ENVIRONMENT ACT PROPOSAL
FAIRHOLME COLONY DOMESTIC
WASTEWATER STABILIZATION POND

Prepared for:

Fairholme Colony

Project No: 131-13812-00

May 2013

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0.0 EXECUTIVE SUMMARY

Leading up to this Environment Act Proposal (EAP), GENIVAR was retained by Fairholme Colony to design and construct an earthen manure storage pond in 2007. At this time, Fairholme Colony was also planning to construct a new domestic wastewater treatment facility at some time in the near future.

Fairholme Colony now proposes to construct a new two-cell wastewater treatment facility, 'lagoon', to replace their existing septic tanks and fields. From our analysis of the organic and hydraulic loadings as well as the proposed site soil conditions, we recommend constructing a new two-cell lagoon with a clay core type liner to be located in SW 35-9-8 WPM, north of the Colony. The lagoon will be discharged into an existing natural drain, which eventually empties into the Assiniboine River, a distance of approximately 940 metres from the lagoon.

Major design appurtenances include installation of a forcemain, perimeter fence, valves, piping and lagoon signage.

Upon approval from Manitoba Conservation and issuance of an Environment licence, it is anticipated that the tender and construction will begin in 2013.

1.0 DEVELOPMENT INFORMATION

Fairholme Colony Domestic Wastewater Stabilization Pond
Name of development

Fairholm Holding Co. Ltd.
Legal name of the proponent of the development

North of the Fairholme Colony in SW 35-9-8 WPM
Location of development

Contact Person for Proponent:

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2.0 DESCRIPTION OF DEVELOPMENT

2.1 CERTIFICATE OF TITLE

The proposed development is to be located to the north of the Fairholme Colony (R.M. of South Norfolk) in SW 35-9-8 WPM. The Certificates of Title for the proposed development area are included in Appendix A.

