SUNTERRA HORTICULTURE (CANADA) INC.

Sunterra Peat Mine Development
Manitoba Environment Act Proposal
FINAL REPORT
December 2011

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File No. 11-1996-01

Manitoba Conservation
Environmental Assessment and Licensing Branch
Suite 160, 123 Main Street
Winnipeg, Manitoba
R3C 1A5

ATTENTION: Ms. Tracey Braun, M.Sc.
Director

RE: Sunterra Horticulture (Canada) Inc.
Peat Mine Development
Environment Act Proposal

Dear Ms. Braun:

On behalf of Sunterra Horticulture (Canada) Inc. (Sunterra), KGS Group is pleased to submit 24 paper and 9 electronic copies of the Environment Act Proposal submission for the proposed major alteration to Sunterra's existing Environmental Act Licence 2288R. The major alteration is for the proposed amendment of the existing peat mine development at the Beaver Point Bog to include Sunterra's existing and pending quarry leases at the Bullhead, Little Deer Lake and Ramsay Point Bogs. As part of the licencing process a Manitoba Conservation Environment Act Proposal Form with the $5,000.00 application fee has been included with this Environmental Assessment report.

Please do not hesitate to contact Mr. Shaun Moffatt or the undersigned if you have any questions or require additional information.

Yours truly,

J.Bert Smith, P.Eng.
Principal

SM/jr
Enclosure

cc: Al Dorish, Sunterra Horticulture (Canada) Inc. (2 copies)

EXECUTIVE SUMMARY

Kontzamanis Graumann Smith MacMillan Inc. (KGS Group) was contracted by Sunterra Horticulture (Canada) Inc. (Sunterra) to prepare a Manitoba Environment Act Proposal (EAP) to obtain the required major alteration to Sunterra's existing Environmental Act Licence 2288R. The major alteration is for the proposed amendment of the existing peat mine development at the Beaver Point Bog to include Sunterra's existing and pending quarry leases at the Bullhead, Little Deer Lake and Ramsay Point Bogs. The proposed peat harvesting developments will not likely result in significant adverse environmental effects, based on the available information for this project, the environment, the assessment of environmental effects outlined in this environmental assessment report, and application of proposed mitigation measures, including conducting the required follow-up.

The primary reason for the proposed development is to ensure that Sunterra continues to have access to quality sphagnum peat moss to supply their existing peat processing facility and support their existing customer base. Sunterra is beginning to decommission and restore their existing peat harvesting area at Beaver Point Bog and in less than 3 years Sunterra will no longer have sufficient quality sphagnum peat moss to maintain the current operation. The proposed project is estimated to extend the peak operation by approximately 30 years. Without the proposed development Sunterra will either have to drastically reduce its workforce and investments within Manitoba and/or seek out resources in other Provinces.

The scope of the project includes planning, designing, constructing, operating, maintaining and eventual decommissioning and restoring the proposed peat mine development at Bullhead, Little Deer Lake and Ramsay Point Bogs. The scope of the assessment includes identification, assessment and mitigation of adverse environmental effects of the project, and evaluation of the significance of residual environmental effects. The scope of the assessment also includes consideration of direct and indirect biophysical and socio-economic effects, including cumulative environmental effects.

The Class 2 peat mining development will include access roads, bog roads, a drainage ditch system with settling ponds and an on-site facility and equipment storage area. Major project activities include providing access, clearing vegetation and surface soils, excavating and trenching drainage ditches, harvesting and stockpiling unprocessed peat, transporting peat and restoring harvested peatland.

The environmental assessment of the proposed peat development was carried out based on project information provided by Sunterra and in accordance with Manitoba Conservation's "Advice for the Preparation of an Environment Act Proposal for a Class 2 Peat Mining Development". Additional considerations included environmental information acquired from literature, internet searches, and publications by the peat industry and environmental organizations; contacts with federal and provincial government representatives; consultations with stakeholders; and site investigations by the project team.

Information regarding the proposed peat development project has been provided to the public in the region through various means, including letters to and telephone conversations with stakeholders and community representatives. Concerns expressed by the public and mitigation measures to address them have been summarized in this EAP.

Potential environmental effects of the proposed peat harvesting development were identified using scoping methods, interaction matrix techniques, public comments, advice from specialists and professional judgment. Effects of accidents and malfunctions, effects of the environment on the project and cumulative environmental effects were also determined. Mitigation measures were identified to eliminate, reduce and control environmental effects determined to be adverse. Follow-up was proposed to verify the accuracy of the assessment and determine the effectiveness of the mitigation measures. Significance of the residual environmental effects remaining after mitigation was then evaluated.

Potential adverse environmental effects of the proposed peat harvesting development assessed to be major in the environmental assessment included: loss and disturbance of soil (harvested peat) and potential accidents, including fire and explosions or vehicle collisions during the transportation of peat. Additional environmental effects assessed to be potentially moderate included: increased dust and particulates; loss of small ponds/streams; increased sediment levels in surface water; loss of terrestrial vegetation; disturbance to bird habitat (olive-sided flycatcher); disturbance to areas of interest; impacts to soil and surface water quality associated with spills and hazardous substance release; and disturbance to public well-being associated with increased traffic. Positive effects identified included improvements in economic conditions, business opportunities and employment, as well as increase in dust control and an increase in varieties of flora and fauna during restoration. With mitigation and follow-up, the residual effects of the project for all of the potential adverse effects were determined to be insignificant. There are no known historic resources or rare to very rare and federal protected vegetation and mammals in the vicinity of the proposed peat harvesting development.

Mitigation for potential adverse effects identified for the proposed peat harvesting development included a wide variety of design and proposed measures, regulatory requirements and management practices. Some of the more important mitigation measures to address the adverse effects included:

- Minimizing surface area disturbed and leaving non-commercial peat reserves in place;
- Maintain buffer zones around water bodies and schedule clearing outside of critical bird nesting and rearing periods
- Constructing the land drainage plan to include sedimentation ponds with floating booms that discharge to the natural drainage system and maintain water levels on adjacent lands;
- Use approved dust suppressant and instructing employees on proper harvest equipment operation to minimize dust;
- Regular removal of stockpiled materials, minimize handling during high winds, utilize wind breaks and covering loads being hauled from the site;
- Drive according to road conditions and posted signs and avoid use of engine breaks near the site access roads;
- Preventing leaks, spills and releases and requiring drip trays for equipment and secondary containment for fuel storage;
- Designating fuel storage and re-fueling areas and providing spill clean-up equipment and materials;
- Preparing and regular updates of an emergency response plan including fire and spill management;
- Providing and maintaining fire suppression equipment with employees trained in their proper use; and

- Implementing a mine closure plan to restore vegetation and surface water to predevelopment conditions;

Follow-up identified for the proposed peat harvesting development included a variety of inspecting, monitoring, record keeping and reporting requirements. Proposed inspection involves periodic observations of the project and local areas for microclimatic changes, dust accumulation, VOC sources, leaks, spills and releases, potential soil impacts, noise levels, surface water runoff, erosion and maintenance of re-vegetated areas. Proposed monitoring includes sampling of surface water quality as required by the license. Record keeping includes maintaining operation files, documentation related to mitigation measures and follow-up implemented such as the mine closure plan and tracking public complaints. Reporting requirements for the proposed peat harvesting development will be placed in the public registry for the project and an annual summary of the detailed reports filed immediately following incidents that require implementation of the emergency response plan.

The proposed peat harvesting development will not likely result in significant adverse environmental effects, based on the available information on the project and the environment, the assessment of environmental effects outlined in this environmental assessment report, and the application of proposed mitigation measures and conducting of required follow-up.

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1.0 INTRODUCTION

Kontzamanis Graumann Smith MacMillan Inc. (KGS Group) was retained by Sunterra Horticulture (Canada) Inc. (Sunterra) to conduct an Environmental Act Proposal (EAP) to obtain the required major alteration to the existing Manitoba Environmental Act License 2288R for the proposed peat harvesting development. The proposed project consists of expanding the existing peat mine development at the Beaver Point Bog to include numerous existing and pending Sunterra quarry leases (QL) in the Interlake area of Manitoba. An EAP is required for all major alterations to existing developments within the province of Manitoba, under the Environment Act (C.C.S.M. c. E125; Section 14). The purpose of this EAP is to ensure that the proposed project is designed, constructed and operated in an environmentally responsible manner consistent with provincial environmental legislation, policies and guidance. A peat harvesting operation such as the one proposed by Sunterra is considered a mining development under Manitoba Regulation 164/88 and is therefore considered a Class 2 Development. The EAP will be prepared in accordance with *Manitoba Conservation's Advice for the Preparation of an Environment Act Proposal for a Class 2 Peat Mining Development*. An Environmental Impact Statement (EIS) will also be included as part of the EAP as required by the province of Manitoba, Mineral Resource Division.

1.1 CORPORATE INFORMATION

Since its formation in 2001, Sunterra has been a family-owned and operated peat moss producer with operations based in the Interlake region of Manitoba, approximately 50 km north of Riverton, Manitoba. Sunterra is the only peat moss producer currently operating in Manitoba that has focused its business and investments exclusively within Manitoba. They have been a Manitoba company since inception and devoted time and resources to developing under-served areas within the Province.

Sunterra harvests peat moss between April and November of each year, and packages and distributes it to markets throughout Canada and the United States. Sunterra employs 30 to 35 persons from Riverton and surrounding communities including the Peguis First Nation, and has an aggregate seasonal payroll in excess of $1 million. All of Sunterra's capital investments are made within Manitoba and all of its employees are based within Manitoba.

The mission of Sunterra is to harvest and process sphagnum peat moss in a responsible way, in order to offer a range of high quality products and services, designed for the needs of horticultural customers located throughout North America. Sunterra is also committed to minimizing the impact on the local environment and takes great pride in its stewardship of its current facilities and its contributions to the local communities.

1.2 ENVIRONMENTAL ASSESSMENT

The purpose of this EAP is to obtain the required major alteration to the existing Environmental Act License 2288R for the proposed peat harvesting development. The proposed project consists of expanding the existing peat mine development at the Beaver Point Bog to include the existing and pending Sunterra QLs at Bullhead, Little Deer Lake and Ramsay Point Bogs located in the Interlake area of Manitoba.

1.3 PREVIOUS STUDIES AND ACTIVITIES

A study of peatland areas in southern Manitoba was conducted by Bannatyne for the Manitoba Department of Energy and Mines and reported in 1980 entitled, *Sphagnum Bogs in South Manitoba and Their Identification by Remote Sensing* [(1)]. The study presented results of a survey of selected bog areas in southern Manitoba and evaluated their potential for commercial development of *Sphagnum* peat moss. Sampling was completed at the Bullhead and Ramsay Point Bogs as part of this study. While Little Deer Lake Bog was not included in this study, Biscuit Harbour Bog located approximately 3 km west was and is considered representative of regional conditions for this project area.

Biological surveys including vegetation, wildlife and aquatic biota and habitat were previously completed by KGS Group at Ramsay Point Bog between May and August, 2010 as part of an environmental assessment for the proposed Sun Gro Horticulture Canada Ltd. (Sun Gro) Ramsay Point Bog development [(2)]. During the KGS Group investigation, a systematic approach was used to ensure that each plant community in the project area was included in the vegetation survey. Observations were made in the morning and evening to represent diurnal and nocturnal bird species. The mammal survey was conducted by recording all mammalian species observed during the vegetation and bird surveys, as well as by sound or any visible

evidence such as dens, tracks or scat. The amphibian and reptile survey was conducted by recording all species observed during the other surveys, as well as by sound or any visible evidence such as tracks or shed skins. The aquatic biota / habitat assessment was conducted to determine the types, abundance, and life stage of fish species utilizing specific reaches within the Ramsay Point Bog.

Peat assessment and topographic surveys were also previously completed by KGS Group at Ramsay Point Bog between January and March 2010 as part of the Sun Gro project in order to supplement and confirm the data collected by the 1980 investigation by Manitoba Department of Energy and Mines on the Ramsay Point Bog and to better determine the quality of peat located in the bog [(2)].

1.4 REPORT ORGANIZATION

The environmental assessment report on the proposed Bullhead, Little Deer Lake and Ramsay Point Bogs peat harvesting development in the Interlake area of Manitoba is organized into ten chapters and appendices as follows:

1.0 Introduction

The purpose of the environmental assessment is discussed and the organization of the report is described. Corporate information for Sunterra is also presented.

2.0 Scope

The scope of the project and the environmental assessment for the proposed peat harvesting development is outlined.

3.0 Project Description

The proposed peat harvesting development is described in general and specific terms. Project need, purpose and alternatives, as well as the proposed schedule and funding are discussed.

The project is broken down into components and activities for the purpose of the environmental assessment.

4.0 Environment Description

The existing environment at the proposed peat harvesting development and the surrounding area is described in general and specific terms. The environment is broken down into biophysical, social and economic components for the purpose of the environmental assessment. Valued Ecosystem Components (important, protected or valued components of the environment) or VECs are identified to focus the assessment of environmental effects.

5.0 Public Consultation

Consultations carried out as part of planning for the proposed peat harvesting development and the environmental assessment of the project are reviewed. Comments and concerns expressed by the public and stakeholders are summarized, and actions taken or proposed to address issues and concerns are outlined.

6.0 Environmental Effect Analysis

Potential environmental effects of the proposed peat harvesting development on biophysical, social and economic conditions are identified and assessed. Mitigation measures are proposed, follow-up needs are identified and significance of residual effects are evaluated. The effects of accidents and malfunctions, cumulative effects and effects of the environment on the project are also considered. Sustainability of the proposed peat harvesting development is discussed in relation to Manitoba's principles and guidelines of sustainable development.

7.0 Mitigation Measures

Measures identified by the environmental assessment to mitigate potential adverse effects of the proposed peat harvesting development are summarized.

8.0 Follow-up Summary

Follow-up requirements identified by the environmental assessment of the proposed peat harvesting development are summarized.

9.0 Conclusions

Conclusions on the significance of residual environmental effects of the proposed peat harvesting developments are presented.

10.0 References

Literature and websites consulted as part of the environmental assessment as well as contacts with governments, stakeholders and the public are listed.

The appendices contain background information on the proposed peat harvesting development, existing environment, environmental effects and public and government consultation.

2.0 SCOPE

2.1 SCOPE OF THE PROJECT

The scope of the project includes planning, designing, constructing, operating, maintaining and eventual decommissioning and restoring of the proposed peat harvesting development at the Bullhead, Little Deer Lake and Ramsay Point Bogs. The scope does not include the continued harvesting and restoration of the Beaver Creek Bog or the continued operation of the existing processing and packaging plant at the Beaver Creek Bog as these are already covered by Environment Act Licence 2288R.

The proposed project includes the development of Bullhead, Little Deer Lake and Ramsay Point Bogs, in the Interlake area of Manitoba. The project is located in an area along the western shoreline of Lake Winnipeg where peat covers between 81 and 100% of the total area (Figure 1). The project is estimated to extend the peak operation by approximately 30 years based on the maximum area of disturbance (715 ha) and estimated peat capacity at each of the sites. The project includes development of access roads, bog roads, drainage ditch systems with settling ponds and an on-site facility and equipment storage area. Major project activities include: clearing vegetation and surface soils; excavating and trenching; harvesting and stockpiling unprocessed peat; transporting peat; and restoring harvested peatland.

2.2 SCOPE OF THE ASSESSMENT

The scope of the assessment for the proposed peat harvesting development includes identification, assessment and mitigation of adverse environmental effects of the project, and evaluation of the significance of residual environmental effects. The scope includes direct and indirect biophysical and socio-economic effects, including cumulative environmental effects. The need for the project, alternatives to the project and requirements for a follow-up are considered in the assessment.

The spatial boundary of the environmental assessment is the project study area and regional study area (Figure 2). The project study area includes the development area defined by the QL boundary and the area within a 3 km radius of the QL boundary. As such there are three defined

project study areas covering an area of 5704 ha, 6758 ha and 6878 ha at the Bullhead, Little Deer Lake and Ramsay Point Bogs, respectively. Whereas the regional study area includes the area within a 10 km radius of the QL at all three sites and the existing processing facility at the Beaver Creek Bog, covering a total area of 128,208 ha. Direct and indirect biological and physical environmental effects of the project are considered within the project study areas, while socio-economic and cumulative environmental effects are considered in the regional study area.

The proposed peat development areas are located in an unorganized area of Crown land in Division no. 19. Although the Village of Riverton is outside of the regional study area, it will be considered during the assessment because of economic opportunities that will develop.

The assessment considered comments received from government reviewers, stakeholders and the public. Public comments were received from mail-outs and via telephone correspondence.

3.0 PROJECT DESCRIPTION

3.1 OVERVIEW

The proposed peat harvesting project includes the development of the Bullhead, Little Deer Lake and Ramsay Point Bogs in the Interlake area of Manitoba. The proposed project is estimated to increase the peak operation of the existing development and extend the production life by approximately 30 years. Initial development of the project is anticipated to begin in the winter of 2013/2014 with site preparation once the necessary approvals are received and peat harvesting anticipated beginning the following summer in 2014. The order in which Sunterra will develop the three bog areas will depend on when the pending QLs are approved. The target peak total harvestable area of approximately 282 ha should be reached by 2015 and is an increase of approximately 50 ha compared to the peak total harvestable area of 232 ha for the existing development. On average 25 ha of peatland would be developed per year at the additional bog areas until the maximum harvestable area of approximately 715 ha has been developed. Although the area developed may range from 20 to 40 ha to offset areas that are being restored and maintain the target peak total harvestable area of 282 ha. During the peak operation progressive closure will occur with the final closure activities completed in approximately 2055.

3.2 PEAT INDUSTRY IN CANADA

Peatlands are wetland ecosystems that are characterized by the accumulation of partially decomposed organic matter. It is estimated that peatlands in Canada cover 113 million ha, and over the past 70 years a total of only 17,000 ha has been harvested. As well, over 70 million tonnes of peat accumulate each year within Canada, with only 1.3 million tonnes of this harvested by the sphagnum peat moss industry [(3)].

North American Wetlands Conservation Council Committee reported in 1999 [(4)] that approximately 85% of peat harvesting operations in Canada produced horticultural peat and approximately 99% of the national production came from the combined operations of 15 corporations. These 15 corporations currently form the Canadian Sphagnum Peat Moss Association (CSPMA).

Southern and southeastern Quebec and eastern and northeastern New Brunswick are the primary focus area of horticultural peat harvesting operations. Alberta, southern Saskatchewan and Manitoba as well as Nova Scotia, Prince Edward Island, Ontario and Newfoundland [(4)] have some peat harvesting operations.

Peat harvesting occurs primarily in the boreal wetland regions, in particular in the Atlantic and Low Boreal Regions [(4)]. These boreal regions, which are characterized by the bog wetland type, are the focus of horticultural peat developments in Canada.

Weakly decomposed peat is the preferred choice for horticultural use. This type of peat is composed mainly of Sphagnum moss. A thick layer of weakly decomposed peat can only be found if the right combination of climatic and topographic conditions exists. Daigle and Gautreau-Daigle [(4)] list several issues that are considered in the selection of a peatland utilized for peat harvest. These issues include the following:

1. Peat quality must meet marketing requirements;
2. The thickness of the high-quality peat layer must be sufficient to warrant development. An average depth of 2 m is a minimum;
3. The aerial extent of the peatland should be large enough to warrant development. An area of 50 ha is generally required, occasionally a smaller site area is also developed;
4. The peatland must have good potential for development of enhanced drainage;
5. Proximity to transportation infrastructure, low density of tree cover, availability of a labour force, access to electrical power and similar factors are preferred; and
6. Climatic factors must be suitable for drying of the peat layer during the harvesting period, such as, there being appropriate periods of consecutive days without rain.

In 2010, total world-wide peat production for horticultural, fuel and other purposes was approximately 23 million tonnes [(5)]. Canada ranked fifth in the global peat production with approximately 1.3 million tonnes, which is approximately 5.6% of the world-wide production. Approximately 0.9 million tonnes of the peat produced in Canada in 2010 was exported to the United Sates for horticultural applications [(5)].

Mr. Dunfield presented various methods for harvesting peat as described in *Methods of Harvesting Peat Moss at the 1975 Seminar on Peat: A resource in Manitoba's Agriculture and Industry*. Three main methods are summarized below [6]:

Block method – Is a method that utilizes manual labour or machines to dig peat blocks. The blocks are subsequently stacked in fields to dry and then stored in buildings during winter months.

Vacuum or Milling Process – Peat is vacuumed and stored in the field before being processed.

Dredging System – Is a continuous, direct line of harvesting, dewatering and drying and delivery to the packing plant.

3.3 PEAT INDUSTRY IN MANITOBA

The peat moss industry in Manitoba has been discussed in several reports in the 1975 *Proceedings of the Seminar on Peat: A Resource in Manitoba's Agricultural and Industry* by Mr. Bannatyne, Mr. Lunan, Mr. Smith, Mr. Dunfield and many other experts at the time.

The first peat production in Manitoba was from the Julius Bog in 1941, which produced 1,480 tonnes of peat moss in its first year. In 1964, Western Peat Moss Ltd. obtained peat permits to harvest at the "Medika" or Elma Bog. However, production of peat at Medika Bog was not in process until 1970. In 1973, Evergreen Peat and Fertilizer Ltd. brought the Evergreen Bog into production. Approximately 42,500 m^3 of moss were produced annually at the Evergreen Bog [7]. Lunan reported that Manitoba has an estimated 19 million ha of peatland, which is of similar size to the amount of agricultural land available in the province [8]. The three bogs that were in commercial production between the late 40's and 70's produced over 30,000 tonnes of peat, with a dollar value of approximately $1.8 million. The majority of peat moss produced during this time period was sold to the United States market for horticultural uses.

Manitoba has approximately 19.3 million ha of peatland, which makes up approximately 35% of Manitoba's land surface, ranking second to glacial till [9]. Approximately 5.1 million ha of these peatlands are located in the area north of Lake Winnipeg that is primarily used for agriculture. The organic deposits are distributed throughout the cool, Subhumid Boreal Forest Region of eastern and central Manitoba and in the cold, humid, Subarctic Region of the Hudson's Bay

Lowland in the northeastern corner of the province (Figure 1). However, the quality and quantity of peat moss in some of these peatlands are unknown due to lack of studies and inaccessibility to the areas [8].

3.4 PROJECT LOCATION

The proposed peat development is located in the Interlake Region of Manitoba, between approximately 40 and 80 km north of Riverton and generally within 4 km of PR 234 (Figure 2). It consists of harvesting at the Bullhead, Little Deer Lake and Ramsay Point Bogs from a total area of approximately 715 ha. The close proximity to the provincial road offers easy access. The entire development area is located within the Peguis First Nation Community Interest Zone (CIZ; Figure 2), and except for Deer Lake Bog the areas are within the Water Power Reserve. Portions of the Moose Creek Wildlife Management Area (WMA) and the Beaver Creek Provincial Park are within the Ramsay Point Bog Project Area.

As the proposed project lies on Crown Land, there are no Certificates of Title available for the properties. However, Sunterra holds the mineral rights for the project areas under existing and pending Manitoba QLs (Table 1). The QL boundaries for each of the bog areas are shown in Figure 2 and a copy of the existing QLs is provided in Appendix A.

Bullhead Bog - The proposed development consist of a North and a South area, both located immediately west adjacent PR 234 as shown in Figure 3 and approximately 4 km northwest of the community of Pine Dock. The northern portion is covered by pending QLs 2401 and 2402 that are 51.4 and 48.9 ha in size, respectively and the southern portion is covered by existing QLs 1134 and 1291 that are 248.4 and 49.7 ha in size, respectively (Table 1). The Bullhead Bog is located within an un-sectioned area of Township 31, Range 5 E1. While the total area within the QL boundaries is approximately 398.4 ha only 197.9 ha of these will be harvested. The harvestable area is estimated to contain approximately 3.76 million m^3 of peat moss based on the average harvestable depth of 1.9 m.

Little Deer Lake Bog - The proposed development is located approximately 2 km south of PR 234 as shown in Figure 4 and approximately 8 km south of the community of Pine Dock. Little Deer Lake Bog is covered by existing QLs 1323 and 1406 that are 266.8 and 100.8 ha,

respectively and pending QLs 2390 and 2391 that are 98.5 and 84.8 ha, respectively (Table 1). These QLs are located on parts of Sections 9 to 11 and 14, Township 30, Range 5 E1. While the total area within the QL boundaries is approximately 550.9 ha only 395.8 ha of these will be harvested. The harvestable area is estimated to contain approximately 7.52 million m^3 of peat moss based on the average harvestable depth of 1.9 m.

Ramsay Point Bog - The proposed development is located approximately 0.5 km west of PR 234, as shown in Figure 5 and approximately 34 km south southwest of the community of Pine Dock. Ramsay Point Bog is covered by pending QLs 2409 and 2410 that are 128.0 and 246.6 ha, respectively (Table 1). These QLs are located on parts of Sections 27, 28, 33, and 34 of Township 27, Range 4 E1. While the total area within the QL boundaries is approximately 374.6 ha only 120.6 ha of these will be harvested. The harvestable area is estimated to contain approximately 2.29 million m^3 of peat moss based on the average harvestable depth of 1.9 m.

3.5 NEED AND PURPOSE OF PROPOSED DEVELOPMENT

The existing Beaver Point Bog is nearing the end of its production lifespan. Progressive restoration will begin in 2014 with approximately 12 to 32 ha of harvesting area removed from production in most years and the closure of all harvesting areas at Beaver Point Bog completed by 2025. As a result of the progressive restoration activities in less than 3 years Sunterra will no longer be harvesting sufficient peat volumes to supply their existing peat processing facility and maintain their existing customer base. Therefore the primary purpose for the proposed development is to ensure that Sunterra continues to have access to quality sphagnum peat moss to continue their existing operation. In 2011, Sunterra invested almost $2 million in its existing Beaver Point facility; however, without the proposed development it would no longer be feasible for Sunterra to operate long term within the Interlake region of Manitoba. Likewise, without the proposed development Sunterra will either have to drastically reduce its workforce and investments within Manitoba and/or seek out resources in other Provinces

3.6 PROJECT COMPONENTS AND ACTIVITIES

3.6.1 Project Components

The proposed peat harvesting development will include the following components:

Main Access Roads

Several access roads will be required to provide access from PR 234 to the proposed peat harvesting developments at Bullhead, Little Deer Lake and Ramsay Point Bogs. The proposed Bullhead Bog development consists of a North and a South area, as previously noted and shown in Figure 3. The North Bullhead access road will be approximately 120 m in length providing access from PR 234 to a 1 ha parking area at the south end of QL 2401. The South Bullhead access road will be approximately 75 m in length and provide access to the 10 ha on-site facility and equipment storage in the northeast corner of QL 1134. The access road to the Little Deer Lake Bog will be approximately 1.6 km in length and provide access to the 10 ha on-site facility and equipment storage along the north edge of QL 1323. The access road to the Ramsay Point Bog will be approximately 750 m in length and provide access to the 10 ha on-site facility and equipment storage in the northeast corner of QL 2409.

The main access roads will intersect PR 234 perpendicularly and will be constructed with ditches along both sides, and a 10 m wide top width with a 2 percent minimum grade. The access road ditches will tie into the PR 234 ditches and be approximately 2 m deep with 1:1.5 side slopes and a top of ditch width of approximately 5 m. Gravel will be hauled on-site from the nearest available source and spread over a geo-textile material to a thickness that will be determined on-site after evaluating the road base condition. Topsoil and any other material not suitable for the stabilizing the road base will be removed and used to create and support Sunterra's peat bog roads.

Culvert Crossings

The proposed access roads will typically require the installation of a culvert crossing of the PR 234 roadside ditch (Appendix B, Photo 1), with the exception of the access road proposed for the Little Deer Lake Bog. The details of each access road crossing are as follows;

- The PR 234 roadside ditch along the east boundary of the North Bullhead Bog collects overland drainage from a 1.0 km^2 sub-basin (Figure 6). This drainage is conveyed to Lake Winnipeg via a 900 mm diameter culvert crossing beneath PR 234 located at the very south end of QL 2401. The roadside ditch crossing of the access road will convey flow from an approximate area of 0.75 km^2 within the sub-basin. However, the culvert will be sized equal to the PR 234 crossing. The culvert will therefore be a 16 m long, 900 mm diameter CMP. The design was based on the existing hydrology for a 1:33 yr return period and a minimum standard pipe size of 900 mm.

- The PR 234 roadside ditch east of the South Bullhead collects overland drainage from 3 separate sub-basins (Figure 6). The drainage from each sub-basin outlets to Lake Winnipeg via a culvert crossing beneath PR 234. The proposed access road is located at a drainage divide of 2 sub-basins near the northeast corner of QL 1134. Although the proposed location is at a high point and has therefore not been designed to convey any specific flow, there is an existing roadside ditch that must be crossed and remain open to equalize any local water that may stand in the ditch during storm and runoff events. The culvert will be a 16 m long, 900 mm diameter CMP. The design was based on a minimum standard pipe size of 900 mm.

- The proposed access road for the Little Deer Lake is located at a high point along PR 234 (Figure 7) where no roadside ditch exists (Photo 2). This location is a natural drainage divide between 2 sub-basins, and drainage from south of PR 234 outlets to Lake Winnipeg via 2 culvert crossings approximately 400 m on either side of the access road location. The access road will not require a culvert crossing at PR 234. However, a culvert crossing will be required approximately 1.2 km south of PR 234 to convey a large drainage path within the sub-basin. The culvert will be a 16 m long, 900 mm diameter CMP. The design was based on a minimum standard pipe size of 900 mm.

- The PR 234 roadside ditch east of the Ramsay Point Bog collects overland drainage from a 2.9 km^2 sub-basin (Figure 8). The drainage is conveyed to Lake Winnipeg via a 1050 mm diameter culvert crossing beneath PR 234. The roadside ditch crossing of the access road will convey flow from an approximate area of 2.25 km^2 within the sub-basin. The culvert will be a 16 m long, 1050 mm diameter CMP. The design was based on the existing hydrology for a 1:33 yr return period.

In accordance with Manitoba Infrastructure and Transportation (MIT) standards for PR roadside ditches, the design for the proposed crossings must have the capacity to accommodate the 1 in 20 year event discharge. The Rational Method was used for flow calculations, utilizing the

nearest recorded precipitation data at the City of Gimli. This method considers the precipitation and the land characteristics to calculate the anticipated runoff. Due to the prevalence of bog area, a reduction factor was applied to the flow value to account for water retention. The Modified Rational Method, as established by the Province of Manitoba, was also used as a secondary method for calculating discharge rates. The more conservative design discharge was used. The 1 in 20 year flow calculated for the drainage area at the proposed North Bullhead, South Bullhead, Little Deer Lake and Ramsay Point access road locations is 0.40, 1.01, 2.02 and 2.47 m^3/s, respectively. The design discharge would produce a headwater just below the top of the proposed culvert crossings at each location, with exit velocities of 1.07, 1.13, 1.18 and 1.20 m/s, respectively. These crossings have been designed to have a negligible impact on the existing drainage patterns.

Facility and Equipment Required at Proposed Peat Development Site

On-site facilities and equipment storage for the proposed development site will be contained in three 10 ha staging areas located at each of the bog development areas as shown in Figures 3, 4 and 5. There will also be a 1 ha parking area located at the Bullhead Bog north area. These areas will be cleared, graded for drainage to match the surrounding topography and will have gravel placed over top of a geo-textile material to stabilize the underlying existing materials. Peat may be temporarily stockpiled in the staging area on a concrete pad before it is hauled to Sunterra's existing processing and packaging facility at the Beaver Point Bog (Figure 2). A typical layout of the required facilities within the staging area at a peat harvesting operation are described below.

A construction trailer will be located at each staging area to provide employees with a lunchroom. A Fabric shelter building (e.g., Coverall/Diamond Shelter building) and/or a shipping container, approximately 30 m^2 in size, will be installed as an equipment repair and maintenance garage at each staging area. The concrete pad will be constructed in stages as storage space is required and will have a maximum size of approximately 45 m x 60m. A chemical toilet will be used and will be cleaned/serviced as required. Drinking water will initially be brought to each site; however, as more employees are on-site, a groundwater well will likely be installed to supply domestic water for use in the washrooms and for washing equipment. Once installed, if the water quality meets the Canadian Drinking Water Quality standards it will also be used as a

source of potable water. If not potable, bottled water will continue to be used. Electricity is expected to be supplied at each staging area by a 30,000 watt generator as well as solar panels to power the lights within the construction trailer.

All fuel required for the proposed development will be stored in the staging areas in accredited (CAN/ULC S601) steel double walled diesel fuel aboveground storage tanks (ASTs). The proposed development will require three 4,500 L portable diesel fuel ASTs, with one located at each area. The ASTs will be equipped with an electric pump for dispensing fuel. Sunterra will comply with the Canadian Council of Ministers of the Environment (CCME) Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products. Manitoba and municipal guidelines and regulations will also be observed and followed for the installation and operation of all ASTs. Small amounts of gasoline will also be stored at the site in 20 L portable containers. The gasoline and all other petroleum products, such as hydraulic oil, motor oil, and lubricants will be stored in a designated contained storage area within the maintenance building.

On-site equipment may include:

- farm tractors to haul and power the different types of peat harvesting operation equipment, including vacuum harvesters, rotary harrows, meri crushers, ditchers, etc.;
- a portable screening system to perform a preliminary screening of harvested peat prior to transportation;
- front end loaders to push stacks and load trucks; and
- bulldozers and excavators for bog maintenance purposes.

Bog Roads

Bog roads will connect the equipment staging and parking areas to the individual bog fields as shown in Figures 3, 4 and 5. The roads/stacklines will be constructed using non-merchantable timber, screened rejects and surface vegetation that are removed from the fields as part of the field preparation for harvesting.

Sedimentation Ponds

As part of developing the QLs for peat harvesting, the propose development requires a controlled drainage plan that allows the surface water to be directed off site, and subsequently lower the water table within the peat moss to be harvested. The drainage plan will include field drainage ditches flowing to main drainage ditches that flow into sedimentation ponds that discharge effluent through outlet ditches. Sedimentation ponds will be constructed before starting main drainage ditch and field drainage ditch construction for peat harvesting areas.

Sedimentation ponds retain surface water to maximize the settlement of suspended peat particles prior to directing the water off-site. Each sedimentation cell of a pond will be approximately 8 m wide by 91 m long and 3 m deep, resulting in a total sedimentation pond volume of approximately 2,184 m^3. Each sedimentation pond is expected to be constructed based on the following design criteria:

- Minimum basin volume of 25 m^3 per ha of peatland area drained;
- Minimum depth at outlet of 1.5 m;
- Optimum length to width ratio of 6.5:1 to 12:1;
- Minimum retention time of two hours to allow for settling of sediments;
- Locating a boom at a distance of 25% of the pond length upstream of the pond outlet to contain floating debris; and
- Five year maximum instantaneous discharge of 0.75 $m^3/sec/km^2$ resulting in a peak five-year flow of 0.148 m^3/sec.

Based on Sunterra's existing operations they construct a sedimentation cell to handle the drainage from an estimated 60 ha of operational peat harvesting providing a basin volume of approximately 36.4 cubic meters per hectare of drained peatland. Sunterra has found that by providing a larger basin volume than the design standard of 25 cubic meters per hectare of drained peatland that monitoring results for total suspended solids (TSS) at their existing Beaver Creek Bog area are typically 7 mg/L or less. Based on the required drainage volume for the peak operation of 282 ha, the project could need up to five sedimentation cells. In order to maintain the existing drainage pattern, a total of 8 sedimentation pond locations have been identified, as shown in Figures 3, 4 and 5. The total number of sedimentation cells that form the sedimentation pond at each of these locations will depend on the production area flowing to that location. The sedimentation ponds will typically be arranged in groups of 2 to 4 cells.

The sedimentation ponds will be constructed such that the main drainage ditches flow to the ponds for a period of retention (minimum of two hours) prior to being discharged to the surrounding environment via an outlet ditch. A control culvert with a sliding gate will be placed in the inlet ditch upstream of the pond. The gate will be used to regulate water levels in the peat layer within the harvesting area. The gate can also be used to reduce or stop inflow to the sediment pond in the event of a major precipitation event, which exceeds the design flow criteria. As a first step, the control culvert will be installed in the upper portion of the drain to limit the flow of water toward the pond location during construction. The control gate will remain closed until the pond construction is complete and the drain blocks have been removed. Excavation of ditches in the harvest area will not begin until the sediment pond is complete and functioning.

Each sedimentation pond will be equipped with a floating boom situated near the outlet to prevent floating debris from escaping. The sedimentation ponds will be cleaned periodically to ensure that the accumulated sediment volume does not exceed 25% of the total basin volume. Water levels will be monitored during periods of normal operation to ensure that there is always at least a 1 m depth of free water over a minimum 10 m distance from the pond outlet. Cleaning will take place before and after any substantial ditch cleaning or cutting takes place within the upstream catchment area. Solids will be scooped from the pond with a backhoe and the recovered settlement will be reapplied to the harvest area.

During cleaning operations the water level will be maintained below the bottom of the outlet culvert to ensure that sediment is not released into the outlet ditch. If required, the control gate on the inlet ditch will be closed before cleaning operations to ensure that additional flow does not raise the water level. Cleaning will not take place during periods of heavy precipitation which could also raise the water level. The control gate would remain closed until the cleaning operation is complete and remaining disturbed sediment has an opportunity to settle.

Water quality will be monitored immediately downstream of the outlet culvert. Water samples will be taken on a weekly basis for analyses of TSS and pH. Additional samples may be taken on an as required basis or as directed by Manitoba Conservation.

Main Drainage Ditches

Following the completion of the sedimentation ponds, main drainage ditches approximately 2 m wide and 3 m deep will be excavated around the perimeter of the active harvesting area. The main drainage ditches are designed with a low gradient to maintain a slow flow so that they will be more conducive to settlement of suspended solids. These main drainage ditches connect the field ditches to the sedimentation ponds. Drainage water from the field ditches flows into the main ditches around the harvesting area where water will then flow to the sedimentation ponds at the edge of the proposed development site. A site layout of the proposed areas is shown in Figures 3, 4 and 5.

Field Drainage Ditches

Field drainage ditches are used to remove interstitial surface water and prepare the peat surface for harvesting after clearing. A network of parallel ditches will be cut through the bog using a screw ditcher. Field drainage ditches will be constructed at 90º angles to the main drainage ditches. Each field ditch is excavated to approximately 1.2 m deep and 1.3 m wide and spaced approximately 30 m apart. Therefore, approximately 333 m lengths of field ditches are required for each hectare of land developed. To handle drainage at peak operation with 282 ha being harvested there will be a total length of approximately 93,900 m of field ditches.

Water will drain from the field ditches into the main ditches, where it will eventually flow into the sedimentation ponds. It takes approximately 1 day to cut a 400 m length of field ditch and once it has been cut water will drain at an accelerated rate from the bog for a period of approximately three weeks. After the initial drainage period, surface water flow leaving the site will closely resemble the existing rates. However, the rate at which water drains from the bog will depend on the amount of precipitation. Water will continue to drain from the bog until the arrival of frost.

Bullhead, Little Deer Lake and Ramsay Point Bogs, as previously discussed, will be developed by opening on average 25 ha of peatland per year of operation to maintain the peak harvesting area of 282 ha (Table 2). The storage volume of each 25 ha area was calculated to estimate the potential water discharge following the construction of the field drains. Although specific data from moisture content within the bog is currently unavailable, the natural moisture content of

peat at Bullhead, Little Deer Lake and Ramsay Point Bogs is likely close to 95 percent, based on the conditions described in the Manitoba Department of Energy and Mines report [(1)].

The total volume of peat to be drained during development of a 25 ha area is approximately 300,000 m^3. This volume of peat will hold approximately 285,000 m^3 of water, assuming an average 95 percent moisture content before drainage. Moisture content varies anywhere between 60 to 85 percent following drainage after the field ditches are cut [(10)]. Therefore, assuming an average of 70 percent moisture content remains after drainage (25 percent drains), the volume of drainage water from 25 ha of peatland will total approximately 75,000 m^3. It will take approximately 3 weeks to cut the 8,325 m of field ditches required for each 25 ha area. However, field ditch construction is typically completed during the winter when the peat is frozen. Therefore, initial site drainage for each 25 ha area will take approximately 3 weeks during the spring runoff period. During this time, the average discharge will be 0.04 m^3/s for each 25 ha area.

