Highway 11 leads westward from Shabaqua Junction to Atikokan and Fort Frances south of Lac des Mille Lacs.

6. HISTORY AND DEVELOPMENT

Peat Resources Limited was formed in 1980 to explore, develop, produce and market peat as a fuel to substitute for, or mix with coal in power generating plants. Focusing on Ontario's peat energy resources, the Company used existing federal and provincial studies to design a peatland inventory program and to develop a process for peat fuel.

R. Bruce Graham (1979) carried out a survey of peat deposits under contract to the Ontario Ministry of Natural Resources during the period 1975-1977. He examined peatlands in selected areas of northern Ontario, including the Districts of Nipissing, Sudbury, Algoma, Thunder Bay and Kenora. The work in Thunder Bay District identified substantial peat resources in large bogs in Fallis, Gibbard, Meinzinger, Stedman, and Trewartha Townships and the following summary of Graham's survey will focus on the results from this region. [These areas were later included within a land use permit obtained by Peat Resources Limited - see Part 3. Property Description and Location].

The objective of Graham's fieldwork was to determine on a reconnaissance basis the peat resources present and whether horticultural peat occurred in sufficient quantity to warrant further investigation. This work was undertaken before interest in fuel grade peat had emerged in Ontario but Graham's results could also be used to obtain a preliminary indication of the extent and quantity of fuel grade peat resources in the areas of interest. The bogs in Gibbard and Fallis Townships that were examined by Graham are connected (and extend into Goodfellow Township) and are now referred to as the Goodfellow-Fallis Bog. The bogs in Trewartha and Meinzinger Townships are also connected and are now referred to as the Meinzinger Bog. Graham carried out reconnaissance sampling of these bogs; sample locations are plotted on aerial photographs in his 1979 report together with cross sections of the bogs along the sampling lines, detailed drill log descriptions, and analytical results.

Although the primary purpose of his study was to examine the potential for horticultural peat resources, Graham was able to make some estimates with respect to fuel peat resources. He noted a substantial potential for fuel peat in the Stedman, Trewartha and Meinzinger Township deposits:

- >83,642,000 m^3 of peat in place; and
- >20,441,000 tonnes of peat at 55% moisture.

Graham cautioned that this estimate was based on the fact that only 52% of the large Meinzinger Bog had been investigated and that further surveys would enlarge the resource estimate. Graham did not include an estimate of the fuel peat resources of the Goodfellow-Fallis Bog but he did show the results of 15 reconnaissance samples taken in the central part of this bog, immediately north of Highway 17.

The work by Graham stimulated the interest of Peat Resources, and in the first phase of its activities, during 1980-1984, the company expended approximately $1.2 million on preliminary market and site analyses, acquisition of quarry and work permits, and assessment of peat processing technologies. The Government of Ontario granted Peat Resources Limited the required permits to evaluate approximately 230,000 hectares of peatlands on Crown Land. These peatlands were located across a broad swathe of northern Ontario from near Cochrane in the east to the Fort Frances district in the northwest. Peat Resources Limited had identified 154 individual areas for evaluation and testing. Twelve work permits from the Ontario Ministry of Natural Resources entitled the company to sample one borehole from each area and carry out necessary testing. In 1984, Peat Resources Limited authorized L.J.Rak Engineering Limited to prepare an engineering report to constitute supporting documentation to a prospectus for public offering of shares of the company. Subsequent work by Peat Resources Limited, together with the results of various government studies as described below, eventually focused the company's interest on peatlands of the Upsala area, 130 km northwest of Thunder Bay.

In 1981, **Monenco Ontario Limited** was contracted by the Ontario Government to carry out a comprehensive review of Ontario's peat resources and their potential energy and non-energy uses. The work included a review of the distribution of peatland in Ontario and resource calculations, review of peat mining methods and recommendations as to methods appropriate for Ontario conditions, review of available processing technologies for generation of energy products, review of environmental issues and considerations for peat resource development, and a summary of proposed regulatory guidelines for efficient administration of the peat industry.

Monenco's work on resource estimates was only a preliminary first step towards a comprehensive inventory of Ontario's peatlands. However, the estimates provided in the Monenco report did indicate the high potential for fuel peat in certain regions of the province. For the Monenco estimates, the main sources of information were literature (eg. the 1979 Graham report), topographical maps (scale 1:250,000) and engineering geology terrain maps produced by the Ontario Geological Survey. These sources were supplemented by aerial photographs, 1:50,000 scale topographic maps where available, and further contacts with specialists working on peatlands in Ontario. Because of the scale factor, only peatlands of >100 hectare in area were taken into account in the resource estimate. In some areas where a number of smaller peatlands occurred in clusters or were approximately contiguous, they would have been measured as generalized peatland areas. Monenco noted a number of other qualifications on the accuracy of these large scale resource estimates. However, the numbers generated by the study were qualitatively indicative.

Monenco divided the province into four resource regions: Southern Lowlands, Eastern Shield Region, Western Shield Region, and Hudson Bay Lowlands. The Upsala peatland corridor that is the subject of this report lies within the Western Shield Region and only the Monenco results pertaining to this region will be discussed here. The Western Shield Region, outside the areas of permafrost, was estimated to contain about 2.2 million hectares of peatlands. The average thickness of fuel peat in the peatlands of this region was estimated to be 1.3 m to 2.1 m, leading to the following volume and tonnage figures:

- Volume: 22.86 billion m^3; and
- Tonnage: 6.86 billion tonnes (fuel peat at 50% moisture).

While these regional figures could not be applied directly to the properties under consideration in the Upsala area, they did point to the significant potential of fuel peat resources in the region and provided strong encouragement for possible developers of these resources. Monenco (1981, p. 25) noted "*large concentrations of peatlands occur along the southern border of the province, as well as along the main transportation corridor from Thunder Bay to Kenora and represent a resource potential worth further detailed inventory work*". As described earlier, the peatlands currently under active interest by Peat Resources Limited lie along this transportation corridor.

The extensive descriptions of peat mining methods and fuel peat processing technologies that are included in the Monenco report also provided important assistance to would-be peat developers in Ontario. Monenco examined and evaluated these methods/technologies in the context of Ontario climatic and other physical conditions. The comprehensive catalogue of methods and technologies became a useful database for planning peat development operations under Ontario conditions.

Monenco's primary recommendation to the Government of Ontario was for a comprehensive resource inventory that would be a necessary prerequisite to the planned and orderly development of a provincial peat industry. In response, the **Peatland Inventory Project** was initiated by the Ontario Geological Survey in 1981 as part of a larger

Hydrocarbon Energy Resources Program to investigate measures for increasing the provincial level of energy self sufficiency. Objectives of the peatland inventory were:

- to carry out reconnaissance field investigations of designated peatlands, in order to assess or confirm which sites should be surveyed in detail;
- to carry out detailed field investigations of designated peatlands, including evaluation of peat type and peat humification stratigraphy, peat volumes, elevations, drainage, surficial vegetation, and other relevant information; and
- to subdivide and map all designated peatlands on the basis of airphoto interpretation and field work into major types (bog, fen, swamp, marsh and open water).

The peatland resources of northwestern Ontario were investigated as part of the Peatland Inventory Project during the period 1982-1985. Surveys were carried out in six areas Table 2.

TABLE 2
MAP AREAS

Study Area	1:250,000 Map Sheet	Total Study Area
Armstrong	Part of 52I	3,470 sq. km
Rainy River	Parts of 52C, 52D	4,600 sq. km
Ignace	52G	16,000 sq. km
Sioux Lookout	52J	16,000 sq. km
Longlac-Nakina	42E, 42L(S Half)	24,000 sq. km
Dryden-Lac Seul	52K, 52F(N Half)	24,000 sq. km

The Ignace study area contains part of the peatland corridor in the Upsala area, northwest of Thunder Bay, which is under consideration by Peat Resources Limited. This study area was surveyed by Proctor and Redfern Group Limited, under contract to the Ontario Geological Survey, during 1983-1984. Results of Proctor and Redfern's work were released as Ontario Geological Survey Open File Report 5487 (1984). A complete account of the inventory of peat and peatland resources of northwestern Ontario was given in Ontario Geological Survey Miscellaneous Paper 144 (Riley and Michaud, 1989).

In the Ignace study area, Proctor and Redfern surveyed 28 peatlands covering 24,540 hectares. Ten sites were surveyed in detail with numbers of samples ranging from 11 to 186 per site. The Meinzinger Bog was sampled at 166 locations in a surveyed grid pattern. The other 18 sites in the Ignace study, some of which lie within the area of interest of Peat Resources Limited, were studied in reconnaissance fashion and number of samples ranged from 1 to 16 per site. Complete details of sample location, sampling results and analytical testing are provided in OGS Open File Report 5487 (Proctor and Redfern, 1984) and a summary and tabulation of this information is included in OGS Miscellaneous Paper 144 (Riley and Michaud, 1989).

The Ignace study area did not include all of the areas under consideration by Peat Resources Limited. For example, the Goodfellow-Fallis Bog lay outside the study area. Of the peatlands that were and are included under the Land Use Permit held by Peat Resources Limited and that lay within Proctor and Redfern's study area, only the large Meinzinger Bog was studied in detail. Nevertheless, the results of this government program were able to assist and encourage further interest and work by Peat Resources Limited.

(NOTE: All sampling and analytical work that was undertaken by the contractors to the Peatland Inventory Project had to conform to strict specifications laid out by the Ontario Geological Survey. Subsequent surveying and sampling of the peatlands in the Upsala area by Peat Resources Limited has followed these guidelines and specifications.)

The Proctor and Redfern work in the Ignace component of the Ontario Peatland Inventory included detailed grid sampling of selected peatlands. Their sampling of the Meinzinger Bog was the first detailed appraisal of a peatland in the PET property area. The results confirmed earlier projections from reconnaissance work that this peatland contained significant fuel peat resources and, by extrapolation, suggested similar results for other large bogs in the subject area, such as the Goodfellow-Fallis Bog.

Proctor and Redfern's detailed survey of the Meinzinger Bog was of particular interest to Peat Resources Limited. The bog was classified in the Ontario Peatland Inventory as a Category A fuel peat deposit. According to the Ontario Peatland Inventory specifications, parameters of a Category A fuel peat deposit are as follows:

Peatland area >2 m deep	*>150 hectare*
Average net heating value	*>4,165 cal/g*
Average ash content	*<15%*

As noted above, the peatland was surveyed and sampled on a grid pattern and the resulting estimates of area, volume and peat quality were based on 166 sampling points on the grid.

Meinzinger Bog	Total area	4,830 hectares
	Total volume	54.7 million m^3
	Volume of peat greater than H4 humification	16.7 million m^3
	Area >2 m depth	882 hectares
	Volume	28.1 million m^3
	Volume of H4+	11.4 million m^3
	Average depth	2.9 metres

Following completion of the Ontario Peatland Inventory, Peat Resources Limited obtained an in-house assessment of the volume and tonnage of possible peat resources in the Upsala peatland corridor (Shotyk and Stevenson-Demeester, 1987). This work was supplemented by further mapping and sampling of the Meinzinger and Goodfellow-Fallis Bogs. Detailed airphoto interpretation and field appraisals were undertaken to identify the most promising areas in terms of accessibility, vegetation conditions and environmental parameters. The work confirmed the peat distribution of earlier surveys and bulk samples were taken at selected sites in both bogs for testing to verify that this source of peat could be processed to an economical fuel peat.

Based on the results provided in the Proctor and Redfern (1984) Open File Report for the Ignace area, especially figures for 10 peatlands that were surveyed in detail, calculations by Shotyk and Stevenson-Demeester (1987) showed:

- an average of 10,950 m^3 usable peat (at least 1 m deep) per hectare of total peatland area; and
- a dry bulk density (kg dry peat/m^3 in situ peat) of 67.7 kg/m^3.

These factors were applied to all peatlands in the Upsala corridor and total peat resources were estimated at 97 million tonnes @ 50% moisture content. (Note: This estimate does not conform to the mineral resource definition standards of NI 43-101 and should be considered as highly speculative.)

Peat Resources Limited then used the results and recommendations of the government studies and surveys and its in-house resource estimate to design a peatland inventory program for its area of interest in the Upsala corridor of Thunder Bay District. The company also designed a program for preliminary development of a practical production process for peat fuel in Ontario.