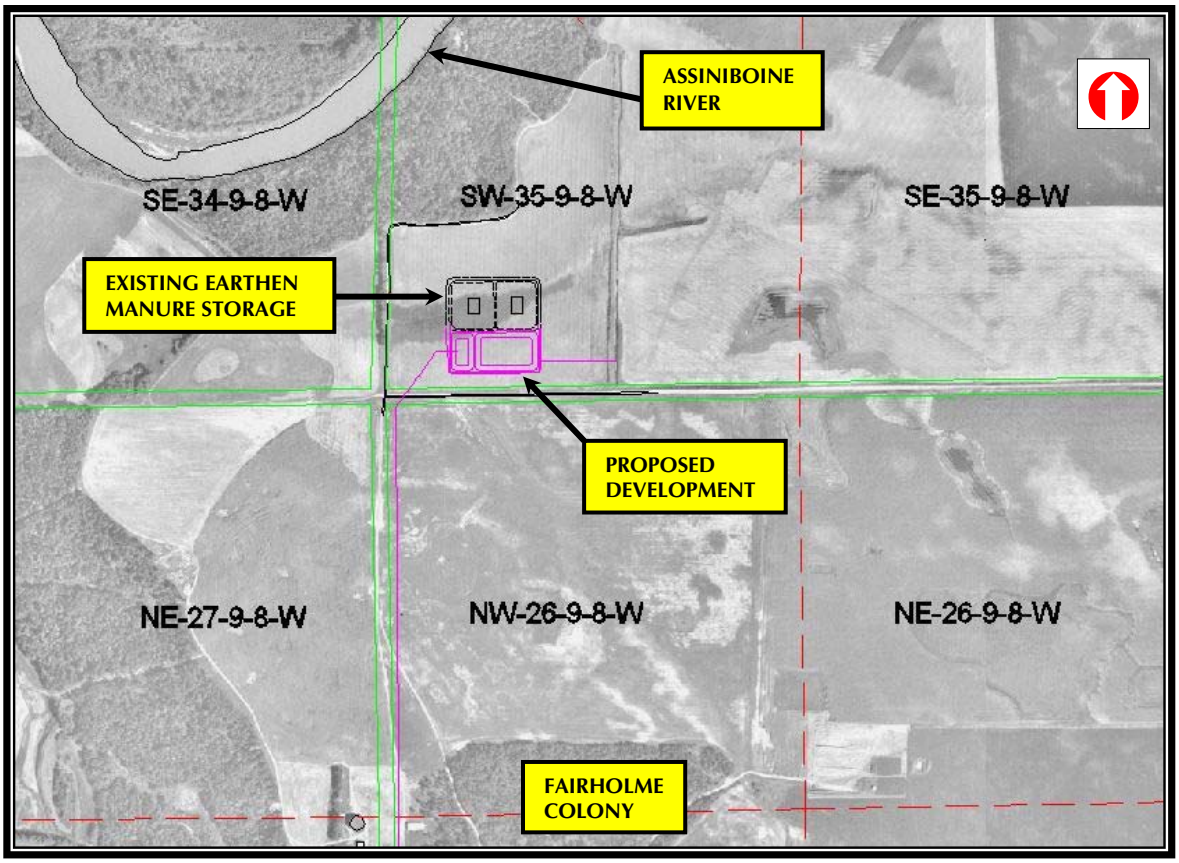

Figure 2.1: Location map of proposed development

2.2 NAME OF OWNER

The lagoon development area is owned by the Fairholm Holding Co. Ltd.

2.3 MINERAL RIGHTS

According to correspondence with Crown Lands & Property Agency – Lands Branch, the mines & minerals and sand & gravel in SW 35-9-8 WPM were originally granted with the surface in 1881 & 1882. The Crown owns no interests. Correspondence is included in Appendix D.

2.4 DESCRIPTION OF EXISTING LAND USE

The land intended for lagoon development is currently agricultural land. Land directly to the north of the proposed site supports an existing earthen manure storage pond owned by the Colony.

2.5 PREVIOUS STUDIES

2005 Geotechnical Report: "Fairholme Colony Manure Storage Pond, Portage La Prairie, Manitoba" prepared by Cochrane Engineering Ltd. for the Fairholme Colony.

This report provides a detailed geotechnical investigation of the now existing manure storage pond (constructed in 2007) and the proposed domestic wastewater treatment lagoon site conducted by Cochrane Engineering Ltd. (currently GENIVAR) on July 22, 2005.

The investigation included a site visit, drilling six testholes, sample collection and laboratory analysis. The report concluded that based on soil conditions, the pond cells should be built with a clay core within the proposed dykes.

2.6 EFFLUENT QUALITY AND DISCHARGE ROUTE

The proposed lagoon will discharge treated effluent into an existing natural drain, which eventually empties into the Assiniboine River, as illustrated in Figure 2.2. The route from the pipe discharge point of the proposed lagoon to the Assiniboine River is approximately 940 metres. The proposed lagoon is in the Assiniboine River Watershed (No. 100).

To meet the requirements of the *Water Quality Standards, Objectives and Guidelines Regulation under The Water Protection Act* (2011), the Colony will implement a nutrient reduction strategy consisting of trickle discharge. The estimated maximum Fairholme Colony population is 150 and thus the proposed Fairholme Colony lagoon may be considered as a small wastewater treatment facility. A trickle discharge extending from two to four weeks will allow the vegetation and the soil in the bottom of the natural drain to absorb nutrients and reduce nutrient loads to surface waters. Figure 2.2 shows the proposed effluent discharge route from the Fairholme Colony lagoon (red arrows).