Under existing conditions, the design runoff (1:33 year return period) from a 25 ha area within the project sub-basins is approximately 0.10 m^3/s. Therefore, the constructed drainage discharge of 0.04 m^3/s is less than the runoff for the design event. However, if the design event occurred during the initial bog drainage, a conservative estimate would be that the total basin drainage would increase 2% to 10% at the point of discharge for the duration of the storm. This temporary increase in flow rate from the bog area would have a negligible impact on the culvert crossings along PR 234 for the following reasons;

- The 25 ha area being drained under development is between 0.9% and 25% of the 100 to 2,800 ha total drainage area of the various sub basins;
- The temporary increase of 0.04 m^3/s at the discharge point represents an increase of 2% to 10.0% compared to the design flow at each PR 234 culvert crossing (33 year rainstorm). Each PR 234 crossing has sufficient capacity to convey the small increase in flow; and
- The total drainage volume of 75,000 m^3 from a 25 ha area over 3 weeks is discharged to either Lake Winnipeg or Little Deer Lake, where the increased volume over this time would have no impact to the Lakes.

Once initial drainage is completed following drain construction, the drainage rate from the developed areas would be equal to drainage prior to development. The timing of drainage, however, would be slightly modified. During a rain event there will be a slight lag (delay in time) before drainage from a developed area begins compared to undeveloped peat land and then the drainage rate would be slightly higher because of the constructed drains. As noted above the increased drainage rate would be negligible compared to the overland flow during the design event, and the sedimentation ponds are equipped with gates to control the flow if required.

Outlet Ditches

The outlet ditches convey the discharge from the sedimentation ponds for conveyance to the surrounding environment. The flow will be directed by the ditches to natural discharge points in order to best integrate the drainage into the existing natural drainage system, and cause minimal change to the water regime.

For the Bullhead Bog development the outlet ditch from the sedimentation pond within QL 2401 will discharge into the proposed access road ditch and direct drainage to the existing PR 234 roadside ditch for conveyance through the PR 234 crossing to Lake Winnipeg. Likewise, the outlet ditch from the sedimentation pond within QL 1291 will extend to the northeast beyond the QL boundary and towards the existing PR 234 roadside ditch for conveyance through PR 234 to Lake Winnipeg. Whereas, the outlet ditch from the sedimentation pond within QL 1134 will discharge to the unnamed stream that flows east from the project area through a PR 234 crossing to Lake Winnipeg.

The outlet ditches from the sedimentation ponds for the Little Deer Lake Bog development will extend beyond the QL boundaries towards Little Deer Lake (Photo 3) and tie into the existing drainage. The outlet ditches from the two sedimentation pond locations within QL 1406 will intersect to form a single discharge point to Little Deer Lake. Unless these ditches are tied into an existing drainage swale, the outlet ditches will extend to within approximately 30 m of Deer Lake to maintain positive drainage away from the sedimentation ponds. The 30 m buffer around the lake will be maintained as an additional environmental protection measure to prevent sediments from entering the lake.

The Ramsay Point Bog outlet ditch from the sedimentation ponds within QL 2410 will discharge to the existing unnamed stream that flows east to the existing PR 234 roadside ditch. The existing roadside ditch conveys the stream discharge south along PR 234 to a culvert crossing for outlet to Lake Winnipeg.

3.6.2 Project Activities

Preliminary Site Investigations

An aquatic survey was also conducted in May, 2011, on the Ranger Lakes to determine the types and abundance of medium- and large-bodied fish species inhabiting the area, as well as to obtain basic water quality and water temperature information within the study area. Results of the vegetation, aquatic, and wildlife surveys within the quarry leases are described in Section 4.

Site investigations were completed by KGS Group between September 2010 and October 2011. Activities conducted during these site investigations are as follows:

- A vegetation and wildlife survey was conducted during site visits in September 2010 at the Bullhead, Little Deer Lake and Beaver Point Bogs and again in May and June, 2011 at Bullhead, Little Deer Lake and Ramsay Point Bogs. A systematic approach was used to ensure that each plant community in the development area was included in the vegetation survey. Observations were made in the morning and evening to represent daytime and nocturnal bird species. The mammal survey was conducted by recording all mammalian species observed during the vegetation and bird surveys, as well as by sound or any visible evidence such as dens, tracks or scat. The amphibian and reptile survey was conducted by recording all species observed during the other surveys, as well as, by sound or any visible evidence such as tracks or shed skins

- Peat assessment and topographic surveys were completed at the Bullhead, Little Deer Lake and Beaver Point Bogs during February and March, 2011 in order to supplement and confirm the data collected by the 1980 investigation by Manitoba Department of Energy and Mines and to better determine the quality of peat located in the proposed development areas.

- Aquatic biota assessment was completed during May 2011 by setting a 2 and 3 inch panel gill net at 10 locations on the Ranger Lakes within Ramsay Point Bog to determine the types and abundance of medium- and large-bodied fish species inhabiting the area, as well as to obtain basic water quality and water temperature information within the study area. This information was collected to supplement the biota and habitat data previously collected in 2010.

- Eleven baseline surface water and bog water samples were collected in October, 2011 from surface water within the peat area, water bodies adjacent to the peat bogs, and from the downstream receiving water (Lake Winnipeg). These were submitted for laboratory analyses for metals and general water quality data.

- A detailed surface water hydrologic investigation and survey was completed in October 2011 at the Bullhead, Little Deer Lake and Ramsay Point Bogs. Visual inspections of water flow at the existing PR 234 culverts and the proposed crossing locations were completed.

Results of the hydrogeological investigations, surface water and bog water sampling events and biological surveys within the quarry leases are described in Section 4.0. The peat assessment and topographic survey is described in detail in a separate report which can be made available upon request.

Site Preparation

Pre-construction activities will include the development of detailed construction plans if required to be submitted to the Director of Environmental Approvals Branch. Prior to the start of site construction, a buffer zone with a minimum of 100 m will be identified and protected between the quarry lease limit and the area to be developed. A 100 m buffer zone will also be established around the Ranger Lakes within the Ramsay Point Bog and a 50 m buffer around any of the drainage streams. The buffer zone will be used to prevent potential damage and disturbance to the surrounding environment. The buffer zone will also be used as a windbreak, a habitat corridor and a reference source of material for the restoration of abandoned areas at a later date.

Construction

Construction activities will commence in the winter of 2013/2014, once all environmental approvals have been received, as previously described. Construction activities will include:

- Clearing a 30 m width for proposed access roads and the two ditches one on either side of the roads;
- Construction of the access road from PR 234 to the staging area;
- Layout of the site;

- Clearing trees and extracting merchantable timber, as authorized by Manitoba Conservation Forestry Branch, for peat harvesting areas during winter months when ground is frozen and can support heavy equipment;
- Construction of sedimentation ponds;
- Construction of main drainage ditches and outlet ditches connected to the sedimentation ponds;
- Construction of field drainage ditches; and
- Construction of bog roads, utilizing non-merchantable timber.

Operation

Sunterra operations follow the best practices developed by the CSPMA, of which Sunterra's management is on the Board of Directors. Operational activities for the proposed development will start during the spring following tree clearing and will include the following:

- ***Field Preparation:*** The peat surface is prepared for harvesting by drawing down the water table through the constructed main drainage ditches, field ditches, sedimentation ponds and outlet ditches (all as described above). The areas located between the field ditches (i.e., the peat fields) are then rotavated or milled and shaped to crown the surface between the field ditches and left to dry by the sun and wind until the moisture content is reduced to the desired level for harvesting.

- ***Field Harrowing:*** Following field preparation, the surface is repeatedly harrowed to a depth of 2 to 3 cm using a tooth rake to break capillary flow and enhance the drying process. The top layer is then turned over to allow the peat particles and fibers to dry by the sun and wind until the moisture content is reduced to the desired level for harvesting.

- ***Peat Harvesting***: Peat is harvested using a vacuum machine once the peat is sufficiently dry (about 40% to 55% moisture content). Harvesting is weather dependant and, when the moisture content of the peat moss is acceptable, all efforts are made to maximize the amount of harvest during optimal weather patterns. The amount of peat harvested will depend upon the weather, but typically Sunterra would expect about 50-55 harvest days each season, with approximately 14 cm of the peat surface being harvested during the season.

- ***Peat Stockpiling:*** Harvested peat is unloaded at designated peat stockpile areas at the field end adjacent to the bog roads, on the bog roads or within the 10 ha staging area. The peat is pushed up by a front-end-loader into windrow shaped stockpiles with an approximate volume of 1,500 m^3.

- ***Transporting:*** Excavators or front-end loaders will load stockpiled peat into open-box trailers with a capacity of approximately 170 m^3 for transporting. The trailers will be covered by a tarp to prevent peat particles from escaping and minimize financial losses for Sunterra. Harvested peat will be transported from the stockpiles along the access road and along PR 234 to Sunterra's existing processing and packaging facility at the

Beaver Point Bog. Approximately 8 truckloads are required to transport each hectare of peat under development. The estimated total number of truck loads required for transporting peat to the processing and packaging plant each year is provided in Table 2. An equal number of truck loads would be required to transport packaged products from the processing facility to the client base.

- ***Maintenance:*** Maintenance activities will be undertaken at regular intervals, including when the weather conditions are not conducive to harvesting, such as frost, high winds, or heavy rainfall. Field maintenance activities include cleaning and deepening the drainage ditches, profiling the fields for harvesting and weed control. Maintenance of the drainage ditches is done throughout the harvest season. Sunterra will be responsible for the maintenance and repair of all the drainage works involved with the bog operation until its restoration activities are completed. This includes the correction of any erosion or silting problems, the correction of any icing problems, the cleaning of the ditches should the capacity become reduced due to vegetative growth, the removal of debris that interferes with the passage of water and the removal of any beaver dams (if required) that cause flow problems. Weed control is done manually without the use of any chemicals. Maintenance of sedimentation ponds includes inspecting them once a week to verify the overall functioning capacity of the pond, the position of the floating wooden boom, and the bank of the pond. The ponds will be cleaned on a regular basis to maintain optimal efficiency with sediments removed before 25% of the pond is filled with sediments. Excavated sediments will be transported to, and spread on the fields for harvesting. Sedimentation ponds will also be cleaned prior to cleaning field ditches.

- ***Monitoring:*** Sunterra proposes that during the peat harvesting activity period, normally from April to October of each year, monitoring of the sedimentation ponds will include taking a 1 L water sample every week per outlet, or 24 hours after heavy rainfall (10 mm/hr for 6 consecutive hours) or after heavy wind with an average speed of 50 km/h or more. Water samples will be sent to an accredited laboratory for analysis of pH and TSS. Results are reviewed, compiled and available for inspection on site at any time. A report will be filled out for every water sample collected and indicate the employee name, date and time of sampling, pond code number, present and past 24 hr weather conditions plus any additional comments.

During the harvesting season, weather permitting, operational activities will occur seven days a week from sunrise to sunset. Sunterra anticipates harvesting an average of approximately 1,410 m^3 of peat moss each year per ha of land being harvested. Harvesting of peat will continue until the peat layer is between 0.5 to 1 m thick as discussed in the mine closure plan. This harvesting technique aids in the peat regeneration process.

Closure and Restoration

Under the provincial Mines and Minerals Act, Subsection 128(3) Non-aggregate Quarry Closure Plan, the holder of a quarry lease for materials other than an aggregate quarry must submit a

Mine Closure plan for approval by the Mines Branch Director prior to commencement of mine development [(11)]. Restoration aims at replacing lost elements due to peat harvesting, such as reintroducing peatland vegetation. Restoration is scheduled to begin once commercial grade peat has been removed or exhausted from the development. Fully harvested areas will be restored based on the experience gained by Sunterra through the guidance of CSPMA and restoration research and following the requirements of The Preservation and Reclamation Policy of the CSPMA.

A mine closure plan for the proposed peat development as prepared by KGS Group has been submitted to Manitoba Innovation Energy and Mines, Mines Branch with a copy provided in Appendix C. The closure plan has been developed in accordance with the Manitoba Mine Closure Regulation 67/99; General Closure Plan Guidelines [(12)] and Mine Closure Guidelines Financial Assurance [(13)]. The purpose of the closure plan is to define a program for the protection of the environment over the duration of peat harvesting activities and for site rehabilitation during the life of the development and after closure. The plan describes the stages of closure (progressive and final), closure activities, closure costs, and outlines operational and post operational monitoring.

3.7 SCHEDULE

The proposed development at Bullhead, Little Deer Lake and Ramsay Point Bogs, as discussed in Section 3.4, is covered by several existing QLs previously issued to Sunterra and several pending QLs, which Sunterra previously applied for. The pending QLs were applied for by Sunterra prior to the introduction of Bill 46 “Save Lake Winnipeg Act” in June 2011, however a decision on these will not be made until at least the end of the two year moratorium. The order in which Sunterra will develop the three bog areas will depend on when the pending QLs are approved. The general peat harvesting schedule will consist of site preparation of an area during the winter months, with peat harvesting to start the following spring and typically continuing until October.

Should the pending QLs be issued before Sunterra proposes to begin site preparation during the winter of 2013/2014 then they will initiate development at Ramsay Point Bog followed by Little Deer Lake Bog and finish with the Bullhead Bog. However, if the pending QLs are not

issued before the winter of 2013/2014, then Sunterra will initiate development at the Little Deer Lake Bog followed by Ramsay Point bog and finish with the Bullhead Bog.

Regardless of which bog area is developed first, the proposed development schedule consists of clearing and preparing approximately 25 ha of land for peat harvesting beginning in 2014 (Table 2). The target peak total harvestable area of approximately 282 ha should be reached by 2015. This peak represents the amount of area Sunterra estimates is necessary to maintain its existing customer base and is an increase of approximately 50 ha compared to the peak total harvestable area of 232 ha for the existing development. To maintain the peak of 282 ha, on average, 25 ha of peat land would be developed per year, although the area may range from 20 to 40 ha to offset areas that are being progressively restored. This peak operation should be maintained until 2041 after which the maximum harvestable area of 715 ha will have been developed and there will be no new bog areas opened. During the peak operation progressive closure will occur on areas harvested to the final planned depth of harvesting with the final closure activities completed in approximately 2053.

3.8 PEAT PRODUCTION DURING PROJECT LIFE

The existing Beaver Point Bog is nearing the end of its production lifespan, as discussed in Section 3.5 with progressive restoration starting in 2014 and the closure of all harvesting areas completed by 2025. The proposed development of the existing and pending QLs at Bullhead, Little Deer Lake and Ramsay Point Bogs is estimated to extend the production lifespan up to an additional 30 years. This is based on the average peat production rate of 1,410 m^3/ha/year, the proposed development schedule and an estimated total of 13.4 million m^3 of harvestable peat. If, however, the pending QLs are not approved, or if the moratorium is not lifted, Sunterra's existing leases on a stand-alone basis are expected to have a productive capacity that would extend the production lifespan up to only 18 years.

At the peak of the existing Beaver Point Bog operation, with 232 ha of peatland under production in 2013, approximately 327,120 m^3 of horticultural grade peat will be harvested (Table 2). The proposed target peak total harvestable area of approximately 282 ha, an increase of approximately 50 ha, would result in approximately 397,620 m^3 of horticultural grade peat harvested per year (an increase of approximately 70,500 m^3). By the end of the peak

production in 2041 a cumulative of 11.1 million m^3 of peat will be harvested whereas by the end of the project lifetime a cumulative of 13.4 million m^3 of peat will be harvested.

3.9 PEAT PROCESSING

The existing Sunterra peat processing and packaging plant, with finished goods storage, is located at the Beaver Point Bog as shown in Figure 2. Peat harvested from the proposed bogs will be processed, bagged, placed on pallets and stored at this plant before transport to markets.

At the existing Beaver Point Bog operation because the processing and packaging plant is located on-site at the bog where peat is being harvested the only truck traffic is associated with transporting packaged product to markets. Therefore at peak operation with 232 ha of peatland under production in 2013, approximately 1,931 truck loads would be required to transport the 327,120 m^3 of peat harvested and packaged (Table 2). This is equivalent to approximately 65 trucks/week or 10 trucks/day based on the proposed operation schedule from April to October (30 weeks) and 7 days/week.

With the proposed development, raw peat harvested from the Bullhead and Little Deer Lake Bogs will increase traffic north of the existing Beaver Point Bog, while raw peat harvested from Ramsay Point Bog plus the increase in packaged product being shipped to market will increase the traffic south of the existing Beaver Point Bog. During the peak operation between 2026 and 2041 when all 397,620 m^3 of peat harvested per year from the active 282 ha is from the Bullhead and Little Deer Lake Bogs, a total of approximately 2,347 truck loads would be required to transport the raw peat for processing (Table 2). This is equivalent to approximately 79 trucks/week or 12 trucks/day. Once all 120.6 ha of harvestable area at Ramsay Point Bog are opened then approximately 1,004 truck loads would be required to transport the 170,000 m^3 of raw peat for processing. The proposed 50 ha increase in peak operation would result in approximately an additional 416 truck loads per year for transporting packaged products. Therefore, the maximum increase in traffic south of the existing Beaver Point Bog would be 1,420 truck loads per year, equivalent to 48 trucks/week or 7 trucks/day.

3.10 GREENHOUSE GAS EMMISSIONS

Recent work by Cleary *et al*. described the net greenhouse gas (GHG) emissions from the Canadian Peat Industry. Land-use change, particularly from undisturbed peatland (which typically has a high water table and full vegetation cover) to peatland under extraction (which has a reduced water table and no vegetation cover), results in a net increase in GHG emissions [(14)]. The net increase is caused by an increase in the rate of *in situ* decomposition through increased diffusion of oxygen, increased CO_2 emissions and reducing CH_4 emissions, and a reduction of ecosystem production resulting through the removal of living biomass from the peatland surface. Cleary *et al.* established a formula for estimating the GHG emissions from land use change which includes a value for the standard flux of GHG per unit area within peatland under extraction (PUE - 1061 t/km^2/yr) and within cutover peatland under restoration (CPUR - 1288 t/km^2/yr).

Recent work conducted by Waddington *et al.* suggested that sphagnum restoration could result in a carbon sink in as little as two years post restoration [(15)]. Regardless, to be conservative KGS Group assumed that the areas experiencing restoration only become net neutral for GHG 5 years post restoration when calculating CO_2 equivalent values.

Without the proposed development, progressive restoration would begin in 2014 with between12 to 32 ha, from the peak operation of 232 ha, closed in most years with the final closure activities completed in 2025. The proposed development plan, as previously discussed, consists of increasing the peak operation by 50 ha from the existing 232 ha/yr to 282 ha/yr with on average 25 ha opened each year to offset the area progressively restored. The peak harvesting area of 282 ha will be reached by 2015 and continue until 2041 after which the remaining approximately 15 ha will be opened and the maximum area of disturbance (715 ha) has been reached. Sunterra will continue to progressively close 25 ha annually and continue harvesting on the remaining areas until 2052), after which the remaining 22 ha will be closed

Using the equations established by Cleary *et al*. incorporating PUE and CPUR, the total quantity of CO_2 equivalent produced due to land use change throughout the 39 years of development and 5 years post restoration was calculated to be 161.65 x 10^3 t - CO_2 eq. Cleary *et al*. estimated the GHG contributions from each component of the life cycle of peat harvesting where land-use change accounted for 15%, peat harvesting and processing accounted for 4%,

transport to market accounted for 10% and decomposition accounted for 71% [14]. However, GHG emissions from decomposition are associated with the end use and should not be attributed to the producer. Therefore, after 39 years of operation and 5 years post restoration of Sunterra's Bullhead, Little Deer Lake and Ramsay Point Bogs, in addition to the quantity of GHG emitted from land-use change the GHG emissions from peat harvesting and processing would be 43.11 x 10^3 t - CO_2 eq. and from transportation to market would be 107.77 x 10^3 t - CO_2 eq., for a total of 312.53 x 10^3 t - CO_2 eq. This is equivalent to 7.10 x 10^3 t - CO_2 eq/yr and is only slightly more than twice as much as the estimated 3.26 x 10^3 t - CO_2 eq/yr associated with the existing operation. The most recent available data for CO_2 emissions in Canada are for 2008 [16], which had a total value of 734,000 x 10^3 t - CO_2 eq. Therefore, an average year of production of the Bullhead, Little Deer Lake and Ramsay Point Bogs will account for approximately 0.001% of the total annual emissions for the country. Regardless, this quantity of CO_2 equivalent can be decreased by incorporating mitigation measures (as presented in Section 6) to reduce and/or prevent GHG emissions throughout the life cycle of peat harvesting.

3.11 EMPLOYEES

Sunterra currently employs approximately 30-35 employees from the regional area and has an aggregate seasonal payroll in excess of C$1 million. Permanent and seasonal employees will continue to be obtained from the regional area as much as possible to fill the estimated total 35 to 40 employees required for the existing peak operation of 232 ha by 2013.

As previously noted, without the proposed development Sunterra will begin restoration in 2014 with complete closure by 2025. Based on this Sunterra will no longer have sufficient peat resources to maintain full operation of the existing processing facility and would need to reduce the amount of employment in the immediate future. Whereas with the proposed peak operation of 282 ha, beginning by 2015, Sunterra will continue to provide employment opportunities requiring approximately 43 to 48 employees. Additional jobs will also be created for the increased transportation associated with the increase in peak operation to 282 ha.

3.12 WASTE DISPOSAL

There are virtually no wastes produced from the peat harvesting operations. Trees, including branches and roots, are saved and used as underlay for bog road construction. Sunterra will continue to manage waste at the on-site facilities as they currently do at their existing Beaver Point Bog operation. Petroleum, oils, lubricants and other hazardous wastes will continue to be managed by the equipment suppliers, who also maintain the equipment. Currently Sunterra obtains their equipment from the Enns Brothers Ltd. and Caterpillar. Domestic sewage from the on-site facilities at the Bullhead, Little Deer Lake and Ramsay Point Bogs will be retained in holding tanks and pumped out on a regular basis by a local licensed contractor. Currently Sunterra has a contract with J.J's Septic Services out of Arnes, Manitoba. Solid wastes such as paper, organics, plastics, packaging materials, etc. are stored in bins and removed by a local licensed contractor. Sunterra currently contracts Simpson's Transfer and Feed Ltd. out of Winnipeg, Manitoba for disposal or recycling as appropriate at the Winnipeg Brady Landfill.

4.0 ENVIRONMENTAL DESCRIPTION

4.1 BIOPHYSICAL

4.1.1 Physiography and Climate

The proposed peat harvesting development is located within the Grindstone Ecodistrict of the Mid-Boreal Lowland Ecoregion in the Boreal Plains Ecozone. The Grindstone Ecodistrict occupies the southern portion of the Mid-Boreal Lowland Ecoregion and consists of an area along the western shore of Lake Winnipeg [(17)].

The surface of the Grindstone Ecodistrict is characterized by ridge and swale topography trending north-south. The ridges range in width from 400 to 800 m and the swales are up to 800 m wide. Due to these characteristics, the Ecodistrict is poorly drained. As a result, the region is extensively covered in peat in the form of flat bogs, raised bogs and horizontal fens. The regional relief in the subject area is approximately 0.6 m per km and the relief between ridges and swales is approximately 0.5 to 3.0 m [(17)].

The Grindstone Ecodistrict is located within the Low Boreal Ecoclimatic region, characterized by short, warm summers, and long, cold winters [(17)]. The nearby Pine Dock weather station is the closest active weather station to the proposed peat harvesting project. The weather data from the Pine Dock weather station is based on a 30-year record from 1971 – 2000 [(18)]. The mean annual air temperature at the weather station is 1.1 ºC and the daily mean temperature ranges between 18.9 ºC in July and –19.7 ºC in January [(18)]. The average growing season is 171 days with about 1470 growing degree-days and an average annual moisture deficit of 50 mm [(18)]. Precipitation at the station averages 612 mm annually, with 425 mm falling as rain and the rest as snow. August has the highest average rainfall (92.3 mm) and November has the highest average snowfall (42.7 cm) [(18)].

4.1.2 Air Quality

Maximum time-based pollutant concentration levels for the protection and preservation of ambient air quality within the Province of Manitoba [(19)] are listed below for selected parameters

(Table 3). Maximum Tolerable Levels denote a time-based concentration of air contaminant beyond which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population. Maximum Acceptable Levels are deemed essential to provide adequate protection for soils, water, vegetation, materials, animals, visibility, personal comfort and well being. Maximum Desirable Levels define the long-term goal for air quality and provide a basis for an anti-degradation policy for the pristine areas of Manitoba for the continuing development of pollution control technology. Maximum Tolerable Levels are used only for evaluation purposes to identify the severity of an anthropogenic or natural phenomenon in order to protect human health and institute appropriate corrective action. In general, Maximum Acceptable Levels are not to be exceeded in any urban centre including areas that are in the vicinity of industries with atmospheric emissions. Within rural areas, the goal is to maintain pollutant concentrations at or below Maximum Desirable Levels.

TABLE 3
MAXIMUM TIME-BASED POLLUTION CONCENTRATION LEVELS
PROVINCE OF MANITOBA [19]

Name of Contaminant	Units of Concentration Measurement	Period of Time Contaminant is Measured	Maximum Tolerable Level Concentration	Maximum Acceptable Level Concentration	Maximum Desirable Level Concentration
Carbon Monoxide	Milligrams per cubic meter (parts per million) of air	1 - hour average 8 - hour average	- 20 (17)	35 (30) 15 (13)	15 (13) 6 (5)
Nitrogen Dioxide	Micrograms per cubic meter (parts per million) of air	1 - hour average 24 - hour average Annual arithmetic mean	1000 (0.53) - -	400 (0.213) 200 (0.106) 100 (0.053)	- - 60 (0.032)
Ground-level Ozone	Micrograms per cubic meter (parts per billion) of air	1 - hour average Annual arithmetic mean 8 - hour average *	400 (200) - -	160 (82) 30 (15) 128 (65)	100 (50) - -
Sulphur Dioxide	Micrograms per cubic meter (parts per million) of air	1 - hour average 24 - hour average Annual arithmetic mean	- 800 (0.31) -	900 (0.34) 300 (0.11) 60 (0.02)	450 (0.17) 150 (0.06) 30 (0.01)
Suspended Particulate Matter	Micrograms per cubic meter of air	24 - hour average Annual geometric mean	400 -	120 70	- 60
Particulate Matter <2.5 µm in diameter ($PM_{2.5}$)	Micrograms per cubic meter of air	24 - hour average *	-	30	-
Particulate Matter <10 µm in diameter (PM_{10})	Micrograms per cubic meter of air	24 - hour average	-	50	-

Notes: For details see http://www.gov.mb.ca/conservation/pollutionprevention/airquality/index.html.
"-" No Data
* - The objective used is the national Canada-wide Standard

Manitoba Conservation in cooperation with Environment Canada and the Manitoba Lung Association and with the assistance of Manitoba Health and Health Canada developed an Air Quality Index (AQI) for Winnipeg [19]. The AQI is a system for rating air quality in urban areas to provide a general idea of air quality to the public. It is provided in this EAP for reference purposes only as the study area is a remote location. The objective of the AQI is to provide a current description of air quality and the potential effect on the environment. The AQI considers five common pollutants that typically effect human health or the environment at specific air concentration levels. These include Carbon Monoxide (CO), Inhalable Particulates (PM_{10}), Ozone (O_3), Soiling Index (COH) and Nitrogen Dioxide (NO_2) [19]. Manitoba Conservation monitors these pollutants each hour and converts the pollutant levels to the index scale resulting in a sub-index for each pollutant. The highest resulting sub-index value becomes the value for the overall AQI. Based on the air pollution levels, Manitoba Conservation divided AQI values into four ranges with effects described as follows:

- Good (0 - 25) – No effects;
- Fair (26 to 50) – Noticeable health effect unlikely, some environmental effects may be observed;
- Poor (51 to 100) – Some people, especially those with pre-existing health problems may notice health effects, some environmental effects may be observed; and
- Very Poor (> 100) – Health effects may be experienced by all and especially those with existing respiratory conditions, some environmental effects may be observed.

It is expected that the AQI for the regional study area is typically good throughout the year; although there are no published sources of air quality data. Air quality in the area is generally excellent compared to large cities and commercial and industrial areas in Manitoba and Canada. No other industrial developments are currently in production in the regional study area, although Sun Gro and Berger Peat Moss Ltd. are both in the process of opening new peat harvesting operations. The only other developments in the regional study area, which is otherwise undeveloped wilderness, include small communities, a gravel quarry, a small airport, cottages, and a camp. The AQI may be periodically reduced to fair during dry periods resulting in dust along PR 234, during periods of high winds affecting the peat harvesting area, or during forest fires that may result in increased particulates. However, Manitoba Conservation indicated that they generally do not have concerns with the air quality in the regional study area [20] (Personal Communication; Mr. Lyle Campbell).

4.1.3 Geology

The surficial geology of the Grindstone Ecodistrict consists of a mixture of silt diamicton and organic deposits. The silt diamicton is calcareous in composition and consists of Paleozoic rocks that come from the Hudson Bay Lowland and Interlake region of Southern Manitoba. The organic deposits are from the Quaternary period and are composed of peat and muck between 1 to 5 m thick. The site is characterized by low relief wetland deposits, with low lying areas where the organic deposits accumulate in fen, bog, swamp and marsh settings [(17)].

4.1.4 Soils

KGS Group completed 17 testholes at Bullhead Bog and 20 testholes at Little Deer Lake Bog in February and March 2011 and previously completed 31 testholes at Ramsay Point Bog in January 2010 as part of the peat investigation. In addition to the testholes numerous probes were completed to confirm depths and generate profiles of peat thickness. The majority of the testholes show a similar stratigraphy consisting of live sphagnum peat from surface to depths ranging from 0.15 to 0.6 m below ground surface. The top layer of sphagnum peat was followed by a layer of organic peat which ranged from 0.15 m to more than 5 m thick. Below the organic peat layer a clayey silt/clay/silty clay layer was encountered in most of the testholes, although rock was found in a few testholes. This low permeability clay cover forms a very good barrier between the perched water within the peat layer and the groundwater in the underlying aquifers described in the following section.

4.1.5 Groundwater

Regional groundwater flow is presumably controlled by the close proximity of Lake Winnipeg, which ranges from as close as .25 km to 4 km at the farthest point and generally east of the proposed development areas; therefore, flow is assumed to be easterly. The groundwater in the Grindstone Ecodistrict is mainly from sand and gravel aquifers associated with till, beach and inter-till outwash and deposits [(17)]. Groundwater is used as a potable water source in the regional study area by many of the cottagers and likely by the towns.

A search of the Provincial GWDrill Database [21] indicated the nearest wells to the Bullhead and Little Deer Lake project areas include approximately 9 domestic wells near Pine Dock / Biscuit Harbour, which is approximately 5 km southeast of the Bullhead Bog and 8 km north of the Little Deer Lake site. The registered wells found in the GWDrill Database are installed in carbonate limestone and/or shale or sandstone. Wells are generally cased to depths of approximately 18.5 m below ground surface (bgs) with open borehole below the casing to approximately 34 m bgs. The primary source of flow is from the Dog Head Member of the Red River Formation. Water quality is generally potable and is of the magnesium-calcium-bicarbonate or calcium-magnesium-bicarbonate type with total dissolved solids (TDS) concentrations ranging from 300 mg/L to 600 mg/L. Based on the GWDrill Database, the water table ranges from 4.9 to 9.1 m bgs (6 m average) with pumping rates of between 0.3 and 3.8 L/s (2 L/s average).

A second cluster of upwards of 20 (mostly domestic) wells is located in the vicinity of Beaver Creek and the Beaver Creek Provincial Park, approximately 5 km southwest of the existing Beaver Point Bog and 5 km northeast of the Ramsay Point Bog sites. As with Pine Dock, the registered wells found in the GWDrill Database are carbonate limestone and/or shale bedrock aquifer wells. Although the wells in the Beaver Creek area are generally cased shallower to depths of between 7.6 m to 9.1 m below ground surface (bgs), with open borehole below the casing. Again the primary source of flow is from the Dog Head Member and while groundwater was generally closer to the surface near Beaver Creek (1.2 m to 3.0 m bgs), measured pumping rates were similar to that at Pine Dock (0.4 L/s to 3.4 L/s).

4.1.6 Surface Water

The Grindstone Ecodistrict is located within the Lake Winnipeg watershed, which is part of the Nelson River drainage system. Lake Winnipeg receives most surface drainage within the basin via rivers, creeks, streams, and overland runoff [17]. As noted in Section 4.1.1, the Ecodistrict is poorly drained; however, the predominant flow direction is easterly, towards Lake Winnipeg.

There are a multitude of water bodies that exist within the project development and in the surrounding study areas. Water bodies within the development areas include:

- The unnamed stream draining east from the Bullhead Bog (QL 1134) at PR 234;
- South Ranger Lakes (1 larger and 2 smaller); and

- The unnamed streams draining the Ranger Lakes.

The water bodies within the project and regional study areas include:

- Lake Winnipeg
- Harry's Lake;
- Dave's Lake;
- The unnamed stream flowing from Harry's Lake to Dave's Lake;
- Bill's Lake;
- Little Deer Lake;
- Deer Lake;
- Moose Lake;
- An unnamed stream connecting Deer Lake to Moose Lake;
- Several unnamed streams outside the QLs draining to Lake Winnipeg;
- Mill Creek;
- Beaver Creek;
- Northern Ranger Lakes; and
- The unnamed streams draining the area around Ranger Lakes.

As previously stated, the overland flow from the proposed development generally drains east into Lake Winnipeg. There are a number of intermittent stream and land drainage crossings along PR 234 that convey the runoff from the Bullhead Bog and the Ramsay Point Bog to the Lake. The exception to this predominant drainage pattern is the Little Deer Lake Bog. Although there are a number of culvert crossings along PR 234 in the vicinity of the Little Deer Lake Bog, the project area is contained within a single sub-basin that drains exclusively into the Little Deer Lake which does not have a natural outlet. The existing flow patterns within the project area are shown in Figures 6, 7 and 8.

The KGS Group environmental assessment team collected baseline surface water samples on October 11 to 13, 2011. The samples were collected from the peat within the development area, the downstream receiving water bodies within the quarry leases, at downstream stations within the project study area, and at the confluence with Lake Winnipeg which is the final receiving water for most surface water leaving the development area (Figures 9, 10 and 11). Water samples were submitted for laboratory analysis for general surface water quality (Table 4) and metals (Table 5) and compared to The Manitoba Water Quality Standards, Objectives and Guidelines (MWQSOG) and the Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life.

These water quality results, as described in the following paragraphs, will form a baseline for comparison of any future surface water sampling at the project areas.

Bullhead Bog – Baseline surface water samples collected from the peat water within QL 1134 (SW-9 and duplicate) and the unnamed stream draining this bog (SW-10) were acidic with pH values of 4.35 and 6.27, respectively, which are below the MWQSOG and CCME criteria (Table 4). Whereas the sample collected in Lake Winnipeg where the drain outlets (SW-11) was basic with a pH of 8.25, which is within the criteria. Baseline samples could not be collected from the peat water within QL 2401 (SW-7) or the downstream roadside drain (SW-8) as they did not contain enough water to collect samples.

The baseline peat water sample (SW-9) had higher nutrient levels compared to the sample collected from Lake Winnipeg (SW-11); however none of these exceeded the CCME criteria and only the ammonia concentration (0.068 mg/L) exceeded the MWQSOG (0.026 mg/L; Table 4). Additionally, the nutrient concentrations in the downstream unnamed stream (SW-10) before the drainage water discharges into Lake Winnipeg was very similar to the concentrations from the sample collected from Lake Winnipeg. Disturbance of the peat surface (Photo 4), which is unavoidable during the sample collection (unless an existing pool is available) resulted in artificially high TSS concentration at SW-9 (168 mg/L and 753 mg/L for the duplicate). This also resulted in the high concentrations of ammonia (0.068 mg/L), total kjeldahl nitrogen (TKN; 1.53 mg/L), total particulate phosphorus (0.318 mg/L) and total phosphorus (0.353 mg/L) as nitrogen and particulate phosphorus readily adheres to soil particles. While the ammonia concentration in the peat water was higher than that measured in Lake Winnipeg during the sample event it was within the range of ammonia concentrations (<0.01 to 0.09 mg/L) observed in Lake Winnipeg as measured during 2008 and 2009 by Manitoba Water Stewardship (Appendix D).

Baseline surface water sampling for metal concentrations at Bullhead Bog indicate that concentrations of aluminum, copper, iron and lead exceed the applicable MWQSOG and CCME criteria for the Protection of Freshwater Aquatic Life while cadmium only exceed the CCME criteria (Table 5). These exceedances were observed in the samples collected from the peat and downstream receiving waters, although only exceedances of aluminum and iron were observed in the Lake Winnipeg sample. All other parameters were below the MWQSOG and CCME criteria. The elevated lead concentrations (0.00262 to 0.00794 mg/L) are an order of

magnitude higher than those typically observed in Lake Winnipeg (<0.0002 to 0.00085 mg/L) as measured during 2008 and 2009 by Manitoba Water Stewardship (Appendix D). In comparison, the other elevated baseline metal concentrations were typically within the range of concentrations observed in Lake Winnipeg, with a few exceptions as follows;

- The aluminum concentration at SW-10 (2.56 mg/L) was slightly higher than the range of 0.14 to 2.31 mg/L;
- The cadmium concentration at SW-9 (0.000067 mg/L) and SW-10 (0.000079 mg/L) were higher than the range of <0.00001 to 0.00004 mg/L; and
- The iron concentration at SW-9 (2.60 mg/L) and SW-10 (7.81 mg/L) were higher than the range of 0.22 to 1.80 mg/L.

Little Deer Lake Bog – The Baseline surface water sample collected from peat water within QL 1323 (SW-6) was acidic with a pH of 3.93, which is below the MWQSOG and CCME criteria, whereas the sample collected in Little Deer Lake (SW-5; the downstream receiving water body) was neutral with a pH of 7.18 and within the criteria (Table 4).

The baseline peat water sample (SW-6) had higher nutrient levels compared to the sample collected from Little Deer Lake (SW-5); however none of these exceeded the CCME criteria and only the ammonia concentration (0.055 mg/L) exceeded the MWQSOG (0.023 mg/L; Table 4). Again the peat surface was disturbed during the sample collection at SW-6 resulting in an artificially high TSS (2,950 mg/L). As previously discussed this resulted in the high concentrations of ammonia (0.055 mg/L), TKN (4.74 mg/L), total particulate phosphorus (0.575 mg/L) and total phosphorus (0.617 mg/L).

Baseline surface water sampling for metal concentrations at Little Deer Lake Bog indicate that concentrations of aluminum, copper, iron, lead and zinc exceed the applicable MWQSOG and CCME criteria for the Protection of Freshwater Aquatic Life while cadmium only exceeded the CCME criteria (Table 5). All other parameters were below the MWQSOG and CCME criteria. The exceedances observed were primarily from the water sample collected from the peat, although the aluminum exceedance was also observed in the Little Deer Lake sample. Although the metal concentrations in the peat water were elevated it does not appear to be affecting Little Deer Lake, which as previously noted, naturally receives water from the Little Deer Lake Bog with no other natural inlets or outlets.

Ramsay Point Bog – The Baseline surface water sample collected from peat water within QL 2410 (SW-2) was acidic with a pH of 4.21, which is below the MWQSOG and CCME criteria (Table 4). Whereas the samples collected from Ranger Lakes (SW-1), the downstream roadside drain (SW-3), and Lake Winnipeg where the drain outlets (SW-4) had near neutral to basic pH values (6.75, 7.44, and 8.46 respectively) which were all within the MWQSOG and CCME criteria.

The baseline peat water sample (SW-2), similar to what was observed at the Ramsay Point Bog, had higher nutrient levels compared to the sample collected from Lake Winnipeg (SW-4). Again, none of the elevated nutrient concentrations in the peat exceeded the CCME criteria and only the ammonia concentration (0.104 mg/L) exceeded the MWQSOG (0.026 mg/L; Table 4). The baseline ammonia concentration (0.070 mg/L) measured in Lake Winnipeg (SW-4) also exceeded the MWQSOG (0.026 mg/L; Table 4). The nutrient concentrations in the downstream water bodies including the Ranger Lakes (SW-1) and the roadside drain (SW-3) that intercept the drainage water before it discharges into Lake Winnipeg were very similar to the concentrations from the sample collected from Lake Winnipeg. The peat surface was again disturbed during the sample collection at SW-2 resulting in an artificially high TSS (3,150 mg/L) and the associated high concentrations of ammonia (0.104 mg/L), TKN (37 mg/L), total particulate phosphorus (2.62 mg/L) and total phosphorus (2.71 mg/L).