In this **Phase II program undertaken in the 1987-1988 period**, Peat Resources Limited secured the financial and technical participation of Inco Limited, Corona Corporation and Esso Resources (Canada) Limited as well as grants from the Ontario government through the NOR-DEV program administered by the Ontario Ministry of Northern Development and Mines. In order to fulfil the conditions of the NOR-DEV grant, Peat Resources Limited was required to complete four reports describing the procedures and results of the Phase II peat development program. These form a useful historical account of the work of Peat Resources Limited and they supplement the information on the Upsala area peatlands that had been produced by the earlier government surveys. The four reports were as follows:

1. Field Program.
2. Testing and Analysis.
3. Engineering Systems Search.
4. Final Summary Report.

The Field Program report consists of three sections: a general introduction to the overall peat development program, a summary of the field program, and reference reports. The report summarizes the work undertaken in the field program under the headings of Prospecting, Selection Criteria, Site Selection, Selected Bog Information, Sampling, Estimates of Reserves, and Environmental Considerations.

The Testing and Analysis report summarized the laboratory process testing and larger scale testing in commercial equipment required to develop a satisfactory flowsheet. The testing was undertaken on samples from the field program as described in report #1. The testing work was described in two main sections - Process Tests and Studies; Equipment Testing in Commercial Units.

The Engineering Systems Search report summarized the engineering studies undertaken in-house by Peat Resources Limited, and those contracted to independent engineering firms, to integrate the results of the test programs into a cost effective flowsheet for peat fuel.

The Final Summary Report includes the summary results of Phase II, objectives and overview of the Peat Development Program, conclusions with respect to the status of the program at that reporting stage, and an outline of proposed future development work.

The principal objective of the Peat Development Program as described in these Phase II reports was to identify a cost effective process, based on the availability of sufficient resources, to produce peat fuel of 10% moisture content (90% solids) with a fuel value equivalent to coal. Terminology used in the reports to define fuel peat were as follows:

- *Fuel-grade peat*: partially decomposed peat which has a minimum calorific value of 4,400 kcal/kg (8,000 BTU/lb) on a 100% dry solids basis;
- *Bulk peat*: fuel-grade peat dried to 50% solids content, having a minimum calorific value of 2,200 kcal/kg (4,000 BTU/lb); and
- *Peat fuel*: fuel-grade peat dried to 90% solids content, having a minimum calorific value of 4,000 kcal/kg (7,200 BYU/lb).

The 1987 field studies were carried out by J.R.Radforth (Venture Technical Services) who is a recognized specialist in peatland surveys. The fieldwork consisted of initial site surveys to verify the existence of large areas of peatlands suitable for extractive development and location of sample sites representative of these peatlands. Criteria for selection of the sample sites were as follows:

- Closeness to existing road and rail access and to other services such as electric power and telephone;
- Sufficient estimated depth (at least 1.5 m) to warrant development;
- Have the quality of typical peat fuel, rather than horticultural grade peat;
- Proximity to future potential markets for peat fuel;
- Location in large areas of peatland with minimum adverse environmental impact (required consideration of the land use policies and guidelines of the Ontario Ministry of Natural Resources, Thunder Bay District);
- Accessibility for sampling without requiring construction of roads or clearing access routes through tree cover;
- Accessibility for a trucked excavator, capable of travelling on peatland, which would be required to excavate and transport a total of at least 4 tons of peat samples; and
- Closeness to service roads for truck traffic, to minimize travel time to and from the sample sites, and to reduce the risk of immobilizing the excavating equipment.

Two main bogs met these selection criteria. They were the Goodfellow-Fallis Bog which extends across parts of Savanne, Gibbard, Fallis and Goodfellow Townships and the Meinzinger Bog which occurs within Meinzinger and Trewartha Townships. Radforth noted that the Trewartha Bog, which lies adjacent to the Meinzinger Bog in Trewartha Township, satisfied the physical criteria but that it had been designated as an Area of Natural and Scientific Interest ("ANSI") by the Ministry of Natural Resources and was not available for development.

Radforth found ten sites in the two selected bogs that met the criteria for bulk sampling. Six sites were located in the central part of the Goodfellow-Fallis Bog adjacent to the south side of Highway 17. Four sites were located on the eastern side of the Meinzinger Bog with access from the Graham Road. The number of samples and the quantity of peat taken (380 to

400 litres per sample) represented a range of peatland conditions for the two bogs. Table 3 summarizes Radforth's sampling program.

TABLE 3
RADFORTH (1987) SAMPLING OF MEINZINGER AND GOODFELLOW-FALLIS BOGS

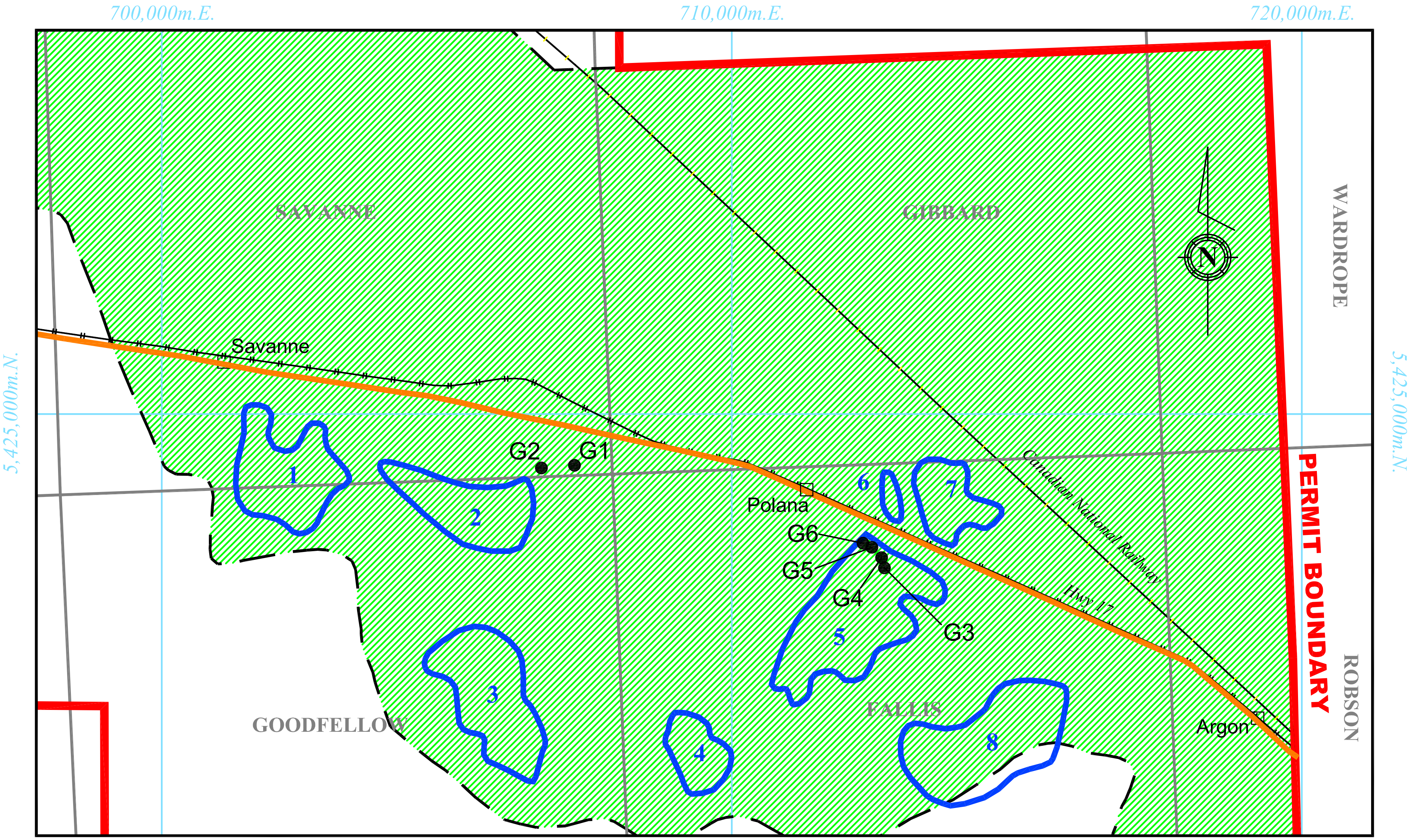
Sample Number	Quantity (litres)	Peat Depth (metres)	Bottom Sediment
G1	380	2	Silt
G2	380	2	Sand
G3	380	4+	?
G4	380	4+	?
G5	380	4+	?
G5 (bulk)	2,470	4+	?
G6	380	4+	?
M1	400	2.5	Clay
M2	400	1	Sand
M3	400	1	Sand
M4	400	2.5	Sand

(G = Goodfellow-Farris; m = Meinzinger)

As part of his assessment of resources, Radforth identified and outlined eight areas of peatland in the Goodfellow-Fallis Bog with vegetation and water conditions equivalent to the conditions of the sampling sites (Figure 7). His preliminary assessment of resources in these areas indicated about 15 million tonnes of peat fuel at 50% moisture content. For example,

Area of identified areas	1,875 hectares
Average peat depth (assumed)	4 metres
Peat volume	75 million m^3
Peat at 50% moisture content	15 million tones
Peat at 10% moisture content	8.25 million tonnes

PET REV / PET_04_Identified_Peat_Area.dwgg (Layout: Peat Areas 100k)
Last revision date: Friday, 3 December 2004



Legend:

- *Identified Peat Area*
- *Samples location (1987 Radforth)*
- *Peatlands*

Scale 1 : 100,000

0 1 5

Kilometres

NAD27, Zone15

Figure 7.

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Peat Fuel Project

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Peatland Areas and Sample Locations

Watts, Griffis and McOuat

(Note: Radforth's estimate of tonnage is based on a wet bulk density of 200 kg/m^3. This value is significantly lower than that used by Riley and Michaud and Monenco, which is 300 kg/m^3. If this latter estimate is used, the estimated tonnage is 22.5 million tonnes.)

Radforth had noted that the Meinzinger Bog had been evaluated by the Ontario Peatland Inventory Project (Proctor and Redfern, 1984) and reserves had been estimated at about 19 million tonnes of peat fuel at 50% moisture content.

Parallel with this 1987 field program, Peat Resources Limited carried out a number of peat mining, peat processing and other engineering studies to determine the viability of development of the Upsala corridor peatlands. Methods and results of this work were reported in the Testing and Analysis and in the Engineering Systems Search reports which the company prepared in fulfilment of its NOR-DEV grant. A summary of the laboratory test work and commercial equipment testing was given in the Testing and Analysis report. Results of the test program were integrated into two flowsheets, one for a pilot plant operation of 1 tonne/hour, and the other for a production plant of 200 tonnes/hour capacity. In addition to this in-house work, other engineering studies were contracted out and all these activities were summarized in the Engineering Systems Search report.

7. GEOLOGICAL SETTING

This portion of the report is taken primarily from the work by the Ontario Geological Survey (OGS, 1989) and Graham (1979).

7.1 REGIONAL GEOLOGY

The northwestern Ontario area is situated on a series of easterly trending structural belts or subprovinces within the Archean Superior Province. The most widespread bedrock assemblages consist of metavolcanic rocks, metaclastic rocks and minor metasedimentary rocks (greenstone units) wedged between extensive granitic intrusive rocks.

Glacial and postglacial features and deposits have had a significant impact on the development of suitable environments for peatland formation. The Late Wisconsinan glaciation of northwestern Ontario was followed by a complex deglaciation history, resulting from pulsating ice lobes in the area and corresponding fluctuations of proglacial lake water levels.

The earliest recognized ice movements over most of the area came from the northeast, although signs of an earlier advance from the northwest have been recorded in the Rainy River area and to the north of the property area in the Dryden-Lac Seul region. A later ice lobe entraining a calcareous clay till from the west covered the Rainy River area. The retreat of this lobe gave rise to the early stages of Lake Agassiz, which subsequently drained, exposing the sediments to wind erosion.