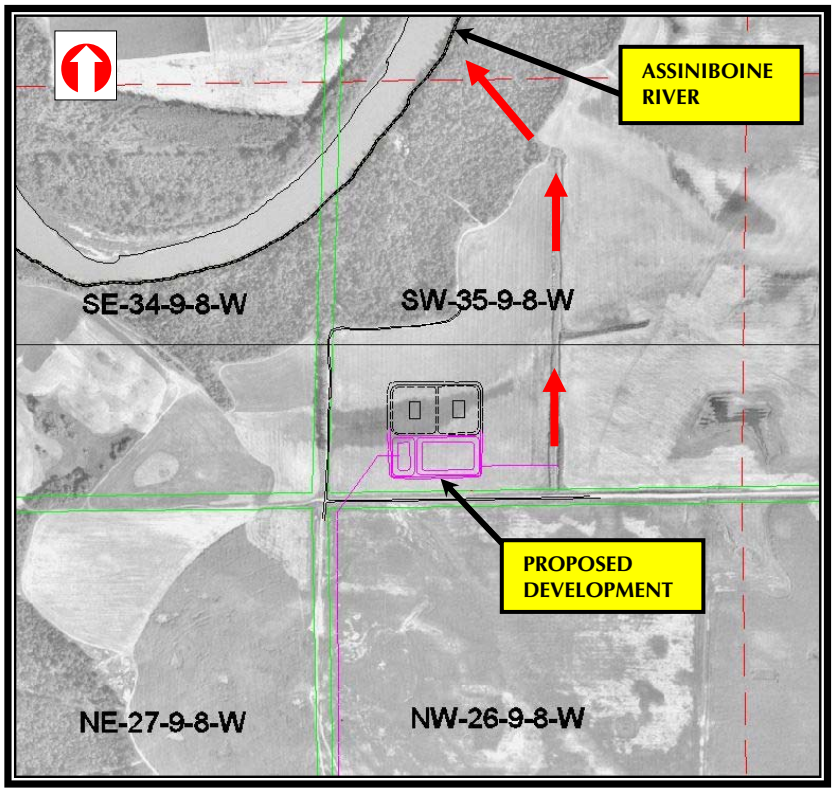

Figure 2.2: Effluent discharge route from the proposed Fairholme Colony lagoon

3.0 POPULATION SERVICED AND DESIGN LOADING

3.1 SOURCES OF WASTEWATER

The proposed lagoon will service the Fairholme Colony with an estimated maximum population of 150.

3.2 ORGANIC LOADING

Organic loading refers to the quantity of organic material present in the incoming wastewater and is measured as the five day Biochemical Oxygen Demand (BOD_5). The organic loading becomes the total mass of BOD_5 in kg/d in the wastewater discharged to a lagoon.

On the basis of accepted practice, the daily BOD_5 production for domestic wastewater is 0.077 kg per person. Therefore, with a population of 150 the organic loading to the proposed Fairholme Colony lagoon is (150 people x 0.077 kg-BOD_5/d =) **11.55 kg-BOD_5/d.**

3.3 HYDRAULIC LOADING

Hydraulic loading refers to the volume of wastewater directed to the lagoon. Lagoons are presently designed for a 227-day storage period beginning November 1st and ending June 15th of the following year. Hydraulic loading over the 227-day storage period is used to calculate the volume of storage required in the lagoon facility.

A water consumption of 250 Lpcd has been assessed to the Colony population. This consumption is based on average consumption quantities obtained from other established colonies. Conservatively, water consumption is assumed to equal wastewater generation and therefore 250 Lpcd is the design wastewater generation for the Colony. Infiltration into the existing sewer system is considered to be negligible.

The Fairholme Colony population of 150 will generate wastewater requiring an active storage capacity of approximately (250 L/c/d/ x 150 people x 227 d =) 8,512,500 L or **8,513 m^3** for a period of 227 days.

4.0 PROPOSED DEVELOPMENT

Considering the wastewater generation of the Fairholme Colony population of 150, a new two-cell wastewater treatment facility is proposed.

4.1 SITE CONDITIONS

On July 22, 2005, Cochrane Engineering Ltd. (currently GENIVAR) conducted a geotechnical investigation at the proposed site located in section SW 35-9-8 WPM during which six testholes, TH1 to TH6 were drilled. The complete Geotechnical Report is included in Appendix B.

4.1.1 Local Topography

The proposed site is located in an area known as Lower Assiniboine Delta. The Lower Assiniboine Delta is a smooth sandy lacustrine plain below the Manitoba Escarpment. The topography is usually level to gently sloping.

Surficial deposits are composed of mainly sandy deposits that vary from 1 to 4.6 m in thickness and are underlain by lacustrine clays and bouldery till. Various shales, sandstones and evaporites of the Cretaceous and Jurassic periods underlie much of the surficial deposits.

4.1.2 Soil Conditions

The general soil profile encountered in testholes, TH1 to TH6 revealed a topsoil layer of 50 to 80 mm in thickness underlain by a sand layer which becomes saturated at a depth of 1.1 to 1.2 m below grade followed by a thick clay layer, which extended to the bottom of the testholes at 10.7 m below grade. Medium seepage from the saturated sand layer in all of the testholes was observed. A detailed description of the soil profile is presented in the attached logs, Appendix B (Geotechnical Report).

