Lindbergh SAGD Expansion Project

Supplemental Information Request Response #2

OSCA Application No. 1784285
EPEA Application No. 008-1581
Water Act File No. 00346828

Table of Contents

List of Tables

List of Figures

List of Appendices

1 ACRONYMS

The following acronyms are used in this Supplemental Information Request and response.

AAAQO	Alberta Ambient Air Quality Objectives
CLFN	Cold Lake First Nation
COPC	Chemicals of Potential Concern
CPF	Central Processing Facility
EIA	Environmental Impact Assessment
FLFN	Frog Lake First Nation
FN	First Nation
FNC	First Nations Consultation
HHRA	Human Health Risk Assessment
HSPF	Hydrological Simulation Program FORTRAN
KCFN	Kehewin Cree First Nation
km	kilometre
LCL	Lower Control Limits
LSA	Local Study Area
m	metre
MMbbls	Million Barrels
PAH	Polycyclic Aromatic Hydrocarbon
POC	Point of Compliance
POM	Point of Management
Rf	Retardation Factor
RSA	Regional Study Area
TDS	Total Dissolved Solids
TOR	Terms of Reference
UCL	Upper Control Limits
UZSN	Upper Zone Storage

2 ALBERTA ENERGY REGULATOR

2.1 OSCA APPLICATION NO. 1784285

General

1) Provide an update on the status of stakeholder (public and industry) notification and consultation respecting the proposed Lindbergh SAGD Project Expansion, including a list of all stakeholders with an outstanding statement of concern (including any statements of concern sent to Alberta Environment and Sustainable Resource Development) and efforts taken to resolve the concerns.

Response:

All stakeholders within the proposed Project Area, public and industry (including both surface and mineral stakeholders), have been notified. Methods of communication include face to face consultation, mail outs, newspaper advertisements and open houses. Pengrowth made additional efforts to notify stakeholders within a 1 mile buffer of the proposed Project Area, which was above the requirements for the Project. Factoring in the newspaper advertisements, open houses, as well as the personal consultation and Project information notifications, Pengrowth believes that all stakeholder notification and consultation requirements have been satisfied.

Following is an update on the outstanding Statements of Concern (SOCs) that have been filed with the Alberta Energy Regulator (AER):

1. SOC No. 29059 dated June 11, 2014 (Heather Harms and Trevor Desilets): Phone conversations and meetings to understand the concern have taken place. Pengrowth has met with Heather Harms and Trevor Desilets. Based on the discussions at this meeting, Pengrowth is currently in the process of drafting an agreement letter to receive final sign-off to mitigate the concerns put forward.
2. SOC No. 29172 dated August 5, 2014 (CNRL): Detailed comprehensive discussions relating to the three items listed in this SOC have taken place. Pengrowth is actively engaged with CNRL in discussions that are expected to take place to resolve the concerns expressed by CNRL.

To date, there have been no additional SOCs filed with Alberta Environment and Sustainable Resource Development (ESRD) or Alberta Environment and Parks (AEP).

2) **SIR Response, Appendix A-1.3, Stakeholder Listing, and Figure A.3.1, Surface Land Owners.** Appendix A 1-3 indicated some of the stakeholders did not receive notification of the application (e.g., mail returned, unknown postal code, etc.).

a) Update Figure A. 3.1 by clearly showing the surface land owners of which did not receive notification of application and Pengrowth's effort to date to notify these surface landowners.

Response:

Since the time of submission of the first round SIR response, all surface land owners as shown on SIR1 Response Figure A.3-1, have either received personal consultation or been notified of the Project. This is reflected in the Personal Consultation Line List presented in Appendix 2-1. This line list provides a breakdown of each landowner by name, legal location, type of consultation they received and when, as well as any additional comments. If the landowner provided a non-objection, this was also reflected. In addition to the Personal Consultation Line List presented in Appendix 2-1, a sample of each of the documents that was provided to each landowner is located in Appendix 2-2. This includes:

- Project information letter;
- Open House invitation;
- Lindbergh EIA Overview Map;
- Stakeholder specific area overview map; and
- Stakeholder Consultation Summary Sheet (only applicable for personal consultation).

Notification of all mineral leaseholders and surface disposition holders within and adjacent to the Project Area was complete as of 2014, as outlined in SIR 1 Response #A.1 and A.2.

b) Figure A. 3.1 shows dwellings in and offsetting the proposed project area. Provide information on who lives in each of the dwellings, how the occupants were consulted, and the concerns that were raised by the occupant.

Response:

In addition to the stakeholders within the Project Area, stakeholders within a 1 mile buffer were mailed information packages, as presented in Appendix 2-3. Each stakeholder was mailed the same project notification package as stakeholders within the Project Area, as described in the response to SIR #2a.

Further to this, as prescribed by the AER for the EIA process, Pengrowth published newspaper advertisements in the St. Paul Journal, Elk Point Review, Bonnyville Nouvelle, and the Lloydminster Source. These advertisements included a brief overview of the Project, direction as to how to get further information, and as well invitations to all four open houses held by Pengrowth. An example of one of these advertisements has been included in Appendix 2-4.