Baseline surface water sampling for metal concentrations at Ramsay Point Bog indicate that concentrations of aluminum, copper, iron, lead and silver exceed the applicable MWQSOG and CCME criteria for the Protection of Freshwater Aquatic Life, while arsenic, cadmium and zinc only exceed the CCME criteria (Table 5). These exceedances were primarily observed in the sample collected from the peat, although the exceedances of aluminum and iron were also observed in the roadside drain and Lake Winnipeg samples. All other parameters were below the MWQSOG and CCME criteria. The elevated metals concentrations in the peat do not appear to be impacting the Ranger Lakes, which are the natural primary downstream receiving water body, as all the metal concentrations measured from the Ranger Lakes were below the MWQSOG and CCME criteria. The elevated aluminum and iron concentrations measured in the roadside drain (0.996 mg/L and 0.80 mg/L, respectively) and lake Winnipeg (1.45 mg/L and 1.28 mg/L, respectively) are within the range of concentrations typically observed in Lake Winnipeg

(aluminum - 0.14 to 2.31 mg/L; iron – 0.20 to 1.8 mg/L) as measured during 2008 and 2009 by Manitoba Water Stewardship (Appendix D).

4.1.7 Vegetation

Wetlands are considered one of the most productive ecosystems, sustaining more life than any other ecosystem. Wetlands in Canada developed following the most recent retreat of glacial ice and are typically between 5,000 and 10,000 years old. According to the Conference on Wetlands Stewardship [4,22], Canada has more than 150 million ha of wetlands covering approximately 15 percent of Canada's land area in fifteen different ecozones. Canada has 25% of the world's wetlands, covering 6% of the earth's land and freshwater surface [4,23].

The Grindstone Ecodistrict is dominated by peatland associated vegetation, however, well drained till areas have a variety of vegetation including trembling aspen, jack pine and white spruce as well as a mix of shrubs, grasses and herbs [17]. The proposed development area is primarily classified as a bog which is described as an ombrotrophic peatland. These are mineral-poor and involves surface vegetation obtaining nutrient from precipitation as they are isolated from groundwater [23,24]. A bog is characteristically acidic with the water table (perched) at or near the surface. It typically has a dense layer of peat usually covered with mosses, shrubs and sedges; trees may also be present. Typical vegetation dominating bog peatlands are stunted black spruce, *Sphagnum* moss and ericaceous shrubs.

The Bullhead, Little Deer Lake and Ramsay Point Bogs can be described as lightly to moderately treed raised bog areas with open areas of *Sphagnum* moss. The Manitoba Conservation Data Center (MBCDC) website lists 42 vegetative species that are being tracked within the ecoregion, twenty-three of which are species of conservation concern as they are either very rare (S1) or rare (S2) throughout the range (Appendix D) [25]. The MBCDC was contacted to provide a list of any known occurrences of vegetative species of conservation concern located specifically within the project study areas. There records indicate that there are 8 species located within the project study areas, 4 of which are very rare or rare including rose pogonia (*Pogonia ophioglossoides* S1), swamp pink (*Calopogon tuberosus* S2), water star-grass (*Heteranthera dubia* S2) and fringed orchid (*Platanthera lacera* S2) (Appendix D) [26].

None of these species of concern were observed during the vegetation surveys conducted at the Bullhead, Little Deer Lake and Ramsay Point Bogs.

The vegetation surveys were completed during site visits in September 2010 and May and June 2011 along transects established throughout the development area as shown in Figures 9, 10 and 11. During the vegetation surveys a total of 117 plants were observed within the proposed development areas at the Bullhead, Little Deer Lake and Ramsay Point Bogs with all but 9 of the plants identified to species level (Table 6). None of the species identified are classified as being provincially very rare (S1) or rare (S2), listed under Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or federally protected under the *Species at Risk Act* (SARA). Of the 117 species observed, 43 were found in all three development areas, with another 35 occurring in at least two of the development areas. Only 39 of the observed species were infrequently found, being observed in only one of the three development areas. Species diversity was fairly similar at the Bullhead and Ramsay Point Bogs with 96 and 83 species observed, respectively, whereas the Little Deer Lake Bog had a more homogenous plant composition with only 59 species observed. The presence or absences of a genera/species within the development areas is noted in the vegetation species list provided in Table 6 along with their global and provincial ranking when applicable.

During the surveys plant communities were classified by 'V-type' based on the forest ecosystem classification (FEC) system developed for Manitoba and northwestern Ontario [(27)]. Most of the development area within the bogs had a consistent vegetation type with the plant communities categorized as V31 – Black Spruce/Herb Rich/Sphagnum (Photo 5) or V33 –Black Spruce/Sphagnum (Photo 6). These vegetation types primarily consist of black spruce with some tamarack and occasional white cedar as the overstory species. Ground cover for these vegetation types is comprised of a continuous cover of Sphagnum and feather moss over a range of poorly drained organic soils to wet peat deposits. There were small areas at the bog edges and approaching the bogs that consisted of a distinctly different plant community which is more closely related to V21 – White Spruce/Balsam Fir Shrub (Photo 7). This vegetation type is characterized by on overstory of white spruce, balsam fir, trembling aspen, black spruce, tamarack, balsam poplar and white birch. The moist to fresh, well drained mineral soils support a ground cover with a more diverse community of shrubs and herbs than the wet areas described above.

4.1.8 Mammals/Habitat

The Mid-Boreal Lowland Ecoregion typically includes terrestrial habitat for moose, black bear, wolf, lynx, red fox and snowshoe hare [17]. The MBCDC website identified the presence of a single species of conservation concern (S1-S2) within the ecoregion; the little brown myotis (S2N, S5B) [27]. Likewise, the MBCDC website noted the woodland caribou Boreal population, which has a provincial rank of S4 (widespread and apparently secure), is located within the ecoregion. Though not categorized as a species of conservation concern in Manitoba, this population of woodland caribou is listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as threatened as a result of habitat loss and increased predation [28]. Neither of these species were identified during the wildlife surveys. MBCDC [26] was also contacted to request a list of wildlife species of concern located specifically within the project study area. Currently there are no occurrences of wildlife species of concern listed within the MBCDC for the project study area (Appendix D).

The wildlife surveys for the Sunterra development at the Bullhead, Little Deer Lake and Ramsay Point Bogs were completed during site visits in September 2010 and May and June 2011 along the vegetation transects established throughout the development area as shown in Figures 9, 10 and 11. These wildlife surveys identified the presence of four mammal species including the American marten, moose, red squirrel and white-tailed deer, all of which are listed provincially as S5 (abundant and secure; Table 7). Previous work conducted at the Ramsay Point Bog during the 2010 and throughout Beaver Point Bog and the adjacent upland environment in 1997 identified the presence of additional species including the American beaver, American black bear, northern grey wolf, and snowshoe hare [2]. None of the species identified are classified as being provincially very rare (S1) or rare (S2) or federally protected under the SARA and only the American black bear and northern grey wolf are listed on COSEWIC and considered Not At Risk (NAR).

4.1.9 Birds/Habitat

The Mid-Boreal Lowland Ecoregion typically provides habitat for various raptor species, sandhill crane, ruffed grouse and waterfowl including various ducks, geese, white pelican and cormorant [17]. The MBCDC website identifies 11 bird species within the mid-boreal lowland

Ecoregion, of which only the piping plover (*Charadrius melodus*) is categorized as a species of conservation concern having a provincial rank of S1B and is listed on COSEWIC as Endangered. However, the nearest record of occurrence for piping plover in Manitoba was approximately 8 km east-northeast of Riverton, Manitoba [(25)], which is approximately 30 km south of the southern most portion of the proposed development. This species will occupy only open sandy shoreline habitat and does not rely on peat-forming boreal wetlands for nesting or foraging purposes. Therefore, the proposed peat harvesting activities will have no affect on the preferred habitat or the conservation status of this species. Additionally, the MBCDC indicated that there were no current records within their database for any bird species of conservation concern within the project study areas (Appendix D) [(26)].

Bird surveys for the Sunterra development at the Bullhead, Little Deer Lake and Ramsay Point Bogs were completed from dawn to dusk during site visits in September 2010 and May and June 2011 along the vegetation transects established throughout the development area as shown in Figures 9, 10 and 11. A total of 47 bird species were identified within the project study areas (Table 7). Previous work conducted at the Ramsay Point Bog during the 2010 and throughout Beaver Point Bog and the adjacent upland environment in 1997 identified the presence of 53 and 32 bird species, respectively some of which were not identified during the current study [(2)]. None of the bird species identified within the development areas are provincially listed as species of conservation concern and only one species, the olive-sided flycatcher (*Contopus cooperi*) is listed on COSEWIC and SARA. The olive-sided flycatcher is listed on the SARA Registry as a Schedule 1, Threatened species and therefore federally protected [(28)]. It is a small insectivorous predator with a thin population distribution associated with open areas such as burnt-over forest, old-growth openings, wetland areas, and forest cut-over areas that support its passive sit-and-see method of hunting [(28)]. Currently, the olive-sided flycatcher is in decline due to unclear reasons likely related to habitat loss and alteration.

As the vegetation cover within the project study areas was generally consistent throughout the development area, the species distribution was fairly uniform and had relatively low diversity throughout. The boreal chickadee, least flycatcher, red-breasted nuthatch, ruby-crowned kinglet and sandhill crane were the only species identified at all three development areas (Table 7). Forest interior species, such as ruby-crowned kinglets and warblers, were detected in the vicinity of transects, where taller and relatively contiguous black spruce stands occurred. While

gray jays and hermit thrushes tended to be more closely associated with taller black spruce stands occurring in patches throughout the development. Species observed less frequently within the project study area were encountered either in proximity to open water, or along the few distinct variations in forest type. For example common yellowthroat was encountered in immediate proximity to the Ranger Lakes. Several species including the alder flycatcher, bay-breasted warbler, blackburnian warbler, cape-may warbler, red-eyed vireo, rose-breasted grosbeak, and veery were found only in the upland mixed wood forest vegetation near the bog edges. The sharp increase in species diversity associated with the upland mixed wood forest is a reflection of a higher level of habitat opportunities afforded by greater structural complexity typical of these forest plant communities.

4.1.10 Aquatic Biota/Habitat

Aquatic biota and habitat, particularly fish and fish habitat are protected under the *Fisheries Act*. In discussions with Mr. Todd Schwartz of Fisheries and Oceans Canada (DFO) [(29)], it was determined that there was no data regarding fish habitat or known fish species within Little Deer Lake, the Ranger Lakes, or the tributary flowing from the south Ranger Lake to Lake Winnipeg. Therefore, it was suggested that all water bodies and watercourses be examined for fish and fish habitat availability (Appendix D). Further discussions with Laureen Janusz of the Aquatic Ecosystem Section of Manitoba Water Stewardship's Fisheries Branch [(30)] confirmed that no data existed for fish species present within any of the subject water bodies, however, the Ranger Lakes were stocked with walleye in 2000. Additionally, the Manitoba Water Stewardship website has fish stocking records from 2002 to the present and indicated that the Ranger Lakes were stocked in 2002 with 100,000 walleye fry (Appendix D) [(31)]. Further information regarding the Ranger Lakes was obtained through discussions with Rick Heuchert, President of the Beaver Creek Cottager's Association, who stated that some cottagers use the lakes for recreational fishing of northern pike.

Fish habitat assessments and fish surveys were conducted by KGS Group in 2010 and again in 2011 within the Ranger Lakes and the unnamed tributary flowing south from the Ranger Lakes to Lake Winnipeg. The Ranger Lakes (Photo 8) are essentially large deep pothole acidic lakes that are surrounded by bog habitat. The aquatic habitat is similar throughout the lake system. The channels separating the ranger lakes are relatively narrow in places; however, they likely

do not act as barriers to fish passage between the lakes as the water depth in these channels remained greater than 0.6 m during the summer months. There are likely some shallow patches at the south end of the southern Ranger Lake as the channel/outlet flowing south from Ranger Lakes originates in a wetland. This would provide appropriate spawning and rearing conditions for northern pike, and perch; however, it is very unlikely that walleye are able to reproduce in these lakes as there were no apparent shallow rock shoals within the chain of lakes. The lack of walleye spawning habitat was supported by the fact that there was no walleye observed or captured during the study even though the lake had been stocked in 2002 as noted.

Fish passage into the lake is likely blocked during the summer months due to numerous beaver dams further downstream and from excess vegetation and low water levels at the mouth of the stream. There may be some passage during the freshet allowing fish to enter the wetland and lake system and spawn, after which those fish that linger in the lake system and their progeny would remain confined for the duration of the year. Twenty-five adult northern pike were captured in the gill nets during the fish survey (Table 8; Photo 9). A single adult perch (dead) was encountered in the channel heading south from the North Ranger Lake (Photo 10). As this fish was found floating at surface, it is uncertain if this specimen was from the Ranger Lakes as the fish could have been carried by a bird from one of the surrounding lakes, or streams that are not connected to the lake system. That being said, the 2010 fish survey resulted in the capture of a single undersized adult perch with a total length of approximately 50 mm. Therefore, perch are known to exist within the Ranger lakes.

The unnamed tributary flowing from the Ranger Lakes collects water from land drainage ditches flowing from the north and south and meet at a confluence just upstream of the water crossing (dual culverts) at PR 234. The channel substrate is primarily covered with fine sediment with patches of approximately 50-70% submergent vegetation. There is a small dam approximately 200 m upstream, which cuts the flow to near stagnant conditions. Moving upstream, water levels drop off continually for approximately 220 m until the channel is completely dry for a stretch of 45 m ending at a large dam (Photo 11, Figure 8). Fish passage beyond this point is impossible during the summer months. Passage may be available during freshet, particularly before damage to the dam from ice and excessive water levels/velocities are repaired in the early spring. Upstream of the dam is a flooded wetland area which continues for approximately 1 km until the open channel is choked out by surrounding vegetation (Photo 12). A fish survey of the

unnamed tributary flowing south from the Ranger Lakes to Lake Winnipeg resulted in the capture of 10 Canadian mud minnow, 1 brook stickleback, and 2 Johnny darter. Several northern pike (juvenile and adult) were observed within the channel up to the first minor beaver dam approximately 200 m upstream. No fish were observed between the first and second much larger dam which resulted in a stretch of stagnant water and dry channel bottom.

Little Deer Lake is also a pothole acidic lake surrounded by bog habitat, however it has no inlet or outlet connecting it to any other water bodies. While there is no data on fish and fish habitat for the Little Deer Lake, the conditions are similar to the Ranger Lakes and would likely have the potential to support forage species such as Canadian mud minnow, stickleback and fathead minnow, but unlikely to support any larger bodied fish.

4.1.11 Amphibians and Reptiles

Several reptile and amphibian species are typically found within the Interlake area of Manitoba generally found in wetlands, riparian zones and forested areas. The MBCDC indicated the presence of the Blue-spotted salamander within the project study areas, however this species is Provincially uncommon to widespread (S3S4) and nationally secure and therefore not considered to be of conservation concern (Appendix D) [(26)].

The Boreal chorus frog was the only amphibian identified during surveys completed for the Sunterra development at the Bullhead, Little Deer Lake and Ramsay Point Bogs in conjunction with the vegetation and wildlife surveys. Previous work conducted at the Ramsay Point Bog during the 2010 and throughout Beaver Point Bog and the adjacent upland environment in 1997 identified the presence of three amphibians: gray treefrog, northern leopard frog, and wood frog; and one reptile: red-sided garter-snake [(2)]. None of the species identified are documented as being provincially very rare (S1) or rare (S2). However, the northern leopard frog is listed as a Schedule 1 special concern (SC) species under the SARA. While the northern leopard frog Eastern population is listed as Not at Risk (NAR), the Western Boreal/Prairie populations is listed as a species of special concern. This is defined as a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats [(32)]. This species remains widespread but is of special concern as it has experienced a considerable reduction of range and loss of populations in the past, combined

with increased isolation of remaining populations, particularly further west of Manitoba [32]. The species was formerly abundant along the southern shores of Lake Winnipeg and Lake Manitoba, and less common up to Southern Indian Lake and east of Lake Winnipeg; however, it had been virtually extirpated from the province by 1976 [28]. The species has reoccupied much of its historic range, although densities are far below previous levels, which is why it remains as Schedule 1 SC under SARA.

The Northern Leopard Frog uses a variety of habitats to meet its overwintering and breeding needs and in the summer is found in a wide variety of habitats, although the preferred habitat seems to be vegetation 15 to 30 cm tall that is relatively close to water [28]. Well-oxygenated water bodies, such as streams or larger ponds that do not freeze solid are used for overwintering sites. Temporary ponds that often dry up in late summer that are typically 30 to 60 m in diameter, 1.5 to 2.0 m deep, located in an open area, with a lot of emergent vegetation, and no fish are used for breeding sites. Therefore, the species is adversely affected by habitat fragmentation and conversion, including wetland drainage and eutrophication, as well as game fish introduction, collecting and pesticide contamination. While the proposed development will alter the existing bog area, as previously noted a 100 m buffer zone of no development will remain around Ranger Lakes and a 50 m buffer zone will remain around the unnamed drainage streams. These buffer zones and the untouched area surrounding Little Deer Lake will provide a substantial area of habitat with emergent vegetation along the shorelines which should mitigate any potential effects of the project on the northern leopard frog.

4.2 SOCIAL

4.2.1 Communities

The proposed peat developments are located on Crown land and there are no communities present within the 3 km project study areas, although there are cottages along the shore of Lake Winnipeg to the east of the Ramsay Point and Bullhead Bogs. Two communities, Pine Dock and Matheson Island, are located within the northern end of the regional study area. The community of Pine Dock is located approximately 4 km southeast and Matheson Island is located approximately 7 km northwest of the Bullhead Bog development area. The nearest larger

community, The Village of Riverton, is outside of the regional study area located approximately 40 km south of the Ramsay Point Bog.

4.2.2 First Nations

There are no First Nation communities located within the project or regional study areas, however, there are three First Nation communities located beyond the regional study area that have interest in the area. The Bloodvein First Nation is located approximately 15 km northeast of the Bullhead Bog along the east shore of Lake Winnipeg and use the ferry from the end of PR 234 as one of the means of access. The Fisher River Cree Nation (Reserve No. 44 and No. 44A) and the Peguis First Nation (Reserve No. 1B and 1C) are located approximately 30 km northwest and 40 km west of the Ramsay Point, respectively. Both communities likely have traditional land use in the area and, as previously noted, the proposed development is located with the Peguis First Nation CIZ.

4.2.3 Population

The proposed development is located in an unorganized area within Division No. 19. Population statistics for the small communities located within the regional study area were not available. Therefore, population information for Division No. 19, Unorganized, which includes Pine Dock and Matheson Island, have been summarized in Table 9 below, along with the information for the Village of Riverton.

TABLE 9
POPULATION STATISTICS FOR SURROUNDING COMMUNITIES [33]

Population and Dwelling Information	Riverton	Division No. 19, Unorganized
Population in 2006	**537**	**3,255**
Population in 2001	**594**	**3,217**
2001 to 2006 Population Change (%)	**- 9.6**	**1.2**
Total Private Dwellings	**241**	**3,114**
Population Density per km^2	**484.4**	**0.1**
Land Area (km^2)	**1.11**	**60,411**

Population information for First Nation communities located beyond the regional assessment area of the proposed peat harvesting project is presented in Table 10.

TABLE 10
POPULATION STATISTICS FOR SURROUNDING FIRST NATION COMMUNITIES

Community	Population on Own Reserve (# of people)	Population on Other Reserve (# of people)	Population Off Reserve (# of people)	Total Population (# of people)
Peguis	3,651	42	5,196	8,889
Fisher River	1,787	8	1,539	3,334
Bloodvein	1006	5	595	1,606

Note: data as of April, 2011 [34]

4.2.4 Services

The proposed peat harvesting development areas are located along gravel PR 234, approximately 160 to 200 km north of Winnipeg, Manitoba. The services in the regional study area besides PR 234 include private cottages, the Beaver Creek Provincial Park with campsites and a public beach, the Beaver Creek Bible Camp, the Beaver Creek waste transfer station, the Pine Dock and Matheson Island airports and the communities of Pine Dock and Matheson Island (and their associated lagoons).

The Royal Canadian Mounted Police (RCMP) provides law enforcement services to the communities located in the area. The nearest hospitals to the proposed developments are located in the towns of Hodgson (Peguis First Nation) and Arborg (RM of Bifrost), Manitoba.

4.2.5 Land Use

The land use in the Grindstone Ecodistrict is predominantly crown land that is leased for pulpwood and saw log forestry [17]; however, at the time of the survey and based on aerial photos of the regional study area there was no evidence of commercial forestry occurring. However, in addition to the existing Sunterra peat mine two additional peat operations are being developed and there are numerous other quarry leases held for peat mining in the regional area.

Additional land uses in the regional study area include recreational land use through Beaver Creek Provincial Park, cottage development along the shore of Lake Winnipeg and the Beaver Creek Bible Camp located at the confluence of Lake Winnipeg and Beaver Creek. The proposed development is located within the Peguis First Nation CIZ, as previously noted, which is a zone where trapping and fishing may occur.

4.2.6 Areas of Interest

The Moose Creek Wildlife Management Area (WMA) and Provincial Forest borders the southern boundary of QL 2410 at Ramsay Point Bog, extending to the south, west and north as shown in Figure 2. The Moose Creek WMA is located within the Ramsay Point Bog project study area and the larger regional area, although it is just outside of the Bullhead and Little Deer Lake project study areas. The Beaver Creek Provincial Park, which is used for cottaging, camping, picnicking, beach and day use is also located within the Ramsay Point Bog project study area along the shore of Lake Winnipeg and PR 234, approximately 2.5 km northeast of the development area. Lake Winnipeg, which has an approximate surface area of 23,750 km^2 (23,750,500 ha) and is about 436 km in length [(35)], is also an area of interest because in addition to recreational use, it supports commercial fishery activities.

4.2.7 Heritage Resources

The Manitoba Historic Resources Branch has reviewed the proposed project development area for Bullhead, Little Deer Lake and Ramsay Point Bogs, and has indicated there are no historical or heritage resources located with the area (Appendix D) [(36)]. Therefore, there are no concerns associated with the project, however, in the event that heritage resources are discovered during, construction the work will cease. The Historic Resources Branch of Manitoba Culture, Heritage and Tourism would be notified immediately, with further construction occurring as directed by the Historic Resources Branch.

4.3 ECONOMY

Industries in the Mid-Boreal Lowland Ecoregion include forestry, fishing, hunting and trapping [(17)]. Lake Winnipeg, in particular, provides an important economic source in the area through

fishing. During 2001 and 2002 there were 1,073 licensed fishers on Lake Winnipeg and the total value of commercial fish production was $20,380,350 [(35)]. Pickerel is the main fish harvested, followed by whitefish and sauger.

Division No. 19, Unorganized, sources of income in 2005 included: employment earnings (57.6%), government transfer payments (33.1%), and other sources (9.1%), with the average income for a person 15 years or older who worked a full year at full time being $13,422 [(33)]. The average family income in Division No. 19, Unorganized, of all census families was $30,728 compared to the Manitoba average of $58,816 [(33)].

In Division No. 19, Unorganized, there were 2,290 people that were 15 years or older in 2006 with 1,080 of these people in the labor force resulting in a 47.2 % participation rate [(33)]. From this labor force, 900 people were employed resulting in an employment rate of 39.3 % of the population. The main industries of agriculture and other resource-based industries, business services, educational services, and health care and social services accounted for approximately 65 % of the jobs. The other 35 % of the jobs in Division No. 19, Unorganized, were in the construction, retail trade, whole sale trade, manufacturing, finance and real estate, and other services industries [(33)].

Sunterra currently employs approximately 30-35 employees from the regional area, as previously noted and has an aggregate seasonal payroll in excess of C$1 million. In addition their total annual expenses are at a minimum $3 million with at least 50% of this spent within the Interlake area and another 25% within Manitoba.

5.0 PUBLIC CONSULTATION

5.1 OVERVIEW

Stakeholders were invited to provide Sunterra and KGS Group with their questions, concerns and comments about the proposed project. Information regarding the proposed development and potential effects associated with the project that were being assessed was provided to the stakeholders and public in the region through various means including telephone conversations and letters. The list of stakeholders and a copy of the letter distributed and any responses received are provided in Appendix E.

5.2 STAKEHOLDERS

The Peguis First Nation were considered a stakeholder as the proposed development at the Bullhead, Little Deer Lake, and Ramsay Point Bogs is located within the Peguis First Nation CIZ, as previously noted (Figure2). Manitoba Conservation (Conservation Programs and Regional Services & Parks) is a stakeholder due to the proximity of the development to the Moose Creek WMA and the Beaver Creek Provincial Park as these areas may be affected by project activities within the area.

There is the potential that the QLs within the proposed development or the surrounding project study areas overlap with existing traplines in the area. Therefore the Manitoba Trappers Association (MTA) and Matheson Island Fur Council (MIFC) were considered stakeholders due to the potential for the project to affect trapping activities.

The communities of Pine Dock and Matheson Island and the Rural Municipality (RM) of Bifrost, all located within the regional study area, and The Village of Riverton (Riverton), outside the regional study area, are also considered stakeholders, because of the potential for the project to have economic consequences for the community. Additionally, the communities of Pine Dock and Matheson Island will be affected by the transportation of peat along PR 234, which is the primary access to these communities.

Other stakeholders identified within the project study area include Beaver Creek Bible Camp, The Beaver Creek Cottager's Association (BCCA), and Pebblestone Beach Cottagers (PBC), all of which are located along the shore of Lake Winnipeg east of the proposed development and PR 234. Again they will be primarily affected by the transportation of peat along PR 234 and associated effects, as they share PR 234 as access.

In addition to being a stakeholder it is the responsibility of Manitoba Conservation, Environmental Assessment and Licensing Branch to approve or deny an Environmental Act license for the project and provide license terms and conditions. Other government agencies, including Manitoba Water Stewardship, the Mines Branch and DFO are also stakeholders in the project as they will be required to review and provide permits or authorization for specific components of the project. DFO has a responsibility to review and potentially provide authorization for the proposed culvert installation and ensure that appropriate design and mitigation measures are implemented. Government officials were contacted to identify concerns with the proposed peat development expansion. These concerns have been addressed in the EAP within Section 6.0.

5.3 STAKEHOLDER CONCERNS

At the completion of this report no responses had been received by the Beaver Creek Bible Camp, Manitoba Trappers Association (Area Director), Peguis First Nation or the R.M. of Bifrost. Responses that were received from stakeholders, either through telephone or paper (fax and mail) correspondence are summarized in the following paragraphs, with a copy of any paper correspondence provided in Appendix E.

The Riverton Mayor, Colin Bjarnason, indicated during a telephone conversation on September 26, 2011 that Riverton is in full support of the proposed development. He noted that there have been no negative issues with Sunterra which has been mining and processing peat in the area for a while. He also noted that the presence of peat mining in the area is a benefit for Riverton and the surrounding area as Sunterra provide more jobs and purchase more goods compared to the recreational cottage development also occurring in the area. These statements were then confirmed in a letter from the Mayor dated October 20, 2011 stating that the proposed

expansion would continue to support the local economy and employment opportunities in the long term (Appendix E).

The MTA requested via fax on September 28, 2011 that our letter and a map of the proposed development be sent to their area director (Appendix E). A follow-up telephone conversation with the MTA, Ms. Cherry White, to discuss and confirm details revealed that the MTA did not have any issues with the project development. However, Ms. White thought it would be a good idea for the area director, Mr. Carl Monkman, be informed of the project and identify any possible concerns. As already noted, to date, no response was received by the area director indicating any concerns.

The Pine Dock Community Council (PDCC), Ms. Jean Simundson, followed-up to our consultation letter with some questions and concerns during a phone conversation on September 29, 2011. After confirming that this was not the same development as described in a letter previously received for the Berger Deer Lake development she noted that the primary concern of the PDCC is the access to and from the new development. The concern, in particular, is with the potential impact to health and safety associated with the increased traffic in the area and with large trucks turning into and out of the site. Ms. Simundson also indicated that she would share the KGS Group consultation letter with the numerous cottagers in the area as they may also have concerns.

The PBC, Mr. Ken Buechler, contacted KGS Group on October 5 and 12, 2011. During these telephone conversations Mr. Buechler identified the PBC as a new stakeholder and discussed details of the environmental assessment process and the proposed development, along with details of the previous Sun Gro and Berger peat developments. While the PBC were not included initially as they only recently formed, with construction of the cottages beginning in September 2011, KGS Group issued a consultation letter as requested. In response the PBC provided a letter dated November 7, 2011 (Appendix E) outlining their concerns regarding potential environmental effects and the assessment methods as follows:

- Increased traffic on gravel PR 234 will degrade the road condition and impact the regional community in terms of dust, noise, vibration, and safety. They do not believe that previous mitigation efforts have been effective, and requests paving for PR 234 and separating mine roads and access away from PR 234;

- Increased fugitive dust may affect local inhabitants, in particular those with asthma and requests a quantitative air quality analysis be completed;

- Run-off will affect TSS and chemistry of the receiving water and considering the Save Lake Winnipeg Act, the PBC do not believe incremental alterations to Lake Winnipeg and other surface waters are acceptable;

- The extent of soil loss from this development combined with the other developments and potential harvestable areas is a significant portion of the Washow-Fisher Peninsula;

- The extent of loss and disturbance to vegetation and wildlife habitat may affect rare species and drive wildlife onto PR234;

- Recreational and residential property values will drop because of the proposed development and while there will be new business opportunities for local contractors related to the mine construction and operation this will be offset by an equal reduction is local spending on residential and recreational development;

- Transport trucks driving on PR 234 and braking or accelerating from the access road will generate noise and vibration, which should be mitigated by paving PR 234, erecting sound barriers and separating mine roads and access away from PR 234;

- There is significant wildfire risk to cottagers due to the size of the development, proximity of the development to the cottages and the single access road there the assessment needs to consider hazards to communities and mitigation measures to address these in addition to the workplace fire hazards;

- All key stakeholders have not been identified, advised, consulted or involved in previous assessments. Most environmental effects are stated in qualitative terms and it is not clear how effective proposed mitigation will reduce impacts. The PBC believes that inherent and residual adversity ratings should use the same scheme, effects and cumulative impacts should be quantified (i.e. measured), the area considered for cumulative impacts was insufficient, and that the proponent should focus on local and regional effects, rather than global scale effects.

The Matheson Island Community Council (MICC), Kevin Mowat, Deputy Mayor, sent a letter dated October 19, 2011 expressing and requesting a reply to the councils concerns as follows:

- Due to previous developments, both peat mining and cottage lots, the condition of PR 234 has been an issue for their community and asked if Manitoba Infrastructure and Transportation has committed to upgrading this road to handle the increase in traffic due to development;

- Because commercial fishing is a major livelihood in the community they wanted to know what adverse effects the project will have on Lake Winnipeg;

- MICC supports Little Bullhead Trappers (Matheson Island Fur Council); and
- Because the study areas include the communities of Matheson Island and Pine Dock which are under jurisdiction of Aboriginal and Northern Affairs Manitoba they asked if the department has been notified of this project.

The MICC also acknowledged the potential job opportunities that would occur due to the development but stated they hesitate to support the project until the environmental effects on trapping, logging, and fishing have been identified. KGS Group prepared a response letter dated October 25, 2001 (Appendix E) responding to their questions as requested.

The MIFC, John Mowat, President stated in a letter dated October 21, 2011 that they are not in support of any peat moss developments within their trapping areas and would appeal the application for the following reasons:

- The MIFC had not been included in consultation;
- They had previously lost significant portions of their Registered Trap Lines (RTL) to Cottage Lots in the Little Deer Area again with no consultation; and
- Peat moss harvesting will destroy the livelihood and way life for trappers in the area including residents of Matheson Island and Aboriginal and Metis peoples.

The BCCA, Rick Heuchert, President sent a letter via fax dated October 24, 2011 stating that they are opposed to any licence to harvest peat moss and maintain the following concerns with the project:

- The proposed development is contrary to Bill 46, The Save Lake Winnipeg Act, in particular Part 3, Section 128.1 (1);
- The Province of Manitoba failed to comply with Section 35 of the Constitution Act, 1982 on the Rights of Aboriginal Peoples of Canada;
- The loss of wetlands due to harvesting of peat will have impacts on air and water quality, particularly for Lake Winnipeg; and
- Previous concerns expressed by the public during the original licensing process for Sunterra were not satisfactorily addressed and the BCCA will be requesting that a full hearing into the EAP be held for the development.

5.4 MITIGATION MEASURES

The PDCC concerns regarding access to and from the development with the increased traffic, in particular associated with the potential impact to health and safety associated will be mitigated by Sunterra installing clear signage near the existing facility instructing drivers that they are approaching the facility, to slow down, and to refrain from using engine brakes. Additionally all traffic associated with the development will be directed to drive according to road conditions and adhere to the posted speed limits.

While the PBC expressed concerns regarding increased truck traffic on gravel PR 234, as discussed in Section 3.9 the proposed 50 ha increase in peak operation plus transporting raw peat from Ramsay Point Bog for processing would result in an increase of only approximately 1,420 truck loads per year, equivalent to an additional 48 trucks/week or only 7 trucks/day. Regardless the impacts of this traffic on the condition of PR 234, dust, noise, vibration and safety can be addressed as follows. Sunterra has indicated they will contact MIT to discuss the concerns outlined by the PBC and express their support that MIT upgrade PR 234 to accommodate increased traffic. Proposed measures to mitigate potential effects associated with the increased truck traffic include, installing clear signage near the existing facility as noted above, using an approved dust suppressant such as water on roads, directing all traffic associated with the development to drive according to road conditions and adhere to the posted speed limits, and in particular to note the reduced speed limit from 90 to 70 km/hr along the section of PR 234 adjacent to the Beaver Creek Provincial Park.

The PBC concerns regarding potential effects on air quality associated with increased fugitive dust may be mitigated by using an approved dust suppressant such as water on roads, minimizing peat harvesting and handling activities during high wind events, reducing the area of exposed peat in fields and peat stockpiles exposed to prevailing winds, controlling vehicle speeds, instructing employees on proper harvest equipment operation to minimize dust, covering loads being hauled from the site, re-vegetating harvested areas and utilizing windbreaks (tree and brush barriers).

While the PBC expressed concerns regarding run-off and potential effects to water quality in the receiving water, in particular Lake Winnipeg, as discussed in section 3.6.1, the drainage from

the harvesting areas will be integrated into the existing natural drainage system. Water from the bogs will continue to discharge into the adjacent streams and lakes in the area as currently occurs. The proposed development will, however, alter the timing and rate of drainage, in particular during the initial drainage of each additional 25 ha harvesting area. The increased volume of water discharged from each area during initial drainage is minimal in comparison to the drainage area within the watershed and the volume of the receiving water bodies. Proposed mitigation to control run-off and associated water quality issues includes using a sedimentation pond with gates and a floating boom to control the rate at which drainage water is discharged and the release of TSS. If the control of the discharge rate is not sufficient in maintaining the water chemistry, a limestone or carbonate lined drainage ditch can be installed to increase the pH of the draining bog water before entering the sedimentation pond.

The PBC concerns regarding potential impacts of the proposed development on soil loss and the associated vegetation and wildlife habitat impacts can be mitigated by limiting construction activities to designated areas, limit operation activities to areas disturbed during construction, maintaining habitat around the quarry leases and re-vegetating disturbed or reclaimed areas during and after operation. In total approximately 715 ha will be harvested, which is less than 1 % of the regional study area and only up to 382 ha will be developed at any given time. Restoration of a site often results in a wider diversity of flora which will result in a wider variety of habitats to support a more diverse fauna. No provincially very rare or rare species were observed at the proposed development area and only the olive-sided flycatcher observed at Ramsay Point Bog is listed as threatened by SARA. While not observed on-site the northern leopard frog, which is listed as special concern by SARA, has previously been observed in similar habitat in the area. Completing all project clearing during the winter outside of the migratory bird nesting period of May 1 to July 31 will mitigate potential impacts to the olive-sided flycatcher. While the 50 to 100 m vegetation buffer zone established around the shorelines will provide a substantial area of habitat with emergent vegetation along the shorelines which should mitigate any potential effects of the project on the northern leopard frog.

While PBC expressed concerns that recreational and residential property values will drop because of the proposed development given that there was an existing peat mine in the area and if the potential effects of the proposed development are mitigated, it is unlikely that there will be a measureable change in property values. The vegetation between PR 234 and the

proposed developments will buffer the aesthetic, noise and vibration effects and as noted above the increase in traffic will be up to a maximum of only 7 additional truck loads per day and only when the Ramsay Point Bog is fully opened. Based on discussions with Riverton Mayor Bjarnason the cottage development has provided very little economic benefit for the region whereas Sunterra, as previously described, has approximately $1.5 million annual expenditures in the regional area.

Sunterra agrees with PBC that fire is a concern not only at the development area but also in the project and regional assessment areas. Sunterra also has concerns with respect to activities of cottagers in relation to fire safety because a fire that starts in the cottage area could also spread to the harvesting area. Uncontrolled fires can result in substantial loss of peat resources to Sunterra, forest cover and wildlife habitat, property damage and the loss of life. Proposed mitigation by Sunterra includes complying with applicable provincial and municipal legislation, codes and guidelines, providing and testing fire suppression equipment on-site, preparing, exercising and implementing an emergency response plan that includes fire prevention, notification and response, regular employee training on use of equipment and notifying Manitoba Conservation immediately if a fire occurs. Specific details about the fire suppression equipment at the proposed development are provided in Section 6.3.6.

While the PBC expressed concerns regarding the EA methods, as described in Section 6.1 the requirements of Manitoba's Environment Act and regulations and the Manitoba Conservation advice for the preparation of an Environment Act Proposal for a Class 2 Peat Mining Development were followed. Additionally the assessment follows the methods and standards prescribed by the Canadian Environmental Assessment Agency and the Canadian Standards Association for assessing cumulative effects and significance. A reasonable effort was made to identify and contact stakeholders in the regional study area with information provided to anyone not initially contacted who identified themselves. Comprehensive field investigations for biological composition, soil conditions, water quality and drainage patters were completed to provide accurate baseline data. This will provide a basis of comparison to data collected during follow-up monitoring to assess the effectiveness of mitigation measures. Consistent with the cumulative effects assessment methodology the effects of the proposed development are considered in combination with the effects of other projects that have been or will be carried out in the foreseeable future. This includes the Sun Gro and Berger peat developments, however, it

is unknown whether the remaining land under existing and pending QLs will be developed in the foreseeable future as these have been held for many years with no evidence of activity and therefore were not included.

The MICC concerns regarding road conditions on PR 234 and water quality in Lake Winnipeg can be mitigated using the measures previously described in this section. The MICC expressed support for the Little Bullhead Trappers and therefore contact was made with the MIFC with their concerns mitigated as described in the following paragraph.

KGS Group contacted MIFC President John Mowat by phone on October 25 2011 to discuss the project and their concerns. The MIFC had not previously been contacted because the MTA had indicated that they had not concerns. The MIFC concerns about further loss of access to their traplines and therefore their livelihood were addressed by clarifying project details. Only approximately 715 ha of the total 1324 ha QL area will be harvested with only up to 282 ha under operation in any given year. Undeveloped areas will remain forested until the year harvesting will begin, leaving much of the proposed development in its natural condition with continued access to traplines. Additionally most of the development activities, except the initial site preparation, will occur between April and November which will not overlap in time with the trapping activities which are primarily done in winter because of the wet and inaccessible condition of the bog areas.

While the BCCA feels that the proposal is contrary to The Save Lake Winnipeg Act (Part 3 Section 128.1) this is not accurate as the act relates to applying for a Quarry Lease, while the proposed project is to develop Sunterra's existing QLs and only develop the pending QLs if they are approved following the current moratorium. The BCCA concerns regarding the loss of wetlands and associated effects to air and water quality will be mitigated by maintaining a 100 m buffer zone around the Ranger Lakes within the Ramsay Point Bog and a 50 m buffer around any of the drainage streams. Restoration work will begin as sections of the mine are closed to create wetland areas and offset the surface water areas lost during project development. Additional mitigation measures include minimizing the area disturbed, formulating a drainage plan to maintain the natural drainage patterns, maintaining water levels on the adjacent undisturbed lands, and preparing and implementing a mine closure plan to restore water levels to predevelopment conditions.