After drainage of this phase of Lake Agassiz, an ice mass advanced from the northeast, terminating at the northeastern end of the Lake of the Woods-Rainy Lake Moraine. This glacier spread a sandy granitic till over most of the area. The next stage was marked by an episodic retreat of the glacier toward the northeast and the transgression of Lake Agassiz. During the retreat, many end moraines were constructed as a result of periods of stagnation or re-advance of the ice front. At the same time, numerous eskers were formed, and large expanses of outwash materials were deposited in front of the Hartman, Lac Seul and Sioux Lookout Moraines, especially notable in the Ignace study area, which includes the property. Most of the major peatlands are on the fine sandy outwash channels draining southwest from these moraines. These peatlands are often characterized by surfaces sloping to the southwest, with minerotrophic tendencies attributable to ongoing groundwater movement through the sites.

As the glacier front receded to the northeast, Lake Agassiz transgressed across low-lying areas as they became free of ice. This lacustrine episode was marked by different stages in which the water level was controlled by the position of the ice front in relation with the eastern outlets, and by the differential isostatic uplift affecting the level of the southern outlets. During the existence of Lake Agassiz, varved clay and silt were deposited in lower areas. These varved sediments occur mainly in the northern and western part of the region. Toward the east, lacustrine deposits are less common and include a coarser fraction which indicates they were deposited in shallower water environments.

After the withdrawal of the ice mass and the drainage of the proglacial lakes, the emergent landscape was soon colonized by vegetation. Extensive wind erosion and deposition occurred as well, resulting in many dune fields in the Ignace, Armstrong and Longlac-Nakina study areas, and a loess veneer in parts of the Ignace study area.

As the ice retreated the Rainy River region was colonized by an open park-tundra vegetation with scattered stands of spruce, ash and elm. This was followed by a cooler period during which ash and elm diminished. As the climate became warmer, the parkland vegetation was replaced by an open boreal forest of spruce, tamarack, birch, jack pine and red pine. Farther northeast, the parkland vegetation stayed only for a short duration because of a later deglaciation and more rapid migration of boreal forest species form the south, particularly red and jack pine.

In mid-postglacial time, the first indications of a warmer and dryer climate (Hypsithermal Period) were an influx of prairie vegetation combined with an increase of oak and ash and a decrease in spruce. The prairie influence was less apparent toward the northeast. After about 7000 years ago, the climate became more humid and white pine migrated into the area. The climate gradually deteriorated toward cooler and wetter conditions favouring an increase in spruce, especially black spruce, over other tree species. This modern boreal vegetation was initiated approximately 3000 years ago.

Peatlands probably started to form in some areas shortly after the land was freed from ice or proglacial waters, although other studies indicate peat formation has occurred mostly during the post-Hypsithermal period, 4000 to 2500 years ago.

7.2 LOCAL GEOLOGY

No detailed geological description of all the bogs within PET's Land Use Permit area has been developed. Graham (1979), Proctor and Redfern (1984) and Radforth (1987) provide descriptions of the Meinzinger Bog, and the Fallis and Gibbard Bogs (Graham (1979).

Radforth provided the following summary description of the Goodfellow-Fallis Bog:

> *"This bog is mostly covered with tall black spruce trees, low shrubs, sedges, and sphagnum mosses, and is classified as a treed, low-shrub bog. There are a few small open areas, some with ponds. No apparent outcrops of mineral upland were noticed within the main part of the deposit, suggesting that the depth of the deposit is fairly uniform.*
>
> *"This bog is divided by the Savanne River which flows into Lac des Milles Lacs. There are no rapids or waterfalls on the river, and the peatland extends westward right to the lake. Although the bog is adjacent to the lake, a buffer zone could be left undisturbed between an eventual peat mining operation and the lake to prevent environmental disturbance of the lake.*
>
> *"At one of the six sampling sites, there was a woody sedge of over 4 m height, plus wet sphagnum peat. The degree of humification was mostly H 4 or higher on the von Post scale, Ref. F1. The Hiller sampler hit many large pieces of wood throughout, and refused on wood at about 4.5 m from the surface. The bottom soil type was not determined. The Hiller sampling indicates that there is a large volume of fuel-grade peat in this area.*

"The presence of the Savanne River running through the deposit, with several small tributary streams, means that the water level in the deposit could not be significantly lowered by drainage. The river would be a potential good source of water for wet mining operations. The environmental implications of these observations are recognized.

"The Savanne River prevents direct ground access to the southern portion of the deposit, but because the vegetation cover on the deposit appears identical on both sides of the river from API surveys, it is reasonable to assume that the peat is also similar in quality, and that samples from the northern portion would be representative of large portions of the rest of the deposit."

Radforth also included the following brief description of the Meinzinger Bog.

"The Meinzinger bog has been surveyed as part of the OGS peatland inventory project, which located large quantities of fuel-grade peat.

"Tree cover varies from tall, dense stands to small, scattered black spruce in the wetter areas of the bog. Other vegetation cover includes low shrubs, sedges, and mosses. The cover is quite variable from place to place with numerous mineral upland outcrops throughout the deposit, suggesting that the peat depth is quite variable. Several small lakes are scattered throughout the bog which could be used as water sources for wet mining of peat. The sample sites were located out from the eastern edge of the peatland, and access routes were found along logging roads through cut-over areas west of Graham Road. The more open surface vegetation, combined with somewhat higher groundwater level, suggests that there would be less wood in the peat here than in the Goodfellow-Fallis."

8. DEPOSIT TYPES

8.1 FORMATION OF PEAT AND PEAT MOSS

Wetlands are commonly divided into three types: marsh, swamp and bog. Peat forms an integral part of all wetlands, while peat moss deposits are restricted to bogs. Bogs are comprised of the accumulation of various types of mosses, sedges, grasses, and reeds. Relatively thick and unaltered accumulations of moss varieties are referred to as peat moss deposits. The bog-forming plants gradually become humified below the surface to form peat. On complete humification the peat is a dark brown to black, plastic, amorphous, homogeneous material. This on burial and consolidation may eventually form coal.

All significant peat moss and peat deposits in Ontario are post-glacial. Their formation is controlled by topography, hydrology, climate and the chemistry of the soil surrounding the deposits. Growth accumulation takes place in poorly drained areas with a high water-table and where essentially stagnant reducing conditions exist. Growth is outwards and upwards. The type of growth depends to a large extent on the chemical content of the waters draining into the deposit. Acid environments and dissolved salt concentrations of less than 50 mg/l favour the faster growing peat forming plants of the sphagnum, eriophorum and polytrichum species. With slightly lower acidity and higher salt contents, slower growing sphagnum and eriophorum varieties are favoured, along with hypnum moss. These types of bogs generally lack trees due to the low level of mineral nutrients and are referred to as ombrotrophic bogs.

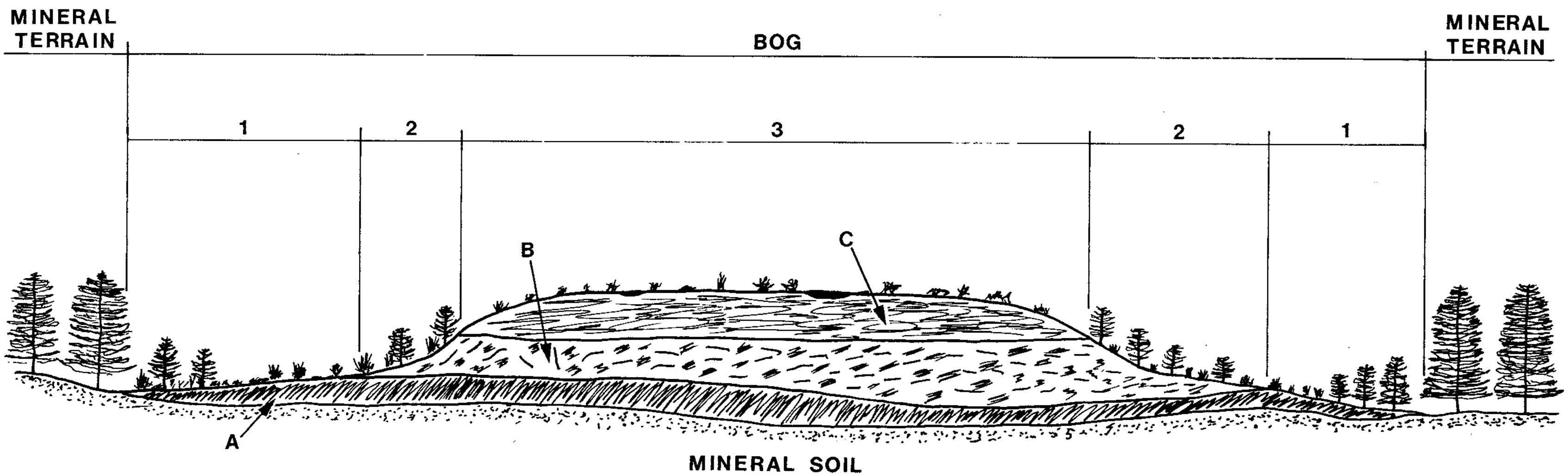
As mineral salt concentrations increase, sedge appears, alder, birch, spruce and tamarack become established, and herbaceous plants tend to be present. These types of bogs are referred to as minerotrophic bogs. The bog transitions to a fen, which may be a true fen (more minertrophic) or a poor fen (weakly minerotrophic). The demarcation between ombrotrophic and minerotrophic bogs is not sharp and both types of bogs may be present within a given area.

The OGS (Riley and Michaud, 1989) provides the following description of bogs:

> *"Less well-defined (wetland) basins in which open standing water is absent or restricted to scattered small pools, often of a seasonal nature; substrates of saturated (or seasonally dry) peat greater than 40 cm deep.*
>
> *Predominantly ombrotrophic or weakly minerotrophic peatlands, developed on acidic peat (pH of water 10 cm below water table usually less than 5.2, unless water has been significantly drawndown by summer drought).*
>
> *Accumulation of peat greater than 40 cm dominated surficially by poorly decomposed sphagnum peat; isolated from mineral soil water movement. Strictly ombrotrophic peatlands usually have ground water pHs less than 4.2 (4.4), with calcium (Ca) levels less than 2 ppm.*
>
> *Forming a level, gradually raised (domed) or sloping surface with a (usually) hummock-hollow topography, usually with a continuous carpet of mosses dominated by Sphagnum ssp. (particularly S. fuscum in the hummock phase). Usually with a ground cover of gramminoids or of mostly ericaceous shrubs, without trees or with short trees 9less than 10 m) with more or less open canopy (usually less than 25 percent, Picea mariana, or Larix larcina in transitional sites). Lacking species indicative of minerotrophy. With or without subsurface discontinuous permafrost or seasonal frost; occasionally with incipient palsa (permafrost eruptions) north of ca. 51°N".*

The bogs within the Land Use Permit area held by PET are generally classified as ombrotrophic to weakly minerotrophic. Figures 8 and 9 provide stylized illustrations of the formation of both ombrotrophic and minerotrophic bogs and the chief physiographic features of such bogs.

The nature of the peat deposit can be affected by changes in the water-table resulting from drainage or climatic rainfall. The organic accumulation may change from a soft, wet deposit to firm and dry one, or vice-versa. The growth pattern will also be affected producing different plant accumulation, which may occur as either regular or irregular layering within the deposit. Fluctuations in the water-table can result in rapid decomposition due to the introduction of oxygenated waters with attendant oxidation. This is not to be confused with humification, which is much slower and takes place under reducing conditions.



1. **Lagg Zone:** This is minerotrophic and constitutes the area of active paludification. The vegetation is composed of stunted trees, herbs, etc. near edges, sedges and sphagna in the middle and increasing quantities of sphagna and shrubs towards the center of the bog. The peat is sedge-sphagnum peat with a moderately high degree of humification (H4-6). (A)
2. **Slope Zone:** This zone is semi-ombrotrophic. Due to improved drainage microbial activity is increased temporarily and small stunted tree growth is supported. The surface vegetation commonly is composed of stunted black spruce, various shrub and sphagna. Peat is predominantly composed of sphagnum with remnants of wood (stumps) with a moderate degree of humification (H2-5). (B)
3. **Central Zone:** This is the zone of mature raised bog characterized by poor drainage and ponds and ridges. Vegetation varies from shrub-sphagnum cover to pure sphagnum and occasional areas of cotton grass. Peat is predominantly composed of sphagnum with a low degree of humification (H1-3). (C)

Note: Vertical scale exaggerated for pictorial clarity.