4.1.3 Groundwater

Based on the nearby well log (NE 35-09-08 WPM), an upper unconfined sand aquifer has been noted in this section. However, the depth of the aquifer (bedrock) ranges from 73 m to 77 m below grade, well beyond the thin sand over a thick clay layer. The proposed site is included in the Groundwater Pollution Hazard Map as it is near a designated groundwater hazard area, Assiniboine River.

4.1.4 Site Investigation

The subsoils encountered were visually classified to the full extent in each testhole and soil samples were recovered at random intervals. Selected samples from TH2 at 1.5 m and 2.3 m and at TH5 at 1.5 m, 3 m and 4.5 m were submitted for Atterberg limit and particle size analysis for classification and estimated hydraulic conductivity. Any groundwater seepage and sloughing encountered in the testholes were noted.

Laboratory test results are attached in Appendix C (Geotechnical Report). The test results classified the 1.5 m sample as sandy silt while the samples at 3 m and 4.6 m as CH material. Based on this test result and particle size analysis, the estimated hydraulic conductivity of the CH in-situ materials is expected to be $<1x10^{-7}$ cm/s. However, if a till pocket, silt seams or sand seams were to be encountered during construction, this material will be removed and replaced with high plasticity clay.

4.2 SUMMARY OF PROPOSED DEVELOPMENT

The proposed development consists of the construction of a new primary cell and a new secondary cell to the north of the Fairholme Colony. The new facility will provide treatment for an organic loading of **11.55 kg-BOD_5/d** and a hydraulic loading of **8,513 m^3**.

4.2.1 New Primary Cell

The new primary cell will be constructed as illustrated in the design drawings (Appendix C). The primary cell is designed with a clay core based on the recommendation of the Geotechnical Report.

The cell will be constructed with 4:1 interior and exterior side slopes and will have a normal operating depth of 1.5 metres with a minimum 1.0 metre freeboard.

A primary treatment cell is typically sized in accordance with a Manitoba Conservation guideline that requires one hectare of liquid surface area per 56 kg-BOD_5 daily loading. For a design population of 150 people contributing 11.55 kg-BOD_5/d, the required (minimum) primary cell liquid surface area is approximately 0.21 ha at a full-level liquid depth of 1.5 metres.

Manitoba Conservation stipulates that only half of the total volume of the primary cell contributes to the hydraulic storage of the facility. At an operating depth of 1.5 m, the primary cell has a total volume of 2,800 m^3 and a storage volume of **1,400 m^3**. The cell has a surface area of **0.24 ha**.

Table 4.1 provides the details for the preliminary design specifications for the new primary cell.

TABLE 4.1: PRELIMINARY DESIGN SPECIFICATIONS FOR THE NEW PRIMARY CELL

Parameter	New Primary Cell
Cell bottom	24.5 m x 54.9 m
Liquid surface (at full design depth)	36.5 m x 66.9 m
Top of dyke (inside to inside)	44.5 m x 74.9 m
Operating depth	1.5 m
Freeboard height	1.0 m
Interior side slope	4:1
Exterior side slope	4:1
Total volume (at operating depth)	2,800 m^3
Storage volume	1,400 m^3
Surface area (at operating depth)	0.24 ha
Liner system	Clay Core

4.2.2 New Secondary Cell

The new secondary cell will be constructed as illustrated in the design drawings (Appendix C). The secondary cell is designed with a clay core based on the recommendation of the Geotechnical Report.

The cell will be constructed with 4:1 interior and exterior side slopes and will have a normal operating depth of 1.5 metres with a minimum 1.0 metre freeboard.

Table 4.2 provides the details for the preliminary design specifications for the new secondary cell.

The proposed secondary cell has a storage volume of **8,213 m^3** resulting in a total lagoon storage of **9,612 m^3**. The excess storage volume provides for potential volume lost due to construction tolerances, as well as any increases to wastewater generation or minor infiltration.

TABLE 4.2: PRELIMINARY DESIGN SPECIFICATIONS FOR THE NEW SECONDARY CELL

Parameter	New Secondary Cell
Cell bottom	102.9 m x 54.9 m
Liquid surface (at full design depth)	114.9 m x 66.9 m
Top of dyke (inside to inside)	122.9 m x 74.9 m
Operating depth	1.5 m
Freeboard height	1.0 m
Interior side slope	4:1
Exterior side slope	4:1
Total volume (at operating depth)	9,965 m^3
Dead storage depth	0.3 m
Dead storage volume (at 0.3 m depth)	1,752 m^3
Storage volume (at operating depth)	8,213 m^3
Liner system	Clay Core

4.2.3 Construction Details

The new facility will be constructed as detailed in the drawings and in accordance with the *Province of Manitoba Design Objectives For Standard Sewage Lagoons (1985)*.