6.0 ENVIRONMENTAL EFFECT ANALYSIS

6.1 ENVIRONMENTAL ASSESSMENT METHODS

The environmental assessment of the proposed peat development was carried out based on project information provided by Sunterra and the advice document from Manitoba Conservation. Additional considerations included: environmental information acquired from literature and internet searches; publications by the peat industry and environmental organizations; contacts with federal and provincial government representatives; consultation with stakeholders; and site investigations by the project team.

Requirements of Manitoba's Environment Act and regulations and the Manitoba Conservation advice for the preparation of an Environment Act Proposal for a Class 2 Peat Mining Development were followed in the preparation of this Environment Act Proposal.

The environmental effects of the proposed peat harvesting project on the environment in the project and regional study areas were identified using checklists, an interaction matrix (Appendix F) and professional judgment. Advice by government representatives, concerns expressed by the stakeholders, and brainstorming among the consultant team was also used to identify environmental issues and associated environmental effects. The adversity of environmental effects was determined based on categories presented in Table 11.

The cumulative environmental effects of the proposed peat harvesting operation with the effects of other projects and activities in the area were assessed following the methods prescribed by the Canadian Environmental Assessment Agency [(37)].

The significance of the residual environmental effects of the proposed peat harvesting operation were evaluated following the procedures outlined in the Canadian Standards Association environmental assessment standard. The degree of change from the existing conditions and the value of the environmental components being affected determine the significance of an adverse effect. Criterion for this determination as referenced in Table 12 include: a) Societal value of affected environmental components, b) Ecological value or sensitivity of affected environmental components, c) Duration, d) Frequency, e) Geographic extent, f) Magnitude, and g)

Reversibility. For each criterion a particular level of significance rating (1, 2 or 3) is assigned. To judge the overall significance of an effect, the rating and criteria should be considered together. An effect is determined significant when: (1) it rates a "3" for at least four criteria, at least one of which must be criteria a or b; or (2) it is rated "2" or "3" for all criteria.

6.2 ENVIRONMENTAL ISSUES

Environmental issues associated with the proposed peat harvesting development at Bullhead, Little Deer Lake and Ramsay Point Bogs are summarized below. The assessment team identified the issues by considering the nature of the project, the location and environmental effects typical of peat harvesting projects. Site specific environmental issues will be discussed in a regional context.

6.2.1 Loss of Wetland

Public concern regarding the loss of wetlands as a function of wildlife habitat and other ecological functions has become acute in some regions in Canada. This is due to land use changes such as urban development, increased population and in particular agricultural development, especially in the prairie regions of Canada, there are fewer wetlands remaining [38]. Already many wetland areas have been lost due to draining for agricultural land use. Overall, development has accounted for approximately 15 percent loss of Canadian wetlands [38]. Horticultural peat harvesting, in comparison, only accounts for a small portion of the loss of wetlands [4,39]. Additionally the CSPMA has research from peatland restoration activities showing that a functioning wetland ecosystem can be restored within 5 to 7 years following completion of restoration.

6.2.2 Loss of Wildlife Habitat

Loss of wildlife habitat, particularly waterfowl nesting areas, is another concern. Waterfowl and other wildlife species favour swamps, marshes and shallow open water wetland classes as habitat due to the diverse range of vegetation. In contrast, bogs and fens have little importance as habitat for waterfowl and some wildlife species because they tend to have very little open water [39], low diversity of vegetation and limited cover for waterfowl or other bird nesting

purposes. The number of waterfowl and wildlife species and the total wildlife populations in bogs and fens are generally lower in comparison to other wetland classes or to mineral soil ecosystems.

A few small mammal species such as muskrat and beaver and game species such as caribou, moose and deer utilize peatland habitat. Rare or endangered bird and mammal species utilizing peatland areas on a seasonal basis include whooping crane, trumpeter swan, piping plover, and the wood bison.

Daigle and Gautreau-Daigle [(4)] evaluated natural peatlands (domed bogs) and peat harvesting areas in close proximity to each other in New Brunswick. It was found that some waterfowl use bog ponds during migration season and for staging. Usage was directly related to the availability of open water in the area. Overall, wildlife use of the bogs was found to be low due to low vegetation productivity of the bog habitat with little variation noted between the natural and developed areas. They also observed that moose populations use bog areas but again no population differences were observed between developed and undeveloped bogs [(22)].

6.2.3 Loss of Rare Vegetative Species

Protecting rare or endangered species and other vegetation has become a growing issue in regard to peat harvesting development. Peat harvesting affects vegetation that is unique to peatland bog environments such as pitcher plants (*Sarracenia* spp.), bladderworts (*Utricularia* spp.) and sundews (*Drosera* spp.) that are not found in other mineral soil environments. Many of these species are widely distributed throughout Canada's boreal wetland regions. These types of species occupy a niche that few other species are suited to and are found in many bog ecosystems. Several orchid species, some of which are rare, also occur in peatland environments [(40)].

The composition of vegetation in bogs tends to have a typical association of species adapted to the regional conditions. As such, the potential effects of a peat harvesting development will depend on the regional environment. If there is a large area of undeveloped bog in the region that will still support the unique vegetation types, then development of a peat bog that is only a small portion of the area will have minimal effects on rare vegetative species.

6.2.4 Release of Greenhouse Gasses

The release of GHG associated with peat development is another environmental concern. As *Sphagnum* grows, carbon is stored in the plant material. The plant material accumulates as peat because of the anaerobic conditions with low oxygen levels due to the high water table. As discussed in Section 3.10 Land-use change from undisturbed peatland (which typically has a high water table and full vegetation cover) to peatland under extraction (which has a reduced water table and no vegetation cover), results in a net increase in GHG emissions. The net increase is caused by an increase in the rate of in situ decomposition through increased diffusion of oxygen, increased CO_2 emissions and reducing CH_4 emissions, and a reduction of ecosystem production resulting through the removal of living biomass from the peatland surface. However, the amount of peat accumulated per year is substantially greater than the amount of horticultural peat harvested. Therefore, horticulture peat developments typically do not have a significant effect on the global carbon cycle.

Throughout the 39 years of operation and 5 years post restoration of Sunterra's Bullhead, Little Deer Lake and Ramsay Point Bogs the estimated total quantity of GHG emitted from land-use change, peat extracting and processing and transportation to market is 312.53 x 10^3 t - CO_2 eq. This is equivalent to 7.10 x 10^3 t - CO_2 eq/yr and is only slightly more than twice as much as the estimated 3.26 x 10^3 t - CO_2 eq/yr associated with the existing operation and accounts for only approximately 0.001% of the total annual emissions for Canada when compared to the 2008 total emissions of 734,000 x 10^3 t - CO_2 eq [16].

6.2.5 Impacted Surface Water Quality

Impacts to surface water quality due to water draining from peat harvesting have become a major concern, which has recently led to the introduction of the Save Lake Winnipeg Act. The exposed peat particles following the removal of surface vegetation can be transported into the drainage system, thus increasing suspended particles and other chemical parameters in the water. Settling ponds that slow down the flow of water enabling solids to settle out of the discharge water have become an integrated part of peat harvesting operations.

During initial drainage, there is an increase in runoff; however, this is over a limited period of time and well below the runoff of large rain events. Once the drainage is constructed, the rate of runoff is slower during a rain event compared to an undeveloped peat bog because of the absorption created by drained peat.

6.2.6 Reclamation and Restoration

Reclamation focuses on the potential after-uses of harvested peatland sites, whereas, restoration focuses more on re-establishment of the site as a peatland, with a functional natural ecosystem with characteristics as close as possible to the pre-harvesting conditions. Though reclamation and restoration requirements for peat harvesting developments in Canada have not been clearly defined, it has become an integral part of peatland management in this country. Canadian industries have little experience in reclamation and restoration of peat harvesting developments because only a few developments have reached the end of their production life. Reclamation; however, is a very fundamental practice in some of the European countries such as Finland, Ireland and Germany because of their long term history of peat harvesting operations where reserves have been exhausted.

There are several methods for peatland reclamation such as transforming the site into a new functioning wetland that would be useful as waterfowl habitat, developing agricultural cropland or establishing a forestry plantation on site. Sunterra proposes to restore the fully harvested areas based on the experience gained by Sunterra through the guidance of CSPMA and restoration research and following the requirements of The Preservation and Reclamation Policy of the CSPMA.

6.2.7 Peat Fire

The Manitoba Clean Environment Commission conducted public hearings in 1977 on smoke problems encountered in southern Manitoba during 1976. The burning of peat deposits in 1976 were the primary cause and resulted in smoke causing traffic accidents and health concerns. Some fires were accidental and started from the overlying brush or grass. However, many fires were deliberately set to remove peat for cereal crop agriculture. The Commission recommended prohibiting the burning of peat moss deposits, with a provision for cases in which the proposed

burning is demonstrated to be an acceptable agricultural practice, in which case, they must be executed with safety [41].

6.3 BIOPHYSICAL EFFECTS ASSESSMENT

6.3.1 Microclimate

The clearing in preparation for the proposed peat harvesting development will likely result in minor changes in airflow, wind speed and snow depositional pattern in and adjacent to the development areas. The potential adverse effects of the project on microclimate were assessed as minor. The effects may be mitigated by installing snow fences to control snow deposition on the property if required. Follow-up involves periodic observation of the changes in airflow patterns and snow deposition. The residual effect was determined to be not significant (Table 13).

6.3.2 Air Quality

Increases in fugitive dust will result in the local area during construction and operation of the project associated with access road construction, clearing, ditching and peat harvesting, stockpiling, loading and transporting activities. A total of approximately 282 ha of peat will be exposed to potential wind erosion at the Bullhead, Little Deer Lake and Ramsay Point Bogs during peak operation. Profiling, harrowing and harvesting peat along with stockpiling and loading the harvested peat will potentially result in fugitive dust. Additionally, the slight increase in vehicle traffic along access roads and PR 234 will result in fugitive dust. It is unlikely that Manitoba's air quality guidelines would be exceeded during construction and operation phases of the project. Additionally, dust is controlled as part of the routine operation and will reduce particulate matter in the air. Regardless, the potential effects on air quality were assessed to be moderate. The effects may be mitigated by using an approved dust suppressant such as water on roads, minimizing peat harvesting and handling activities during high wind events, reducing the area of exposed peat in fields and peat stockpiles exposed to prevailing winds, controlling vehicle speeds, instructing employees on proper harvest equipment operation to minimize dust, covering loads being hauled from the site, re-vegetating harvested areas and utilizing windbreaks (tree and brush barriers). Proposed follow-up involves periodic observations for

fugitive dust levels, inspections of the local area for accumulated dust and tracking of public complaints. The residual environmental effect of increased fugitive dust during construction and operation was determined to be not significant (Table 13).

Increased levels of NO_x, SO_2 and GHG may result from equipment and vehicle emissions during site preparation, peat harvesting and transporting activities. Additionally some construction materials and the use of fuel may release volatile organic carbons (VOC). As discussed in Section 3.10 the GHG emissions from peat harvesting and processing would be 43.11 x 10^3 t - CO_2 eq. and from transportation to market would be 107.77 x 10^3 t - CO_2 eq. The potential adverse effects on air quality in the local area were assessed to be minor. Proposed mitigation measures include using low sulphur fuels, requiring a high standard of maintenance for equipment and vehicles, limiting unnecessary long-term idling and using appropriate fuel dispensing equipment. Proposed follow-up includes periodic observation of air quality during construction, recording maintenance of heavy equipment and requiring submission of MSDSs for all products used. Residual environmental effects of NO_x, SO_2, GHG and VOC on air quality were determined to be not significant (Table 13).

Increased releases of GHG into the atmosphere will result from clearing and land use change associated with peat-harvesting activities. While construction of ditches reduces the release of methane, harvesting peat releases carbon dioxide and reduces carbon sequestering. The overall net flux, as discussed in Section 3.10 is an increase in GHG with an estimated release of 161.65 x 10^3 t - CO_2 eq. from land use change throughout the 39 years of development and 5 years post restoration. However, this potential increase in GHG when compared to national levels is considered to be a minor effect. Regardless, mitigation measures proposed to address greenhouse gas concerns include minimizing the areas cleared and preparing and implementing a restoration plan that restores the area to a carbon sink condition. The proposed follow-up involves adherence to license terms and conditions. The residual effect of increased greenhouse gases during construction and operation was determined to be not significant (Table 13).

6.3.3 Soils

Site preparation and peat harvesting activities will result in a loss of 1 to 5 m depth of surface cover and peat with approximately 1410 m^3 of peat harvested per hectare each year. The depth of loss will vary across the site as the peat thickness is variable and the harvesting depth will depend on what depth of peat is required to be retained undisturbed. Based on the development plan, as previously described, during the approximately 30 years at peak operation, with a total of 282 ha of peatland under production, approximately 397,620 m^3 of horticultural grade peat may be harvested each year. By the end of the Bullhead, Little Deer Lake and Ramsay Point Bogs lifetime, in approximately 2053, a cumulative of up to 13.4 million m^3 of peat may be harvested. This removal of soil (peat) from the site through the process of harvesting was assessed to be major. Mitigation measures proposed to address the effects of soil loss include minimizing the surface area disturbed to the area being harvested, leaving non-commercial peat reserves in place, and preparing and implementing a Mine Closure plan to restore the area to natural conditions. Proposed follow-up includes annual monitoring and reporting on implementation of the progressive restoration activities. The residual effect of soil loss was determined to be not significant (Table 13).

Soils in the development area may become impacted from accidental leaks, spills and releases of fuel or other hazardous substances during site preparation and peat harvesting activities. The potential adverse effects on soil quality were assessed to be moderate. Proposed mitigation includes preventing leaks, spills and releases, providing ULC Certified double-walled fuel storage tanks with spill prevention and leak detection, requiring drip trays for equipment, designating fuel storage and re-fueling areas, ensuring equipment arrives to site in good condition, providing spill clean-up equipment and materials, and providing an emergency spill response plan. Follow-up proposed involves periodic inspections for leaks, spills and releases, ensuring construction and operation crews adhere to designated areas, remediate and record fuel spills and releases, adherence to license terms and conditions and periodic updates of the emergency response plan. The residual effect of accidental leaks, spills and releases on soil quality was determined to be not significant (Table 13).

6.3.4 Surface Water

Surface water bodies, such as small ponds and intermittent streams, within the project area will be lost due to site drainage for peat harvesting operations. Approximately 715 ha of land will be cleared and drained over the expected life of the Bullhead, Little Deer Lake and Ramsay Point Bogs. A 100 m buffer zone of no development will remain around Ranger Lakes and a 50 m buffer zone will remain around the unnamed drainage streams. The remaining water bodies and water courses are far enough from the developmental footprint that a natural buffer zone of greater than 100 m will remain. The restoration work to begin as sections of the development are closed will result in development of wetland areas that will offset the surface water area lost during project development. Potential adverse effects on surface waters associated with drainage for the proposed development were assessed to be moderate. Proposed mitigation includes minimizing the area disturbed, formulating a drainage plan to maintain the natural drainage patterns, maintaining water levels on the adjacent undisturbed land, and preparing and implementing a mine closure plan to restore water levels to predevelopment conditions. Follow-up proposed includes periodic inspection of surface waters and annual reporting on implementation of the mine closure activities. The residual effect of loss of surface waters was determined to be not significant (Table 13).

Site drainage and land profiling activities during construction will result in changes to the flow rate; however there will be minimal change to the direction of surface water runoff within the production area. As discussed in section 3.6.1, the drainage from the harvesting area will be directed from the sedimentation ponds through outlet ditches to natural discharge points in order to best integrate the drainage into the existing natural drainage system, and cause minimal change to the water regime. All of the drainage patterns in the development area indirectly discharge to Lake Winnipeg, except the drainage from the QLs 1323, 1406, 2390 and 2391 that will discharge through outlet ditches towards the Little Deer Lake, which has no natural outlet. Although the rate and timing of drainage from the development area will be slightly modified during the extent of operation, the effect of the project on the drainage pattern was assessed as minor. No mitigation measures are proposed as the flow rate is a negligible increase to any of the receiving waters, and all of the downstream culvert crossings have sufficient capacity to accommodate this incremental increase. However, follow-up proposed includes monitoring of discharge flow rates from the peat development in accordance with license terms and

conditions. The residual effect of changes to the surface water regime was determined to be not significant (Table 13).

Suspended sediment levels in the surrounding wetlands, ponds and stream may become elevated during spring snowmelt and major precipitation events due to increased exposed peat area associated with harvesting. Based on the baseline surface water samples collected, as discussed in section 4.1.6, the TSS concentrations in the water bodies and water courses within and immediately downstream of the quarry leases were generally lower (6 to 18 mg/L) compared to TSS in Lake Winnipeg (33 to 37 mg/L). In comparison TSS concentrations measured in areas with disturbed peat could be substantially higher (up to 3150 mg/L). Therefore the potential adverse environmental effects to surface water quality were determined to be moderate. Proposed mitigation includes directing drainage water into sedimentation ponds equipped with floating booms before discharging by an outlet to the existing drainage system. Proposed follow-up includes collecting surface water samples from each outlet weekly with analysis for TSS, develop additional surface water sampling if required in consultation with Manitoba Conservation, cleaning of drainage ditches and sedimentation ponds on a regular basis, periodically inspecting for evidence of erosion and adherence to license terms and conditions. The residual effect of increase surface water runoff on suspended sediments was determined to be not significant (Table 13).

The surface water chemistry in the downstream receiving water, in particular Lake Winnipeg and Little Deer Lake, may become altered during site construction and operation associated with the draining of the peat bog. As discussed in section 4.1.6, baseline surface water samples collected from within the peat bog at the development areas had acidic pH levels that were outside of the MWQSOG and CCME criteria for the Protection of Freshwater Aquatic Life. In comparison the downstream receiving waters were within the applicable criteria and ranged from slightly acidic to slightly basic with Lake Winnipeg being slightly basic. The nutrient and metal concentrations were generally higher in the peat samples compared to the downstream receiving water and often associated with the elevated TSS concentrations. However elevated concentrations of ammonia, aluminum, iron and lead that exceeded either the MWQSOG or CCME criteria were measured in the both the peat and downstream receiving water. The proposed development will not alter the existing natural drainage patterns with water from the bogs continuing to discharge into the adjacent streams and lakes in the area. The proposed

development will, however, alter the timing and rate of drainage, in particular during the initial drainage of each additional 25 ha harvesting area. The increased volume of water discharged from each area during initial drainage is minimal in comparison to the drainage area within the watershed and the volume of the receiving water bodies as described in Section 3.6.1. Therefore, the potential adverse environmental effects to surface water quality were determined to be minor. Proposed mitigation includes using a sedimentation pond to control the rate at which drainage water is discharged into the existing drainage system and capture nutrient bound to sediment particles. If the control of the discharge rate is not sufficient in maintaining the water chemistry, a limestone or carbonate lined drainage ditch can be installed to increase the pH of the draining bog water before entering the sedimentation pond. Proposed follow-up includes collecting surface water samples from each outlet weekly to carry out pH analysis. Any additional surface water sampling required will be developed in consultation with Manitoba Conservation. The residual effect of bog water runoff on surrounding water bodies was determined to be not significant (Table 13).

Surface water in the development area may become impacted during construction and operation from accidental leaks, spills or releases of fuels or other hazardous substances. The baseline surface water sampling did not include parameters such as hydrocarbons; however, it is assumed that they would not be present as there is minimal use of this area by motorized vehicles. The potential adverse effect of spills on surface water quality was assessed to be moderate. Proposed mitigation and follow up would be the same as those described in Section 6.3.3 for accidental leaks, spills and releases to soil. The residual effects of accidental leaks, spills and releases on surface water quality were determined to be not significant (Table 13).

6.3.5 Groundwater

Groundwater in the development area may become impacted during construction from leaks and accidental spills or releases of fuels or other hazardous substances. Groundwater quality in the development area has not been analyzed for parameters such as hydrocarbons or other hazardous substances however it is assumed to be good quality as cottagers east of the development use it as a potable water source. The low permeability clay cover on-site, as discussed in Section 4.1.4 forms a very good barrier between the perched water in the peat and the underlying local bedrock aquifer. This essentially isolates the peat from the groundwater so

the proposed development will have minimal effects on the groundwater table. However, the proposed development does include the potential for future installation of a groundwater well in the staging areas that if improperly installed could provide a conduit. Therefore, the potential adverse effects of the project on groundwater quality were assessed to be minor. Proposed mitigation and follow up would be the same as those described in Section 6.3.3 for accidental leaks, spills and releases to soil. An additional mitigation includes ensuring the new supply wells (if developed) are properly sealed at ground level to prevent downward migration of surface contaminants. The residual effects of accidental leaks, spills and releases on groundwater quality were determined to be not significant (Table 13).

6.3.6 Vegetation

The proposed development activities will result in the loss and disturbance of terrestrial vegetation including tree, shrub, herbaceous and grass species. Up to a total of 1324 ha of land within the QL boundaries could be cleared for the peat development. However, based on the vegetation surveys completed at the proposed development areas none of the species identified are classified as being provincially very rare (S1) or rare (S2), listed under COSEWIC or federally protected under SARA. Regardless given the areal extent of vegetation to be disturbed the potential adverse effect of the project on vegetation loss was assessed to be moderate. Proposed mitigation measures include minimizing loss and disturbance of vegetation, limiting construction to designated areas, utilizing timber removed from site, and re-vegetating disturbed or reclaimed areas during and after peat harvesting operations. Positive outcomes of the proposed development will prevail during the restoration as restoration of a site often results in increased diversity of flora. Follow-up proposed includes periodic inspections for vegetation stress and mortality around the cleared areas, performing periodic inspections for invasion of nuisance or weed species and report annually on restoration activities implemented. The residual effects were determined to be not significant (Table 13).

Increases in fugitive dust will result in the local area during construction and operation of the project, as previously noted, which can settle on and stress vegetation. The potential adverse effects of dust on vegetation were assessed to be minor. However, the effects may be mitigated by controlling dust and stopping operational activities during high wind events. Proposed follow-

up involves periodic inspection of the local area for accumulated dust. The residual effects of dust on vegetation were determined to be not significant (Table 13).

Peat harvesting and restoration activities pose a risk of starting a peat fire. Sources of fire include spontaneous combustion, lightning strikes in drained areas, equipment and accidents. Sparks or dust accumulation on hot surfaces of the engines and exhaust pipes are common causes of fire from equipment. Fire is a concern in the development area as well as the project and regional areas. Uncontrolled fires can result in substantial loss of peat resources to Sunterra, loss of forest cover and wildlife habitat, property damage and the loss of life. Potential adverse effects from a peat fire were assessed to be major. Mitigation measures proposed to address potential fires include preparation and implementation of a fire management plan. At Sunterra a Management Committee is responsible for reviewing the Emergency Response Plan, which includes fire management. The committee objectives are to detect, prevent and make recommendations to company representatives and employees. This committee will work in full collaboration with provincial and municipal regulations, codes and guidelines to provide fire suppression equipment on-site, prepare, exercise and implement an emergency response plan that includes fire and explosion prevention, notification and response. The committee will notify Manitoba Conservation immediately if a fire or explosion occurs. Every harvester will be cleaned each day and equipped with a fire extinguisher, a 2 gallon pail, filled water backpack and shovel. Each loader will be blown or washed down regularly and equipped with a fire extinguisher. A fire wagon with a filled 600 gallon water tank will be located adjacent the peat fields and additional fire pumps and hoses will be located along the bog roads to draw water from the drainage ditches, although the preferred method of fire control is smothering with wet peat using a harrower. Proposed follow-up includes regular inspections, including routine examination of fire suppression equipment, and periodic testing and evaluation of the emergency response plan, as well as, checking all fire fighting equipment. Preventative measures will include regular employee education and training in the use of this equipment. The residual effects of the project on the risk of fire were determined to be not significant (Table 13).

6.3.7 Mammals/Habitat

Site preparation will result in loss and disturbance of mammal habitat. The 1324 ha of land within the QL boundaries that could be cleared for the peat development is approximately 7% of the project study areas and 1% of the regional study area in which there is abundant undisturbed habitat as this is a relatively undeveloped region. In particular there is abundant protected habitat within the Moose Creek WMA located west of the proposed development. There are no occurrences of wildlife species of concern listed within the MBCDC for the project study area and none of the species observed during the site investigations were provincially very rare (S1) or rare (S2), listed under COSEWIC or federally protected under SARA. Therefore, the potential adverse effects of clearing on habitat loss were assessed to be minor. Proposed mitigation measures include minimizing loss and disturbance of vegetation, limiting construction activities to designated areas, limit operation activities to areas disturbed during construction and re-vegetating disturbed or reclaimed areas during and after operation. Proposed follow-up involves periodic inspection during construction and operation, maintenance of re-vegetated areas, and ensuring adherence to environmental guidelines and protocols. The positive aspect of the proposed development is that restoration of a site often results in a wider diversity of flora which will result in a wider variety of habitats to support a more diverse fauna. The residual effects of wildlife habitat loss and disturbance were determined to be not significant (Table 13).

Construction activities and equipment use during operation may have adverse effects on large, small and burrowing terrestrial mammals. Some of the mammals may adapt, whereas most will avoid the area and use the surrounding undisturbed habitat. As previously noted, MBCDC has no records of wildlife species of concern within the project study area and none of the species observed during the site investigations were provincially very rare (S1) or rare (S2), listed under COSEWIC or federally protected under SARA. Therefore the potential adverse effects were assessed to be minor. Proposed mitigation measures include minimizing the area of disturbance by limiting construction activities to designated areas, limit operation activities to areas disturbed during construction, maintaining habitat around the quarry leases and implementing a closure plan to restore wildlife habitat. Follow-up proposed includes maintenance of re-vegetated areas and ensuring adherence to license terms and conditions. The residual effects were determined to be not significant (Table 13).

Vehicle traffic associated with site preparation and operation activities, in particular transporting peat, may result in increased vehicle – wildlife interactions and associated wildlife mortalities, vehicle damage, and human injury or death. No local data are available on wildlife mortalities, vehicle damage or human injury/deaths. As noted in Section 3.9 during peak operation the proposed development will result in an additional 1420 to 2347 truck loads per year, equivalent to an additional 48 to 79 trucks/week or 7 to 12 trucks/day. Most of the increased traffic will be travelling less than 5 km along PR 234 and therefore the potential adverse environmental effect of peat harvesting operations on vehicle – wildlife interactions was assessed to be negligible. Regardless, mitigation measures proposed to address the effects on wildlife-vehicle interactions include providing wildlife awareness information to drivers and adhering to posted speed limits. Proposed follow-up includes maintaining records of vehicle-wildlife interactions. The residual effect was determined to be not significant (Table 13).

Domestic waste materials at the each of the on-site facilities may attract problem or nuisance wildlife to the development areas. Problem or nuisance wildlife may include black bear, porcupine, skunk, rodents or raccoons. The potential environmental effect was assessed to be minor. Mitigation measures proposed include use of bear-proof garbage containers and regular disposal of waste at existing waste facilities. As required, animal deterrents such as noise-makers, reflectors and scents may be used. Proposed follow-up includes maintaining records of problem or nuisance wildlife and adhering to license terms and conditions. The residual effect of problem or nuisance wildlife associated with the peat harvesting operation was determined to be not significant (Table 13).

6.3.8 Birds/Habitat

The proposed project will result in the loss and disturbance of bird habitat and potentially waterfowl habitat during site preparation. In addition to the tree clearing being a direct impact on bird habitat, disturbance through noise in proximity to Little Deer Lake and the Ranger Lakes may have the potential to adversely impact waterfowl habitat. The MBCDC, as noted in Section 4.1.9, indicated that there were no current records of bird species of conservation concern within the project study areas. Additionally, none of the bird species identified during the site investigations within the development areas are provincially listed as species of conservation concern. However the olive-sided flycatcher which is listed as a Schedule 1, Threatened

species and federally protected under SARA was observed at Ramsay Point Bog. It is associated with open areas such as burnt-over forest, old-growth openings, wetland areas, and forest cut-over areas that support its passive sit-and-see method of hunting and therefore the site clearing should provide habitat that supports the olive-sided flycatcher. The potential adverse environmental effects of habitat loss were generally assessed to be minor, however, for the olive-sided flycatcher it was assessed as moderate. The vegetation buffer zones of no development which will be established around the water bodies will preserve habitat along the shoreline and reduce effects from construction activities from directly impacting the habitat surrounding the water bodies. Additional proposed mitigation measures includes completing tree clearing outside of critical nesting and rearing periods of May 1 to July 31, limiting activities to designated areas and re-vegetating disturbed or reclaimed areas during and after operation. Proposed follow-up involves periodic inspection during site preparation for signs of potential effects (if directed a biologist will be contracted) and maintenance of buffer zone and re-vegetated areas. The residual effects of loss and disturbance of bird habitat were determined to be not significant (Table 13).

Noise and vibrations associated with heavy equipment use during operation of the proposed peat development may result in the disturbance of birds and waterfowl during nesting and rearing periods. Spring and early summer are the most critical times for most of these bird species. As noted above there are no provincially rare or endangered bird or waterfowl species in the area, however the federally protected olive-sided flycatcher was observed at Ramsay Point Bog. Therefore, the potential adverse effects of the project construction and operation on birds were assessed to be minor. Proposed mitigation measures include maintaining the 100 m buffer between peat harvesting components and potential bird habitat as well as around the water bodies, and limit operation activities to areas disturbed during construction. Proposed follow-up involves periodic observations for bird nesting and rearing activities and success (if directed a biologist will be contracted), and adherence to license terms and conditions. The positive aspect of the proposed development is that restoration of a site often results in increased diversity of flora and fauna, thus, a potential increase in the variety of migratory and other bird species. The residual effects on bird nesting and rearing were determined to be not significant (Table 13).

6.3.9 Aquatic Biota/Habitat

Construction and operation of the proposed project may have adverse effects on aquatic biota and habitat in the development area. As noted in section 4.1.10, fish habitat is present in Deer Lake, the Ranger Lakes and the drainage system from the Ranger Lakes. This available fish habitat is likely able to support forage species such as Canadian mudminnow, sculpin and stickleback; additionally sport fish such as northern pike and perch utilize the streams and Ranger Lakes. The presence of northern pike (juvenile and adult), perch, Canadian mud minnow, brook stickle back, and Johnny darter were confirmed during the fish sampling program. Little Deer Lake has no natural outlet and while the other water bodies are connected to Lake Winnipeg there are substantial physical barriers, primarily beaver dams, that likely block passage except during the spring freshet. No development will occur within 100 m of any of these water bodies and therefore the concerns are primarily associated with the drainage from the harvesting area as described in the following paragraph.

Drainage and harvesting activities during operation of the project could result in increased sediment loads to adjacent water bodies. Elevated levels of suspended sediment can reduce water quality, which may interfere with fish spawning, navigation and the ability to locate food and escape predators. Settling suspended particles can potentially smother and kill fish eggs or larvae. Sedimentation ponds have been designed, as described in Section 3.6.1, to treat peat harvesting drainage water by slowing down the water flow to maximize the settlement of suspended peat particles. Sedimentation ponds will be constructed at the end of the main drainage ditches and will be equipped with a floating boom situated near the outlet to prevent escape of floating debris. Water leaving the sedimentation ponds will discharge through outlet ditches that are connected to the natural drainage system. A control culvert with a sliding gate will be placed in the inlet ditch upstream of the pond that can be used to reduce or stop inflow to the sediment pond in the event of a major precipitation event, which exceeds the design flow criteria. The potential adverse effects of sediments on aquatic biota and habitat were assessed to be minor. No additional mitigation is proposed beyond the use of properly designed and operated settling ponds as described above. Follow-up measures included periodically inspecting sedimentation ponds for debris, cleaning of drainage ditches and sedimentation ponds and monitoring water discharge for TSS on a weekly basis as previously detailed in Section 3.6.1. The residual effects were assessed to be not significant (Table 13).

Installation of the culvert crossings of the PR 234 roadside ditch for each of the proposed access roads for the Bullhead Bog (north and south) and Ramsay Point Bog may have potential adverse effects on aquatic biota and habitat. The Little Deer Lake Bog access road is located at a high point along PR 234 where no roadside ditch exists, as discussed in Section 3.6.1, and therefore will not require a culvert crossing at PR 234. The roadside ditch, where the access road culvert crossings are located, collects overland drainage from the sub-basins adjacent to PR 234 and could provide forage fish habitat. As such, the potential adverse effects were determined to be minor. Proposed mitigation includes following the Manitoba Stream Crossing Guidelines for the protection of Fish and Fish Habitat, following best management practices (regarding timing window, sediment/erosion control, revegetation of disturbed soils), size culverts accordingly to permit fish passage, and installing the culvert such that low flow connectivity is maintained (i.e. embedding the pipe below the ditch invert). Follow-up includes periodic inspection of the new culvert to ensure that the pipe is not blocked by sediment or debris. The residual effect of disturbance to aquatic biota and habitat was determined to be not significant (Table 13).

6.3.10 Amphibians and Reptiles

Peat harvesting construction and operation activities, in particular site drainage and equipment and vehicle use may have adverse effects on amphibians and reptiles and their habitat in the development area. None of the amphibian and reptile observed during the site investigations or reported by MCDC as being in the project areas are provincially very rare (S1) or rare (S2) or federally protected under SARA. However, the northern leopard frog, which was previously observed at the Ramsay Point Bog north of the proposed development is listed as a Schedule 1 special concern (SC) species under the SARA. The habitat conditions within the proposed development area are similar to those where the northern leopard frog was observed and therefore could also support the northern leopard frog. As discussed in Section 4.1.11, this species remains widespread but is of special concern as it has experienced a considerable reduction of range and loss of populations in the past. While the proposed development will alter the existing bog areas; the water bodies in close proximity to the development will have a 50 or 100 m vegetation buffer zone established around the shoreline. These buffer zones will provide a substantial area of habitat with emergent vegetation along the shorelines which should mitigate any potential effects of the project on the northern leopard frog. The potential adverse

effects were assessed to be minor. Proposed mitigation includes minimizing the area of disturbance by limiting construction activities to designated areas, limit operation activities to areas disturbed during construction and minimizing loss and disturbance of vegetation around water bodies by retaining buffer zones. Follow-up proposed includes keeping records of amphibians and reptiles observed on the site. The residual effects of the project on amphibians and reptiles were determined to be not significant (Table 13).

6.4 SOCIO-ECONOMIC EFFECTS ASSESSMENT

6.4.1 Economic Conditions

The economy in the regional area surrounding the proposed development is dependent on fishing, forestry, tourism and recreational related activities and government operations. The existing Sunterra Beaver Point Bog operation currently has a positive impact in the development area, employing 35 to 40 residents from the surrounding communities with an aggregate seasonal payroll in excess of $1 million. Additionally, Sunterra supports local businesses by purchasing supplies and contracting local companies for service works (e.g. trucking, sewage and waste disposal) having a minimum total annual expenses of $3 million with at least 50% of this spent within the Interlake area and another 25% within Manitoba. With the proposed peak operation of 282 ha beginning by 2015 Sunterra will continue to provide employment opportunities requiring approximately 43 to 48 employees. Therefore, the potential effect to the regional economy was determined to be positive (Table 13). As such no mitigation or follow-up activities are proposed.

6.4.2 Business Opportunities

Continued business opportunities for local contractors will include the contracts for harvesting merchantable timber, constructing the access roads with culvert installation, transporting harvested peat, disposal of sewage and domestic wastes as well as the eventual restoration. The potential effects were determined to be positive (Table 13). As such no mitigation or follow-up measures have been proposed.

6.4.3 Traffic

Construction activities will result in a small and temporary increase in traffic whereas transportation of peat from the bog areas to the existing facility at Beaver Point Bog during operation will result in a seasonal increase in traffic volumes on PR 234. As noted in Section 3.9 during peak operation the proposed development will result in an additional 1420 to 2347 truck loads per year, equivalent to an additional 48 to 79 trucks/week or 7 to 12 trucks/day. Increased truck traffic along PR 234 will increase dust, will further degrade the road requiring more frequent road maintenance and has the potential to increase the number of vehicle accidents and vehicle-wildlife interactions. Most of the increased traffic will be travelling less than 5 km along PR 234 and the increase is relatively small compared to existing traffic along PR 234, therefore the potential adverse effects were assessed to be minor. Sunterra has indicated their willingness to contact MIT, in conjunction with other peat producers in the area, to discuss the issues associated with deterioration of the gravel highway, increased dust, and safety concerns. Proposed mitigation measures include dust control by using an approved suppressant such as water and by reducing the number of vehicles traveling on PR 234 during high wind events, directing all traffic associated with the development to drive according to road conditions and adhere to the posted speed limits and providing wildlife awareness information to drivers. Follow-up measures proposed include recording the number of vehicles traveling along PR 234 associated with the harvesting operation and any public complaints and vehicle accidents. Further action will be considered as warranted. The residual effect was determined to be not significant (Table 13).

6.4.4 Noise and Vibration

Construction and operation activities including the use of heavy equipment and transport trucks will result in increased noise and vibration levels in the local area, as well, the transport trucks along PR 234 will result in increased noise and vibration. There is an existing forest buffer between the proposed harvesting areas and PR 234. However, construction of the access road and the transport trucks will not be buffered and, therefore, the potential adverse effects were assessed to be minor. Proposed mitigation includes muffling vehicles and equipment, limiting unnecessary long-term idling, requiring a high standard of maintenance for heavy equipment, maintaining the vegetation buffer along PR 234 near the sites and installing signs near the

facility warning drivers not to use engine brakes. Proposed follow-up involves monitoring and periodically tracking noise levels and public complaints. The residual effects of noise and vibration during construction and operating were determined to be not significant (Table 13).

6.4.5 Human Health

Due to the relatively sparse population density within the vicinity of the proposed peat harvesting areas, there are very few people that would be affected by the operational activities. Regardless, the increased noise, vibrations and dust generated from the increased traffic transporting peat will affect the public attitude toward the project and may adversely affect their well being. Additionally, with the slight increase in traffic there is an increased risk of vehicle collisions that could adversely affect the public and workers health. The potential adverse effects on human health and general public attitude/well being were assessed to be moderate. Proposed mitigation measures include applying dust control such as water, reducing the number of vehicles traveling on PR 234 during high wind events, driving according to road conditions, adhering to the posted speed limits, maintaining the vegetation buffer along PR 234 near the sites and installing signs near the facility warning drivers to slow down and not use engine brakes. Proposed follow-up involves periodic monitoring of dust levels and tracking any public complaints. Further action will be considered as warranted. The residual effect on human health was determined to be not significant (Table 13).

Indoor air quality inside the lunchroom and service garage facilities may potentially be affected by volatile organic carbons (VOCs) and carbon monoxide (CO), propane gas, dust, refrigerants and moulds. VOCs and CO in the maintenance garage is of particular concern. The potential adverse effects of indoor air quality on human health were determined to be minor. Mitigation measures proposed include providing adequate ventilation and ensuring a high standard of facility and equipment maintenance. Follow-up includes regular maintenance of the facility and equipment. The residual effect was determined to be not significant (Table 13).

Construction and operation of the proposed peat development may have adverse effects on public and worker safety. Due to the remote location and limited access to the project site, security measures will be limited. Signs indicating ‘No Trespassing’ and locked gates will be placed on the main access roads. Signs indicating open ditches and receiving drainage water

areas will be installed next to the designated areas and visible to employees and trespassers. The gates will remain locked at night and during inactivity at the site. The main ditches surrounding the harvesting areas will limit access to trespassers during open water conditions; however, as fences will not surround the harvesting areas, trappers will be able to access and cross the harvesting areas during frozen conditions. With the exception of the access road construction, the potential adverse effects on public safety are negligible, whereas the effects on worker safety were assessed as minor. Proposed mitigation to reduce the risk to worker safety includes compliance with Manitoba Workplace Safety and Health regulations, development and enforcement of standard operation procedure guidelines, provision of training to employees and ensuring all visitors to the site have reported in and are accompanied by an employee. Follow-up proposed includes recording the occurrence of workplace accidents and updating employee training and safety guidelines as required. The residual effect was determined to be not significant (Table 13).