Figure 8.

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Peat Fuel Project

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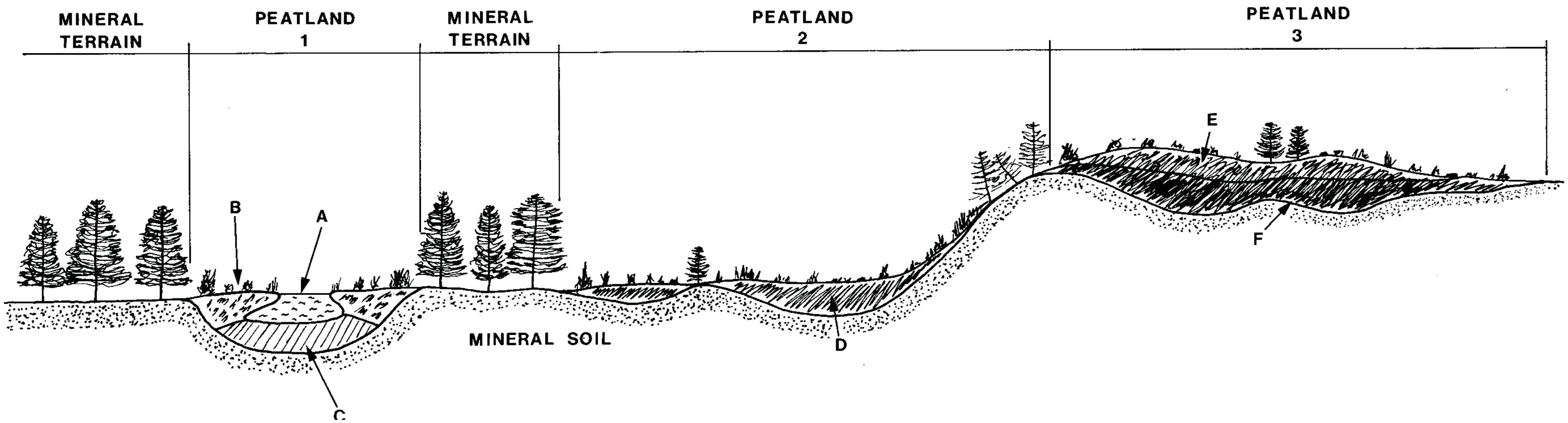
Diagram of Ombrotrophic Bog

(from Monenco, 1981)

Watts, Griffis and McOuat



1. Pond being filled in by vegetation.
   A = open water
   B = semiaquatic vegetation, partly floating, forming peat.
   C = submerged aquatic vegetation and debris falling from the floating mat forming peat.
2. Peatland formed by paludification of forest through spill-off effect from adjacent peatland (3). Upslope the vegetation is composed of sphagna in the ground story and dying trees as the higher vegetation. Downslope the peat is already established and is covered by sedge-herb-shrub vegetation. Peat is composed of a variety of types mainly predominated by sedges. Degree of humification is generally high (H5-8). (D)
3. Peatland formed on higher ground in waterlogged conditions. Vegetation consists of occasional islands of low trees in large areas of sedge dominated vegetation. Peat is predominantly composed of sedge types near the surface and of forest peats near the base. The degree of humification varies from H3-5 near the surface (E) to H8-9 near the base. (F)

Note: Vertical scale exaggerated for pictorial clarity.

Figure 9.

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Peat Fuel Project

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Diagram of Minerotrophic Bog

(from Monenco, 1981)

The morphology of bogs can change appreciably over short periods of time. Peat growth can be extensive enough to be noted on air photographs in 20 years. Features such as lakes and streams can appear or disappear over time periods as short as 12 to 30 years. Rapid humification can result in substantial decreases in horticultural grade peat moss, but with no overall change in volume. Changes in drainage can substantially alter the volume of peat moss and peat in a deposit, while tree growth can completely overgrow a bog or substantially encroach on open bogs in periods as short as 15 years (Graham, 1979).

8.2 TYPES OF BOGS

Peat bogs are classified in four main physiographic types:

1. High Moor: raised or domed bogs which are elevated above their perimeter.
2. Low Moor or Fen: occur on gently sloping basins on mineral terrain or in bedrock depressions due to glacial scouring. They are not raised above their perimeter and are flat to gently lying.
3. Blanket: occupy slopes, undulating uplands or occur on hills.
4. Transition: areas between High Moor or Low Moor bogs with incipient doming.

Only the Low Moor or Fen type of bog is recognized in the interior of Canada. Canadian low moor deposits have a sphagnum top layer of from 0.2 to 2.5 m thick and average 0.5 to 1 m. The sphagnum overlies fibrous to amorphous peat. The peat may contain strata and lenses of less humified sphagnum, hypnum, reeds or sedge. These deposits generally have depths of 2.5 to 5 m but depths of up to 8 m have been recorded.

Typically, all classes of bog rest on a clay, sand or gravel bottom, and occasionally directly on bedrock. Some deposits have a bottom layer of from 0.25 to 3.25 m thick of ooze, which results from the accumulation of plankton or from high lime content in the underlying soil.

All peatlands of interest on the PET property may be classed as Low Moor deposits. Depending on tree cover they can be further subdivided into Open or Treed Bog. An Open

Bog is one in which tree cover is <10%. The bogs of interest on the PET property are a combination of Open and Treed Bogs. The marginal areas of the Meinzinger and Goodfellow-Farris Bogs are thickly treed but they are less treed and more open in their central portions.

Peatlands can be further classified according to their fuel peat characteristics. The Ontario Peatland Inventory Project (Riley and Michaud, 1989) defined two classes of fuel peat deposits.

Category A Fuel Peat Deposit

Peatland area >2 m deep	>150 hectare
Average net heating value	>4,165 cal/g
Average ash content	<15%

Category B Fuel Peat Deposit

Peatland Area >2 m deep	50-150 hectares
Average net heating value	>4,165 cal/g
Average ash content	<15%

The Meinzinger and Goodfellow-Farris Bogs are considered to be Category A Fuel Peat Deposits. Some of the smaller bogs on the PET property fall within Category B.

9. MINERALIZATION

Peat is a generic term and discussion of peatlands is best done by discriminating between peat moss deposits and true peat deposits. Peat moss is composed of thick beds of simple mosses such as sphagnum. The moss has a low level of humification, H1–H3 on the von Post scale. The moss is highly fibrous and has a high degree of water absorption. Peat moss is readily harvested by draining the bogs and allowing the uppermost layers to dry. On drying, the moss has good resiliency and can compressed to a considerable degree, with good rebound characteristics. Cultivation of the moss layer by harrows, etc. permits harvesting of thin layers of the moss. Peat moss is valued for its use in horticulture, where it is used as a soil conditioner, in the manufacture of plant containers, and in emerging industrial applications such as oil spill absorption. The fuel value of peat moss is relatively low and it finds little use in this application. However, where available in sufficient quantity and where other uses are limited, peat moss can be burned as a source of fuel.

Fuel peat is the deeper lying, more humified material in a peat bog. The basic characteristics of a fuel peat are a high degree of humification, high bulk density, relatively low ash content, low content of pollutants such as sulphur and mercury, and a calorific value as high as possible. Fuel grade peat in Ontario can be defined generally as organic material having more than 4,165 cal/g net heating value and <25% ash content. The calorific value of the peat is a function of the degree of humification (higher H value peats have higher calorific content) and the type of organic matter from which the peat is derived.

As a general rule in field inventories, fuel grade peats are considered to have a humification value of H4 or more on the von Post humification scale. Peat material which is less humified (i.e. H1-3) can also be considered as potential fuel peat if the net heating value is sufficiently high. However, the bulk density of this material may be less attractive in terms of materials handling costs and therefore would be less economically viable.

Fuel grade peat may be used in the form of milled peat (typical in Europe) or as more highly compressed material in the form of briquettes. As a general rule, peats with high humification factors, >H6, are best for briquettes, while peats with humification factors in the H3 to H5 range are best for milled peat (Graham, 1979). PET is proposing to produce highly compressed briquettes.

Reconnaissance and detailed sampling of the Meinzinger and Goodfellow-Farris Bogs by PET staff and in previous government surveys have identified significant resources of fuel grade peats (H4+) usually averaging >2 m in thickness, lying below a cover of 1-3 m thickness of less humified (H1-3) peat. Further detailed grid surveys and sampling of the most promising areas will be required to define the precise extent of fuel peat deposits suitable for development.

10. EXPLORATION

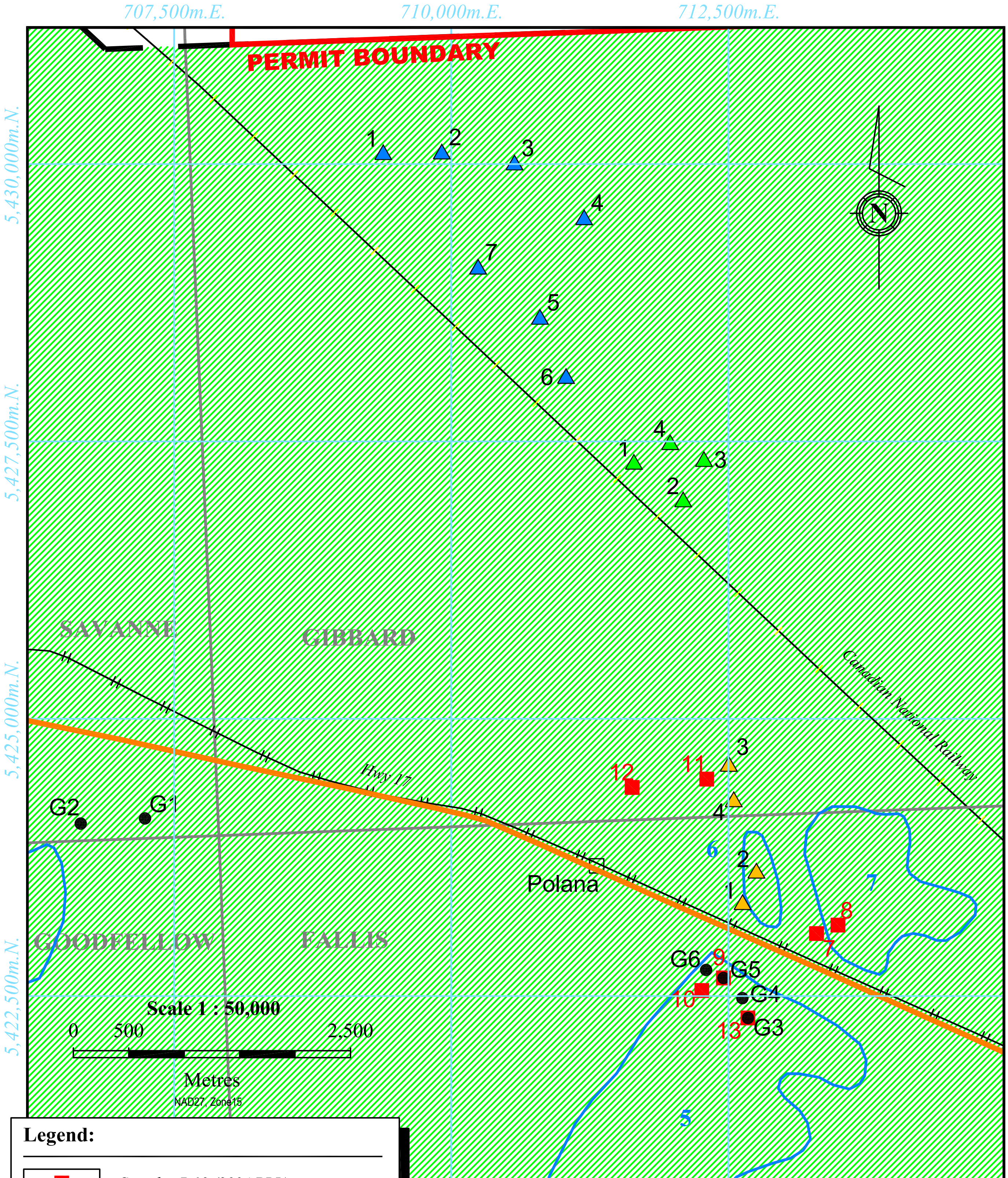
Section 6. History and Development detailed historical information on peat resource exploration programs in the area of the subject lands conducted by the Ontario government and PET in the late 1970s through the 1980s. In 2004, PET staff carried out additional reconnaissance sampling of the Goodfellow-Fallis Bog and further evaluation and testing of this material is currently underway. Samples were collected on a reconnaissance basis across sections of the Goodfellow–Fallis and Inwood bogs (Figure 10). The sample points and key results are summarized in Table 4.