According to the subsurface profiles in the Geotechnical Report, the topsoil in the proposed development area varied between depths of 50 mm to 80 mm. Organic soil from the lagoon area will be stripped, stockpiled and reapplied at the end of construction on the applicable disturbed areas and on the dykes as shown in the drawings. The topsoil is to be stockpiled in an area where it will not be susceptible to erosion.

For lagoon construction, Manitoba Conservation requires that the proposed dykes and bottom of the proposed cells be provided with a layer consisting of at least one metre of soil having a permeability of less than $1x10^{-7}$ cm/s or equivalent.

The clay core should be compacted to 95% standard Proctor density at minus one percent to plus three percent of optimum moisture content with a sheepsfoot roller. Any unsuitable material such as sand or high percentage silt materials should be removed and replaced with the recommended CH material liner and compacted to 95% standard Proctor density.

The unsuitable material can be used as backfill on the outside face of the dykes. The embankment material should be placed in 150 mm lifts compacted with sufficient passes with a fully ballasted sheepsfoot roller to achieve a minimum compaction of 95% standard Proctor clay density.

The interior and exterior side slopes of the constructed cells will be 4:1. The proposed cells will have a 1.5 metre operating depth with a minimum 1.0 metre freeboard. The top of the dykes will be 3.0 m wide to permit vehicle access to all points of the lagoon.

Rip rap is proposed for the interior dykes and the inlet and outlet areas of the inter-cell piping. All inter-cell piping and valves will be located as shown on the design drawings.

A lockable access gate will be installed as part of the construction activities. The gate will be located across the lagoon access road and will connect with the perimeter fence. Signage identifying the nature of the facility will be placed on the perimeter fence around the lagoon.

5.0 ENVIRONMENTAL IMPACTS

5.1 ODOUR CONSIDERATIONS

The only time of the year that some minor odours may be present is during the spring while the ice thaws. During the winter, ice cover largely prevents free oxygen from entering the water. This condition leads to the production of hydrogen sulphide gas (H_2S) during the winter by bacteria that do not require free oxygen. These accumulated gases dissipate quickly into the atmosphere when the ice breaks and the pond returns to a non-odorous condition.

The closest residence to the lagoon is located approximately 1,300 metres away, which meets the Manitoba Conservation minimum setback distance of 300 metres, and belongs to the Colony.

5.2 LAND IMPACT

The land intended for lagoon development is currently agricultural land. Natural native land and habitat is not being disturbed by the lagoon expansion.

5.3 SURFACE WATER

Treated effluent will be discharged into an existing natural drain, which eventually empties into the Assiniboine River. The distance of the route from the discharge point of the proposed lagoon to the Assiniboine River is approximately 940 metres.

The Water Licensing Branch of Manitoba Water Stewardship was consulted to provide a list of water users along the drainage route up to the Assiniboine River. There are no water users on the discharge route (Appendix D).

As per the Manitoba Infrastructure and Transportation, Water Management and Structures Division information, the site was not affected by the 2011 flood, which was estimated to be a 1 in 300-year event.

5.3.1 Fuel Storage on Site

The proposed facility does not require the onsite storage of gasoline or diesel fuel. During construction and upgrading, the contractor will be required to ensure that all equipment is

properly maintained to prevent leaks and spills of fuel and motor fluids. Refuelling of equipment will not be within 100 metres of a water body, stream or wetland.

5.4 SPECIES IMPACT

A file search with the Biodiversity Conservation Wildlife and Ecosystem Protection Branch of Manitoba Conservation resulted in no occurrences found near the development site. Correspondence is included in Appendix D.

5.5 FISHERIES

From the discharge point into an existing natural drain and eventually converges with the Assiniboine River (Figure 2.2). According to Fisheries and Oceans Canada (DFO) the identified segment of the drain would likely be type E habitat (indirect fish habitat), but it becomes type A (complex habitat, with indicators present) in the Assiniboine River. Correspondence is included in Appendix D.