6.4.6 Aesthetic Values

The proposed peat operation is located in a relatively remote location with very few local residents and is unlikely to be seen by regional visitors. Additionally the Bullhead, Little Deer Lake and Ramsay Point Bogs are only accessible by the proposed new access roads and separated from the public by a forest buffer zone along PR 234. Therefore any potential effects of the project on aesthetics are primarily associated with the presence of the access roads and transportation of peat. The increase in truck traffic on gravel roads will contribute to covering vegetation in a layer of dust between rain events. The potential adverse effects of the project on aesthetic values were assessed to be minor. Proposed mitigation measures include utilizing dust control methods, covering loads during transport to and from the site and maintaining the vegetation buffer along PR 234 near the sites. While not visible to the public re-vegetation of the peat fields in accordance with provisions in the mine closure plan will return the aesthetics in the area to a natural environment after peat harvesting operation. Proposed follow-up includes observing dust levels and debris and recording public complaints. Further action will be considered as warranted. The residual effect of decreased aesthetics was determined to be not significant (Table 13).

6.4.7 Areas of Interest

The proposed project is commensurate with the land use in the regional area as Sunterra currently operates their existing peat harvesting operation at Beaver Point Bog. Additional land uses in the regional study area includes a small communities and their supporting infrastructure (including two airports), cottage development along the shore of Lake Winnipeg and the Beaver Creek Bible Camp located at the confluence of Lake Winnipeg and Beaver Creek. With the measures proposed to mitigate the environmental effects of the project the effect on these communities and recreational land uses will be negligible, except for the increased traffic along PR 234. The proposed development is also located near or within various areas of interest that include the Beaver Creek Provincial Park, Moose Creek WMA, the Water Power Reserve and the Peguis First Nation CIZ. The proposed harvesting areas will be utilizing land within the CIZ that may be used for trapping and hunting no longer accessible to the Peguis First Nation, although the surrounding land would still be accessible. The potential adverse environmental effect of the project on these areas of interest was assessed as moderate. Proposed mitigation measures include limiting construction activities to designated areas, marking maximum clearing of the proposed development site, protecting adjacent trees from blow-down and re-using timber from clearing. Follow-up measures include periodically tracking the site during construction for signs of potential disturbances and ensuring construction crews adhere to designated areas. Residual environmental effects of the proposed development site on land use and areas of interest were evaluated to be not significant (Table 13).

6.4.8 Recreation/Tourism

The areas along the shoreline of Lake Winnipeg within the regional study area for the proposed peat harvesting development are prominent tourism and recreation areas. The Beaver Creek Bible Camp, Beaver Creek Provincial Park and cottage developments along Lake Winnipeg attract a large number of visitors each year during the summer season. Recreational activities including water sports, fishing, camping and outdoor adventures in the area provide employment and income to the regional area. The potential adverse environmental effects of the peat harvesting operation on these recreational areas were assessed to be negligible due to the nature of the activities and the distance to these areas. However, as these attractions are all accessed along PR 234 the slight increase in traffic associated with transporting peat was

assessed as having a minor impact on tourism. Proposed mitigation measures are those previously outlined for controlling dust and driving safety which include applying dust control such as water, covering loads during transport to and from the site, reducing the number of vehicles traveling on PR 234 during high wind events, driving according to road conditions and adhering to the posted speed limits. Proposed follow-up includes tracking public complaints. Further action will be considered as warranted. The residual effect was determined to be not significant (Table 13).

6.4.9 Heritage Resources

Historic Resources Branch of Manitoba Conservation has indicated a low potential to impact significant resources and therefore has no concerns with the project [(40)]. In the event that heritage resources are discovered, construction will cease and Historic Resources Branch of Manitoba Culture, Heritage and Tourism will be notified immediately. If this occurs, construction will occur as directed by the Historic Resources Branch. Therefore, the potential for adverse environmental effects of the project on cultural resources is unlikely and assessed as not significant.

6.5 EFFECTS OF ACCIDENTS AND MALFUNCTIONS

6.5.1 Fires and Explosions

Fires and explosions may result from spontaneous combustion, lightning strikes, equipment malfunctions, improper handling and storage of hazardous materials, as well as various construction and operation activities. Diesel fuel and small quantities of gasoline are stored, transported and dispensed as part of peat harvesting operations. Small quantities of hazardous materials and potentially flammable materials will be stored on-site. Fires and explosions can cause serious harm to staff, construction workers, contractors, the public and the environment. Project delays and increased costs to Sunterra are possible. Potential adverse environmental effects of fires and explosions were assessed to be major. Proposed mitigation includes complying with applicable provincial and municipal legislation, codes and guidelines, providing and testing fire suppression equipment on-site, preparing, exercising and implementing an emergency response plan that includes fire and explosion prevention, notification and response,

regular employee training on use of equipment and notifying Manitoba Conservation immediately if a fire or explosion occurs. Follow-up proposed includes adhering to license terms and conditions, regular inspections, routine examination of fire suppression equipment, and periodic testing and evaluation of the emergency response plan. The residual effect of fires and explosions was determined to be not significant.

6.5.2 Transportation Accidents

Heavy equipment, specialty equipment, large trucks and support vehicles are used during peat harvesting operation activities. Construction equipment and some materials will be brought onto the project site during construction. Once the peat harvesting development is operational, transport trucks will haul peat to the existing processing plant at Beaver Point Bog. There is a risk of accidents involving trucks and other vehicles accessing the peat harvesting sites operated by staff, the public and others. Accidents may also occur while transporting fuel and other materials onto the project site. The potential adverse effects of ground transportation accidents were assessed to be major. Mitigation proposed includes safe transportation routes, speed restrictions and signage, compliance with applicable provincial and municipal legislation, an emergency spill response plan that includes transportation accident prevention and response, and notification of Manitoba Conservation immediately if an accident occurs. Proposed follow-up includes adhering to license terms and conditions, periodic testing and evaluation of the emergency response plan, ensuring that dangerous goods carriers are licensed and inspecting all shipments for compliance with regulatory requirements. The residual effect of ground transportation accidents on the environment was determined to be not significant.

6.5.3 Petroleum Spills

During peat harvesting site preparation and operation activities, there is potential for petroleum spills as a result of improper storage, negligent fuelling or collision by a vehicle. Spills of petroleum products from leaking vehicles and large trucks are also possible. Impacts to soil, surface water and groundwater, and impaired air quality could result depending on the type of product as well as the nature, size and location of the spill. There is also possibility that spills and releases can flow along drainage channels and into surrounding vegetation and water

where drains are discharged. Indirect effects of a spill on worker and public health and safety are also concerns. Potential adverse environmental effects associated with spills were assessed to be moderate. Proposed mitigation includes preventing spills, releases and accidents, ensuring compliance with applicable provincial and municipal legislation, using double wall storage tanks, providing protective barriers around fuel storage tanks, using drip trays, preparing and implementing an emergency response plan that includes petroleum spill prevention, notification and response, and notifying Manitoba Conservation immediately if a spill occurs. Follow-up proposed includes remediation of petroleum spills, adhering to license terms and conditions, periodic testing and evaluation of the emergency response plan, inspecting fuel storage tanks for compliance with regulatory requirements, and maintaining records of fuel volumes delivered and used. The residual effect of fuel spills was determined to be not significant.

6.5.4 Hazardous Substances Release

Hazardous substances may be released during site preparation and operation. Common hazardous substances include fuels (diesel, gasoline and propane), waste oils and lubricants as well as concrete wash water, chemicals, paints and solvents. Releases of hazardous substances may impair air quality, cause impacts to soil, surface water and groundwater, and affect worker and public health. Remediation of soil and groundwater impacts would be costly for Sunterra and could result in project and operational delays. The potential adverse effects were assessed to be moderate. Proposed mitigation includes preventing spills, releases and accidents, ensuring compliance with applicable provincial legislation, guidelines, codes and best practices, using licensed contractors, preparing an emergency response plan that includes hazardous substance release prevention, notification and response, and notifying Manitoba Conservation immediately if a release occurs. Follow-up includes adhering to license terms and conditions, periodic testing and evaluation of the emergency response plan, inspecting hazardous substance storage for compliance with regulatory requirements, and maintaining waste manifests and tipping receipts. The residual effect of hazardous substances releases was determined to be not significant.

6.6 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

6.6.1 Climate

The cold continental climate of southern Manitoba produces very harsh environmental conditions for buildings, infrastructure and facilities. The nearby Pine Dock weather station is the closest active weather station to the proposed peat harvesting project. The mean annual air temperature at the weather station is 1.1 ºC and the daily mean temperature ranges between 18.9 ºC in July and –19.7 ºC in January [18]. The highest temperature ever recorded was 34.4 ºC in July 1979 whereas the lowest was –48.9 ºC in February 1967 [18]. The proposed infrastructure at the peat harvesting facility must be designed to withstand extreme high and low temperatures, damaging winds, significant precipitation events and hail, and even tornadoes.

High wind velocities can cause increased dust and blow loose peat materials off the property. Mitigation measures include limiting stockpiled material during high wind events, orienting peat stockpiles in the prevailing wind direction to minimize the area exposed, observing wind directions before unloading and loading of peat, using a tree or brush buffer to act as a windbreak, modifying and equipping peat harvesters to reduce peat dust emissions, covering peat transport trucks with tarps to eliminate dust emissions during transport, instructing employees in proper harvesting equipment operation to reduce dust emissions and suspending operations during high wind events. The residual effect of wind on the project was determined to be not significant.

Heavy rains or abrupt snowmelt can potentially flood the peat harvesting area, cause soil erosion and create unsafe working conditions, slippery surfaces, and reduced visibility. The resulting high volumes of surface water runoff can erode outlet drainage channels and wash out roads and culverts. Proposed mitigation includes designing adequate drainage channels, installing sedimentation ponds with a gated inlet ditch, providing additional on-site pumping capacity, suspending work during high precipitation events and includes the potential of flooding in the emergency response plan. The residual effect of precipitation on the project was determined to be not significant.

Manitoba is in a low seismic hazard area in Canada. Further consideration of the effects of an earthquake on the project is not warranted in this environmental assessment.

6.6.2 Flooding

The proposed peat harvesting development site is not normally subjected to significant overland flooding during spring runoff, or following significant precipitation events. The site is typically wet in low lying locations, but the peat does contain a large capacity for absorption, and the surface water within the site eventually drains towards either Lake Winnipeg or Little Deer Lake. Temporary flooding may occur from extreme precipitation events when on-site drainage becomes overwhelmed. Mitigation measures are the same as those proposed to deal with heavy rains as noted in Section 6.6.1. The residual effect of flooding on the proposed project was determined to be not significant.

6.6.3 Wildfire

Wildfire is common in the region. The mid-Boreal uplands ecoregion forest composition and succession stages are largely controlled by forest fire. Operation and construction of the proposed project can potentially be interrupted in the event of a forest fire burning adjacent to the harvesting areas. Forest fires risk the safety and health of workers and may damage equipment. Potential effects of wildfire on the construction and operation of the project were assessed to be minor. Proposed mitigation measures include providing fire suppression equipment at harvesting areas and within buildings during operation and implementing an emergency response plan that includes fire prevention, notification and response. Follow-up includes periodic testing of fire suppression equipment during construction and operation, periodic assessment of wildfire risk during construction and operation and periodically updating the emergency response plan. The residual effect of wildfires on the operation and construction of the project was determined to be not significant.

6.7 CUMULATIVE ENVIRONMENTAL EFFECTS

Cumulative environmental effects are defined as effects that are likely to result from the proposed project in combination with the effects of other projects or activities that have been or

will be carried out in the foreseeable future [35]. The Canadian Environmental Assessment Agency advocates a 5-step approach for assessing cumulative environmental effects [35]. The methodology involves five sequential steps: 1) scoping, 2) analysis of effects, 3) identification of mitigation, 4) evaluation of significance, and 5) follow-up.

6.7.1 Scoping

Scoping for a cumulative effects assessment (Table 11) involves determining regional issues, selecting appropriate regional Valued Ecosystem Components (VECs), defining spatial and temporal boundaries, describing other actions that may affect the VECs and identifying environmental effects of actions on VECs.

Regional Issues

The main regional issues identified in relation to the proposed peat harvesting are as follows:

- Loss of wetlands
- Loss of wildlife habitat
- Loss of rare vegetative species
- Surface water quality
- Increased traffic
- Impacts on Recreation/Tourism
- Reclamation and restoration

Valued Environmental Components

Valued Environmental Components (VECs) are components of the natural and human world that are considered to be valuable and should receive specific consideration in an environmental assessment. Value may be attributed for ecological, economic, social, cultural, aesthetic or ethical reasons. VECs in the regional study area for the proposed peat harvesting development include the following:

Air Quality

Air quality in the region is good and there are no industrial sources of pollution. Particulate matter from fields and roads is likely the major source of air quality impacts in the regional area. There are no known exceedences of Manitoba's ambient air quality objectives. Pristine air quality is valued by rural Manitobans for health and aesthetic reasons.

Soils

Soils in the region are poorly drained forming wetlands therefore the area is less suitable for agriculture and the potential for forestry operations is limited due to the nature of wetlands, making it less economically feasible.

Surface Water Quality

Surface water quality in the region is generally good with the exception of recent algal blooms on Lake Winnipeg in response to elevated nutrient levels. The Pine Dock and Matheson Island airports, lagoons and waste transfer areas are potential sources of impacts to surface water quality in the region. Good surface water quality is valued by Manitobans for consumption, agriculture and recreation, and is important for migratory birds and aquatic biota. Surface water in the vicinity of bogs tends to be slightly acidic as was confirmed during the baseline surface water monitoring (Section 4.1.6). The baseline monitoring also indicated that a few parameter concentrations in the surface water were elevated above the applicable MWQSOG and CCME criteria for the protection of freshwater aquatic life.

Groundwater Quality

According to GWDRILL logs in the regional area, the groundwater is generally potable with no known exceedences of MWQSOG. Pristine groundwater quality is valued by Manitobans for consumption, industry and agriculture. The groundwater in the regional area is generally protected from impacts by the low permeability clay cover, as discussed in section 4.1.4, which forms a very good barrier between surface water and the underlying local bedrock aquifer.

Recreation/Tourism Economy

The recreation/tourism economy in the regional study area is growing in importance. The industry benefits from a pristine environment with abundant and diverse natural resources and a general absence of industrial or other commercial development.

Wildlife/Habitat

Native wildlife species play an important role in the recreation and tourism industry in the regional area. Additionally, hunting is one of the traditional land-uses by the First Nations.

Aquatic Biota/Habitat

Native fish species also play an important role in the tourism, recreation and fishing industries in the regional area. Fish and fish habitat are protected under the Fisheries Act.

Quality of Life

The rural quality of life is of value to Manitobans. The quality of life is characterized by a remote setting with open spaces, peace and quiet, clean air, water and soil, and a general absence of industrial or other commercial development.

Spatial and Temporal Boundaries

Spatial and temporal boundaries for the proposed project cumulative effects assessment are as follows:

Spatial Boundary

The spatial boundary for the cumulative effects assessment is the regional study area, which includes the area within 10 km from the edges of the Bullhead, Little Deer Lake and Ramsay Point Bogs and the existing facility at Beaver Point Bog as previously described. This covers a total area of approximately 128,208 ha (Figure 2).

Temporal Boundary

The temporal boundary for the cumulative effects assessment is the life expectancy of the proposed peat harvesting operation. This is estimated to be approximately 39 years of harvesting. Following the expected decommissioning of the peat harvesting site, monitoring would continue for a number of years until outstanding environmental issues are addressed or Manitoba Conservation is satisfied.

Other Projects and Activities

Existing Projects and Activities

The proposed peat development is located in a relatively isolated area in the Interlake area of Manitoba. The following is a list of known development, projects and activities in the cumulative effects spatial boundary:

- Sunterra; existing Beaver Point Bog Peat Mine
- Beaver Creek Provincial Park
- Beaver Creek Bible Camp
- Beaver Creek transfer station
- Communities/Cottage Developments: Pine Dock, Matheson Island, Calders Dock (harbour), Bullhead, Little Bullhead, Leaside Beach, Beaver Creek and Pebblestone Beach
- Airports: Pine Dock and Matheson Island
- Commercial trucking along PR 234
- Road maintenance of PR 234 and park access roads
- Recreation including hunting, fishing and camping

Proposed (Known) Projects and Activities

There are currently two other peat harvesting developments in the area that have been recently issued an Environment Act Licence and likely to begin site preparation and construction within the year. These are being carried out by Sun Gro looking to develop a peat mine at Ramsay Point Bog immediately north adjacent the proposed Sunterra Ramsay Point Bog QLs 2409 and 2410. Berger is looking at develop a peat mine at the Deer Lake Bog south of the proposed

Sunterra Little Deer Lake Bog development. Additionally, new cottage developments are also being developed near Mill Creek and Little Deer Lake.

Potential (Rumored) Projects and Activities

The regional area has substantial peat reserves with much of the area parceled out through existing and pending quarry leases, thus there are several potential peat mine projects that may arise. These include potential peat mine developments by Premier Horticulture and Tourbiers-Lambert Inc. in addition to the other companies already noted to be developing in the area. However, at this time it is unknown if and or when any of these will be developed and therefore they have not been included as part of the cumulative effects assessment.

Environmental Effects

Environmental effects of the proposed peat harvesting development project are outlined in Table 13 and described in Sections 6.3 and 6.4 of this report. The potential environmental effects used in the cumulative effects assessment are listed below:

- Increased particulates
- Increased greenhouse gases, SO_2, NO_x, etc.
- Impacts to soils / surface water (hydrocarbons and hazardous materials)
- Loss of soil (harvested peat)
- Loss of wetlands
- Change in drainage pattern
- Change in receiving water quality (TSS, ph and nutrients)
- Loss and disturbance of terrestrial vegetation
- Loss and disturbance of terrestrial wildlife and habitat
- Loss and disturbance of birds/waterfowl and habitat
- Loss and disturbance of aquatic biota and habitat
- Increased traffic and deterioration of PR 234
- Impacts to public safety / human health
- Increased wildlife mortalities
- Improved regional social conditions
- Improved regional economic conditions

6.7.2 Analysis

Analysis involves additional baseline information, assessing the effects of the proposed development on VECs and assessing the effects cumulative of all developments, projects and activities on VECs.

Baseline Information

Hydraulic assessments were completed to determine the existing drainage patterns in the area. Samples were collected from water bodies and water courses within the quarry leases, at downstream stations within the project study area, and at the confluence with the Lake Winnipeg and in Little Deer Lake which are the receiving water for surface water leaving the harvesting areas. Biological surveys were also conducted to obtain lists of plant species present on site.

Environmental Effects

Environmental effects associated with project activities for the proposed peat harvesting development project are identified in Table 13. Effects are identified for the site preparation, construction, operation and decommissioning stages of the project.

Cumulative Environmental Effects

Environmental effects of the proposed peat harvesting development project and environmental effects of other known and potential projects and activities occur within the cumulative effects assessment area (Table 14). As such, there is some potential for the effects of the proposed project to be cumulative with the effects of other projects and activities within this area. While these projects and activities overlay in time most of them do not overlap in space. Therefore most of the potentially cumulative effects are negligible and none of the cumulative effects identified were assessed as major. Cumulative effects identified that were assessed as potentially minor include the loss of soil (peat harvesting), loss and disturbance of bird habitat (olive-sided flycatcher) and increased traffic on PR 234 with the associated deterioration of the

road. These effects were assessed as minor as they overlay in time and overlap in space with the other regional projects and activities.

The effects at the existing Sunterra Beaver Point peat mine and the new peat mines being developed by Sun Gro at Ramsay Point Bog and Berger at Deer Lake Bog would be similar to those at the proposed project and would likely be mitigated in a similar fashion. The magnitudes of the residual effects of the proposed peat harvesting project and the effects of other projects and activities are small relative to each other and the regional study area. The proposed project includes harvesting approximately 715 ha of peatland while the existing Sunterra and new Sun Gro and Berger developments includes harvesting approximately 232 ha, 1,170 ha and 2,085 ha of peatland, respectively. All of these developments combined only account for approximately 4,200 ha of peatland, which is approximately 3.3 % of the overall 128,208 ha of area within the regional assessment area. The effects assessed as minor associated with the area of disturbance include the loss of soil from harvesting peat and the potential loss of bird habitat for the olive-sided flycatcher. Although as previously noted this species prefers open habitats and therefore as long as clearing is completed outside of critical nesting and rearing periods this species may benefit from the increased open space.

Increased traffic and deterioration of PR 234 associated with transporting peat was also assessed as potentially cumulative with the other peat mines and commercial trucking along PR 234. As noted in Section 3.9 during peak operation the proposed development will result in an additional 1420 to 2347 truck loads per year, equivalent to an additional 48 to 79 trucks/week or 7 to 12 trucks/day, with most of the increased traffic travelling less than 5 km along PR 234. However in combination with the other existing and proposed peat operations, during a 10 year period from 2032 to 2041 at the peak of operations, up to a maximum of approximately 12,386 truck loads would be required to transport the peat harvested per year. This is equivalent to approximately 59 truck loads per day. While the proposed development would account for only approximately 19% of the maximum truck traffic, the effects would be similar and potentially cumulative.

6.7.3 Mitigation

No additional mitigation measures are required as a result of the cumulative effects assessment. The mitigation measures proposed already provides elimination, reduction and control of adverse environmental effects including any potential cumulative effects with the other peat harvesting developments. However, additional mitigation measures may be required if follow-up identifies any significant cumulative environmental effects.

6.7.4 Significance

Potential cumulative effects associated with the proposed peat harvesting development were determined to be not significant.

6.7.5 Follow-up

No additional follow-up is required as a result of the cumulative effects assessment. The already proposed follow-up measures would potentially identify if any cumulative effects occur associated with the other peat harvesting developments.

6.8 SUSTAINABILITY

6.8.1 Principles of Sustainable Development

Integration of Environmental and Economic Decisions

Economic decisions should adequately reflect environmental, human health and social effects, and environmental and health initiatives, as well as, should adequately take into account economic, human health and social consequences. Sunterra is committed to following the principles of sustainable development at their peat harvesting operations. The site selection process for the proposed operations considered environmental and human health protection issues, social effects, and economics of the site locations.

Stewardship

The economy, environment, human health and social well-being should be managed for the equal benefit of present and future generations. Manitobans are caretakers of the economy, the environment, human health and social well-being for the benefit of present and future generations. Today's decisions are to be balanced with tomorrow's effects.

Sunterra is committed to long-term management that provides economic benefit while ensuring the integrity of the development. The proposed peat harvesting development will provide approximately 43 to 48 jobs and additional contracts (transporting) over the 30 years that the production life will be extended. The natural soil conditions at the site will protect potential underlying groundwater sources. Site design will protect surface water quality and surrounding wildlife habitat. Long term adverse effects on the environment, human health, and social well-being are expected to be negligible.

Shared Responsibility and Understanding

Manitobans should acknowledge responsibility for sustaining the economy, the environment, human health and social well-being, with each being accountable for decisions and actions in a spirit of partnership and open cooperation. Citizens share a common economic, physical and social environment and should understand and respect differing economic and social views, values, traditions and aspirations. Manitobans should consider the aspirations, needs and views of the people of the various geographical regions and ethnic groups in Manitoba, including Aboriginal peoples, to facilitate equitable management of Manitoba's common resources.

Sunterra will be responsible for the day-to-day operations at the proposed peat harvesting development and will be responsible for keeping the general public informed about issues, actions, and decisions relevant to the facility.

Prevention

Manitobans should anticipate, and prevent or mitigate, significant adverse economic, environmental, human health and social effects of decisions and actions, having particular

careful regard to decisions whose impacts are not entirely certain but which, on reasonable and well-informed grounds, appear to pose serious threats to the economy, the environment, human health and social well-being.

Sunterra takes a proactive approach to prevent environmental and socio-economic effects by developing concrete policies and programs such as fire policy, health and safety and emergency response planning rather than reacting to effects after they occur. Sunterra will complete environmental investigations and monitoring at the site as proposed and any additional monitoring specified in the Environmental Act License. Compliance monitoring will enable early detection of potential environmental issues at the site and allow for mitigation measures to be implemented.

Conservation and Enhancement

Manitobans should maintain the ecological processes, biological diversity and life-support systems of the environment, harvest renewable resources on a sustainable yield basis, make wise and efficient use of renewable and non-renewable resources, and enhance the long-term productive capability, quality and capacity of natural ecosystems.

The proposed development will protect existing potential wildlife and fish habitat areas by creating buffer zones around water bodies and water courses within the development area. Additional measures, such as maintaining flow connectivity at crossings and ensuring protection against erosion and sedimentation, will be included in all stages of construction and development.

Rehabilitation and Reclamation

Manitobans should endeavor to repair any damage or degradation to the environment, and consider the need for rehabilitation and reclamation in future decisions and actions.

The closure plan for the proposed development will enable the entire site to be restored back to a functioning wetland supporting a more diverse collection of native species and their habitat.

Global Responsibility

Manitobans should think globally when acting locally, recognizing that there is economic, ecological and social interdependence among provinces and nations, and working cooperatively, within Canada and internationally, to integrate economic, environmental, human health and social factors in decision making while developing comprehensive and equitable solutions to problems.

The proposed development will be operated using sound environmental management practices for the protection of the environment and local ecosystem. Sunterra is a Manitoba based company and will address environmental, human health, social, and economic issues to ensure that the needs and concerns of the region are being met, while meeting their market need on an international basis.

6.8.2 Guidelines for Sustainable Development

Efficient Use of Resources

This means encouraging and facilitating development and application of systems for proper resource pricing, demand management and resource allocation together with incentives to encourage efficient use of resources, and employing full-cost accounting to provide better information for decision makers. Sunterra encourages efficient use of resources, materials and its operations through standard operating procedures established through past experience gained at their existing Beaver Point Bog peat operation.

Public Participation

This means establishing forums which encourage and provide opportunity for consultation and meaningful participation in decision making processes by Manitobans, endeavoring to provide due process, prior notification and appropriate and timely redress for those adversely affected by decisions and actions, and striving to achieve consensus amongst citizens with regard to decisions affecting them.

Information regarding the proposed development and potential effects associated with the project that were being assessed was provided to the stakeholders and public in the region through various means including telephone conversations and letters. The list of stakeholders and a copy of the letter distributed and any responses received are provided in Appendix E.

Access to Information

This means encouraging and facilitating the improvement and refinement of economic, environmental, human health and social information, and promoting the opportunity for equal and timely access to information by all Manitobans. To promote a greater understanding of their peat operations, Sunterra provides relevant information to governments, the public and their employees.

Integrated Decision-Making and Planning

This means encouraging and facilitating decision making and planning processes that are efficient, timely, accountable and cross-sector and which incorporate an inter-generational perspective of future needs and consequences. Sunterra encourages involvement from all levels of the organization through team design which supports decision making at the most appropriate levels. Sunterra will continue to work closely with communities, local and provincial governments as they currently do regarding the existing Beaver Point Bog.

Waste Minimization and Substitution

This means encouraging and promoting the development and use of substitutes for scarce resources where such substitutes are both environmentally sound and economically viable, and reducing, reusing, recycling and recovering the products of society.

Sunterra is committed to the environment and fully embraces these concepts through its operating procedures such as re-using a variety of materials once considered waste and recycling. Sunterra reduces their need for outside resources during access and bog road construction by using non-marketable timber and waste vegetation.

Research and Innovation

This means encouraging and assisting the researching, development, application and sharing of knowledge and technologies, which further our economic, environmental, human health and social well-being.

Sunterra will monitor the site as directed in the Environmental Act License for the project. The monitoring results submitted to Manitoba Conservation are public documents as is this EAP. Additionally, Sunterra continually researches new innovations in restoration procedures.

7.0 MITIGATIVE SUMMARY

Mitigation is defined under the Canadian Environmental Assessment Act as the elimination, reduction and control of the adverse effects of a project and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means. Mitigation measures for the proposed peat harvesting development are identified in Sections 6.3 and 6.4 and are summarized in Table 15. The nature of the mitigation measures, whether they are design, proposed, regulatory or management is shown in the table and described in the following sections.

7.1 DESIGN MITIGATION

Design mitigation includes measures that are either already included in the design of the proposed development or are to be addressed as a result of this environmental assessment. The design of the proposed development incorporates components, systems, controls and features, such as the drainage plan with sedimentation ponds, which will mitigate potential adverse environmental effects typically associated with peat harvesting operations. Design mitigation for the proposed peat harvesting development is summarized in Table 15. Responsibility for implementing design mitigation rests with the proponent and their contractors.

7.2 PROPOSED MITIGATION

Proposed mitigation includes measures that are identified in the environmental assessment report to address potential adverse environmental effects. These mitigation measures, such as use of snow fences and restricting activities to designated areas to minimize area disturbed, while not required by legislation, serve to eliminate, reduce and control potential adverse environmental effects and render them not significant. These measures are summarized in Table 15. For the most part, the measures are operational in nature and require incorporation into specifications for construction and standard operational procedures.

7.3 REGULATORY REQUIREMENTS

The proposed peat harvesting development is subject to various federal and provincial environmental legislations. Regulatory requirements serve to mitigate adverse environmental effects, which may have potentially significant environmental and human health consequences. Environmental legislation applicable to this development includes the following:

Manitoba

- *Environment Act*
  - Peat Smoke Control Regulation
  - Litter Regulation
  - Waste Disposal Grounds Regulation
- *The Mines and Minerals Act*
  - Operation of Mines Regulation
  - Mine Closure Regulation
- *Dangerous Goods Handling and Transportation Act*
  - Environmental Accident Reporting Regulations
  - Storage and Handling of Petroleum Products and Allied Products Regulation
  - Generator Registration and Carrier Licensing Regulation
  - Manifest Regulation
- *Public Health Act*
  - Atmospheric Pollution Regulation
  - Protection of Water Sources Regulation
- *Ozone Depleting Substances Act and Regulations*
- *The Forest Act*
  - Forest Use and Management Regulations
- *Forest Fire Prevention Act*
- *Workplace Safety and Health Act and Regulations*
- *Contaminated Sites Remediation Act*
- *Sustainable Development Act*
- *The Endangered Species Act*
- *Wildlife Act*

- *The Highway Traffic Act and Regulations*
- *Water Protection Act*
- *Crown Lands Act*

Canada

- *Canadian Environmental Assessment Act* and Regulations
- *Canadian Environmental Protection Act* and Regulations
- *Fisheries Act*
- *Species at Risk Act*

Regulatory mitigation applies to site preparation activities, harvesting operations, transport and storage of hazardous substances, reporting of spills and accidental releases, reporting as a license condition, worker and public safety, etc. Table 15 includes mitigation measures that are regulatory in nature.

Guidelines followed in the preparation of an EAP for peat harvesting developments include the following:

- Manitoba Water Quality Standards, Objectives, and Guidelines
- Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines, Summary of Guidelines for Fresh Water Aquatic Life
- Advice for the Preparation of an Environment Act Proposal for a Class 2 Peat Mining Development

7.4 MANAGEMENT PRACTICES

Good environmental management practices can further protect the environment and human health and safety from potentially adverse effects of peat harvesting site preparation and operation activities. While many of the practices are not required by legislation, various policies, guidelines and procedures exist that provide direction in relation to environmental protection, environmental stewardship and sustainable development principles and guidelines. Examples of good management practices are summarized in Table 15.

Implementation of mitigation measures proposed by Sunterra will be carried out through development of an Environmental Protection Plan that includes mitigation measures, follow-up requirements, license and permit terms and conditions, and other related requirements. The Environmental Protection Plan also provides for effective integration of environmental assessment results into contract specifications and operational procedures.

7.5 CONTINGENCY PLANNING

Sunterra will prepare and implement a contingency plan for the proposed peat harvesting development site at Bullhead, Little Deer Lake and Ramsay Point Bogs. The plan will include provisions for fires, explosions, accidents, malfunctions, spills, storms and floods. Sunterra will form a fully functional team at the site made up of employees from all levels of the operation. The team will work closely with communities, local and provincial governments on regulations, codes and guidelines as well as implement emergency response procedures for the existing bog site. These procedures will include training in emergency preparedness and evacuation plans for emergencies such as fire and explosion.

7.6 CLOSURE PLAN

A closure plan for the proposed harvesting sites has been developed in accordance with requirements of Manitoba Regulation 67/99 of the Mines and Mineral Act. The mine closure plan outlines the restoration of the site and all final closure activities and cost (Appendix C).

8.0 FOLLOW-UP

Follow-up is defined under the *Canadian Environmental Assessment Act* as a program to verify the accuracy of the environmental assessment of a project and determine the effectiveness of measures taken to mitigate the adverse environmental effects of the project. Follow-up requirements identified for the proposed peat harvesting development in Sections 6.3 and 6.4 are summarized in Table 16. The primary nature of the follow-up, whether they are inspecting, monitoring, record keeping or reporting is shown in Table 16 and described in the following sections.

8.1 INSPECTING

Inspecting involves periodic or regular observations of the project and local area during site preparation, construction and operation activities to determine whether mitigation measures are implemented and if they are effective in eliminating, reducing or controlling adverse environmental effects. Inspecting includes surveillance to identify problems, issues and concerns, and environmental effects not predicted in the environmental assessment report. Inspections may involve the use of checklists and should be maintained at the project site. Inspection requirements for the proposed peat harvesting development during site preparations and construction are summarized in Table 16. Sunterra staff is typically responsible for most of the inspections during the site preparation and operation phases.

8.2 MONITORING

Monitoring includes periodic or regularly scheduled collection or sampling for environmental information in the development or project area. Monitoring may be required by the environmental assessment or it may become necessary as a result of inspections that are carried out after the assessment. Follow-up monitoring for the proposed development during site preparation and operation includes weekly monitoring of the effluent from the sedimentation pond outlets and monitoring surface water quality in sedimentation ponds and adjacent water bodies three times a year or as directed by Manitoba Conservation in the Environment Act License. Sunterra is responsible for monitoring during the site preparation and operating phases.

8.3 RECORD KEEPING

Record keeping includes maintaining files and documentation related to mitigation measures and follow-up implemented, as well as, recording public complaints. Record keeping requirements for the proposed development includes monitoring and tracking complaints from local residents, submission of Material Safety Data Sheets (MSDSs) for all products used, number of vehicle-wildlife interactions, number of problem or nuisance wildlife situations, number of amphibians and reptiles observed on the site, fuel volumes delivered and used, maintaining peat transportation manifests, number of monitoring and testing samples collected and analytical data generated, details of incidents requiring implementation of the emergency response plan and updating the emergency response plan following testing.

8.4 REPORTING

Reporting, in the context of environmental assessment follow-up, includes documentation and communication that mitigation measures and follow-up are implemented and whether or not they have been effective. Such reports are normally required by the Manitoba Conservation Environment Act License and are placed in the public registry for the project. Reporting is also required in the event of an accidental spill or release of hazardous substances. Reporting requirements for the proposed development will also likely include an annual compliance surface water quality report, summary of annual generation of peat and a detailed report following incidents that require implementation of the emergency response plan. Sunterra will be responsible for submitting all required reports to Manitoba Conservation as specified in the Environment Act License.

9.0 CONCLUSIONS

The Environmental Act Proposal (EAP) for the proposed peat harvesting development was prepared based on project information provided by Sunterra. The report followed the requirements of the *Environmental Assessment and Licensing Process Under the Manitoba Environment Act*. A peat harvesting operation such as the one proposed by Sunterra is considered a mining development under Manitoba Regulation 164/88 and therefore considered a Class 2 Development. The EAP was also completed in accordance with Manitoba Conservation's *Advice for the Preparation of an Environment Act Proposal for a Class 2 Peat Mining Development*.

The EAP was carried out using available biophysical, social and economic information for the regional assessment area. Potential environmental effects of the proposed peat harvesting development were identified using scoping methods, interaction matrix techniques, public comments, advice from specialists and professional judgment. Direct biophysical effects and indirect social and economic effects were identified in accordance with the *Canadian Environmental Assessment Act*. Cumulative environmental effects for the project were also considered. Mitigation measures were identified to eliminate, reduce and control environmental effects determined to be adverse. Follow-up was proposed to verify accuracy of the assessment and determine effectiveness of the mitigation measures. Significance of the residual environmental effects remaining after mitigation was then evaluated.

The proposed peat harvesting operation at Bullhead, Little Deer Lake and Ramsay Point Bogs, will not likely result in significant adverse environmental effects based on the available information on the project, the environment, the assessment of environmental effects outlined in this EAP, the application of proposed mitigation measures and the conduct of required follow-up. Similarly, the cumulative environmental effects of the project in combination with the effects of other projects or activities that have been and will likely be carried out in the reasonably foreseeable future were determined to be not significant.