TABLE 4
2004 SAMPLING PROGRAM, UPSALA AREA

Sample Number	Coordinates	Elevation (m)	Blond Peat (H1-3) (m)	Fuel Peat (H4-10) (m)	Bottom Sediment
001 (GF Bog)	N48 55,472’ W90 05,298’	469	0 – 0.5 (H3)	0.5 – 5.0 H5	Clay
002 (GF Bog)	N48 55,514’ W90 05,168’	473		0 – 5.5 H5	Clay
006 (GF Bog)	N48 55,286’ W90 05,844’	464		0 – 3.5 H6	?
007 (GF Bog)	N48 55,199’ W90 05,961’	464		0 – 4.5 H6	Clay
008 (GF Bog)	N48 55,366’ W90 05,856’	?		0 – 5.0 H7	
009 (Gibbard)	N48 56,256’ W90 06,049’	473		0 – 0.5 H8	?
010 (Gibbard)	N48 56,264’ W90 06,590’	468		0 – 0.7 H8	?
011 (Inwood)	N48 57,994’ W90 27,101’	468		0 – 1.2 H9	?
013 (Inwood)	N48 57,797’ W90 27,101’	471		0 – 1.0 H9	?

(GF Bog = Goodfellow Bog)

Bulk Sample Location: Goodfellow Bog (N48 55,474’, W90 05,758’), about 100 lbs of peat was sent for analysis. Test results are pending.



Legend:

- Samples 7-13 (2004 PRL)
- Samples G1-G6 (1987 Radforth)
- Samples 1-4 Fallis Township (1979 R.Bruce Graham)
- Samples 1-4 Gibbard Township North (1979 R.Bruce Graham)
- Samples 1-7 Gibbard Township South (1979 R.Bruce Graham)
- Peat lands

Figure 10.

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Sample Locations, 2004 Field Program

11. DRILLING AND SAMPLING

Recent sampling of the peat deposits on the property has concentrated on reconnaissance level activity using hand sampling devices. Evaluation and sampling of peat deposits does not call for extensive drilling programs. The unconsolidated nature of the peat and the general shallowness of the peat bogs mean that manual methods are normally employed. These usually involve various types of portable hand augers or tube samplers that can be transported by a small field crew on foot or on vehicles that can negotiate the soft terrain. Larger vehicles such as specialized Bombardiers may be required for extraction of large or bulk samples.

Graham (1979) employed two types of samplers:

- Davis sampler. Piston sampler consisting of a sample chamber 1.9 cm in diameter by 50 cm long and a piston with a tapered end to allow easy movement through the material of the bog; 1.15 m extension tubes are screwed into the sampler and each other; and

- Djos Peat Borer. Auger borer with a sample chamber that is initially closed and is then opened by turning the device when sampling depth has been reached; sample chamber is 2 cm in diameter and 50 cm in length while the extension rod are about 1 m long.

For the Ontario Peatland Inventory Project, field crews were encouraged to use a Mini-McCauley sampler. This is an auger-type sampler with a sample chamber of 5 cm diameter and 50 cm length, and 1 m extension rods. It is operated in a similar fashion to the Djos sampler but has a larger sample chamber and therefore provides a larger sample size. A drawback can be that, in heavy well-humified peat, the sampler can be cumbersome to use.

Radforth (1987) used a Hiller sampler. This is another type of auger hand sampler similar to the Mini-McCauley and Djos samplers and with a narrow sample chamber.

Section 6. History and Development has described the field surveys and other peat inventory programs using various sampling technologies that have been undertaken by Peat Resources Limited and government agencies since 1980 in the Upsala corridor area.

12. SAMPLING METHOD AND APPROACH

Assessment of the potential resources in a peatland is dependent on a carefully designed sampling strategy. The technologies used must provide adequate and consistent samples but the most important factor is an accurate survey of sample locations in a pattern that will provide appropriate coverage of the bog area and produce meaningful results. The **Ontario Geological Survey** ("OGS") developed precise specifications as guidance for contractors used in the Ontario Peatland Inventory Project. These were designed to ensure reliable and consistent results from both the reconnaissance-level assessment of the majority of peatlands in the Inventory regions and from the detailed evaluation of selected peatlands.

For reconnaissance investigations, the OGS specifications called for the following approach:

1. Mapping of vegetation from air photos, ground-truthed to physiognomic group by fieldwork.

2. Coring and core-logging at a minimum of two representative sample points for each physiognomic group of vegetation covering more than 20% of the particular peatland, and other sample points of interest. Overall sampling densities will be approximately one point per 60 ha, aligned where possible as a transect so that stratigraphic data can be presented in profile form.

3. Discussion (and calculations where applicable) of the areal extent of the peatland and each constituent physiognomic group, the location and accessibility of the peatland, its general surficial topography (especially in relation to local and regional drainage), its general vegetation types, its peat depths, peat type and humification levels (based on cores samples), and its drainage.

4. Assessment of the suitability of each site for more detailed investigation, based on the following criteria:
   a. High potential for peat extraction as assessed on the basis of anticipated peat depths, volumes and quality, and the absence of constraints to development such as dense tree cover, difficult drainage problems, or conflict with existing land uses;
   b. Proximity to population centers, accessibility by existing road or rail installations, and site ownership; and
   c. Representativeness of the frequency of occurrence, geographic distribution, and type of similarly sized peatlands in the study area.

For detailed investigation sites, the OGS specifications called for a sampling grid pattern with a central baseline and appropriate numbers of sidelines. This led to the following approach:

1. Baseline will be established through the central part of the peatland with sampling points at 100 m intervals along the line.

2. Sideline spacing can be varied to reflect the configuration of the deposit, but should be in the order of 500 m; sample points will be located at 100 m intervals along the sideline.

3. At each sampling point a core will be retrieved (OGS recommended the Mini-McCauley sampler) and a site data record form will be completed (OGS provided templates of the site data record form).

4. In parts of selected peatlands which have homogeneous surficial vegetation and which are considered, from points on the grid already completed, to have homogeneous peat depths, peat types and peat humification levels, individual points may be spread to a maximum of one per 200 m.

5. Sampling at closer than 100 m intervals may be necessary in order to define peatland edges, positions of mineral islands or anomalous shallowing of the deposit.

6. Traverse points between widely spaced transects should be sampled in order to clarify the positioning of depth contour lines where the extrapolation of line position is over distances >700 m.

7. If extensive areas of shallow peats (<1 m deep) are encountered, especially in combination with dense tree cover, the grid lines may be terminated and compass methods and photo interpretation used to complete investigation of the transect with traverse points.

8. The density of sampling points on detailed study sites should be in the order of one for each 8-10 ha of peatlands on sites >1,000 ha, and one for each 6-8 ha on smaller sites.

Section 6. History and Development has described the field surveys and other peat inventory programs that have been undertaken by Peat Resources Limited and government agencies since 1980 in the Upsala corridor area. Most of this work has been undertaken at a reconnaissance level. Only one of the bogs in the Upsala corridor area, on the Peat Resources Limited property, has been investigated in detailed fashion. This is the Meinzinger Bog which was investigated in detail by Proctor and Redfern Limited (1984) as part of the Ontario Peatland Inventory Project.

Random and reconnaissance investigation and sampling of the Goodfellow-Farris Bog by Graham (1979), Radforth (1987) and by PET staff in 2004 has generated useful and indicative results but additional more systematic sampling of the complete peatland area is required.

WGM did not conduct any sampling as part of its site visit and due diligence review in preparing this report. The authors of the report are of the opinion that due to the nature of the sample material and the extensive previous sampling by the OGS that additional sampling was not warranted.

13. SAMPLE PREPARATION, ASSAYING AND SECURITY

The key parameters that need to be measured with respect to the quality of fuel peat are heating value, percentage of volatile matter, and ash content. An analysis of major elements is also useful in order to identify potential post-combustion pollutants.

The Ontario Geological Survey prepared comprehensive specifications for the collection, handling, storage, preparation and analysis of peat samples collected during the Ontario Peatland Inventory Project. Details of these specifications will not be reproduced here but may be reviewed in the following publication available through the Ontario Ministry of Northern Development and Mines.

Riley, J.L. 1989. Laboratory Methods for Testing Peat – Ontario Peatland Inventory Project. Ontario Geological Survey, Miscellaneous Paper 145.

For specific description of analytical results for samples taken by OGS contractors from peatlands of the Upsala corridor area see

Riley, J.L. and Michaud, L. 1989. Peat and peatland resources of northwestern Ontario. Ontario Geological Survey, Miscellaneous Paper 144.

The specifications developed by OGS were based in part on standard methods that have wide and accepted usage in the peat industry. Analytical work undertaken on behalf of Peat Resources Limited on material from the Upsala peatlands has, therefore, followed the same or similar practices to the OGS laboratory tests.

Security issues have not been a concern with respect to laboratory testing of the peat materials from the Upsala corridor. The nature of the material and the broad parameters that are measured preclude any concern regarding deliberate adulteration of samples. The main issue is really the maintenance of accurate and consistent laboratory practices and prevention of inadvertent contamination or other errors from occurring. To maintain quality control on the large number of samples gathered by different individuals and contractors during the Ontario Peatland Inventory Project, OGS used a system where blind samples of known values were introduced randomly as a check against the accuracy and consistency of laboratory methods that were being used.

Accuracy and security of sample locations is much less of a concern now than when the bulk of the mapping and sampling of the Upsala peatlands was undertaken in the 1980s. Sample points can now be logged according to GPS coordinates. The 2004 reconnaissance sampling carried out by Peat Resources Limited used the GPS system for location of data points.

14. DATA CORROBORATION

WGM did not collect any samples during its site visit. WGM is of the opinion that a limited number of random samples would not provide meaningful comparative data and would not prejudice the analysis and overall conclusions and recommendations contained in this report.

Because of the variety of approaches taken in the mapping, surveying, sampling and assessment of the peatlands in the Upsala corridor it is difficult to make direct comparisons of the data gathered from these exercises. For example:

- Graham (1979) – reconnaissance sampling along surveyed transects in selected bogs (mainly Meinzinger and Goodfellow-Farris Bogs);
- Proctor and Redfern (1984) – detailed sampling on surveyed grid pattern in Meinzinger Bog only;
- Radforth (1987) – detailed airphoto interpretation together with random bulk sampling of Meinzinger and Goodfellow-Farris Bogs;
- Shotyk and Stevenson-Demeester (1987) – desk-top resource estimate of all peatlands in Upsala corridor based on extrapolation from the Proctor and Redfern results from the Meinzinger Bog; and
- Peat Resources Limited (2004) – random GPS located samples from Inwood and Goodfellow-Farris Bog to confirm previously reported fuel peat thicknesses.

This variety of approaches has led to a range of values for availability of fuel peat resources. Peatland area and fuel peat volumes and tonnages vary according to the criteria used by the individual investigators.

The most systematic approach to data collection and analysis of peat resources is provided by the Ontario Geological Survey's Ontario Peatland Inventory Project where fuel peat Categories A and B are defined by specific physical and chemical values (see section 8 Deposit Types). It is the opinion of WGM that data gathered and analyzed in accordance with the OGS specifications would correspond to the level of accuracy required for definition of

Inferred Resources (for reconnaissance surveys) and Indicated Resources (for detailed surveys).

15. ADJACENT AND SIGNIFICANT OTHER PROPERTIES

With respect to the Land Use Permit held by Peat Resources Limited for the Upsala corridor area, there are no adjoining properties held by other parties that have similar or competing interests with Peat Resources Limited. Large corporations such as Bowater Inc. and Abitibi-Consolidated Inc hold most of the region, including the area under Land Use Permit to Peat Resources Limited, as forestry concessions.