In order to protect any potential fish in the critical springtime spawning season, when effluent un-ionized ammonia tends to be high, the lagoon has been designed for a 227-day storage period. The lagoon will discharge after June 15th which will allow for significant conversion of toxic un-ionized ammonia into relatively benign nitrates.

5.5.1 Fisheries Act Information

As noted from Fisheries and Oceans Canada (DFO), the deposit of deleterious substances into water frequented by fish is prohibited under the *Fisheries Act*. In addition, according to subsection 35(1) of the *Fisheries Act*, "no person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat."

5.6 FORESTRY

There is no known forestry activity in the development area. The construction of the lagoon will not affect any forested area.

5.7 HERITAGE RESOURCES

In a letter dated March 18, 2013 from the Historic Resources Branch (Appendix D), it was stated that the Historic Resources Branch has found no areas of potential concern regarding heritage recourses for this project.

5.8 SOCIO-ECONOMIC IMPACTS

The lagoon construction will result in a short-term boost to the construction industry in the area.

5.9 PUBLIC INVOLVEMENT

Comments from concerned members of the public will be solicited as part of Manitoba Conservation review prior to issuing a licence.

6.0 MANAGEMENT PRACTICE

The new wastewater treatment facility is specifically designed to provide wastewater treatment and storage capacity for the proposed population. The proposed lagoon is designed to treat wastewater up to an average loading of 13.44 kg-BOD_5/d and provide storage up to 9,625 m^3 for 227 days. The facility will normally discharge in spring after June 15th, and again in the fall prior to October 31st if required for winter storage. It may be possible to discharge just once in the fall until population approaches the design number. Treated effluent will be discharged by pumping from the isolated secondary cell at a rate that optimizes the opportunity for nutrients in the effluent to be assimilated in the discharge route prior to reaching the Assiniboine River while not challenging the normal operation of the wastewater treatment lagoon.

6.1 DISCHARGE PROCEDURE

1) Manipulate the valves to isolate the secondary storage cell two weeks before collecting the BOD_5, bacteriological, and any other samples required in the new Environment Act Licence.

2) Sample the isolated secondary cell. Allow at least one week to analyse the sample(s), plus shipment time.

3) If wastewater effluent quality meets licence requirements the effluent can be discharged. If wastewater effluent quality does not meet licence requirements, re-test until they meet the required quality. Further discharge requirements may be instituted in the new Environment Act Licence that should be satisfied prior to discharge.

4) While discharging, the valve between the primary cell and the secondary cell being discharged remains closed to prevent additional liquid from transferring into the discharging secondary cell.

5) Once the secondary cell is discharged, reopen the valve between the primary cell and the secondary cell. This will allow the water levels in the cells to equalize. In many cases a sufficient amount of treated effluent is discharged from the secondary cell using this procedure to permit operation until the next scheduled discharge period. However, it may be necessary to discharge additional treated effluent to have enough storage for the wastewater flows in the following operational year.

6) If further discharging is necessary, repeat the isolation, testing and discharge process.

6.2 RECORD KEEPING AND INSPECTION ROUTINE

A record book, organized in five sections, should be maintained:

1) Daily Records – Pumping records for the lift station should be collected and retained for future estimation of flows to the wastewater treatment facility, i.e. elapsed time meter readings on the lift station pumps or flow meter.
2) Weekly Records - The weekly summer inspection would consist of recording the following: The water level, presence of odours and their source, and presence of floating objects (removal). The summer maintenance should also include grass cutting on the dykes, if necessary, elimination of emergent vegetation, extermination of burrowing animals, repair of the dykes and rip rap if damaged by wind erosion and wave action, repair of the fence and gate.
3) Periodic Winter Inspection is confined to inspecting for frozen piping, checking if the water level in the cells is as it should be.
4) Discharge Records - The records should contain all treated effluent quality analyses, dates of discharge, discharge procedure followed, water levels and other pertinent data.
5) Service Records - The lift station pumps should be serviced according to the manufacturer's instructions.

7.0 SCHEDULE

It is anticipated that the Environment Act Licence process will be finalized by the summer of 2013 and construction will begin in the fall of 2013.

8.0 FUNDING

The construction project is to be funded primarily by Fairholme Colony. Fairholme Colony will pursue any and all applicable funding sources for this project.

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