10.0 STATEMENT OF LIMITATIONS

Third Party Use of Report

This report has been prepared for Sunterra Horticulture (Canada) Inc. and any use a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

Environmental Statement of Limitations

KGS Group prepared the environmental conclusions and recommendations for this report in a professional manner using the degree of skill and care exercised for similar projects under similar conditions by reputable and competent environmental consultants. The information contained in this report is based on the information that was made available to KGS Group during the investigation and upon the services described which were performed within the time and budgetary requirements of the Sunterra Horticulture (Canada) Inc. As the report is based on the available information, some of its conclusions could be different if the information upon which it is based is determined to be false, inaccurate or contradicted by additional information. KGS Group makes no representation concerning the legal significance of its findings or the value of the property investigated

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TABLES

TABLE 1
QUARRY LEASE INFORMATION
SUNTERRA PEAT MINE DEVELOPMENT

Site	Quarry Lease No.	Area (Ha)
Little Deer Lake Bog	QL-1323	266.8
	QL-1406	100.8
	QL-2390*	98.5
	QL-2391*	84.8
	Sub-Total	**550.94**
Bullhead Bog	QL-1134	248.4
	QL-1291	49.7
	QL-2401*	51.4
	QL-2402*	48.9
	Sub-Total	**398.36**
Ramsay Point Bog	QL-2409*	128.0
	QL-2410*	246.6
	Sub-Total	**374.60**
	Total	**1323.90**

Notes: * indicates that the Quarry Lease is still pending

TABLE 2
ESTIMATED PEAT PRODUCTION SCHEDULE
SUNTERRA PEAT MINE DEVELOPMENT

Production Year	Harvest Area (ha)	Total Volume (m^3) Harvested/Year	Truck Loads/Year
Existing Beaver Point Bog Development			
2013	232	327,120	1,931
Existing Beaver Point Bog Development			
2014	257	362,370	2,139
2015	282	397,620	2,347
2016	282	397,620	2,347
2017	282	397,620	2,347
2018	282	397,620	2,347
2019	282	397,620	2,347
2020	282	397,620	2,347
2021	282	397,620	2,347
2022	282	397,620	2,347
2023	282	397,620	2,347
2024	282	397,620	2,347
2025	282	397,620	2,347
2026	282	397,620	2,347
2027	282	397,620	2,347
2028	282	397,620	2,347
2029	282	397,620	2,347
2030	282	397,620	2,347
2031	282	397,620	2,347
2032	282	397,620	2,347
2033	282	397,620	2,347
2034	282	397,620	2,347
2035	282	397,620	2,347
2036	282	397,620	2,347
2037	282	397,620	2,347
2038	282	397,620	2,347
2039	282	397,620	2,347
2040	282	397,620	2,347
2041	282	397,620	2,347
2042	272	383,520	2,264
2043	247	348,270	2,055
2044	222	313,020	1,847
2045	197	277,770	1,639
2046	172	242,520	1,431
2047	147	207,270	1,223
2048	122	172,020	1,015
2049	97	136,770	807
2050	72	101,520	599
2051	47	66,270	391
2052	22	31,020	183
2053	0	0	0

TABLE 4
GENERAL WATER QUALITY
SUNTERRA PEAT MINE DEVELOPMENT

Sample No.	Date	Water Source	Parameters [1]																	
			pH (units)	E.C. (µS/cm)	Alkalinity as $CaCO_3$	Bicarbonate as $CaCO_3$	Carbonate as $CaCO_3$	Hydroxide as $CaCO_3$	Hardness as $CaCO_3$	Sulphate	Ortho-phosphate as P	Ammonia	Nitrate & Nitrite (as N)	B.O.D.	Total Phosphorus	Total Dissolved Phosphorus	Total Pariculate Phosphorus	T.D.S.	T.S.S.	T.K.N.	Acidity
EQL			*0.10*	*0.40*	*1.0*	*2.0*	*0.60*	*0.40*	*0.30*	*0.50*	*0.01*	*0.05*	*0.05*	*1.00*	*0.010*	*0.010*	*0.014*	*5.0*	*5.0*	*0.20*	*1.0/25*
Ramsay Point Bog																					
SW-1	12-Oct-11	Ranger Lakes	6.75	33.8	13.1	16	<0.60	<0.40	16.7	<0.50	<0.010	<0.050	<0.050	2.5	0.053	0.018	0.035	20	8	1.26	3.4
SW-2	12-Oct-11	Peat	**4.21**	65.8	<1.0	<2.0	<0.60	<0.40	66.7	<0.50	0.011	**0.104**	<0.050	42	2.71	0.093	2.62	40	3150	37	38
SW-3	12-Oct-11	Roadside Drain	7.44	203	85.2	104	<0.60	<0.40	123	26.0	0.010	<0.050	<0.050	2.1	0.031	0.019	<0.014	144	6	1.59	1.7
SW-4	13-Oct-11	Lake Winnipeg	8.46	365	127	145	4.32	<0.40	193	73.5	0.043	**0.070**	<0.050	1.5	0.079	0.053	0.026	248	33	0.86	<25
Little Deer Lake Bog																					
SW-5	11-Oct-11	Little Deer Lake	7.18	65.4	32.4	39.5	<0.60	<0.40	42.5	<0.50	<0.010	<0.050	<0.050	3.7	0.040	<0.010	0.031	48	18	1.65	3.4
SW-6	11-Oct-11	Peat	**3.93**	63.3	<1.0	<2.0	<0.60	<0.40	44.3	<0.50	0.011	**0.055**	<0.050	21	0.617	0.042	0.575	44	2950	4.74	39
Bullhead Bog																					
SW-7	13-Oct-11	Peat (Dry)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SW-8	13-Oct-11	Roadside Drain (Dry)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SW-9	13-Oct-11	Peat	**4.35**	39.8	<1.0	<2.0	<0.60	<0.40	20.7	<0.50	0.014	**0.068**	<0.050	6.6	0.353	0.035	0.318	28	168	1.53	22.6
	Field Dup	Peat	**4.35**	41.0	<1.0	<2.0	<0.60	<0.40	30.8	<0.50	0.016	**0.079**	<0.050	7.4	0.615	0.040	0.575	30	753	61	22.9
SW-10	13-Oct-11	Unnamed Creek	**6.27**	56.7	16.2	19.7	<0.60	<0.40	82.6	7.91	0.011	<0.050	<0.050	2.2	0.056	0.018	0.038	44	800	0.80	5.8
SW-11	13-Oct-11	Lake Winnipeg	8.25	331	114	139	<0.60	<0.40	176	61.8	0.071	<0.050	0.149	1.7	0.114	0.081	0.033	252	37	0.74	<1.0
BLANK	12-Oct-11		**5.98**	0.91	1.8	2.3	<0.60	<0.40	<0.30	<0.50	<0.010	<0.050	<0.050	<1.0	<0.010	<0.010	<0.014	<5.0	<5.0	<0.20	1.2
Manitoba Surface Water Quality Objectives [2]																					
Freshwater Aquatic Life			6.5 - 9.0	-	-	-	-	-	-	-	-	[4]	-	-	-	-	-	-	[6]	-	-
CCME [3]																					
Freshwater Aquatic Life			6.5 - 9.0	-	-	-	-	-	-	-	-	1.54 [5]	-	-	-	-	-	-	-	-	-

Notes:

"-" = No Data
E.C. = Electrical Conductivity
B.O.D. = Biochemical Oxygen Demand
T.K.N. = Total Kjeldahl Nitrogen
T.D.S. = Total Dissolved Solids
T.S.S. = Total Suspended Solids

1. All values are expressed in milligrams per litre (mg/L) unless indicated otherwise.
2. Manitoba Surface Water Quality Objectives, Manitoba Conservation Report 2002-11, Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG), November 22, 2002.
3. CCME - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines, 1999. Updated 2011.
   Guidelines for Canadian Drinking Water Quality.
   Chapter 4 - Aquatic Life
4. See Tier II Water Quality Objective for calculations (averaging 4 day duration).

Sample No.	*pH*	*Temperature*	*Ammonia*
SW-1	6.75	13.20	0.01734
SW-2	4.21	9.10	0.02363
SW-3	7.44	13.24	0.01246
SW-4	8.46	12.10	0.00341
SW-5	7.18	14.70	0.01346
SW-6	3.93	9.81	0.02258
SW-9	4.35	7.45	0.02629
SW-9 Dup	4.35	7.45	0.02629
SW-10	6.27	9.31	0.02332
SW-11	8.25	11.80	0.00493

5. Ammonia as N is pH and Temperature dependant. See Factsheet for details.
6. Total Suspended Sediment Tier II
   - Background TSS less than or equal to 25 mg/L: 5 mg/L induced change from background (30 day averaging duration)
   - Background TSS less than or equal to 250 mg/L: 25 mg/L induced change from background (1 day averaging duration)
   - Background TSS greater than 250 mg/L: 10% induced change from background (1 day averaging duration)

BOLD	- Exceedance of MWQSOG Freshwater Aquatic Life
Underline	- Exceedance of CCME Freshwater Aquatic Life

TABLE 5
METALS IN WATER
SUNTERRA PEAT MINE DEVELOPMENT

Sample No.	Date	Water Source	Parameter [1]																	
			Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Molybdenum
EQL			*0.005*	*0.0002*	*0.0002*	*0.0002*	*0.0002*	*0.0002*	*0.01*	*0.00001*	*0.10*	*0.0001*	0.001	*0.0002*	*0.0002*	*0.10*	*0.00009*	*0.002*	*0.01*	*0.0003*	*0.0002*
Ramsay Point Bog																					
SW-1	12-Oct-11	Ranger Lakes	0.049	<0.0002	0.00073	0.0050	<0.0002	<0.0002	0.012	<0.00001	2.78	<0.0001	<0.001	<0.0002	<0.0002	<0.10	0.00013	<0.002	2.37	0.01750	<0.0002
SW-2	12-Oct-11	Peat	**5.710**	0.0003	0.00577	0.1110	<0.0002	<0.0002	0.028	0.000500	14.9	0.00131	0.0071	0.00171	**0.0129**	**5.33**	**0.03090**	<0.002	7.16	0.62500	0.0005
SW-3	12-Oct-11	Roadside Drain	**0.996**	<0.0002	0.00090	0.0157	<0.0002	<0.0002	<0.010	<0.00001	23.5	<0.0001	0.0013	0.00042	0.0014	**0.80**	0.00041	0.0108	15.6	0.14900	<0.0002
SW-4	13-Oct-11	Lake Winnipeg	**1.450**	<0.0002	0.00270	0.0429	<0.0002	<0.0002	0.031	<0.00001	43.1	0.00013	0.0024	0.00073	0.0034	**1.28**	0.00082	0.0211	20.6	0.04640	0.0010
Little Deer Lake Bog																					
SW-5	11-Oct-11	Little Deer Lake	**0.110**	<0.0002	0.00074	0.0057	<0.0002	<0.0002	<0.010	<0.00001	11.8	<0.0001	<0.001	<0.0002	0.0006	0.20	0.00031	<0.002	3.17	0.04910	<0.0002
SW-6	11-Oct-11	Peat	**2.380**	<0.0002	0.00308	0.0673	<0.0002	<0.0002	0.018	0.000238	13.2	0.00072	0.0030	0.00067	**0.0061**	**1.75**	**0.01300**	<0.002	2.77	1.01000	<0.0002
Bullhead Bog																					
SW-7	13-Oct-11	Peat (Dry)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SW-8	13-Oct-11	Roadside Drain (Dry)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SW-9	13-Oct-11	Peat	**0.613**	<0.0002	0.00186	0.0119	<0.0002	<0.0002	<0.010	0.000067	5.38	0.00016	<0.001	0.00037	0.0022	**1.38**	**0.00346**	<0.002	1.76	0.08160	<0.0002
	SW-9 Dup	Peat	**1.380**	<0.0002	0.00329	0.0408	<0.0002	<0.0002	<0.010	0.000023	8.49	0.00026	0.0019	0.00063	**0.0042**	**2.60**	**0.00794**	0.0043	2.33	0.11000	0.0005
SW-10	13-Oct-11	Unnamed Creek	**2.560**	<0.0002	0.00373	0.0338	<0.0002	<0.0002	0.013	0.000079	25.0	0.00047	0.004	0.00308	0.0020	**7.81**	**0.00262**	0.0051	4.92	0.86500	<0.0002
SW-11	13-Oct-11	Lake Winnipeg	**1.090**	<0.0002	0.00258	0.0401	<0.0002	<0.0002	0.031	0.000012	39.4	0.00011	0.0018	0.00068	0.0034	**1.13**	0.00060	0.0176	18.7	0.07350	0.0010
BLANK	12-Oct-11		<0.005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.010	<0.00001	<0.10	<0.0001	<0.001	<0.0002	<0.0002	<0.10	<0.00009	<0.002	<0.01	<0.0003	<0.0002
MWQSOG [2]																					
Freshwater Aquatic Life			0.005; 0.1 [4]	-	[5]	-	-	-	-	[6]	-	-	-	-	[6]	0.3	[6]	-	-	-	0.073
CCME [3]																					
Freshwater Aquatic Life			0.005; 0.1 [4]	-	0.005	-	-	-	29 [7] 1.5 [8]	[9]	-	-	0.0089 (III), 0.001 (VI)	-	[9]	0.3	[9]	-	-	-	0.073

Sample No.	Date	Water Source	Parameter [1]																	
			Nickel	Phosphorus	Potassium	Rubidium	Selenium	Silicon	Silver	Sodium	Strontium	Tellurium	Thallium	Thorium	Tin	Titanium	Tungsten	Uranium	Vanadium	Zinc	Zirconium
EQL			*0.0020*	*0.20*	*0.020*	*0.0002*	*0.001*	*0.050*	*0.0001*	*0.03*	*0.0001*	*0.0002*	*0.0001*	*0.0001*	*0.0002*	*0.0002*	*0.001*	*0.0001*	*0.0002*	*0.005*	*0.0004*
Ramsay Point Bog																					
SW-1	12-Oct-11	Ranger Lakes	<0.0020	<0.20	1.180	0.00238	<0.001	0.92	<0.0001	1.760	0.0157	<0.0002	<0.0001	<0.0001	<0.0002	0.0006	<0.0010	<0.0001	0.0003	<0.005	<0.0004
SW-2	12-Oct-11	Peat	0.0064	2.66	7.520	0.02180	<0.001	12.6	**0.00051**	3.530	0.0444	<0.0002	0.0004	0.0002	0.00021	0.1200	<0.0010	0.00023	0.0120	0.0781	0.0014
SW-3	12-Oct-11	Roadside Drain	<0.0020	<0.20	1.460	0.00323	<0.001	11.8	<0.0001	4.340	0.0889	<0.0002	<0.0001	0.0002	<0.0002	0.0360	<0.0010	0.0004	0.0027	<0.005	0.0007
SW-4	13-Oct-11	Lake Winnipeg	0.0036	<0.20	4.790	0.00399	<0.001	4.75	<0.0001	18.80	0.1340	<0.0002	<0.0001	0.0004	<0.0002	0.0548	<0.0010	0.00269	0.0058	<0.005	0.0009
Little Deer Lake Bog																					
SW-5	11-Oct-11	Little Deer Lake	<0.0020	<0.20	0.717	0.00172	<0.001	1.42	<0.0001	0.806	0.0172	<0.0002	<0.0001	<0.0001	<0.0002	0.0027	<0.0010	<0.0001	0.0007	<0.005	<0.0004
SW-6	11-Oct-11	Peat	0.0022	0.94	3.400	0.01100	<0.001	7.48	<0.0001	0.846	0.0221	<0.0002	<0.0001	<0.0001	0.00075	0.0470	<0.0010	<0.0001	0.0069	**0.127**	0.0006
Bullhead Bog																					
SW-7	13-Oct-11	Peat (Dry)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SW-8	13-Oct-11	Roadside Drain (Dry)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SW-9	13-Oct-11	Peat	<0.0020	0.36	1.040	0.00317	<0.001	5.57	<0.0001	0.872	0.0117	<0.0002	<0.0001	<0.0001	<0.0002	0.0102	<0.0010	<0.0001	0.0015	0.0151	<0.0004
	SW-9 Dup	Peat	0.0023	0.91	1.560	0.00490	<0.001	8.62	<0.0001	0.870	0.0199	<0.0002	<0.0001	<0.0001	<0.0002	0.0268	<0.0010	<0.0001	0.0036	0.0249	0.0005
SW-10	13-Oct-11	Unnamed Creek	0.0026	<0.20	1.380	0.00718	<0.001	8.94	<0.0001	1.050	0.0305	<0.0002	<0.0001	0.0005	<0.0002	0.0811	<0.0010	0.00029	0.0058	0.0209	0.0008
SW-11	13-Oct-11	Lake Winnipeg	0.0032	<0.20	4.600	0.00387	<0.001	5.57	<0.0001	17.60	0.1270	<0.0002	<0.0001	0.0003	<0.0002	0.0451	<0.0010	0.00223	0.0049	<0.005	0.0008
BLANK	12-Oct-11		<0.0020	<0.20	<0.020	<0.0002	<0.001	<0.050	<0.0001	<0.030	<0.0001	<0.0002	<0.0001	<0.0001	<0.0002	<0.0002	<0.0010	<0.0001	<0.0002	<0.005	<0.0004
MWQSOG [2]																					
Freshwater Aquatic Life			[6]	-	-	-	0.001	-	0.0001	-	-	-	0.0008	-	-	-	-	-	-	[6]	-
CCME [3]																					
Freshwater Aquatic Life			[9]	[10]	-	-	0.001	-	0.0001	-	-	-	0.0008	-	-	-	-	-	-	0.03	-

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TABLE 5
METALS IN WATER
SUNTERRA PEAT MINE DEVELOPMENT

Notes:

1. All values are expressed in milligrams per litre (mg/L).
2. Manitoba Surface Water Quality Objectives, Manitoba Conservation Report 2002-11, Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG), November 22, 2002.
3. CCME - Canadian Council of Ministers of the Environment. Canadian Environmental Quality Guidelines, 1999. Updated 2011.
   Guidelines for Canadian Drinking Water Quality. Chapter 4 - Aquatic Life
4. Total aluminum should not exceed 0.005 mg/L in waters with a pH below 6.5.
   The concentration of total aluminum should not exceed 0.1 mg/L in waters with a pH greater or equal to 6.5.
5. Arsenic Tier II Objectives:
   0.15 mg/L = Duration 4 Days, Not more than once each 3 years, on average
   0.34 mg/L = Duration 1 Hour, Not more than once each 3 years, on average
6. See Tier II Objectives for calculations (averaging 4 day duration).

Sample No.	*Hardness*	*Cadmium*	*Copper*	*Lead*	*Nickel*	*Zinc*
SW-1	16.70	0.00059	0.00194	0.00034	0.0114	0.0259
SW-2	66.70	0.00166	0.00634	0.00162	0.0369	0.0838
SW-3	123.00	0.00261	0.01069	0.00315	0.0620	0.1408
SW-4	193.00	0.00364	0.01571	0.00511	0.0907	0.2062
SW-5	42.50	0.00119	0.00431	0.00098	0.0252	0.0572
SW-6	44.30	0.00123	0.00447	0.00103	0.0261	0.0593
SW-9	20.70	0.00070	0.00233	0.00044	0.0137	0.0311
Sw-9 Dup	30.80	0.00094	0.00327	0.00068	0.0192	0.0436
SW-10	82.60	0.00194	0.00761	0.00204	0.0442	0.1005
SW-11	176.00	0.00340	0.01452	0.00463	0.0839	0.1907

7. Short-term exposure periods (24 to 96 hours) on the impacts of severe transient situations (spill events to aquatic receiving environments and infrequent releases of short-lived/non persistent substances).
8. Long-term exposure guidelines that protect all forms of aquatic life for indefinite exposure periods (>7d exposures for fish and invertebrates, 24h exposures for aquatic plants and algae).
9. For the following equations, hardness is expressed as $CaCO_3$ in mg/L and the calculated guideline is in µg/L; however for the tables below the guideline values were further modified to be expressed in mg/L .

Cadmium Guideline = 10^{0.86[log(hardness)] - 3.2} µg/L; **Copper** Guideline = e^(0.8545[ln(hardness)]-1.465) * 0.2 µg/L; **Lead** Guideline = e^(1.273[ln(hardness)]-4.705) µg/L; **Nickel** Guideline = e^(0.76[ln(hardness)]+1.06) µg/L

Sample No.	*Hardness*	*Cadmium*	*Copper*	*Lead*	*Nickel*
SW-1	16.70	0.00000710	0.000512	0.000326	0.02453
SW-2	66.70	0.00002337	0.001673	0.001900	0.07026
SW-3	123.00	0.00003957	0.002822	0.004141	0.11186
SW-4	193.00	0.00005829	0.004148	0.007348	0.15753
SW-5	42.50	0.00001586	0.001138	0.001070	0.04988
SW-6	44.30	0.00001644	0.001179	0.001129	0.05148
SW-9	20.70	0.00000855	0.000616	0.000428	0.02887
Sw-9 Dup	30.80	0.00001203	0.000864	0.000711	0.03905
SW-10	82.60	0.00002809	0.002008	0.002494	0.08265
SW-11	176.00	0.00005384	0.003833	0.006534	0.14687

10. If trigger ranges for total phosphorous are exceeded, the potential exists for an environmental impact. If trigger range is not exceeded, but TP is more than 50% above baseline values, the potential exists for an environmental impact.

Trigger ranges (mg/L):				
	ultra-oligotrophic	<0.004	meso-eutrophic	0.020-0.035
	oligotrophic	0.004-0.010	eutrophic	0.035-0.100
	mesotrophic	0.010-0.020	hyper-eutrophic	>0.100

BOLD	- Exceedance of MWQSOG Freshwater Aquatic Life Criteria
UNDERLINE	- Exceedance of CCME Freshwater Aquatic Life Criteria

TABLE 6
VEGETATION SPECIES LIST
SUNTERRA PEAT MINE DEVELOPMENT

Species		Proposed Development Areas			Status		
Common Name	**Scientific Name**	**Bullhead**	**Little DeerLake**	**Ramsay Point**	**Provincial (S)**	**COSEWIC**	**National (G)**
Trees							
Balsam fir	*Abies balsamea*	•	•	•	S5	-	G5
Balsam poplar	*Populus balsamea*	•	•	•	S5	-	G5
Black spruce	*Picea mariana*	•	•	•	S5	-	G5
Jack pine	*Pinus banksiana*			•	S5	-	G5
Northern mountain ash	*Sorbus decora*	•			S4	-	G4G5
Tamarak	*Larix laricina*	•	•	•	S5	-	G5
Trembling aspen	*Populus tremuloides*	•			S5	-	G5
White birch	*Betula papyrifera*	•		•	S5	-	G5
White spruce	*Picea glauca*	•			S5	-	G5
Shrubs							
Alderleaf buckthorn	*Rhamnus alnifolia*	•			S5	-	G5
Baneberry	*Actaea rubra*	•			S5	-	G5
Common blueberry	*Vaccinium myrtilloides*	•	•	•	S5	-	G5
Common Labrador tea	*Ledum groenlandicum*	•	•	•	S5	-	G5
Creeping snowberry	*Gaultheria hispidula*	•	•	•	S5	-	G5
Fire cherry	*Prunus pensylvanica*	•			S5	-	G5
Highbush cranberry	*Viburnum opulus var. americanum*	•		•	S5	-	G5T5
Leather leaf	*Chamaedaphne calyculata*	•	•	•	S5	-	G5
Mountain cranberry	*Vaccinium vitis-idaea*	•	•	•	S5	-	G5
Mountain maple	*Acer spicatum*	•		•	S5	-	G5
Northern bush-honeysuckle	*Diervilla lonicera*	•			S5	-	G5
Northern gooseberry	*Ribes oxyacanthoides*	•	•	•	S5	-	G5
Raspberry	*Rubus idaeus*			•	S5	-	G5
Red-osier dogwood	*Cornus sericea*	•		•	S5	-	G5
Skunk currant	*Ribes glandulosum*	•		•	S5	-	G5
Small cranberry	*Oxycoccus microcarpus*	•	•	•	S5	-	G5
Snowberry	*Symphoricarpos albus*	•			S5	-	G5
Speckled alder	*Alnus incana ssp. rugosa*	•	•	•	S5	-	G5T5
Squashberry	*Viburnum edule*	•		•	S5	-	G5
Swamp birch	*Betula pumila*	•	•	•	S5	-	G5
Sweet bayberry	*Myrica gale*	•		•	S5	-	G5
Wild black currant	*Ribes americanum*	•			S5	-	G5
Willow	*Salix* spp.			•	-	-	-
Wood's rose	*Rosa woodsii*	•	•	•	S4	-	G5
Herbaceous Vegetation							
Arrow-leaved colt's foot	*Petasites sagittatus*	•		•	S5	-	G5
Beaked hazelnut	*Corylus cornuta*	•			S5	-	G5
Bog rosemary	*Andromeda glaucophylla*	•	•	•	S4	-	G5T5
Buck-bean	*Menyanthes trifoliata*	•	•	•	S5	-	G5
Canada thistle	*Cirsium arvense*			•	SNA	-	GNR
Canada wild ginger	*Asarum canadense*			•	S3S4	-	G5
Cloudberry	*Rubus chamaemorus*	•	•	•	S5	-	G5
Common dandelion	*Taraxacum officinale*			•	S5	-	G5
Common wintergreen	*Chimaphila umbellata*	•		•	S4S5	-	G5
Dwarf dogwood	*Cornus canadensis*	•	•	•	S5	-	G5
Dwarf raspberry	*Rubus pubescens*	•	•		S5	-	G5
Dwarf scouring rush	*Equisetum scirpoides*	•		•	S5	-	G5
Enchanter's nightshade	*Circaea alpina*	•			S5	-	G5
Fairy-slipper	*Calypso bulbosa*	•			S4	-	G5
Fireweed	*Chamerion angustifolium*			•	S5	-	G5
Goldenrod	*Solidago* spp.			•	-	-	-
Goldthread	*Coptis trifolia*	•	•		S5	-	G5

TABLE 6
VEGETATION SPECIES LIST
SUNTERRA PEAT MINE DEVELOPMENT

Species		Proposed Development Areas			Status		
Common Name	**Scientific Name**	**Bullhead**	**Little DeerLake**	**Ramsay Point**	**Provincial (S)**	**COSEWIC**	**National (G)**
Herbaceous Vegetation (cont'd)							
Kidney-leaved violet	*Viola renifolia*	•	•	•	S5	-	G5
Lesser rattlesnake-orchid	*Goodyera repens*	•			S5	-	G5
Loesel's twayblade	*Liparis loeselii*	•			S3S4	-	G5
Lung wort	*Mertensia paniculata*		•		S5	-	G5
Marsh cinqfoil	*Comarum palustre*	•	•	•	S5	-	G5
Marsh marigold	*Caltha palustris*	•	•	•	S5	-	G5
Naked bishop's cap	*Mitella nuda*	•	•	•	S5	-	G5
Northern bedstraw	*Galium boreal*	•	•		S5	-	G5
Northern bog violet	*Viola nephrophylla*	•		•	S5	-	G5
Northern comandra	*Geocaulon lividum*			•	S5	-	G5
Northern pitcher plant	*Sarracenia purpurea*	•	•	•	S5	-	G5
Northern starflower	*Trientalis borealis*	•	•	•	S5	-	G5
One flowered wintergreen	*Monesis uniflora*	•	•		S5	-	G5
One-sided wintergreen	*Orthilia secunda*	•		•	S5	-	G5
Orange jewelweed	*Impatiens capensis*			•	S5	-	G5
Pale laurel	*Kalmia polifolia*	•	•	•	S5	-	G5
Palmate-leaved colt's foot	*Petasites palamatus*	•	•	•	S5	-	G5T5
Pink wintergreen	*Pyrola asarifolia*	•		•	S5	-	G5
Pixie-cup	*Cladonia* spp.		•		-	-	-
Running club moss	*Lycopodium clavatum*	•			S4	-	G5
Smooth veiny peavine	*Lathyrus venosus*	•			S5	-	G5
Starflower Solomon's-plume	*Maianthemum stellatum*	•		•	S5	-	G5
Stemless lady's slipper	*Cypripedium acaule*			•	S4	-	G5
Sweet-scented bedstraw	*Galium triflorum*	•	•	•	S5	-	G5
Tall bluebells	*Mertensia paniculata*	•		•	S5	-	G5
Three-leaved solomon's seal	*Maianthemum trifolium*	•	•	•	S5	-	G5
Twinflower	*Linnaea borealis*	•	•		S5	-	G5
Water arum	*Calla palustris*	•	•	•	S5	-	G5
Wild lily-of-the-valley	*Maianthemum canadensis*	•	•	•	S5	-	G5
Wild sarsaparila	*Aralia nudicaulus*	•	•	•	S5	-	G5
Wild strawberry	*Fragaria vesca*			•	S4S5	-	G5
Yellow avens	*Geum aleppicum*		•	•	S5	-	G5
Cattails, Grasses, Sedges and Rushes							
Bebb's sedge	*Carex bebbii*		•	•	S5	-	G5
Blueflag	*Iris versicolor*			•	S4	-	G5
Bluejoint	*Calamagrostis canadensis*	•	•	•	S5	-	G5
Broad-leaved cattail	*Typha latifolia*			•	S5	-	G5
Drooping wood reed	*Cinna latifolia*	•			S5	-	G5
Few-flowered sedge	*Carex pauciflora*	•	•		S3	-	G5
Hardstem bulrush	*Schoenoplectus acutus*			•	S4	-	G5
Inland sedge	*Carex interior*	•			S4?	-	G5
Lake-bank sedge	*Carex lacustris*	•	•	•	S5	-	G5
Mud sedge	*Carex limosa*	•	•	•	S5	-	G5
Narrow-leaved cottongrass	*Eriophorum angustifolium*	•	•	•	S5	-	G5
Rough-leaved rice grass	*Oryzopsis asarifolia*	•	•		S5	-	G5
Sheathed sedge	*Carex vaginata*	•			S5	-	G5
Softleaf sedge	*Carex disperma*	•		•	S5	-	G5
Spike rush	*Eleocharis* spp.			•	-	-	-
Water sedge	*Carex aquatilis*	•	•		S5	-	G5
Wooly sedge	*Carex pellita*		•	•	S5	-	G5

TABLE 6
VEGETATION SPECIES LIST
SUNTERRA PEAT MINE DEVELOPMENT

Species		Proposed Development Areas			Status		
Common Name	**Scientific Name**	**Bullhead**	**Little DeerLake**	**Ramsay Point**	**Provincial (S)**	**COSEWIC**	**National (G)**
Clubmosses, Horsetails, Ferns and Mosses							
Beaked moss	*Eurynchium* spp.	•	•	•	-	-	-
Broom moss	*Dicranum* spp.	•	•	•	-	-	-
Feather moss	*Pleurzium schreberi*	•	•	•	SNR	-	G5
Field horsetail	*Equisetum arvense*	•	•	•	S5	-	G5
Grey reindeer lichen	*Cladina rangiferina*	•	•	•	SNR	-	G5
Hair-cap moss	*Polytrichum* spp.	•		•	-	-	-
Knight's-plume moss	*Ptillium crista-castrensis*	•	•		SNR	-	G5
Meadow horsetail	*Equisetum pratense*	•			S4S5	-	G5
Neckera moss	*Neckera pennata*	•		•	SNR	-	G5
Oak fern	*Gymnocarpium dryopteris*	•		•	S5	-	G5
Old man's beard	*Usnea* spp.	•	•		-	-	-
Peat moss	*Sphagnum* spp.	•	•	•	-	-	-
Ribbed bog moss	*Aulacomnium* spp.	•		•	-	-	-
Spinulose shield fern	*Dryopteris carthusiana*	•	•	•	S5	-	G5
Stair-step moss	*Hylocomium splendens*	•	•	•	SNR	-	G5
Stiff club-moss	*Lycopodium annotinum*	•			S5	-	G5
Tree moss	*Climacium dendroides*	•		•	SNR	-	G5
Water horsetail	*Equisetum fluviatile*	•	•		S5	-	G5

Notes:
Provincial Status (S-Rank): S1= Very rare throughout range, S2= Rare throughout range, S3= Uncommon throughout range, S4= Widespread and apparently secure, S5= Abundant and secure, SNR = Rank not yet assigned.
Global Status (G-rank): G1= Critically Imperiled, G2= Imperiled, G3= Vulnerable, G4= Apparently Secure, G5= Secure, G#G# indicates range of uncertainty in status
Status modifiers: T = Ranking for subspecies or varieties.
? =Inexact or uncertain; for numeric ranks, denotes inexactness.
COSEWIC descriptors - = No protection designation assigned

TABLE 7
WILDLIFE SPECIES LIST
SUNTERRA PEAT MINE DEVELOPMENT

Species			Proposed Development Areas			Status		
Common Name	**Scientific Name**	**Observation**	**Bullhead**	**Little Deer Lake**	**Ramsay Point**	**Provincial (S)**	**COSEWIC**	**National (G)**
Mammals								
American marten	*Martes americana*	Observed (1)		•		S5	-	G5
Moose	*Alces americanus*	Tracks/Scat/Trails	•	•	•	S5	-	G5
Red squirrel	*Tamiasciurus hudsonicus*	Midden/Observed/Auditory	•	•		S5	-	G5
White tailed deer	*Odocoileus virginianus*	Observed (1)	•	•	•	S5	-	G5
Amphibian and Reptiles								
Boreal chorus frog	*Pseudacris maculata*	Observed	•			S5	-	G5
Birds								
Alder flycatcher	*Empidonax alnorum*	Auditory			•	S5B	-	G5
American redstart	*Setophaga ruticilla*	Observed/Auditory			•	S5B	-	G5
American robin	*Turdus migratorius*	Observed/Auditory			•	S5B	-	G5
Bay-breasted warbler	*Dendroica castanea*	Auditory	•			S4S5B	-	G5
Black-and-white warbler	*Mniotilta varia*	Observed/Auditory	•		•	S5B	-	G5
Blackburnian warbler	*Dendroica fusca*	Auditory	•			S5B	-	G5
Black-throated blue warbler	*Dendroica caerulescens*	Auditory	•			SNR	-	G5
Black-throated green warbler	*Dendroica virens*	Aditory	•		•	S4S5B	-	G5
Blue-headed vireo	*Vireo solitarius*	Auditory			•	S5B	-	G5
Blue jay	*Cyanocitta cristata*	Auditory			•	S5	-	G5
Bonaparte's gull	*Chroicocephalus philadelphia*	Observed				S5B	-	G5
Boreal chickadee	*Poecile hudsonicus*	Observed/Auditory	•	•	•	S4	-	G5
Broad-winged hawk	*Buteo platypterus*	Observed/Auditory			•	S4S5B	-	G5
Canada warbler	*Wilsonia canadensis*	Observed/Auditory	•			S4B	-	G5
Cape May Warbler	*Dendroica tigrina*	Auditory	•			S5B	-	G5
Chipping sparrow	*Spizella passerina*	Auditory			•	S5B	-	G5
Common loon	*Gavia immer*	Auditory		•	•	S4S5B	NAR	G5
Common raven	*Corvus corax*	Auditory/Observed	•			S5	-	G5
Common yellowthroat	*Geothlypis trichas*	Auditory			•	S5B	-	G5
Dark-eyed junco	*Junco hyemalis*	Observed		•	•	S5B	-	G5
Gray jay	*Perisoreus canadensis*	Observed/Auditory		•		S5	-	G5
Great blue heron	*Ardea herodias*	Observed			•	S4S5B	-	G5
Hermit thrush	*Catharus guttatus*	Auditory			•	S5B	-	G5
Least flycatcher	*Empidonax minimus*	Auditory	•	•	•	S5B	-	G5
Lincoln's sparrow	*Melospiza lincolnii*	Auditory		•	•	S5B	-	G5
Magnolia warbler	*Dendroica magnolia*	Auditory/Observed	•		•	S5B	-	G5
Marsh wren	*Cistothorus palustris*	Auditory			•	S5B	-	G5
Mourning warbler	*Oporornis philadelphia*	Auditory			•	S5B	-	G5
Nashville warbler	*Oreothlypis ruficapilla*	Auditory	•		•	S5B	-	G5
Northern harrier	*Circus cyaneus*	Observed		•	•	S4B	NAR	G5
Olive-sided flycatcher	*Contopus cooperi*	Auditory			•	S3S4B	**T**	G4
Ovenbird	*Seiurus aurocapilla*	Auditory			•	S5B	-	G5
Palm warbler	*Dendroica palmarum*	Auditory/Observed		•		S5B	-	G5
Pileated woodpecker	*Dryocopus pileatus*	Drilling Holes	•			S5	-	G5
Red-breasted nuthatch	*Sitta canadensis*	Auditory	•	•	•	S5	-	G5
Red-eyed vireo	*Vireo olivaceus*	Auditory	•		•	S5B	-	G5
Rose-breasted grosbeak	*Pheucticus ludovicianus*	Auditory			•	S4S5B	-	G5
Ruby-crowned kinglet	*Regulus calendula*	Auditory	•	•	•	S5B	-	G5
Ruby-throated hummingbird	*Archilochus colubris*	Observed	•	•		S5B	-	G5
Sandhill crane	*Grus canadensis*	Auditory	•	•	•	S5B	-	G5
Savannah sparrow	*Passerculus sandwichensis*	Auditory/Observed			•	S5B	-	G5
Spruce grouse	*Falcipennis canadensis*	Observed	•			S4S5	-	G5
Swamp sparrow	*Melospiza georgiana*	Auditory			•	S5B	-	G5
Tennessee warbler	*Oreothlypis peregrina*	Auditory			•	S5B	-	G5
Veery	*Catharus fuscescens*	Auditory			•	S4S5B	-	G5
White-throated sparrow	*Zonotrichia albicollis*	Auditory	•		•	S5B	-	G5
Wilson's snipe	*Gallinago delicata*	Auditory/Observed			•	S5B	-	G5

Notes:
(1) Seen from road in the vicinity of indicated area
Provincial Status (S-Rank): S1= Very rare throughout range, S2= Rare throughout range, S3= Uncommon throughout range, S4= Widespread and apparently secure, S5= Abundant and secure, SNR = Rank not yet assigned
Global Status (G-rank): G1= Critically Imperiled, G2= Imperiled, G3= Vulnerable, G4= Apparently Secure, G5= Secure G#G# indicates range of uncertainty in status
Status modifiers: B = For a migratory species, rank applies to the breeding population in the province
COSEWIC descriptors - = No protection designation assigned
NAR = not at risk of extinction
T = A wildlfe species likely to become endagered if not action taker

TABLE 8
AQUATIC BIOTA SURVEY
SUNTERRA PEAT MINE DEVELOPMENT

Sample Location	Sample Date	Scientific Name	Common Name	Fork Length (mm)	Weight (g)
GN 1	17-May-11	*Esox lucius*	northern pike	n/d	n/d
				333	220
				478	590
				484	900
				480	880
				505	1000
GN 2	17-May-11	*Esox lucius*	northern pike	373	310
				555	900
GN 3	18-May-11	*Esox lucius*	northern pike	518	790
				558	880
GN 4	18-May-11	*Esox lucius*	northern pike	445	550
				459	700
GN 5	18-May-11	*Esox lucius*	northern pike	458	600
GN 6	18-May-11	*Esox lucius*	northern pike	--	--
GN 7	18-May-11	*Esox lucius*	northern pike	500	800
				493	700
GN 8	18-May-11	*Esox lucius*	northern pike	448	550
				466	625
				476	825
				490	800
				547	950
				494	725
				460	600
				548	1150
GN 9	18-May-11	*Esox lucius*	northern pike	467	700
GN 10	18-May-11	*Esox lucius*	northern pike	444	650

Notes:
GN = Gill Net; a 2 and 3 inch pannel were set at each location
n/d = Fish identified in net, fell off net before being sampled
"--" = No fish captured during net set

TABLE 11

CATEGORIES OF ADVERSE BIOPHYSICAL, SOCIO-ECONOMIC AND CULTURAL EFFECTS

Adversity Category	Biophysical	Socio-Economic	Physical and Cultural Heritage
Negligible	Effect on the population or a specific group of individuals at a local project area and/or over a short period in such a way as to be similar to small random changes in the population due to environmental irregularities but having no measurable effect on the population as a whole.	Effect of either very short duration or affects a small group of people or which occurs in the local project area in a manner similar to small random changes to extraneous irregularities, but having no measurable effect on the population as a whole.	Effect on physical and cultural heritage resources of short duration and in the local project area. The effect on physical and cultural resources is not detectable. The resources are not publicly recognized or protected by legislation.
Minor	Effect on a specific group of individuals in a population in the project area and/or over a short period (one generation or less), but not affecting other trophic levels or the integrity of the population itself.	Effect either of short-term duration or affects a specific group of people in the local project area but not necessarily affecting the integrity of the entire group itself.	Effect on physical and cultural heritage resources of short duration but over the adjacent local area. The effect on physical and cultural resources is minor or repairable. The resources are publicly recognized but not protected by legislation.
Moderate	Effect on a portion of a population that results in a change in abundance and/or distribution over one or more generations of that portion of the population or any population dependent upon it, but does not change the integrity of any population as a whole. The effect may be localized.	Effect either of medium-term duration (which affects one or two generations and/or the portion of the population dependent upon it) or affects a moderate portion of the population without affecting the integrity of the population as a whole.	Effects on physical and cultural heritage resources of moderate duration. Resources affected over the adjacent local area. The effect on physical and cultural resources is reversible. The resources are protected by legislation.
Major	Effect on a whole stock or population of a species in sufficient magnitude to cause a decline in abundance and/or change in distribution beyond which natural recruitment would not return that population or species dependent upon it, to its former level within several generations.	Effect either of long duration (lasting several generations) or affecting an entire definable group of people in sufficient magnitude to cause severe change in economic, physical or psychological well-being or long established activity patterns that would not return to pre-project levels or patterns within several generations.	Effect on physical and cultural heritage resources of long duration. Resources affected over large regional area. There is an irreversible effect on physical/cultural resources. The resources are protected by legislation.