Proctor and Redfern, in their 1984 report on peat and peatland resources in the Ignace area, surveyed a number of bogs in the northeast quadrant and immediately outside of the area of PET's land use permit. The most significant of these bogs are:

Bog	**Location**	**Common Name**
Peatland 52G-176	49°15' N, 90°27' W	
Peatland 52G-195	49°07' N, 90°25' W	Langworthy Bog
Peatland 52G-198	49°06' N, 90°20' W	Larson Bog
Peatland 52G-226	49°04' N, 90°06' W	Abitibi Bog

Reconnaissance surveys were conducted on the first three of these bogs, while the Abitibi Bog was surveyed in detail. The results of the 1984 work are summarized in Table 5.

TABLE 5
PEAT BOG CHARACTERISTICS

Bog ID	Total Area (ha)	Total Vol. (x 10^6 m^3)	Area >2 m Depth (ha)	Total Vol. H4+ Peat (x 10^6 m^3)	Avg. Depth of Peat H4+ (m)	Avg. Humification (von Post), H4+	Peatland Classification & Comments
52G-176	744	9.7	n.a.	2.6	0.35	4.1	Low Potential
52G-195	1,386	19.5	n.a.	5.0	0.27	4.2	Low Potential
52G-198	388	10.4	n.a.	2.6	0.68	4.9	Low Potential
52G-226	1,977	33.8	959	14.9	1.47	4.3	Category A Fuel & horticultural peat Owned by Abitibi-Consolidated Paper

Source: Proctor & Redfern, 1984

The Abitibi Bog is held under Land Use Permit by Abitibi-Consolidated. Although the average thickness of H4+ humified peat was less than 1.5 m and only about 50% of the peatland had <10% tree cover, the bog was rated as a Category A fuel peat deposit. It is understood that Abitibi was considering development of the peatland but there has been no recent activity on the property.

The Abitibi Bog would appear to offer good potential for development as a source of fuel peat and should be considered in evaluating the resource potential of the region. Negotiations with Abitibi-Consolidated Paper to secure access will be required.

16. ENGINEERING SUITABILITY TESTING AND EVALUATION

The following section of the report is based on historic data provided by PET.

PET is not currently in production. The company has conducted extensive resource evaluation, engineering process development work in the past related to mining methods, dewatering methods, peat drying and peat compaction/briquetting, and tests of the combustion efficiency of low moisture content peat. This work was primarily conducted in the mid-1980s through the early 1990s time period. A considerable portion of the work was conducted in association with other proponents of fuel peat and was assisted through various federal and provincial government research and development programs. The research and development program conducted by the company and its partners included the following:

- Phase I ($1.6 million):
    - Inventorying of peat resources in northwestern Ontario;
    - Selected sampling of peat bogs;
    - Laboratory testing to determine thermal values of various peats;
    - Acquisition of technical library related to peat resources, peat mining and processing, and peat combustion technology; and
    - Acquisition of quarry and work permits related to significant portions of peatlands in northwestern Ontario.

- Phase II ($1.25 million):
    - Engineering and process development studies related to peat mining, dewatering, drying, briquetting and combustion, plus market and financial analyses in support of a pre-feasibility study.

Of the total amount of $2.85 million, PET has paid $1.4 million, the balance being represented by project participation by INCO, Ontario Hydro, Corona Mining, Esso Resources Canada, and various government agencies and departments.

The work to date has indicated the following:

1. Peat resources on the Property are substantial but detailed sampling to develop a reliable estimate of available resources is required.

2. A wet mining method is most suitable for the anticipated conditions on the property. Detailed engineering analysis will be required to select the most appropriate method of wet mining.

3. Methods for effective mechanical dewatering of peat to high solids (>40%) content are available. Selection of the most appropriate technology will require detailed engineering analysis.

4. Briquetting technologies to produce a very high solids (90% dry) fuel peat product are available. The most suitable conditions for the feed material and the specific process conditions required for production of high quality, high density peat fuel are subject in part to final end user specification and will require addition work.

5. Combustion tests by Ontario Hydro indicate peat fuel may be a suitable fuel for firing thermal power plants. These tests were conducted on a bulk dry (90% solids) peat fuel and may not be representative of the performance of the company's planned high density peat fuel product. Additional combustion tests incorporating a range of peat fuel types (briquettes or pellets) and fuel mixes are required to fully establish peat fuel performance characteristics.

The key process requirement is the production of a high density, high calorific value peat fuel that can compete with other fuels in supplying the energy needs of thermal power generation stations.

Given the northwestern Ontario climate and costs, it is not practical to mine and process peat to a high grade fuel on a large commercial scale using traditional dry mining methods, as are practiced in Europe. Rather, wet mining methods must be employed. This necessitates mechanical dewatering to give as low a moisture as possible prior to thermal drying. Thermal drying is required to produce a high calorific fuel, and it is necessary to briquette or pelletize the peat at high density to permit handling both in stockpile and at the burner in a manner similar to conventional coal.

PET has conducted preliminary engineering analyses of two wet mining methods, dredge mining and open pit mining. Comparison of the two methods is shown in Table 6.

TABLE 6
POTENTIAL MINING METHODS

Criterion	Dredge Mining	Open Pit Mining
Definition	Operation from barges floating in mining area. Excavation done under water. A slurry is pumped to processing plant.	An open pit within an excavation in the bog. Continuous pumping to remove seepage water, to permit use of tracked or wide-tired mining equipment.
Development Required	Experience on peat is very limited and on a smaller scale. Monenco pilot tests have some application. Field tests on-site essential.	Bearing strength of ground on-site is first priority in testing. Seepage rate must be measured. Mining in all seasons to be tested.
Seasonal restrictions	Winter mining probably impractical	Water to be pumped will be variable. Winter operation should be possible, and could be best season.
Environmental	Large volumes of water to be pumped over large bog areas to maintain flotation of barges.	Less water required & less disturbance of terrain compared to dredge mining.
Mining Selectivity	Difficult to avoid mining of some undesired sediment under the peat	Avoidance of bottom sediment should be less difficult than with dredge mining.
Peat Maceration	Some degradation of desirable fibrous peat will be unavoidable in pumping mined peat.	Conveyor belts for transport should reduce degradation of fibrous peat.
Quantities	Excess water to be mined and handled. Dilution to <5% solids will be needed for pumping via pipeline.	No deliberate dilution needed. Quantities much reduced.
Capital Cost	High relative to open pit mining	
Operating cost		Should be less than for dredge. If 12 month operation possible, saving could be substantial.

Cost calculations prepared by PET in the mid-1990s indicate the open pit method may be more cost-effective. Detailed engineering analyses are required to verify the prior work. Selection of the preferred mining method will depend on the site under consideration. Detailed information is required respecting the resource size and quality of peat and conditions of the production bog, as well as consideration of the location of the process plant and overall production costs.

Fines removal to enhance mechanical dewatering is believed to be an essential process step. Development work has been conducted on several concepts, but additional research is required to determine an optimal solution embodying high fines removal with high throughput, minimal water usage and minimal product loss.

Several concepts have been explored for mechanical dewatering of the peat. Additional process development work is required to determine the most suitable system to achieve a high solids content product suitable as feed for the thermal drying plant. Investigations are required to compare different dryer designs and the physical form of the peat best suited to each for maximum thermal efficiency.

Briquetting processes require process development work to select the most suitable equipment for production of high density peat. Briquetting efficiency is a function of the moisture content of the peat and the nature of the peat substance and equipment selection can only be determine determined based on experimentation.

The performance of peat fuel in thermal power plants is obviously key to the success of the company’s proposal. A comparison of fuel peat versus other solid fuels used in Ontario thermal power generation plants showed the following (Table 7).

The results of the peat combustion tests conducted by Ontario Hydro Research in 1990 are summarized in Table 8.

TABLE 7
FUEL COMPARISON

Properties	FUEL TYPE					
	Upgraded Peat Fuel	Lignite (Design Fuel)	Lignite (Atikokan)	Powder River Basin Coal (sub-bituminous)	U.S. Coal (eastern U.S. bituminous)	
	Res. Div.		Actual		Res. Div.	Actual
Proximate Analysis (as received)						
Moisture	6.5%	34.0%	33.0%	25 – 33%	1.4%	6.0%
Ash	5.2%	9.0%	9.8%	5 – 10%	8.0%	8.0%
Volatile Matter	59.5%	26.3%	25.5%	29 – 34%	35.7%	35.0%
(% dry)	(63.6%)	(39.8%)	(38.1%)	(38 – 45%)	(36.3%)	
Fixed Carbon	28.8%	30.7%	31.7%	30 – 38%	54.8%	51.0%
Sulphur	0.22%	0.6%	0.40%	0.3% - 0.8%	1.7%	1.5%
Calorific Value (Kj/kg)	20,750	16,430	16,300	18,600–20,500	31,550	30,300
Ultimate Analysis (dry basis)						
Carbon	56.0%	63.5%	62.3%	70.0%	75.6%	(N/A)
Hydrogen	5.2%	4.2%	4.4%	4.7%	5.7%	
Nitrogen	1.4%	1.2%	0.93%	1.1%	1.6%	
Sulphur	0.24%	0.9%	0.47%	0.5%	1.7%	
Oxygen	31.6%	16.5%	17.62%	16.6%	7.4%	
Ash	5.6%	13.6%	12.95%	7.0%	8.1%	
Calorific Value (Kj/kg)	23,500	28,830	28,500	Avg. 30,100	34,450	36,100
Bulk Density (g/cm^3)	0.26[1]	~ 0.8	~ 0.8	~ 0.8	0.46[1]	0.8–0.88
Heat/Volume – as tested (Kj/cm^3)	5.40	N/A	N/A	N/A	13.54	

a. measured on pulverized samples

Source: Ontario Hydro Research Division, Report No. 90-174-P

TABLE 8
PEAT COMBUSTION TESTS

		FUEL TYPE			
Parameter		Propane	Peat/Propane	Coal	Peat/Coal
Firing Rate (MJ/hr)		432	493	464	467
Peat (% MJ/hr)			63%		30%
Flame Temperature (^{0}C)		1315	1434	1450	1350
Flame Stability		Stable	Stable	Stable	Not very stable
% Carbon in ash		-	0.7	5	5.3
% Loss on Ignition		-	0.62	8	6
Carbon Burnout (%)		-	99.9	99.4	99.6
Flue Gas Composition:	% O_2	5.0	5.0	5.0	5.0
	% CO_2	10.3	13.8	14.1	14.5
	ppm CO	3	3	140	77
	ppm SO_2	0.0	92	1375	705
	ppm NO_x	325	650	508	512
Pollutants Emisssion:	g SO_2/MJ	0.00	0.07	1.15	0.59
	g NO_x/MJ	0.12	0.25	0.20	0.20
Ash Resistivity (Ohm.cm)		-	4.8×10^{11}	2.7×10^{11}	7.1×10^{11}
ESP Efficiency (%)		-	93	89	91
Dust Loading:	before ESP (mg/l)	-	1.31	1.40	1.56
	after ESP (mg/l)	-	0.09	0.15	0.14
Slagging & Fouling		None	None	None	None

Source: Ontario Hydro Research Division, Report No. 90-174-P

Ontario Hydro Research concluded that "an upgraded fuel peat can be effectively cofired with propane or coal without any serious adverse affects. …SO_2 and CO emissions in the cofiring experiment were very low … NO_x levels were very similar for coal and coal/peat emissions. Ash resistivities measured at 4.8 x 10^{11} ohm.cm for peat/propane co-firing and 7.1 x 10^{11} ohm.cm for peat/coal cofiring are in the range where reasonably good precipitator performance is expected". Ontario Hydro did not report on reduction in mercury emissions resulting from the use of a peat/coal cofired mixture. However, as peat contains significantly less mercury than the typical coals and lignite used in Ontario thermal power plants, a reduction in mercury emissions would be expected.

Combustion tests using pellets and/or briquettes are required to supplement and validate the earlier work. Especially important will be work related to the impact of high density briquettes or pellets on the flame stability of a peat/coal co-fired mixture and the limits of such a mixture. Research and operating experience with fuel peat in Europe indicates high density, high energy content briquettes can be successfully fired even up to levels of 100% peat fuel in conventional pulverized coal-fired thermal generating stations. Large scale burn tests are also required to develop engineering data related to burner and electrostatic precipitator performance, and the overall materials handling requirements at the thermal power stations.

17. MINERAL RESOURCE ESTIMATE

Several historical estimates have been prepared related to peat resources on the subject lands. These estimates have utilized area and peat depth to calculate in-situ peat volumes. Factors have then been applied to derive estimates of tonnage at designated moisture contents, generally 50%. In many cases, peat depth measurements and humification factors were unknown and data from a limited number of sample points have been extrapolated over quite large areas. Similarly, different sources have applied a range of wet bulk density factors. Estimates of volume and tonnage derived from these calculations are subject to wide variations due to differences both in the base information, and in assumptions regarding the wet bulk density of peat. For these reasons, caution should be exercised when reviewing estimates of peat volumes and tonnage. Further, it should be noted that all historical estimates are at a level of detail insufficient to apply meaningful economic analysis to the data and all these resource estimates should be regarded as speculative.

With the exception of the detailed site assessments conducted by the OGS as part of the Peatland Inventory project in 1984, all estimates prepared to date of available fuel peat resources on this property do not conform to the CIM standards as specified in NI 43-101 for estimation of mineral resources and mineral reserves. It is the author's opinion that the estimates prepared by the OGS would meet the requirements for classification as Inferred Resources under NI 43-101. Those areas which were the subject of a Detailed Survey by the OGS may qualify as Indicated Resources.

The work by Graham (1979) generally meets the requirements for classification of resources as Inferred Resources, although sampling density is limited and caution should be exercised when considering the estimates. Graham reported the following estimates of fuel peat for portions of the Gibbard and Stedman Bogs:

	Area (ha)	**10^6 x m^3 in place**	**10^6 x Tonnes @ 50% Moisture**
Gibbard Bog	406	11.6	3.48
Stedman Bog	208	4.74	1.42

The balance of prior resource estimates are too limited in sampling density to permit meaningful classification and should be regarded as indicative only.

Historic resource estimates for the Goodfellow-Fallis Bog have been prepared by Radforth (1987). Radforth, in his 1987 work for PET, examined eight sites within the Goodfelow-Fallis Bog. Two sites were located between Highway 17 and the CN Rail line, 2 sites south of Highway 17 and north of the Savanne River, and the balance south of the Savanne River. Radforth calculated a total resource of +75 million m^3 peat equating to 15 million tonnes peat at 50% moisture content over a total of 1,875 ha. This resource estimate did not incorporate any of the extensive bog area in Savanne Township, nor a large area between Highway 17 and the Savanne River.

PET prepared preliminary resource estimates in 2004 based on incorporation of the additional areas. PET has identified a total of 92,600 ha of peatland within the Goodfellow-Fallis-Gibbard Bog complex. Based on the assumption that 10% of the area was usable for peat extraction, and assuming a typical 2 m thickness of H4+ peat, PET estimated the possible available peat volume to be 185.2 million tonnes. Assuming a wet bulk density of 300 kg/m^3 for 50% moisture peat, PET estimates the available tonnage to be 55.5 million tonnes at 50% moisture. Such a volume of material would be sufficient to support the planned production of 1 million tonnes dry fuel peat for a period of at least 20 years. WGM would caution that these estimates do not conform to the CIM standards as required in NI 43-101 and are highly speculative.

Substantial additional work is required to develop sufficient data to enable resource estimates to be prepared in accordance with NI 43-101 standards. WGM recommends that all sampling and testing work associated with resource estimation must be conducted in accordance with the Ontario Geological Survey standards for evaluation of peatlands.

18. OTHER RELEVANT DATA AND INFORMATION

18.1 ENVIRONMENTAL IMPACTS

WGM notes that the potential environmental impact of peatland development in the Upsala corridor area will require the examination of impacts within each of the three development phases.

1. Pre-production/peatland preparation.
2. Production.
3. Post-production/reclamation of peatland.

The Pre-production phase will require assessment of two main issues, the effect of land clearing and impacts of bog drainage.

Peat bogs are not an important habitat for wildlife and tend to be biologically inactive. Therefore, clearing vegetation cover from the bog area to be mined will not have a significant impact on wildlife and is unlikely to have serious environmental consequences. The edges of a bog will be more biologically active with a more dense forest cover. Generally, however, such marginal areas would be left untouched except for access points. Leaving the marginal areas relatively untouched also reduces the visual effect of the clearing of the central part of the bog.

Drainage can be the most serious environmental issue during the Pre-production (and perhaps Production) phase. Peat bog waters are acidic and generally have pH range of 4-5. The initial accelerated flow of run-off waters due to drainage may temporarily disrupt the viability of aquatic invertebrate populations and affect the growth and survival of young fish in the drainage area.

When designing a drainage system and evaluating the potential impact of the drainage, operators need to consider the local hydrogeology and groundwater conditions, drainage rates from the peat, zone of influence of the lowered water table, and quality of the drained water. In its 1981 Evaluation of the Potential of Peat in Ontario, Monenco Ontario Limited provided a comprehensive review of these drainage factors and suggested various measures to mitigate potential adverse environmental impacts (Monenco, 1981, pp. 127-130).

Draining of a waterlogged area, such as a peatland, can also improve the biological productivity of the area. Improved drainage can enhance growth of vegetation at the edges of the peatlands, thus creating habitats more suitable to a wider range of wildlife species.

Measures that can be taken in the Pre-production and Production phases to mitigate the potentially adverse effects of bog drainage include:

- Weir construction, to allow monitoring of water flow and control of the rates of water discharge;
- Settling ponds, to capture fine particles and silt and/or to buffer chemical and other effects of peat water discharge; and
- Directing the drainage flow to adjacent wetland areas (marshes) or even to adjacent bogs to allow a natural filtering and buffering of the peat water discharge before it reaches nearby rivers or lakes.

During the Production phase, environmental impacts will also depend on the harvesting or mining method that is used. For example, dry harvesting of the peat can lead to airborne dust problems. However, most peat development operations are usually some distance from urban or otherwise inhabited regions where the dust could be a problem. The properties in the Upsala corridor are certainly well removed from residential areas. Wet mining or dredging methods of peat extraction can lead to the drainage issues noted above.

The Post-production phase will also require careful planning and monitoring to ensure that the land is returned to a condition or habitat that is suitable for subsequent use. For example, a mined bog that is left with elevated water levels could have the potential for creation of biologically productive marshland, for cranberry or wild rice production, for enhanced waterfowl or fish habitats, or for construction of a pond or lake for recreational purposes. A mined bog that is left with lowered water levels could be suitable for pasturage, forestry or other cultivated products.

All of these environmental issues potentially exist to varying degrees in the peatlands of the Upsala corridor and care will need to be taken in the planning and development of the peat bogs. For example, the Goodfellow-Farris Bog is bisected by the Savanne River which then flows into Lac des Mille Lacs. Both this river and lake complex are important fish habitats and recreational areas which must be protected from the potentially adverse effects of bog drainage by one or more of the mitigation measures described above. Accelerated changes of water levels and changes to water chemistry would need to be carefully monitored throughout the operational phases of the peatland development. The potentially mineable part of the Goodfellow-Farris Bog is separated from the Savanne River by a zone of marshland. It may be possible to use a system of natural buffering through the marshes for the discharged peat waters.

Although not directly relevant to the environmental concerns associated with land use in the Upsala corridor, consideration should also be given to potential benefits of the usage of the fuel peat. It is the intention of Peat Resources Limited to market the fuel peat as a source of supply for the electricity generating stations in Thunder Bay and Atikokan. Combustion of carbon based fuels such as coal, lignite and peat will produce air emissions of varying types. For example, burning of coal and lignite generates sulphur dioxide emissions which are the main precursors of acid rain and have other harmful health and environmental effects. Peat has a very low sulphur content so that combustion of peat will produce minimal sulphur dioxide emissions. Similarly, peat is low in heavy metals – especially mercury which is a very harmful by-product and pollutant of coal burning.

18.2 STAKEHOLDER ISSUES

The peatland development proposed by Peat Resources Limited is most economically and technically viable if it is situated in relatively close proximity to potential markets and in an area of suitable transportation infrastructure. Therefore, in addition to the regulatory requirements of a number of provincial government agencies, Peat Resources Limited will need to establish effective working relationships with other stakeholder groups in the Upsala corridor and/or groups with particular interests in the area. These include:

Provincial Government Agencies:

- Ministry of Natural Resources (e.g. Land Use Permits for exploration and development of the peatlands; other regulatory matters);
- Ministry of the Environment (e.g. potential environmental assessment requirements; water and air quality monitoring);
- Ministry of Transportation (e.g. Highway 17 and other road usage and access issues);
- Ministry of Northern Development and Mines; and
- Ministry of Energy.

Forestry industry. Bowater Inc. and Abitibi-Consolidated Inc hold large forestry concessions in the region, including over parts of the Peat Resources Limited property. Arrangements will be needed regarding the use of private logging roads. As noted earlier, Abitibi holds the rights to a peatland northeast of the Peat Resources Limited property which has potentially attractive fuel peat resources. Arrangements for this resource may need to be negotiated.

Railways. The Canadian Pacific mainline parallels Highway 17 and bisects the Goodfellow-Farris Bog. The Canadian National line passes through the northern part of this peatland. The CP line also borders the southern margin of the Meinzinger Bog and passes close to other peatlands that have development potential. Arrangements will need to be negotiated for access crossings of the lines and, possibly, location and construction of appropriate rail sidings. The railway companies will also need to be consulted about the possible effects of bog drainage and peat extraction on the railway foundations.

Natural gas pipeline. The TransCanada natural gas pipeline parallels Highway 17 and the CP railway. There are significant restrictions on excavation activities close to the pipeline and also with respect to crossings of the pipeline. Special access arrangements will have to be negotiated. TransCanada Pipelines should also be consulted about the effects of changing water tables due to bog drainage.

First Nations. There are two small First Nations reserve areas in the region. They lie outside the boundaries of the Peat Resources Limited property and do not seem to be permanently inhabited. However, Peat Resources Limited will need to satisfy the bands or band councils that the proposed peat development will not have an adverse impact, directly or indirectly, on the reserves or activities on the reserves.

Hunting/fishing/recreation community. Considerable hunting, fishing and commercial trapping is undertaken in the area, mainly through lodges and resorts on the Savanne River – Lac des Mille Lacs complex. There are also private cottage communities on many lakes in the region. Revenue from these activities is very important to the local community. Peat Resources Limited must consult with this community as part of its environmental and socio-economic strategy for the peat development.

19. ECONOMIC CONSIDERATIONS

PET has prepared various economic analyses in support of its project. WGM has reviewed this historic information, and while caution should be exercised in the interpretation of the information; the data do indicate the project can be financially viable. Confirmation and updating of the capital cost, operating cost and revenue assumptions and projections will be required as part of any prefeasibility work associated with advancing the project.

Fuel peat competes against other energy sources based on the specific energy density of the fuel (BTU/lb or kJ/kg), cost/energy density ($/BTU or $/MJ), and the chemical content of the fuel off-gases and solid waste products (eg. SO_2, NO_x, CO, Hg, ash, etc.). Cost comparisons evaluating the effectiveness of fuel peat versus other fuel types are best made on a delivered cost basis at the end-use facility. Costs associated with materials handling and preparation of the fuel for firing at the generating station are generally ignored in the analysis, but may be important in final selection of a fuel for thermal power generation.

A comparison of fuels used in thermal power generation shows the following (Table 9):

TABLE 9
COMPARISONS OF PEAT WITH OTHER FUELS

Fuel	Ash (% dry wt)	Sulphur (% dry wt)	Common Moisture (% wet wt)	Common Sp. Gravity (kg/m^3)	As Received Gross Calorific Value (kJ/kg)
Fuel Peat	1 - 10	0.1 – 0.2	50	300 – 400	11,630
Lignite (SK)	9	0.4	37	1,120 – 1,280	16,282
Coal:					
Sub-bit.(AB)	16	0.5	20	1,200 – 1,360	18,608
Bit. (E. US)	13	1.5	6	1,200 – 1,440	29,075
Bit (W. US)	16	0.6	7	1,280 – 1,440	26,749
Heavy Oil	0.3	2 – 2.8	0.1	920 – 990	43,356
Nat. Gas	-	-	-	-	1,065/ft^3

Source: Monenco, 1981

These data indicate that to be economic in comparison to other fuels, peat must have either a substantially higher energy density or a significantly lower price. Higher energy densities can be achieved by reducing the moisture content of the peat and increasing the density of the product by compression. PET is proposing to produce a high density, low moisture fuel product with an effective heat value of approximately 19,770 kJ/kg (8,500 BTU/lb).