TABLE 12

CRITERIA AND RATINGS FOR EVALUATING SIGNIFICANCE

Criteria	Rating		
	1	2	3
a) Societal value of the affected environmental components – includes nature and degree of protection provided	Not valuable (no designation)	Moderately valuable (designated or protected locally, regionally or provincially)	Highly valuable (designated or protected nationally or internationally)
b) Ecological value – includes rarity and uniqueness, fragility, importance within ecosystem, importance to scientific studies	Not valuable	Moderately valuable	Highly valuable
c) Duration – length of time the project activity will last	Short-term (less than 1 year)	Moderate (between 1 and 100 years)	Long-term (more than 100 years)
d) Frequency – rate of reoccurrence of the project activity causing the effect	Rarely (less than once per year)	Sporadically (less than once per month)	Frequently (more than once per week)
e) Geographic extent – area over which the effect will occur	Single point	Localized	Regional or greater
f) Magnitude – predicted disturbance compared to existing conditions	No measurable disturbance	Measurable disturbance but no loss of function	Measurable disturbance with loss of function
g) Reversibility – time the environmental component will take to recover after the source of the effect ceases	Less than a year	Between 1 and 100 years	Irreversible

TABLE 13

ENVIRONMENTAL EFFECTS ANALYSIS SUMMARY FOR THE PROPOSED PEAT HARVESTING DEVELOPMENT

Environmental Effect	Adversity (Table 11)	Mitigation Measures	Follow-up	Significance (S)* (see Table 12)							
				a	b	c	d	e	f	g	S
Microclimate											
Changes in airflow, wind speed and snow deposition pattern	Minor	- Install snow fences to control snow deposition on the property if required	- Observe for changes in airflow patterns and snow deposition periodically	1	2	2	2	2	1	2	N
Air Quality											
Increased fugitive dust from site preparation, construction, operation and reclamation activities	Moderate	- Use approved dust suppressant - Minimize peat handling activities during high wind events - Reduce exposed peat area (harvesting fields and peat stockpiles) to prevailing winds - Control vehicle speeds - Instruct employees on proper harvest equipment operation to minimize dust - Cover loads being hauled from the site - Re-vegetate harvested areas - Utilize windbreaks (tree and brush barriers)	- Observe site periodically for fugitive dust levels - Perform inspections of local area for accumulated dust - Track public complaints	2	1	2	3	3	2	1	N
Increased levels of NO_x, SO_2, greenhouse gases and VOCs from equipment and vehicle emissions during site preparation, peat harvesting and transporting activities, construction materials and fuel use	Minor	- Use low sulphur fuels - Require a high standard of maintenance of equipments and vehicles - Limit unnecessary long-term idling - Use appropriate fuel dispensing equipment	- Perform periodic inspections of air quality during construction - Record maintenance of heavy equipment - Require submission of MSDSs for all products used	2	1	2	3	3	2	1	N
Increased releases of GHG into the atmosphere from clearing and land use change associated with peat-harvesting activities	Minor	- Minimize the areas cleared - Prepare and implement a reclamation plan that restores the area to a carbon sink condition	- Adhere to licence terms and conditions	3	1	2	3	3	1	2	N

Table 13 Cont'd

Environmental Effect	Adversity (Table 11)	Mitigation Measures	Follow-up	Significance (S)* (see Table 12)							
				a	b	c	d	e	f	g	S
Soils											
Loss and disturbance of surface soil during site preparation and harvesting activities	Major	- Minimize the surface area disturbed - Leave non-commercial peat reserves in place - Prepare and implement a Mine Closure plan to restore the area to natural conditions	- Monitor annually and report on implementation of progressive restoration activities	1	2	2	3	2	3	2	N
Contamination of soils from leaks and accidental spills and releases of fuel or other hazardous substances	Moderate	- Prevent leaks, spills and releases - Provide ULC Certified double-walled fuel storage tanks with spill prevention and leak detection - Require drip trays for equipment - Designate fuel storage and re-fueling areas - Ensure equipment arrives to site in good condition - Provide spill clean-up equipment and materials - Provide an emergency spill response plan	- Perform periodic inspections for leaks, spills and releases - Ensure construction and operation crews adhere to designated areas - Remediate and record fuel spills and releases - Adhere to licence terms and conditions - Update the emergency spill response plan periodically	3	2	2	1	1	2	1	N
Surface Water											
Loss of small ponds and intermittent streams due to site drainage for peat harvesting operations	Moderate	- Minimize the area disturbed - Formulate a drainage plan to maintain the natural drainage patterns - Maintain water levels on adjacent undisturbed lands - Prepare and implement a mine closure plan to restore predevelopment water levels	- Perform periodic inspections of surface waters - Report annually on implementation of the mine closure activities	1	2	2	3	2	3	1	N
Modified surface water runoff flow rate due to site drainage and land profiling activities during construction	Minor	- None proposed	- Monitor discharge flow rates from peat development according to licence terms and conditions	2	1	2	3	2	2	1	N

Table 13 Cont'd

Environmental Effect	Adversity (Table 11)	Mitigation Measures	Follow-up	Significance (S)* (see Table 12)							
				a	b	c	d	e	f	g	S
Increased suspended sediment levels in surface water	Moderate	- Direct drainage water into sedimentation ponds equipped with floating booms before discharging by an outlet to existing drainage system	- Collect weekly surface water samples from each outlet for TSS analysis - Clean drainage ditches and sedimentation ponds on a regular basis - Perform periodic inspections for evidence of erosion - Adhere to licence terms and conditions - Conduct additional monitoring if required in consultation with Manitoba Conservation	3	2	2	3	2	2	1	N
Alteration of surface water chemistry of downstream receiving waters	Minor	- Use a sedimentation pond to control the discharge rate of drainage water into the existing drainage system - If necessary, install a limestone or carbonate-lined drainage ditch to increase pH of draining bog water	- Collect weekly surface water samples from each outlet for pH analysis	3	2	2	3	2	1	1	N
Contamination of surface water from leaks and accidental spills and releases of fuels or other hazardous substances	Moderate	- Follow mitigation measures identified for leaks and spills in soil	- Apply follow-up as identified for leaks and spills in soil	3	2	2	1	1	2	2	N
Groundwater											
Contamination of groundwater from leaks and accidental spills and releases of fuels or other hazardous substances	Minor	- Follow mitigation measures identified for leaks and spills in soil - Ensure new supply well in staging areas are properly sealed at ground level	- Apply follow-up as identified for leaks and spills in soil	3	1	2	1	1	1	2	N

Table 13 Cont'd

Environmental Effect	Adversity (Table 11)	Mitigation Measures	Follow-up	Significance (S)* (see Table 12)							
				a	b	c	d	e	f	g	S
Vegetation											
Loss and disturbance of terrestrial vegetation during site preparation and construction	Moderate	- Minimize loss and disturbance of vegetation - Limit construction activities to designated areas - Utilize timber removed from site - Re-vegetate disturbed or reclaimed areas	- Perform periodic inspections for vegetation stress and mortality around the cleared area - Perform periodic inspections for invasion of nuisance or weed species - Report annually on restoration activities implemented	1	2	2	3	2	2	2	N
Impairment of vegetation from dust accumulation during operation	Minor	- Control dust using approved suppressant - Curtail construction and operation during high wind events	- Perform periodic inspections of local area for accumulated dust	1	2	2	2	2	1	1	N
Risk of fire during construction and operation	Major	- Prepare and implement an emergency response plan consistent with provincial and municipal legislation, codes and guidelines - Provide fire suppression equipment on-site (extinguishers, pumping equipment, shovels, etc.) - Notify Manitoba Conservation immediately if a fire or explosion occurs	- Examine fire fighting equipment regularly - Conduct periodic testing, evaluation and updating of the emergency response plan - Provide employee education and training in the use of this equipment regularly	2	3	1	1	3	2	2	N
Mammals / Habitat											
Loss and disturbance of wildlife habitat during site preparation activities	Minor	- Minimize loss and disturbance to vegetation - Limit construction to area designated - Limit operation activities to areas disturbed during construction - Re-vegetate disturbed or reclaimed areas	- Perform periodic inspections during construction and operation - Maintain re-vegetated areas - Ensure adherence to environmental guidelines and protocols	1	2	2	2	2	2	2	N
Loss and disturbance of large, small and burrowing mammals during construction and operation activities	Minor	- Minimize the area of disturbance by limiting construction to designated areas - Limit operation activities to areas disturbed during construction - Maintain habitat around the QL's - Implement a closure plan to restore wildlife habitat	- Adhere to licence terms and conditions - Maintain re-vegetated areas	1	2	2	3	2	2	2	N

Table 13 Cont'd

Environmental Effect	Adversity (Table 11)	Mitigation Measures	Follow-up	Significance (S)* (see Table 12)							
				a	b	c	d	e	f	g	S
Increased wildlife-vehicle interactions during peat transportation	Negligible	- Provide wildlife awareness information to drivers - Adhere to posted speed limits	- Maintain records of vehicle-wildlife interactions	1	1	2	3	3	1	2	N
Attraction of problem or nuisance animals	Minor	- Bear-proof garbage containers - Regular disposal of waste at existing waste facilities - Use animal deterrents such as noise-makers, reflectors and scents if required	- Maintain records of problem or nuisance wildlife - Adhere to licence terms and conditions	1	1	2	3	2	1	1	N
Birds / Habitat											
Loss and disturbance of bird and waterfowl habitat during site preparation and construction	Moderate	- Minimize disturbance of vegetation around water bodies with buffer zones - Schedule clearing outside of critical nesting and rearing periods (May 1 to July 31) - Limit activities to designated areas - Re-vegetate disturbed or reclaimed areas during and after operation	- Perform periodic inspections during site preparation for signs of potential effects - Maintain buffer zones - Maintain re-vegetated areas	3	2	2	2	2	2	1	N
Disturbance of bird nesting during operation activities	Minor	- Maintain 100 m buffer zone between harvesting and potential bird habitat and water bodies - Limit operation activities to areas disturbed during construction	- periodic observations of bird nesting and rearing activities and success - Adhere to licence terms and conditions	3	2	2	3	2	1	1	N
Aquatic Biota / Habitat											
Disturbance to aquatic biota and habitat due to elevated levels of suspended sediment in peatland drainage water	Minor	-Use of properly designed and operated settling ponds	- Perform periodic inspections of sedimentation ponds for debris - Clean drainage ditches and sedimentation ponds on a regular basis - Monitor effluent for TSS levels on a weekly basis	3	2	2	3	2	1	1	N

Table 13 Cont'd

Environmental Effect	Adversity (Table 11)	Mitigation Measures	Follow-up	Significance (S)* (see Table 12)							
				a	b	c	d	e	f	g	S
Disturbance of habitat due to construction activities involved in installation of culvert crossings	Minor	- Follow the Manitoba Stream Crossing Guidelines for the protection of Fish and Fish Habitat - Follow best management practices (re: timing window, sediment/erosion control, revegetation, etc.) - Install culverts such that low flow connectivity is maintained - Ensure culverts are large enough to permit fish passage	- Perform periodic inspections of the installed culverts to ensure that the pipe is not blocked by sediment or debris	3	1	1	1	1	2	1	N
Amphibians and Reptiles											
Loss and disturbance to amphibians and reptiles	Minor	- Minimize the area of disturbance by limiting construction to designated areas - Limit operation activities to areas disturbed during construction - Minimize disturbance of vegetation around water bodies by maintaining buffer zones	- Maintain records of on-site amphibian and reptile observations	1	2	2	3	2	1	2	N
Economic Conditions											
Creation of employment and introduction of money to the regional economy	Positive	- None proposed	- None proposed	3	1	2	3	3	1	2	N
Business Opportunities											
Creation of jobs and contracts for construction and operation requirements	Positive	- None proposed	- None proposed	3	1	2	2	3	1	2	N
Traffic											
Increased traffic may increase dust, the number of road kills, and it will require more road maintenance	Moderate	- Utilize dust control methods - Drive according to road conditions and follow posted speed limits - Reduce the number of vehicles traveling during high wind events - Provide wildlife information to drivers	- Monitor the number of vehicles traveling associated with peat production - Record public complaints and vehicle accidents - Consider further action as warranted	2	1	2	3	3	2	1	N

Table 13 Cont'd

Environmental Effect	Adversity (Table 11)	Mitigation Measures	Follow-up	Significance (S)* (see Table 12)							
				a	b	c	d	e	f	g	S
Noise / Vibration											
Increased noise and vibration levels from construction and operation activities	Minor	- Muffle vehicles and equipment - Limit unnecessary long-term idling - Require a high standard of maintenance for heavy equipment - Maintain a vegetation buffer along PR 234 near the sites - Installing signs near the facility warning drivers not to use engine brakes	- Monitor and periodically track noise levels and public complaints	2	1	2	3	2	2	1	N
Human Health											
Risk of adverse effects on public attitude and general health and well-being due to increased noise, vibrations and dust generated	Moderate	- Utilize dust control methods - Reduce number of vehicles travelling during high wind events - Drive according to road conditions - Adhere to posted speed limits - Maintain a vegetation buffer along PR 234 near the sites - Installing signs near the facility warning drivers to slow down and not use engine brakes	- Monitor dust levels - Track public complaints - Consider further action as warranted	3	1	2	3	3	2	1	N
Risk of effects to worker health associated with poor indoor air quality from VOCs, carbon monoxide, propane gas, dust, refrigerants and moulds	Minor	- Provide adequate ventilation - Ensure a high standard of facility and equipment maintenance	- Conduct regular maintenance of the facility and equipment	3	1	2	2	2	2	1	N
Potential threat to public and worker safety during construction and operation activities	Public - Negligible and Worker - Minor	- Locked gate signed with no trespassing - Warning signs for ditches and ponds - Compliance with Manitoba Workplace Safety and Health regulations - Develop and enforce standard operation procedure guidelines - Provide training to employees - Ensure visitors have reported in and are accompanied by an employee	- Record occurrence of workplace accidents - Update employee training and safety guidelines as required	3	1	2	3	2	2	1	N

Table 13 Cont'd

Environmental Effect	Adversity (Table 11)	Mitigation Measures	Follow-up	Significance (S)* (see Table 12)							
				a	b	c	d	e	f	g	S
Aesthetic Values											
Impaired aesthetic from new infrastructure (access road) and increased dust during operation from transport trucks	Minor	- Utilize dust control methods and cover loads during transport to and from the site - Maintain a vegetation buffer along PR 234 near the sites - Re-vegetate the peat fields in accordance with provisions in the mine closure plan	- Observe dust and debris levels - Record public complaints - Take further action as warranted	2	1	2	3	3	2	1	N
Areas of Interest											
Disturbance and alteration to the Peguis First Nation CIZ	Moderate	- Limit construction activities to designated areas - Mark maximum clearing of the proposed development site - Protect adjacent trees from blow-down - Re-use timber from clearing	- Periodically inspect the site during construction for signs of potential disturbances - Ensure construction crews adhere to designated areas	3	1	2	3	2	2	2	N
Recreation / Tourism											
Increased truck traffic on PR 234 and resulting dust could cause decline in tourism to nearby recreational areas	Minor	- Utilize dust control methods - Cover loads during transport to and from the site - Reduce number of vehicles travelling during high wind events - Drive according to road conditions - Adhere to posted speed limits	- Track public complaints - Take further action as warranted	2	1	2	2	3	2	1	N
Heritage Resources											
Impact to historic resources during preparation, construction and operation	Negligible	- Cease activities in the event historic resources are discovered	- Contact Historic Resource Branch immediately if historic resources are discovered	2	1	2	3	2	1	1	N

* S = significance
Y = significant - rated a "3" for at least four criteria, at least one of which must be criteria a or b; or rated "2" or "3" for all criteria
N = not significant

TABLE 14

PROJECT AND CUMULATIVE ENVIRONMENTAL EFFECTS FOR PROPOSED PEAT DEVELOPMENT

Project Activities x Project effect (minor) X Project effect (moderate) P Project effect (major) o Cumulative effect (negligible) O Cumulative effect (minor) C Cumulative effect (major)	Residual Environmental Effects															
	Increased particulates	Increased greenhouse gases, SO_2, NOx, etc.	Contamination of soils / surface water	Loss of soil	Loss of wetlands	Change in drainage pattern	Change in receiving water quality (TSS, pH, nutrients)	Loss and disturbance of terrestrial vegetation	Loss and disturbance of terrestrial wildlife & habitat	Loss and disturbance of birds/waterfowl & habitat	Loss and disturbance of aquatic biota & habitat	Increased traffic and deterioration of PR 234	Impacts to public safety / human health	Increased wildlife mortalities	Improved social conditions	Improved economic conditions
Proposed Peatland Development Project																
Site preparation	x	x	x					x	x	**X**	x					
Construction	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x
Operation	x	x	x	**X**	x	x	x	x	x	x	x	**X**	x	x	x	x
Decommissioning	x	x	x			x									x	x
Other Projects and Activities (existing and known)																
Sunterra – Beaver Point Peat Mine	o	o	o	**O**	o	o	o	o	o	**O**	o	**O**	o	o	o	o
Berger – Deer Lake Peat Mine	o	o	o	**O**	o	o	o	o	o	**O**	o	**O**	o	o	o	o
Sun Gro – Ramsay Point Peat Mine	o	o	o	**O**	o	o	o	o	o	**O**	o	**O**	o	o	o	o
Beaver Creek Provincial Park												o			o	o
Beaver Creek Bible Camp												o			o	o
Beaver Creek transfer station	o	o	o										o			
Communities/Cottages: Pine Dock, Matheson Island, Calders Dock, Bullhead, Little Bullhead, Leaside Beach, Beaver Creek, Pebblestone Beach, Mill Creek and Little Deer Lake		o	o				o					o			o	
Airports at Pine Dock and Matheson Island		o	o							o			o			
Commercial trucking on PR 234	o	o					o					**O**	o	o		o
Road Maintenance of PR 234	o	o	o				o		o	o	o	o	o	o	o	
Recreation; hunting, fishing and camping									o	o	o	o			o	o

TABLE 15

MITIGATION MEASURES SUMMARY FOR THE PROPOSED PEAT DEVELOPMENT

Mitigation Measures	Design	Proposed	Regulatory	Management	
Microclimate					
Install snow fences to control snow deposition on the property if required		•			
Air Quality					
Cover loads being hauled		•			
Use an approved dust suppressant and control vehicle speed		•		•	
Limit peat handling activities during high wind events				•	
Orient peat harvesting and stockpiles with prevailing winds	•	•			
Re-establish vegetation on disturbed areas		•			
Instruct employees on proper equipment operation to minimize dust				•	
Require a high standard of maintenance for construction equipment and vehicles, use low sulphur-containing fuels and limit unnecessary idling				•	
Use appropriate fuel dispensing equipment			•	•	
Utilize windbreaks (tree and brush barriers)	•	•			
Implement a reclamation plan that addresses greenhouse gas emissions		•		•	
Minimize the area cleared	•				
Soils					
Minimize the surface area disturbed	•				
Leave non-commercial peat reserves in place	•			•	
Prepare and implement a mine closure plan			•	•	
Prevent leaks, spills and releases	•				
Provide drip trays for equipment and spill clean-up equipment and materials	•			•	
Prepare an emergency (spill) response plan		•		•	
Comply with provincial fuel storage and dispensing regulations and storing hazardous materials in approved containers (secondary containment)			•	•	
Provide ULC Certified double-walled fuel storage tanks with spill prevention and leak detection			•	•	
Ensure equipment arrives to site in good condition				•	
Designate fuel storage and refueling areas	•			•	
Surface Water					
Limit surface area disturbance	•				
Maintain water levels on undisturbed areas		•		•	
Implement a mine closure plan that restores predevelopment water levels			•	•	

Table 15 Cont'd

Mitigation Measures	Design	Proposed	Regulatory	Management	
Direct drainage water into sedimentation ponds equipped with floating booms before discharging at a controlled rate	•	•			
Formulate a drainage plan to maintain the natural drainage patterns	•				
Prevent leaks, spills and releases and provide fuel storage secondary containment	•			•	
Provide drip trays for equipment and spill clean-up equipment and materials	•			•	
Prepare an emergency (spill) response plan		•		•	
Comply with provincial fuel storage and dispensing regulations and storing hazardous materials in approved containers (secondary containment)			•		
Groundwater					
Ensure proper seal at ground level of new supply well in staging area	•		•		
Prevent leaks, spills and releases	•				
Provide drip trays for equipment and spill clean-up equipment and materials	•			•	
Preparing an emergency (spill) response plan		•		•	
Comply with provincial fuel storage and dispensing regulations and storing hazardous materials in approved containers (secondary containment)			•		
Vegetation					
Restrict activities to designated areas	•				
Minimize vegetation loss or disturbance		•			
Utilizing timber removed from site		•		•	
Re-vegetate disturbed and reclaimed areas during and after operation	•				
Use an approved dust suppressant and limit construction activity during high wind events	•	•		•	
Provide on-site fire suppression equipment		•		•	
Prepare an emergency fire response plan		•		•	
Notify Manitoba Conservation immediately in event of a fire				•	
Mammals / Habitat					
Minimize habitat (vegetation) loss or disturbance		•			
Limit construction to designated areas and operation activities to areas disturbed during construction	•				
Maintain habitat around the Quarry Leases		•			
Provide wildlife awareness information to drivers	•			•	
Implement a closure plan to revegetate disturbed and reclaimed areas during and after operation	•		•	•	

Table 15 Cont'd

Mitigation Measures	Design	Proposed	Regulatory	Management	
Post signs to warn and educate drivers to avoid wildlife on the highway and adhere to posted speed limits				•	
Regular disposal of waste at existing waste facilities		•			
Animal deterrents such as noise makers, reflectors and scents if required		•			
Bear-proof garbage containers	•				
Birds / Habitat					
Minimize disturbance around water bodies by retaining buffer zones and maintain buffer zones between harvesting areas and bird habitat	•				
Schedule clearing outside of critical nesting and rearing periods	•				
Limit construction to designated areas and operation activities to areas disturbed during construction	•				
Implement a closure plan to revegetate disturbed and reclaimed areas during and after operation	•		•	•	
Aquatic Biota / Habitat					
Use of properly designed and operated settling ponds	•	•			
Follow the Manitoba Stream Crossing Guidelines for the protection of Fish and Fish Habitat	•		•		
Follow best management practices		•		•	
Install culverts such that low flow connectivity is maintained	•				
Ensure culverts are large enough to permit fish passage	•		•		
Amphibians and Reptiles					
Minimize disturbance around water bodies by retaining buffer zones	•				
Limit construction to designated areas and operation activities to areas disturbed during construction	•				
Economic Conditions					
No mitigation proposed					
Business Opportunities					
No mitigation proposed					
Traffic					
Reduce wildlife interactions by providing wildlife information to drivers		•		•	
Road dust control by approved dust suppressant, reducing speed, following posted limits and reducing the number of vehicles during wind events		•		•	
Noise and Vibration					
Require a high standard of maintenance for construction equipment and vehicles, muffle vehicles and equipment and limit unnecessary idling				•	

Table 15 Cont'd

Mitigation Measures	Design	Proposed	Regulatory	Management	
Maintain a vegetation buffer along PR 234 near the sites	•				
Post signs near the facility to warn drivers to slow down and not use engine brakes				•	
Human Health					
Limit dust generation by using water, reducing number of vehicles travelling during high winds, adhering to posted speed limits and driving according to road conditions		•	•	•	
Limit noise and vibration by maintaining a vegetation buffer along PR 234 near the sites and post signs near the facility to warn drivers to slow down and not use engine brakes	•			•	
Provide adequate ventilation of buildings and a high standard of facility and equipment maintenance	•			•	
Provide locked gate with no trespassing signs and warning signs of ditches and ponds	•				
Comply with Manitoba Workplace Safety and Health regulations			•	•	
Provide employee training and develop and enforce standard operation procedure guidelines			•	•	
Ensure all visitors have reported in and are accompanied by an employee				•	
Aesthetic Values					
Utilize dust control methods and cover loads during transport to and from the site		•			
Maintain a vegetation buffer along PR 234 near the sites	•				
Re-vegetate the peat fields in accordance with provisions in a reclamation plan	•				
Areas of Interest					
Limit construction activities to designated areas, mark maximum clearing of the proposed development site, protect adjacent trees from blow-down and re-use timber from clearing	•	•			
Recreation/Tourism					
Limit dust generation by using water, reducing number of vehicles travelling during high winds, adhering to posted speed limits and driving according to road conditions		•	•	•	
Heritage Resources					
Cease activities in the event historic resources are discovered			•		

TABLE 16

FOLLOW-UP SUMMARY FOR THE PROPOSED PEAT DEVELOPMENT

Follow-up	Inspecting	Monitoring	Record Keeping	Reporting	
Microclimate					
Inspect airflow and snow deposition patterns	•				
Air Quality					
Observe fugitive dust levels during construction and accumulated dust during operation	•				
Perform periodic inspections of adjacent properties and access roads for dust and debris	•				
Track complaints from local residents			•		
Perform periodic inspections of air quality during construction	•				
Record maintenance of facility and equipment			•		
Require submission of MSDSs for all products used			•	•	
Adhere to licence terms and conditions	•				
Soils					
Conduct annual monitoring and report on implementation of the progressive restoration activities		•	•	•	
Perform periodic inspections for leaks, spills and releases	•				
Ensure construction and operation crews adhere to designated areas	•				
Remediate and record fuel spills and releases	•		•	•	
Update the emergency response plan periodically			•		
Adhere to licence terms and conditions	•				
Surface Water					
Perform periodic inspections of surface water bodies	•				
Report on implementation of the progressive restoration activities annually	•		•	•	
Monitor surface water runoff flows from the development area		•	•	•	
Perform periodic inspections for evidence of erosion	•				
During operation collect weekly surface water samples from each outlet for analysis of TSS and pH		•	•	•	
Conduct additional water monitoring as developed with Manitoba Conservation		•	•	•	
Clean drainage ditches & sedimentation ponds on a regular basis	•				
Perform periodic inspections for leaks, spills and releases	•				

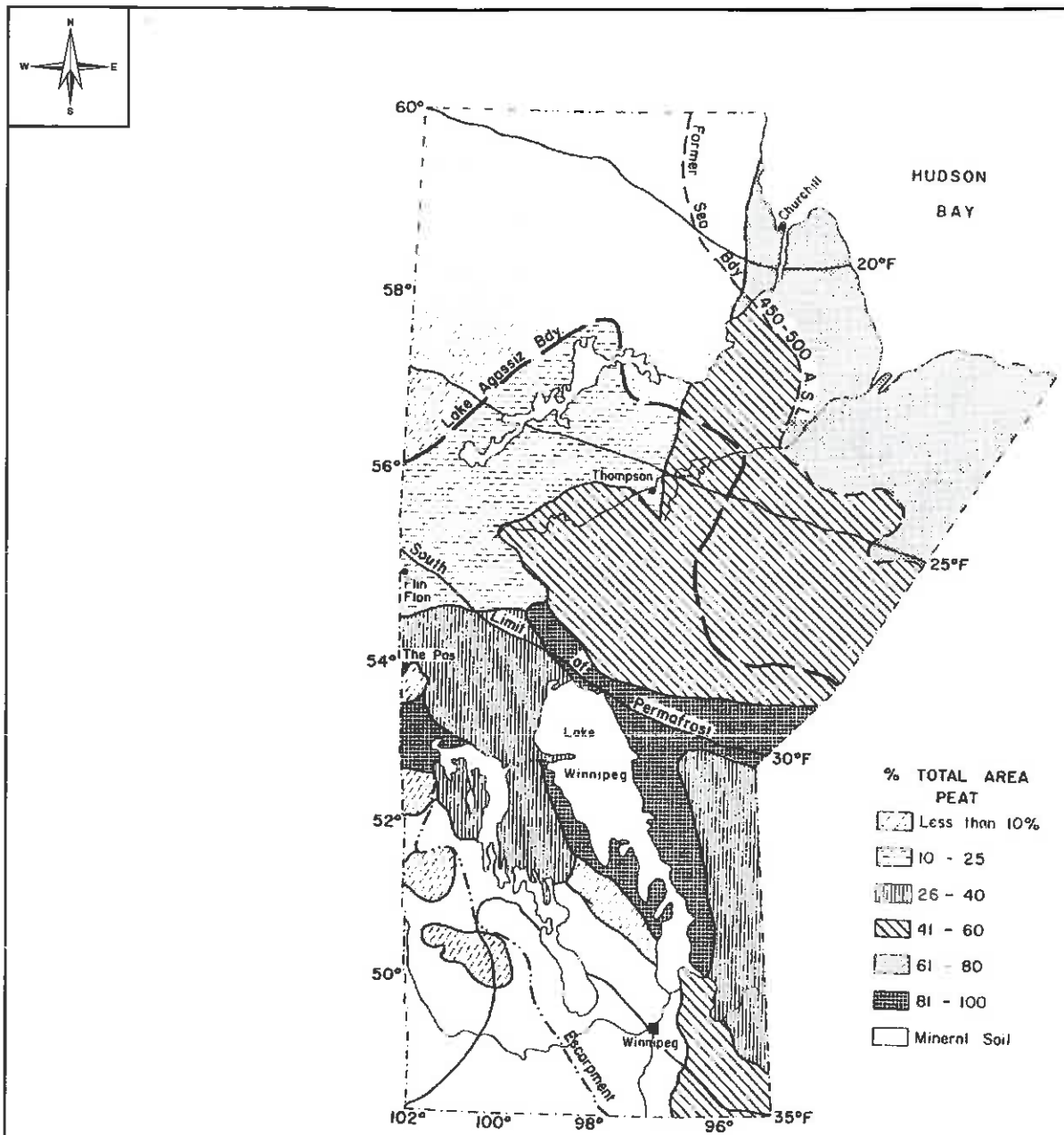
Table 16 Cont'd

Follow-up	Inspecting	Monitoring	Record Keeping	Reporting	
Remediate and record fuel spills and releases	•		•	•	
Update the emergency (spill) response plan periodically			•		
Adhere to licence terms and conditions	•				
Groundwater					
Perform periodic inspections for leaks, spills and releases	•				
Remediate and record fuel spills and releases	•		•	•	
Update the emergency (spill) response plan periodically			•		
Adhere to licence terms and conditions	•				
Vegetation					
Perform periodic inspections for vegetation stress and mortality around cleared area and invasion of nuisance or weed species	•				
Conduct annual monitoring and report on implementation of the progressive restoration activities		•	•	•	
Observe accumulated dust on plants during operation	•				
Conduct periodic assessments of fire risk and updates to emergency (fire) response plan			•		
Examine fire fighting equipment regularly	•		•		
Conduct employee training in the use of this equipment regularly			•		
Mammals / Habitat					
Perform periodic inspections of habitat during construction and operation	•				
Maintain re-vegetated areas and buffer zones	•				
Ensure adherence to environmental guidelines and protocols	•				
Maintain records of vehicle-wildlife interactions			•		
Maintain records of problem or nuisance wildlife situations			•		
Adhere to licence terms and conditions	•				
Birds / Habitat					
Perform periodic inspections of habitat during construction and operation	•				
Maintain re-vegetated areas and buffer zones	•				
Perform inspections of bird nesting and rearing activities and success	•				
Adhere to licence terms and conditions	•				
Aquatic Biota / Habitat					
Perform periodic inspections of sedimentation ponds for debris	•				
Clean drainage ditches and sedimentation ponds regularly	•				

Table 16 Cont'd

Follow-up	Inspecting	Monitoring	Record Keeping	Reporting	
Monitor effluent discharged from ponds for TSS on a weekly basis		•	•	•	
Perform periodic inspections of installed culverts to ensure the pipe is not blocked by sediment or debris	•				
Amphibians and Reptiles					
Maintain records of amphibians and reptiles observed on the site			•		
Economic Conditions					
No follow-up proposed					
Business Opportunities					
No follow-up proposed					
Traffic					
Monitor number of vehicles travelling associated with harvesting			•		
Record public complaints and vehicle accidents			•		
Monitor situation and take further action as warranted	•				
Noise and Vibration					
Observe and periodically track noise levels and public complaints	•		•		
Human Health					
Observe dust levels	•				
Track health complaints from local residents			•		
Monitor situation and take further action as warranted	•				
Conduct regular maintenance of the facility and equipment	•		•		
Record workplace accidents			•		
Update employee training and safety guidelines as required			•		
Aesthetic Values					
Inspect dust and debris levels	•				
Track public complaints			•		
Monitor situation and take further action as warranted	•				
Areas of Interest					
Inspect site during construction for signs of potential disturbances	•				
Ensure crews adhere to designated construction areas	•				
Recreation/Tourism					
Track public complaints			•		
Monitor situation and take further action as warranted	•				
Heritage Resources					
Contact Historic Resources Branch immediately if resources found				•	

FIGURES



PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

NO.	YY/MM/DD	DESCRIPTION	BY
0	11/12/02	ISSUED WITH FINAL REPORT	JFM

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

SUNTERRA HORTICULTURE (CANADA) INC.

PROPOSED PEAT MINE DEVELOPMENT

DISTRIBUTION OF PEATLAND IN MANITOBA

DECEMBER 2011 | FIGURE 01 | 0

Source: Smith, R.E. (1975) Organic Soil Resources in Manitoba and their Possibilities for Crop Production. Proceedings of the Seminar on Peat: A Resource in Manitoba's Agriculture and Industry.

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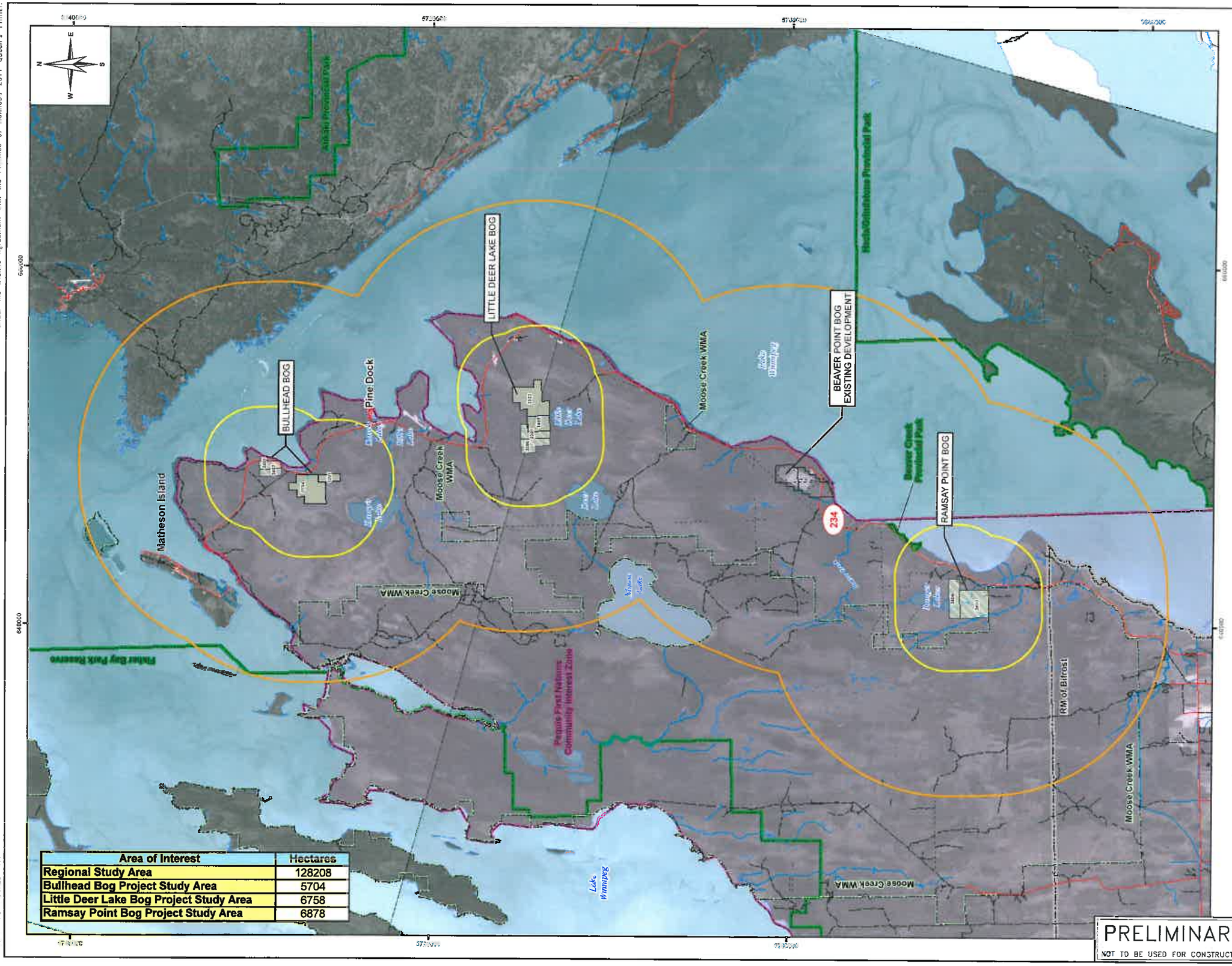

LEGEND:

- Project Study Area
- Regional Study Area
- Existing Development Area
- Pending By Lease Owner
- Proposed Development AREA
- Provincial Park Boundary
- Wildlife Management Area (WMA)
- Peguis FN Community Interest Zone
- RM Boundary
- Road
- Trail
- Existing Cutline
- River
- Lake

Area of Interest	Hectares
Regional Study Area	128208
Bullhead Bog Project Study Area	5704
Little Deer Lake Bog Project Study Area	6758
Ramsay Point Bog Project Study Area	6878

Notes:
1. Imagery is Spot 5, from NRCAN (Natural Resources Canada), September 3, 2006.
2. All units are metric and in metre unless otherwise specified. Universal Transverse Mercator Projection, NAD 1983, Zone 14. Elevations are in metres above sea level (MSL)

2 0 2 4 6 8
Kilometres

SCALE: 1:200,000 METRIC 11"x17"

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

NO.	YY/MM/DD	DESCRIPTION	BY
0	11/12/08	ISSUED WITH FINAL REPORT	JFM

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PROPOSED PEAT MINE DEVELOPMENT

REGIONAL SITE LOCATION OF PROPOSED DEVELOPMENT

DECEMBER 2011 | FIGURE 02 | 0

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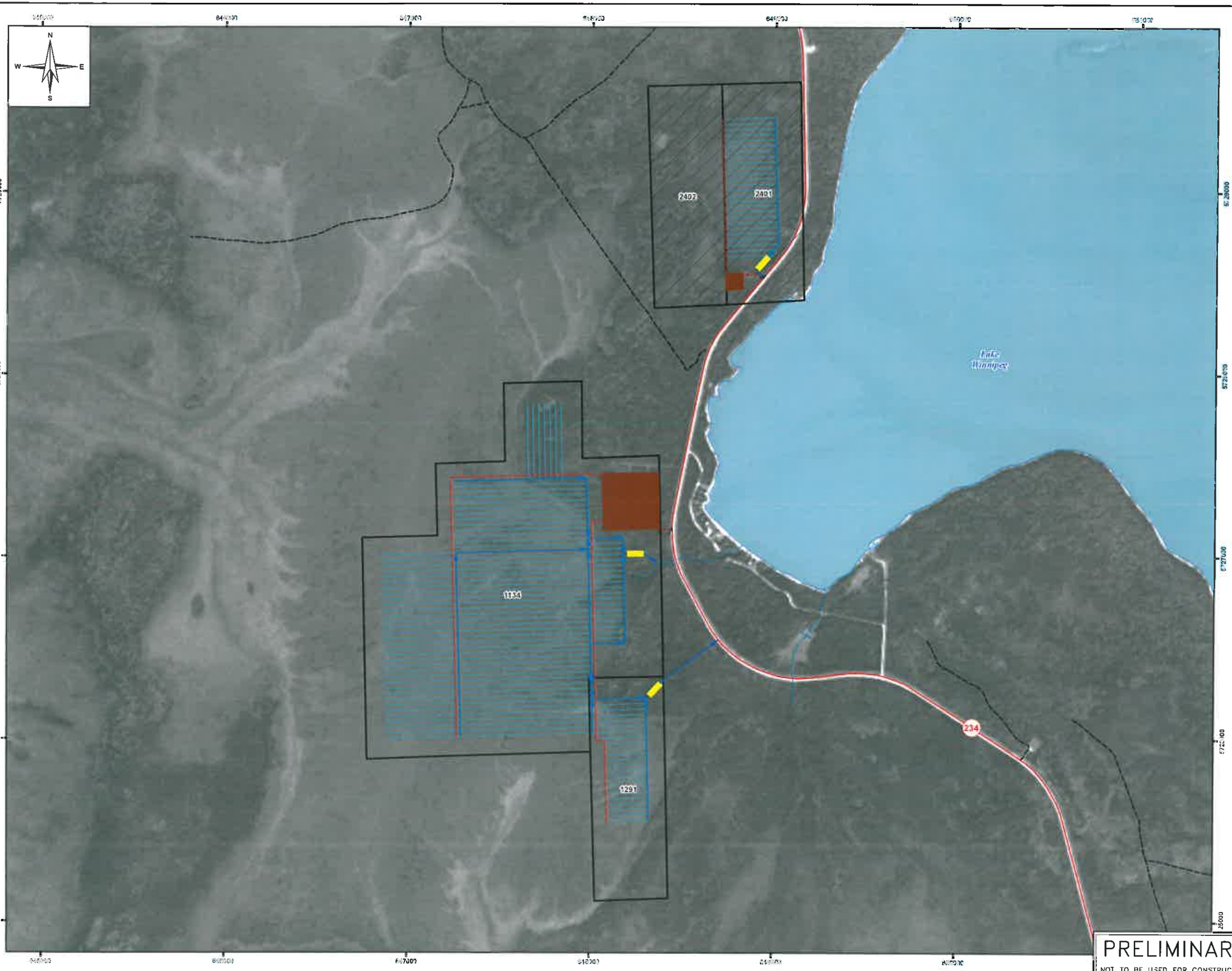

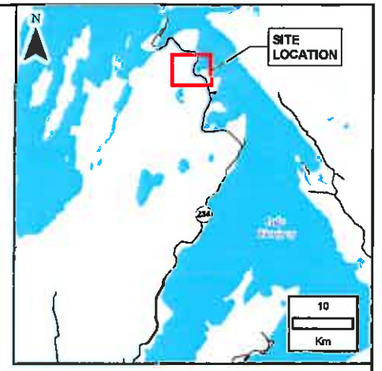

LEGEND:

- Proposed Culvert
- Field Drainage Ditch
- Main Drainage Ditch /Flow Direction
- Outlet Drainage Ditch /Flow Direction
- Access Road
- Bog Road
- Road
- Trail
- River
- Lake
- Quarry Lease
- Proposed Quarry Lease
- Staging Area
- Sedimentation Pond

Notes:
1. Imagery is Spot 5, from NRCAN (Natural Resources Canada), September 3, 2006.
2. All units are metric and in metre unless otherwise specified. Universal Transverse Mercator Projection, NAD 1983, Zone 14 Elevations are in metres above sea level (MSL)

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Kilometres

SCALE: 1:20,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
0	11/12/06	ISSUED WITH FINAL REPORT	SFM

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SUNTERRA HORTICULTURE (CANADA) INC.