PET has developed a financial model for the analysis of the financial returns from fuel peat production. The analysis is based on historical capital and operating cost estimates prepared in 1994. Management believes the forecasts prepared in 1994 are still relatively representative. However, updated cost information will be required as part of any prefeasibility study.

PET historical cash flow analyses were based on the following assumptions:

1. One million tonne/year production.
2. Fuel value of 8,500 BTU/lb (19.77 GJ/tonne).
3. Construction period – 18 months.
4. Capital cost - $100 million.
5. Transportation cost to Thunder Bay included in sales price.
6. Interest on borrowed funds – 8.5%.
7. Financing fee – 5%.
8. Borrowed funds repaid over 15 years.
9. Depreciation – 10% declining balance.
10. Project life 20 years.
11. Fuel Price Base Case - $42.00/tonne $2.13/MM BTU.

Based on these historical data, the project showed an indicated Internal Rate of Return ("IRR") of 21.78% assuming 50% debt financing.

PET anticipates that fuel prices will remain at relatively high levels for the foreseeable future due to the following factors:

- increasing demand and decreasing low cost availability of liquid fuels such as heavy fuel oil;
- increasing demand and decreasing low cost availability of natural gas due to fuel substitution for power generation and home heating; and
- increasing demand for low sulphur solid fuels such as western US and Canadian coal.

Provided these assumptions hold true, fuel peat appears to be a viable alternative energy source.

20. PROJECT EXPENDITURES

The company has recorded total project expenditures of $1.65 million since inception in 1980 through to May 31, 2004, based on the company's 2004 Annual Report. Project expenditures for the period November 2003 through October 2004 have totalled $139,252, distributed as follows:

Data compilation and analysis	$45,554
Engineering	$37,000
Mapping, sample collection, travel	$16,198
Supplies and equipment	$500
Project Management	$40,000
Total Project Expenditures	**$139,252**

The company is proposing to spend a total of $4.1 million (Table 10) on a Stage I exploration and development program leading to completion of a prefeasibility study.

WGM has reviewed the budget with PET management and is in agreement with the total amount and the distribution of expenditures. The budget is sufficient to complete the work required for a prefeasibility study. Negotiations will be required with the Ministry of Natural Resources to permit extraction of sufficient material to provide for all of the required bulk sample test work. Additional expenditures will be required to complete a bankable feasibility study.

TABLE 10
ESTIMATED BUDGET

Items	Cost ($)
Resource/Reserve Definition	**$1,000,000**
- Drill bogs at recommended intervals to establish resources/reserves sufficient for 20 years production	
- Identify depth, humification, biological composition of the peat and contours of the peat bottom	
- determine adequacy of the designated bogs for 20 years production	
Prepare Bulk Samples	**$500,000**
- Thermal value, chemical analysis, physical analysis	-
- Combustion tests	-
Engineering Testing	**$500,000**
- Bulk sample testing for mine equipment selection	-
- Bulk sample testing for dewatering and drying equipment selection	-
- Bulk sample testing of biomass conversion technologies at CANMET Energy Technology Centre	-
Process Engineering Design	**$1,000,000**
- Optimization of engineering design for mining and processing; equipment testing; selection of equipment suppliers	-
Preliminary Environmental Plan	$500,000
General and administration	$200,00
Contingency	$400,000
TOTAL	**$4,100,000**

21. INTERPRETATIONS AND CONCLUSIONS

1. The lands held by Peat Resources Limited contain substantial resources of peat.
2. The highest potential area within the currently permitted area is the Goodfellow-Fallis-Gibbard Bog complex.
3. Historical preliminary estimates of available peat resources indicate sufficient material may be available to support planned production of 1 million tonnes/year dry peat fuel for a period in excess of 20 years.
4. Extensive engineering analysis and test work over the 1980 to 1994 period by Peat Resources has demonstrated the potential to produce a high density, high energy content peat fuel product from this material.
5. Mining methods have been proposed which appear capable of recovering fuel peat.
6. Processing methods have been evaluated. The engineering and test work to date has demonstrated that suitable processes and equipment are available for dewatering, drying and compacting the recovered peat.
7. Combustion tests on a fuel peat product have been conducted and demonstrate that a high calorific value, high solids content fuel peat product can be successfully utilized in a combustion boiler for thermal power generation.
8. A significant amount of exploration and sampling work will be required to measure the quantity and quality of the available peat resources on the property.
9. Once a potential resource has been confirmed, additional work will be required to more fully define the mining method(s) and to select the most suitable equipment and determine capital and operating costs.
10. Test work will also be required to more fully define the processes and determine final equipment selection, capital costs and operating costs.
11. Larger scale combustion tests to more fully evaluate the performance of the material in the burner and the materials handling characteristics of the material are also required.

12. Although historic economic analysis of the production of fuel peat indicates the project can be profitable, current and comprehensive financial analyses are required as part of a prefeasibility study.

13. Considerable environmental and stakeholder issues will need to be addressed in completing a prefeasibility study.

14. Sufficient time and financial resources will need to be committed to this phase of the work to ensure that all affected parties are satisfied sufficient consultation has taken place.

22. RECOMMENDATIONS

WGM recommend that PET proceed first with the exploration of the existing bog areas to establish sufficient resources for the 20 years of production which formed the basis of the prior feasibility study. This work must be in accordance with the specifications established by the Ontario Geological Survey.

Estimated Budget

Items	Cost ($)
Resource/Reserve Definition	**$1,000,000**
- Drill bogs at recommended intervals to establish resources/reserves sufficient for 20 years production	
- Identify depth, humification, biological composition of the peat and contours of the peat bottom	
- determine adequacy of the designated bogs for 20 years production	
Prepare Bulk Samples	**$500,000**
- Thermal value, chemical analysis, physical analysis	-
- Combustion tests	-
Engineering Testing	**$500,000**
- Bulk sample testing for mine equipment selection	-
- Bulk sample testing for dewatering and drying equipment selection	-
- Bulk sample testing of biomass conversion technologies at CANMET Energy Technology Centre	-
Process Engineering Design	**$1,000,000**
- Optimization of engineering design for mining and processing; equipment testing; selection of equipment suppliers	-
Preliminary Environmental Plan	$500,000
General and administration	$200,00
Contingency	$400,000
TOTAL	**$4,100,000**

1. WGM also recommends that a comprehensive stakeholder consultation process be initiated as soon as possible to identify critical issues affecting each party early in the process to allow adequate time to develop agreed solutions to resolve potential conflicts and issues.

2. Initial exploration efforts should be focussed on the Goodfellow-Fallis-Gibbard Bog area.

3. Environmental baseline data should be collected as part of this exploration activity.
4. WGM recommends that bulk samples be collected from several locations as soon as possible to allow for the (metallurgical) physical, chemical and thermal characteristic evaluation of the material.
5. Marketing of the fuel peat to local power plants will require the establishment of close relations with consumers. WGM recommends the potential consumers be identified and involved during the testing phase of the material.
6. Once the suitability of the material as a fuel has been confirmed and sufficient quality material identified engineering test work to select the most appropriate mining and processing methods should be undertaken.
7. WGM recommends that process engineering and design work begin as soon as possible to help define all the required costing parameters required for the feasibility study.

CERTIFICATE

To Accompany the Report titled "Technical Report on the Peat Fuel Project, Northwestern Ontario (NTS 52G/1, 52G/2, 52B/15, 52B/16) for Peat Resources Limited" dated December 3, 2004

I, Donald Hains, do hereby certify that:

1. I reside at P.O. Box 846, Shelburne, Ontario, Canada, L0N 1S0.

2. I am a graduate from Queen's University at Kingston, Kingston, Ontario with a B.A. (Hons) Degree in Chemistry (1974), and a graduate of Dalhousie University, Halifax, N.S. with an MBA (1976).

3. I have consulted in industrial minerals geology and minerals economic continuously since 1986. From 1976 to 1985 I was engaged in research and development related to industrial minerals products and applications.

4. I am a Practising Member of the Association of Professional Geoscientists of Ontario (Registration Number 0494).

5. I am a Senior Associate Industrial Minerals Specialist with Watts, Griffis and McOuat Limited, a firm of consulting geologists and engineers, which has been authorized to practice professional engineering by Professional Engineers Ontario since 1969, and professional geoscience by the Association of Professional Geoscientists of Ontario.

6. I am a Qualified Person for the purposes of NI 43-101 and have experience with a wide variety of mineral deposits, including peat, and with the preparation of technical studies.

7. I visited the Peat Resources Limited property on November 15, 2004.

8. I was responsible for preparing, either in whole or in part, all sections of this report. I was solely responsible for the following sections:

   1, 2, 3, 5, 7, 8, 9, 15, 16, 17, 19, 20, 21 and 22

9. I have no personal knowledge as of the date of this certificate of any material fact or change, which is not reflected in this report.

10. Neither I, nor any affiliated entity of mine, is at present, under an agreement, arrangement or understanding or expects to become, an insider, associate, affiliated entity or employee of Peat Resources Limited or any associated or affiliated entities.

11. Neither I, nor any affiliated entity of mine own, directly or indirectly, nor expect to receive, any interest in the properties or securities of Peat Resources Limited., or any associated or affiliated companies.

12. Neither I, nor any affiliated entity of mine, have earned the majority of our income during the preceding three years from Peat Resources Limited. or any associated or affiliated companies.

13. I have read NI 43-101 and Form 43-101F1 and have prepared this report in compliance with NI 43-101 and Form 43-101F1, and have prepared the report in conformity with generally accepted Canadian mining industry practice.

Don Hains, P.Geo., MBA, B.Sc.
December 3, 2004

CERTIFICATE

To Accompany the Report titled "Technical Report on the Peat Fuel Project, Northwestern Ontario (NTS 52G/1, 52G/2, 52B/15, 52B/16) for Peat Resources Limited" dated December 3, 2004

I, Peter G. Telford, do hereby certify that:

1. I reside at 19 Orchard Crest Road, Toronto, Ontario, Canada, M6S 4N2.

2. I am a graduate of the University of Queensland with a B.Sc. in Geology (1968) and Ph.D. (1972), and I have practised my profession for 32 years.

3. I am a Fellow in good standing with the Geological Association of Canada.

4. I am a Senior Associate Geologist with Watts, Griffis and McOuat Limited, a firm of consulting geologists and engineers, which has been authorized to practice professional engineering by Professional Engineers Ontario since 1969, and professional geoscience by the Association of Professional Geoscientists of Ontario.

5. I was a Senior Geologist and Program Manager for the Ontario Geological Survey from 1973 to 1986. During that period, I was manager of the Ontario Peatland Inventory Project (1981 to 1985) and other Ontario government initiatives aimed at development of a provincial peat industry.

6. I visited the Upsala area (northwestern Ontario) property on November 15, 2004.

7. I am responsible for the preparation of this report, either as a lead author for sections 6 and 18 or in conjunction with my co-author, Don Hains, P.Geo.

8. I have been involved on a consulting basis in provision of expertise to Peat Resources Limited with reference to technical environmental and government relations aspects of the assessment of the Upsala property.

9. I have no personal knowledge as of the date of this certificate of any material fact or change, which is not reflected in this report.

10. I am independent of Peat Resources Limited, applying all of the tests in section 1.5 of National Instrument 43-101.

11. Neither I, nor any affiliated entity of mine, is at present, under an agreement, arrangement or understanding or expects to become, an insider, associate, affiliated entity or employee of Peat Resources Limited or any associated or affiliated entities.

12. Neither I, nor any affiliated entity of mine own, directly or indirectly, nor expect to receive, any interest in the properties or securities of Peat Resources Limited., or any associated or affiliated companies.

13. Neither I, nor any affiliated entity of mine, have earned the majority of our income during the preceding three years from Peat Resources Limited. or any associated or affiliated companies.

14. I have read NI 43-101 and Form 43-101F1 and have prepared this report in compliance with NI 43-101 and Form 43-101F1, and have prepared the report in conformity with generally accepted Canadian mining industry practice.

Peter G. Telford, FGAC, Ph.D.
December 3, 2004

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