PROPOSED PEAT MINE DEVELOPMENT

GENERAL SITE DEVELOPMENT AREA BULLHEAD BOG

DECEMBER 2011 | FIGURE 03 | REV. 0

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

FileName: P:\Projects\2011\11-1235-01\Drawings\GIS\MXD\ESPRe 0\11-1235-01_Fig3_REV0.mxd
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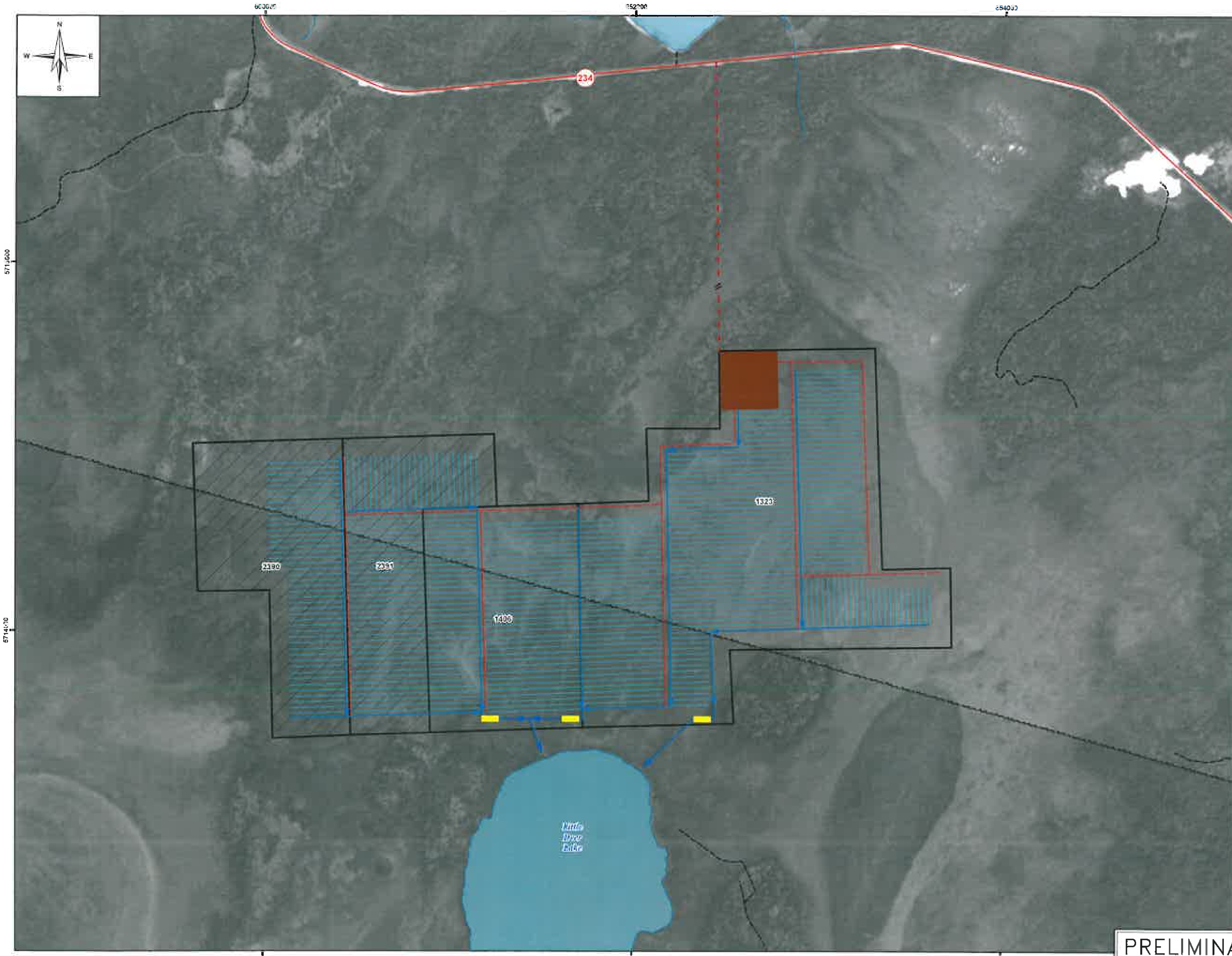

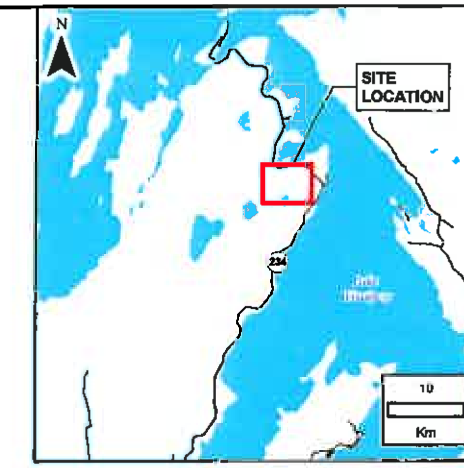

LEGEND:

- Proposed Culvert
- Field Drainage Ditch
- Main Drainage Ditch/Flow Direction
- Outlet Drainage Ditch/Flow Direction
- Access Road
- Bog Road
- Road
- Trail
- River
- Lake
- Quarry Lease
- Proposed Quarry Lease
- Staging Area
- Sedimentation Pond

Notes:

1. Imagery is Spot 5, from NRCAN (Natural Resources Canada), September 3, 2006.
2. All units are metric and in metre unless otherwise specified. Universal Transverse Mercator Projection, NAD 1983, Zone 14 Elevations are in metres above sea level (MSL)

0.2 0 0.2 0.4 0.6 0.8

Kilometres

SCALE: 1:20,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
0	11/12/08	ISSUED WITH FINAL REPORT	SFM

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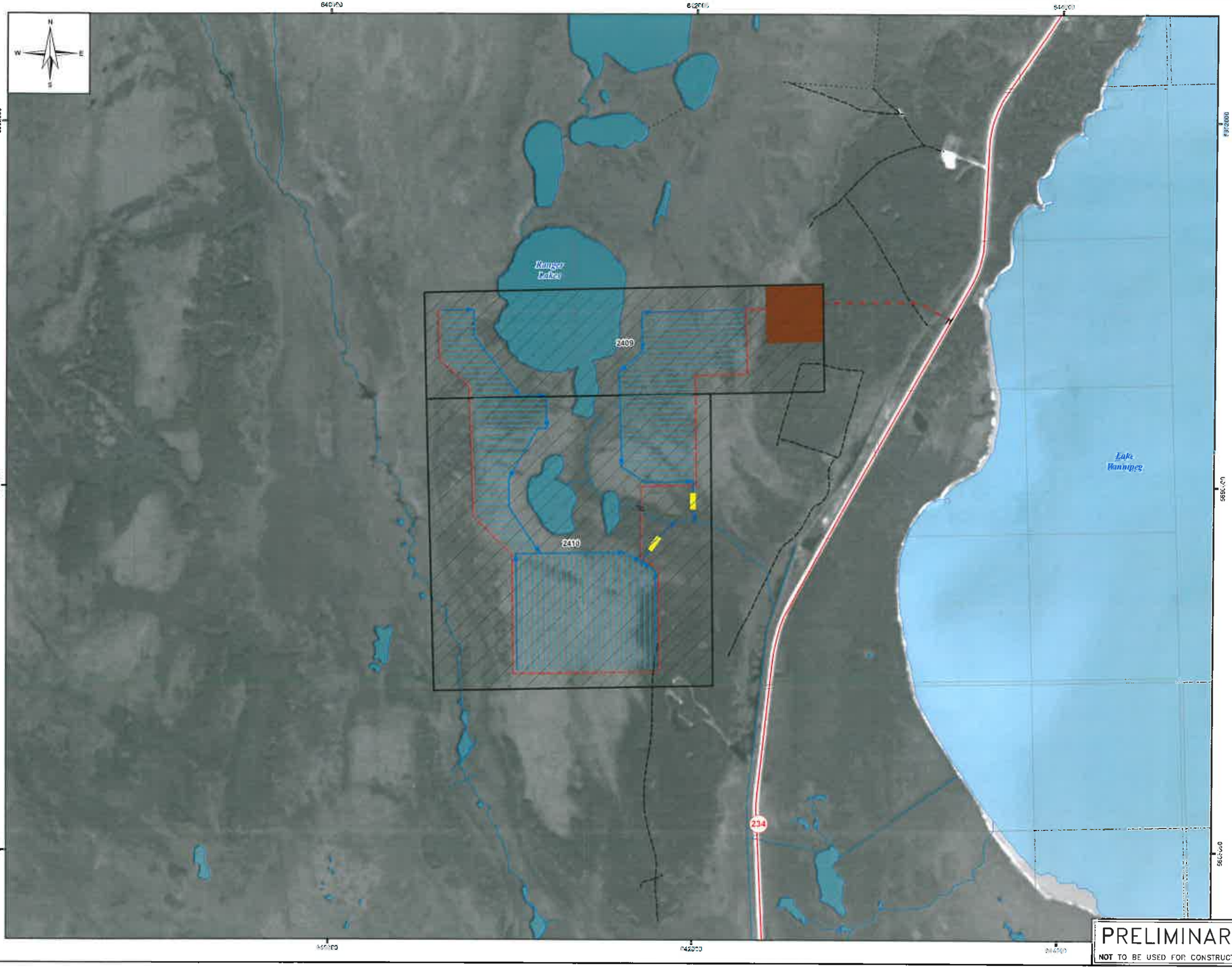
SUNTERRA HORTICULTURE (CANADA) INC.

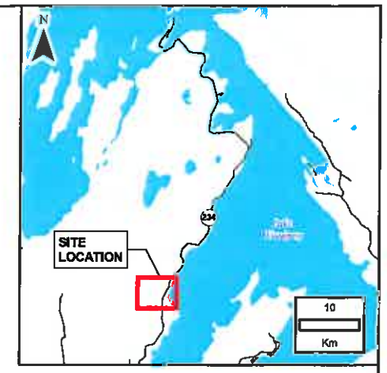
PROPOSED PEAT MINE DEVELOPMENT

GENERAL SITE DEVELOPMENT AREA LITTLE DEER LAKE BOG

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

DECEMBER 2011 | FIGURE 04 | 0





LEGEND:

- Proposed Culvert
- Field Drainage Ditch
- Main Drainage Ditch/Flow Direction
- Outlet Drainage Ditch/Flow Direction
- Access Road
- Bog Road
- Road
- Trail
- Existing Cutline
- River
- Lake
- Quarter Section
- Proposed Quarry Lease
- Staging Area
- Sedimentation Pond

Notes:
1. Imagery is Spot 5, from NRCAN (Natural Resources Canada), September 3, 2009.
2. All units are metric and in metre unless otherwise specified. Universal Transverse Mercator Projection, NAD 1983, Zone 14 Elevations are in metres above sea level (MSL)

0.2 0 0.2 0.4 0.6 0.8
Kilometres

SCALE: 1:20,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
0	11/12/08	ISSUED WITH FINAL REPORT	SFM

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

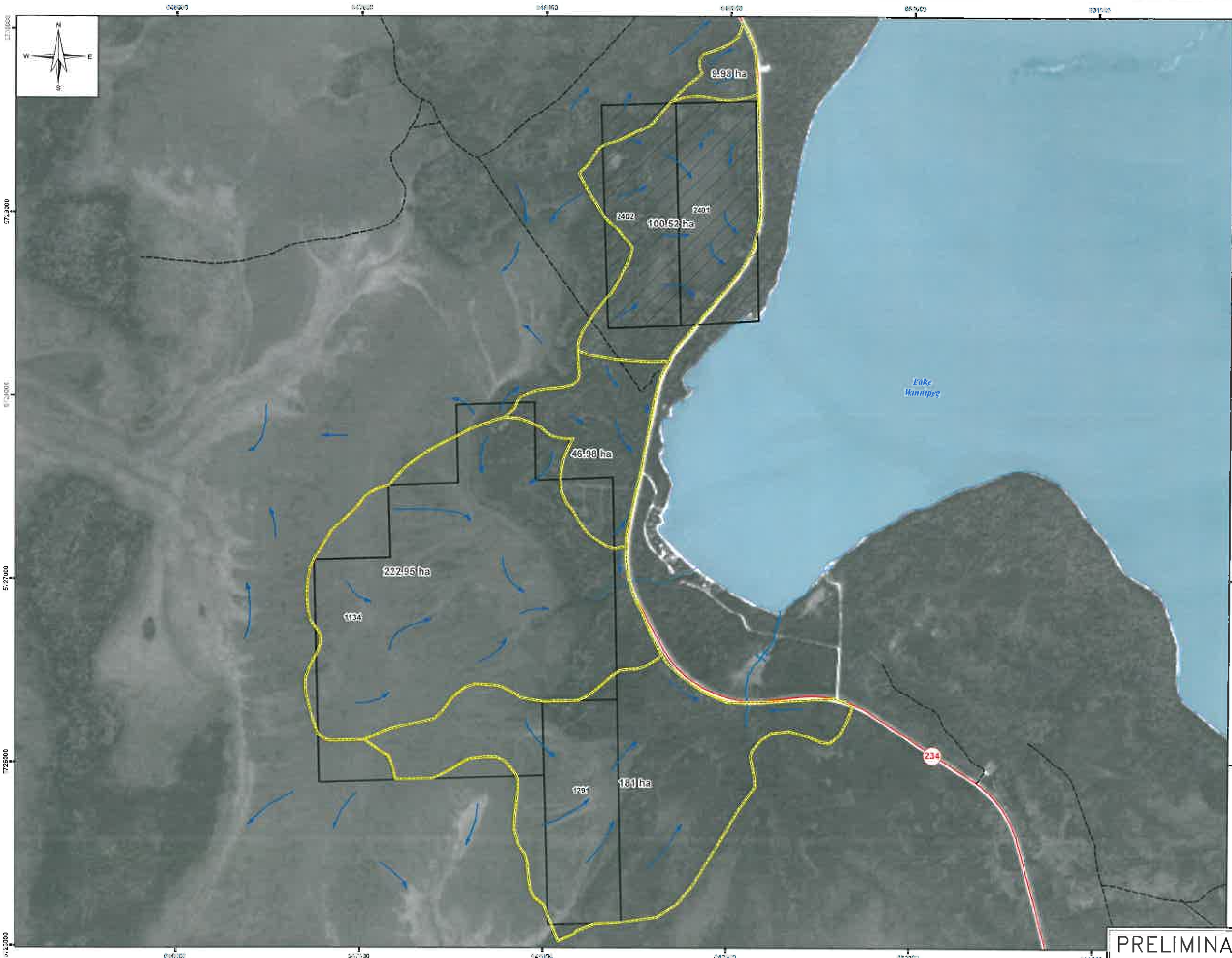
SUNTERRA HORTICULTURE (CANADA) INC.

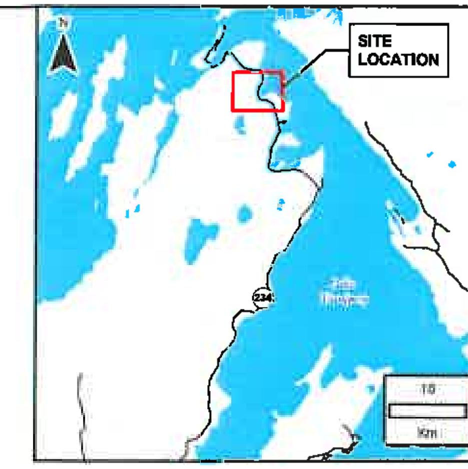
PROPOSED PEAT MINE DEVELOPMENT

GENERAL SITE DEVELOPMENT AREA
RAMSAY POINT BOG

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

DECEMBER 2011 | FIGURE 05 | REV. 0





LEGEND:

- Road
- Existing Cutline
- Trail
- River
- Lake
- Quarry Lease
- Proposed Quarry Lease
- Drainage Basin
- Flow Direction

Notes:

1. Imagery is Spot 5, from NRCAN (Natural Resources Canada), September 5, 2006.
2. All units are metric and in metre unless otherwise specified. Universal Transverse Mercator Projection, NAD 1983, Zone 14 Elevations are in metres above sea level (MSL)

0.2 0 0.2 0.4 0.6 0.8
Kilometres

SCALE: 1:20,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
0	11/12/08	ISSUED WITH FINAL REPORT	CFM

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KGS GROUP CONSULTING ENGINEERS

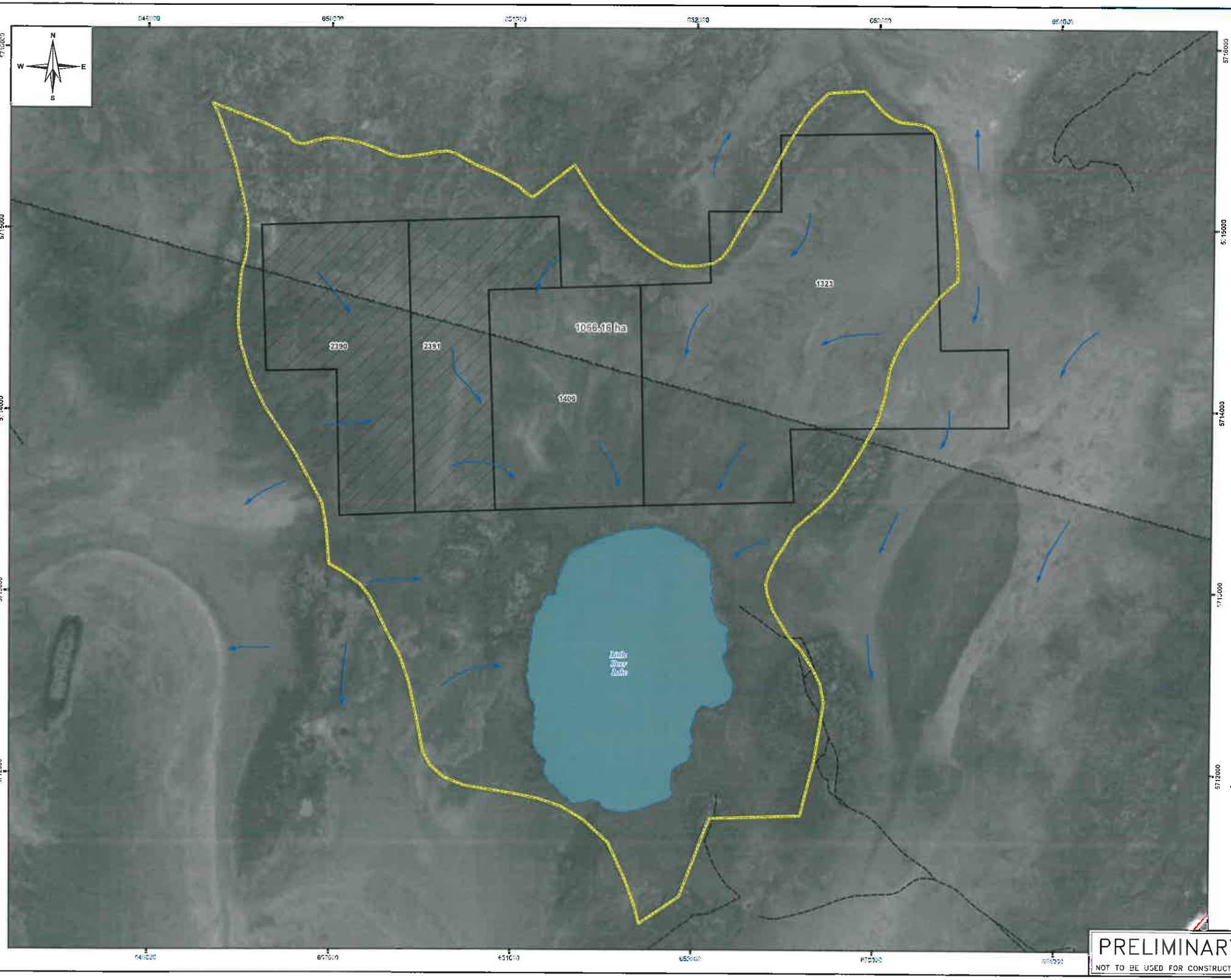
SUNTERRA HORTICULTURE (CANADA) INC.

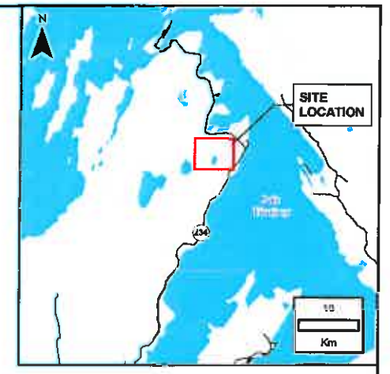
PROPOSED PEAT MINE DEVELOPMENT

NATURAL LAND DRAINAGE PATTERNS BULLHEAD BOG

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

DECEMBER 2011 | FIGURE 06 | 0





LEGEND:

- Road
- Existing Cutline
- Trail
- River
- Lake
- Quarry Lease
- Proposed Quarry Lease
- Drainage Basin
- Flow Direction

Notes:
1. Imagery is Spot 5, from NRCAN (Natural Resources Canada), September 3, 2005.
2. All units are metric and in metre unless otherwise specified. Universal Transverse Mercator Projection, NAD 1983, Zone 14 Elevations are in metres above sea level (MSL)

0.2 0 0.2 0.4 0.6 0.8
Kilometres

SCALE: 1:20,000 METRIC 11"x17"

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SUNTERRA HORTICULTURE (CANADA) INC.

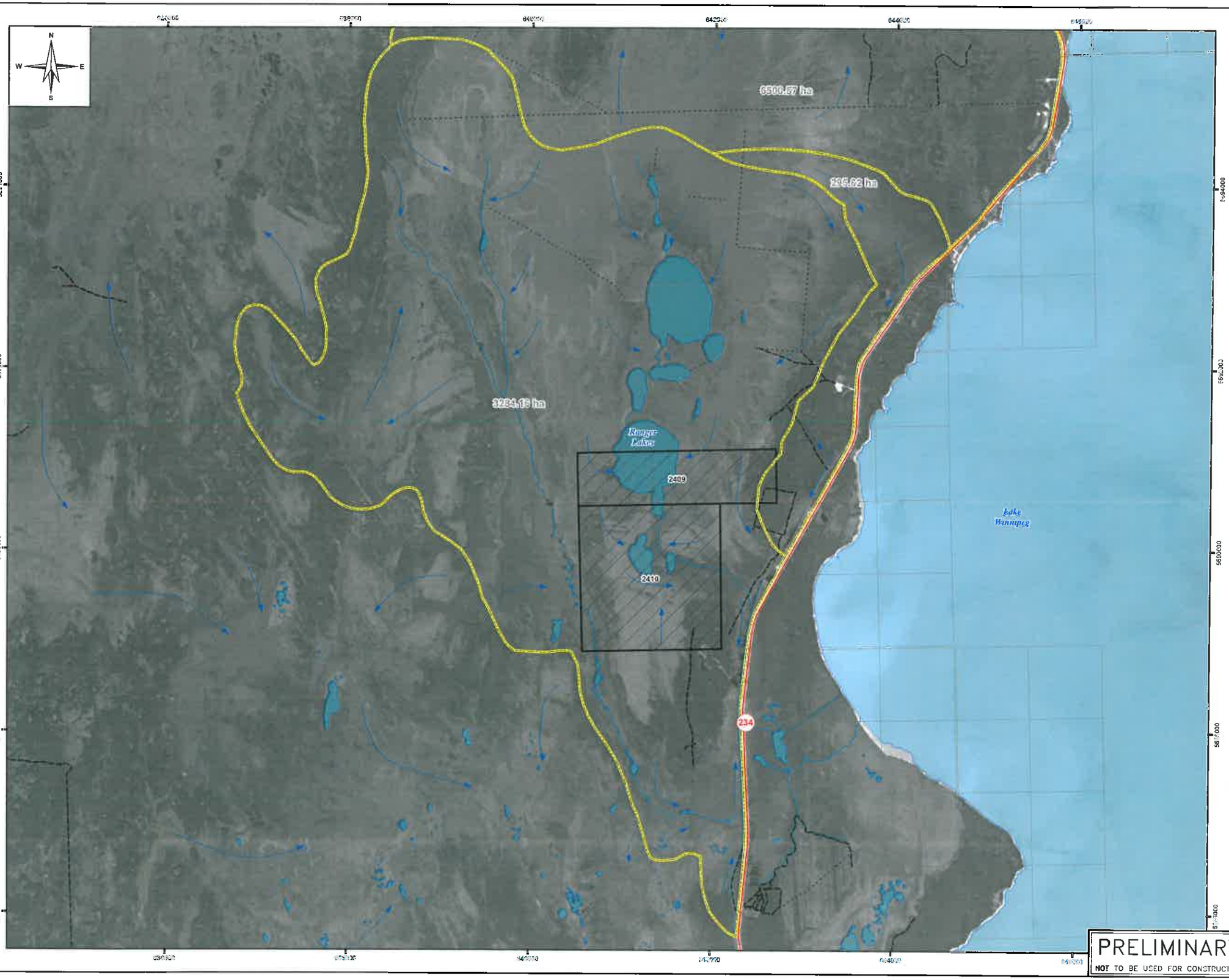
PROPOSED PEAT MINE DEVELOPMENT

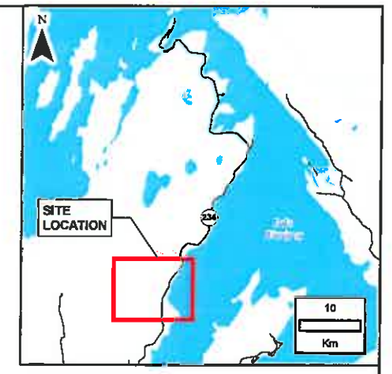
NATURAL LAND DRAINAGE PATTERNS LITTLE DEER LAKE BOG

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

DECEMBER 2011 | FIGURE 07 | 0

FileName: P:\Projects\2011\11-1916-01\Dwg\GIS\MXD\NRCAN\Rev0\11-1916-01_F07_Rev0.mxd
11"x17" PLOT SCALE 1:1





LEGEND:

- Road
- Existing Cutline
- Trail
- River
- Lake
- Quarter Section
- Proposed Quarry Lease
- Drainage Basin
- Flow Direction

Notes:
1. Imagery is Spot 5, from NRCAN (Natural Resources Canada), September 3, 2006.
2. All units are metric and in metre unless otherwise specified. Universal Transverse Mercator Projection, NAD 1983, Zone 14 Elevations are in metres above sea level (MSL)

0.5 0 0.5 1 1.5
Kilometres

SCALE: 1:40,000 METRIC 11"x17"

NO.	YY/MM, DD	DESCRIPTION	BY
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KGS GROUP CONSULTING ENGINEERS

SUNTERRA HORTICULTURE (CANADA) INC.

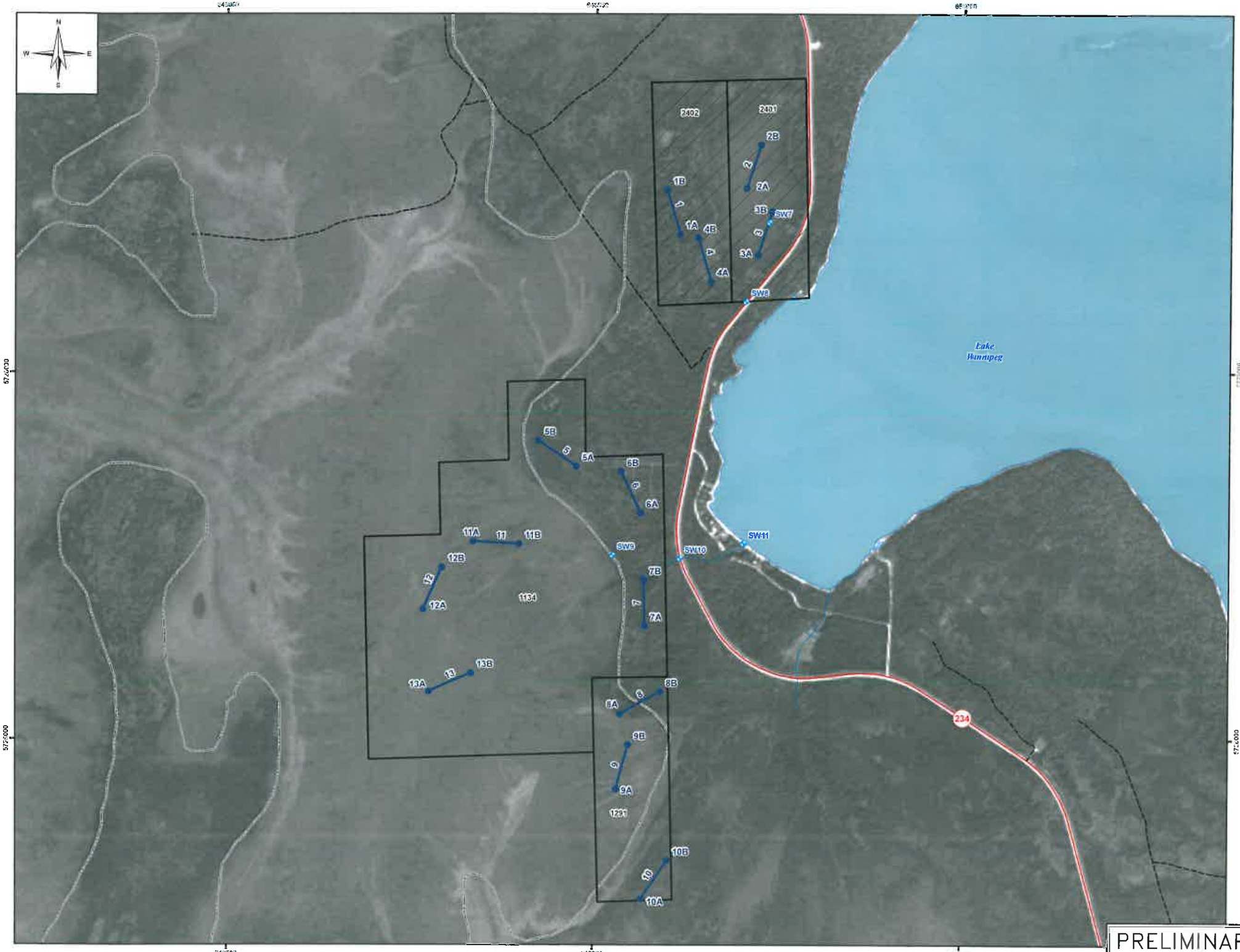
PROPOSED PEAT MINE DEVELOPMENT

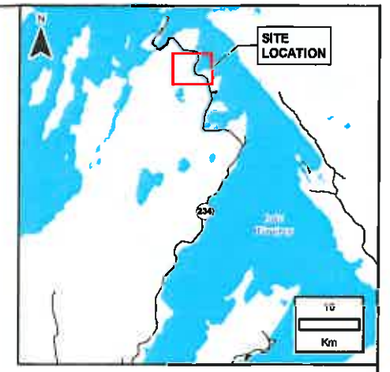
NATURAL LAND DRAINAGE PATTERNS RAMSAY POINT BOG

DECEMBER 2011 | FIGURE 08 | REV. 0

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

FileName: P:\Project\2011\11-1366-01\Dwg\GIS\MXD\EP\Rev 0\11-1366-01_F08_Rev 0.mxd
11"x17" PLOT SCALE 1:1





LEGEND:

- Baseline Water Quality Sample
- Vegetation Transect Point
- Vegetation Survey Transect Line
- Approximate Limits of Julius Complex
- Road
- Trail
- Existing Cutline
- River
- Lake
- Quarry Lease
- Proposed Quarry Lease

Notes:
1. Imagery is Spot 5, from NRCAN (Natural Resources Canada), September 2, 2008.
2. All units are metric and in metres unless otherwise specified. Universal Transverse Mercator Projection, NAD 1983, Zone 14 Elevations are in metres above sea level (MSL)

SCALE: 1:20,000 METRIC 11"x17"

NO.	YY/MM/DD	DESCRIPTION	BY
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KGS GROUP CONSULTING ENGINEERS

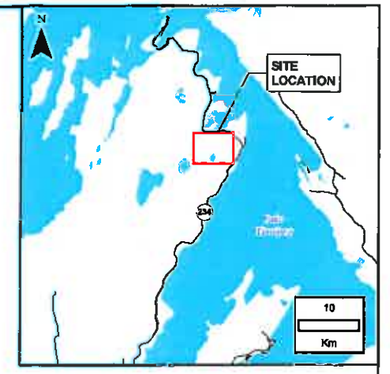
SUNTERRA HORTICULTURE (CANADA) INC.

PROPOSED PEAT MINE DEVELOPMENT

2011 SAMPLING PROGRAM
BULLHEAD BOG

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

DECEMBER 2011 | FIGURE 09 | 0



LEGEND:

- Baseline Water Quality Sample
- Vegetation Transect Point
- Vegetation Survey Transect Line
- Approximate Limits of Julius Complex
- Road
- Trail
- Existing Cutline
- River
- Lake
- Quarry Lease
- Proposed Quarry Lease

Notes:
1. Imagery is Spot 5, from NRCAN (Natural Resources Canada), September 2, 2006.
2. All units are metric and in metre unless otherwise specified. Universal Transverse Mercator Projection, NAD 1983, Zone 14 Elevations are in metres above sea level (MSL)

0.2 0 0.2 0.4 0.6 0.8
Kilometres

SCALE: 1:20,000 METRIC 11"x17"

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KGS GROUP CONSULTING ENGINEERS

SUNTERRA HORTICULTURE (CANADA) INC.

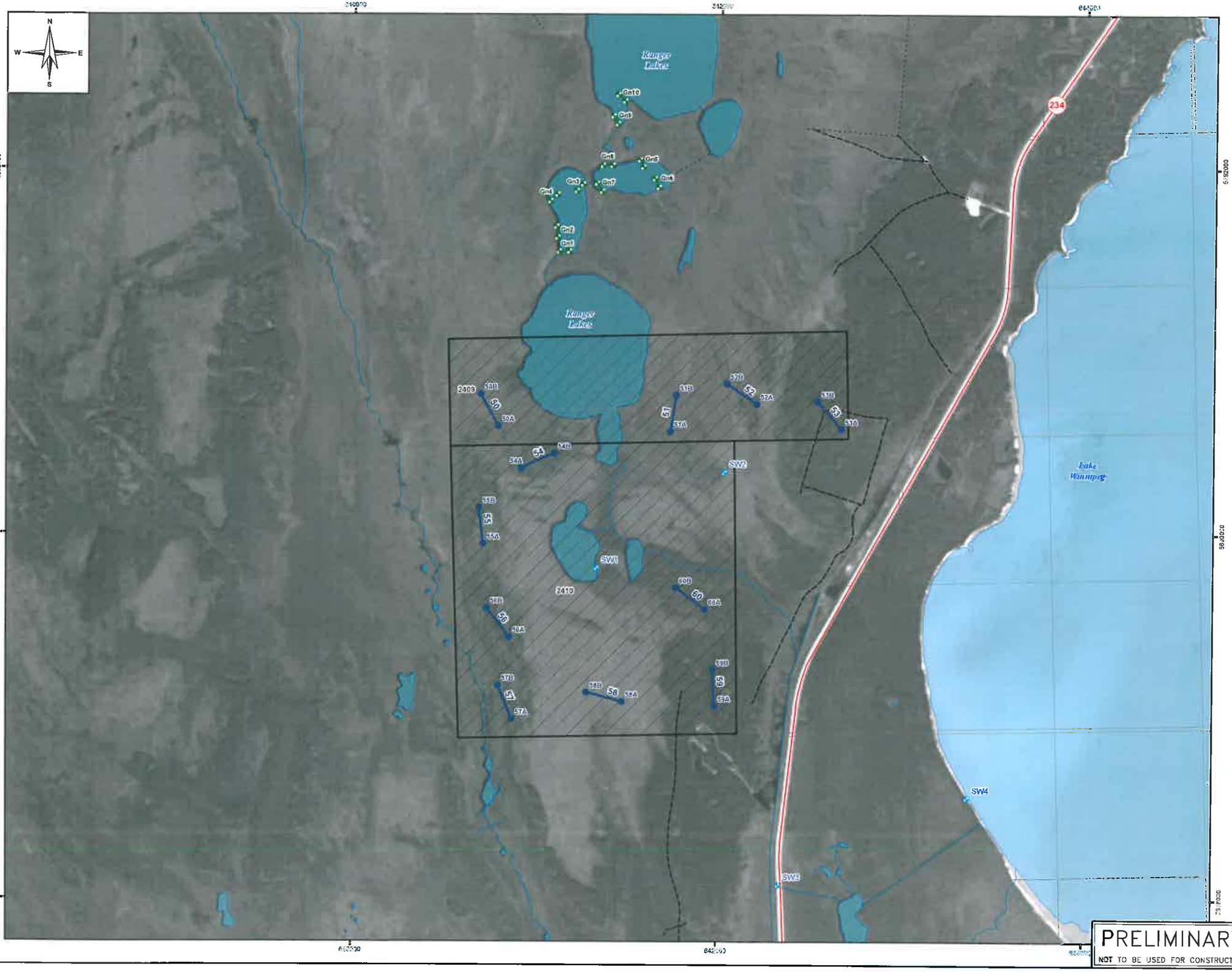
PROPOSED PEAT MINE DEVELOPMENT

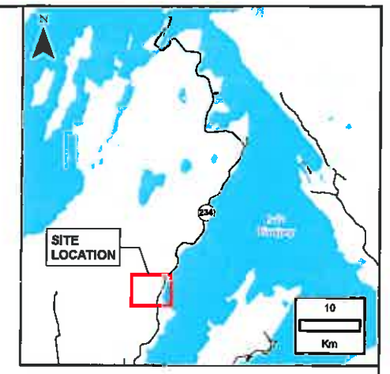
2011 SAMPLING PROGRAM
LITTLE DEER LAKE BOG

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

DECEMBER 2011 | FIGURE 10 | 0

Filename: P:\Project\2011\11-1226-01\Drawing\GIS\MXD\EIA\Rev0\11-1226-01_F10_Rev0.mxd
11"x17" PLOT SCALE 1:1





LEGEND:

- Baseline Water Quality Sample
- Fish Sampling
- Vegetation Transect Point
- Vegetation Survey Transect Line
- Fishnet
- Approximate Limits of Julius Complex
- Road
- Trail
- Existing Cutline
- River
- Lake
- Quarter Section
- Quarry Lease
- Proposed Quarry Lease

Notes:
1. Imagery is Spot 5, from NRCAN (Natural Resources Canada), September 3, 2006.
2. All units are metric and in metre unless otherwise specified. Universal Transverse Mercator Projection, NAD 1983, Zone 14 Elevations are in metres above sea level (MSL)

0.2 0 0.2 0.4 0.6 0.8
Kilometres

SCALE: 1:20,000 METRIC 11"x17"

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0	11/12/08	ISSUED WITH FINAL REPORT	SFM

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SUNTERRA HORTICULTURE (CANADA) INC.

PROPOSED PEAT MINE DEVELOPMENT

2011 SAMPLING PROGRAM
RAMSAY POINT BOG

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

DECEMBER 2011 | FIGURE 11 | 0

FileName: P:\Projects\2011\11-1356-01\GIS\MXD\E_PVRe 0\11-1356-01_F11_Re 0.mxd
11"x17" PLOT SCALE 1:1