Figure A.3-1 has been updated as Figure 2-1, to reflect each dwelling/landowner, all of which received consultation.

As mentioned previously, all stakeholders within the Project Area and surrounding 1 mile have been notified of the Project either through personal consultation, mailings, newspaper advertisements or open houses. Pengrowth believes that all stakeholder notification and consultation requirements have been satisfied.

Hydrogeology

3) **SIR A.13 Response – Proposed monitoring near the waste brine storage tanks**

a) Discuss how Pengrowth will monitor the waste brine tanks and the secondary containment liner to prevent releases to groundwater.

Response:

The waste brine tanks are located in a lined tank farm, which provides the secondary containment. The tanks are mounted on elevated piles so any leakage will be visible to operators during their daily rounds.

b) Discuss whether Pengrowth will revise the proposed groundwater monitoring program pursuant to its EPEA approval to improve monitoring of Domestic Use Aquifers near this potential source.

Response:

As indicated in SIR1 Response #13d, groundwater monitoring wells in the vicinity of the waste brine storage tanks will be installed to target shallow surficial aquifers or the water table within 15 m of the ground surface. Groundwater monitoring of deeper Domestic Use Aquifers is not planned at the Project's Central Processing Facility (CPF), because the potential impacts at this location would originate at surface in the form of spills or leaks. The uppermost formation is the Grand Centre Formation that is interpreted as an overall aquitard. Based on monitoring well installation at the CPF for Phase 1, the Sand River Formation equivalent is not expected to be present. Where the Sand River Formation equivalent is absent, 30 to 40 m of Marie Creek Formation gravelly clay underlies the Grand Centre Formation.

There are no plans to revise the proposed monitoring well locations or depths at the CPF. Domestic Use Aquifers in the Project CPF area are expected to be at depths of over 30 m, which are at very low risk of impact from surface activities. In the event of a verified impact, however, additional deeper monitoring wells will be considered as part of the Groundwater Response Plan.

4) **SIR A.14 Response – Monitoring of the Spring in NE01-060-05W4M**

Table A.14 only shows Field Results for the above noted Spring and Pengrowth did not monitor the flow at the above noted spring or identify seasonal changes in the flow rate.

a) Update Table A.14 to include a summary of all analytical results for the spring.

Response:

The analytical results for the spring located in NE ¼ 01-060-05 W4M, including routine chemistry, dissolved metals and total metals, are presented in Tables 4-1, 4-2 and 4-3, respectively.

Table 4-1 Spring at NE ¼ 01-060-05 W4M - Routine Chemistry Results

Sample ID	Sampling Date	Inorganics														General Chemistry				
		Alkalinity (P) as $CaCO_3$	Alkalinity (T) as $CaCO_3$	Bicarbonate	Calcium	Carbonate	Chloride	Hydroxide	Magnesium	Nitrate (as N)	Nitrate + Nitrite-N	Nitrite (as N)	Potassium	Sodium	Sulphate	Electrical Conductivity (lab)	Ionic Balance	pH (Lab)	Hardness as $CaCO_3$	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µS/cm	%	pH	mg/L	mg/L
NE 01-060-05 W4M Spring	19-Oct-13	<5	615	750	109	<6	11.8	<5	69.3	<0.01	<0.01	<0.005	7.1	45.1	30	1,050	100	7.84	557	642

Table 4-2 Spring at NE ¼ 01-060-05 W4M - Dissolved Metal Results

Sample ID	Sampling Date	Dissolved Metals																											
		Aluminium	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silicon	Silver	Strontium	Sulphur as S	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
NE 01-060-05 W4M Spring	19-Oct-13	<0.002	<0.0002	0.022	0.331	<0.0001	<0.0005	0.158	<0.00001	<0.0005	0.0006	<0.001	5.12	<0.0001	0.07	0.195	<0.0001	0.004	0.001	<0.0002	10.4	<0.00001	0.618	10	<0.00005	<0.001	<0.0005	0.001	<0.0001	0.003

Table 4-3 Spring at NE ¼ 01-060-05 W4M - Total Metal Results

Sample ID	Sampling Date	Total Metals																											
		Aluminium	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Molybdenum	Nickel	Selenium	Silicon	Silver	Strontium	Sulphur as S	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
NE 01-060-05 W4M Spring	19-Oct-13	0.1	0.0004	0.359	3.03	0.0002	<0.001	0.19	0.00006	<0.001	0.001	0.003	95.5	0.0006	0.072	0.312	0.005	0.003	0.0005	13.1	<0.00002	0.929	9.3	<0.0001	<0.002	0.01	0.0021	0.0028	0.032

b) Discuss whether the flow at the spring can be measured and whether Pengrowth can commit to measuring the flow to improve baseline data at this location.

Response:

The flow rate at the spring can be measured. Pengrowth will measure the flow from the spring if directed to do so by approval conditions and pending landowner consent.

5) **SIR A.15 Response – Possible channel under Garnier and Bluet Lakes and Southernmost 3D not interpreted**

The 3D seismic interpretation of the top of bedrock at the southwest lease was noisy so it was not possible for Pengrowth to confirm whether or not a buried channel is present in this area. Pengrowth indicated that a downhole sonic log across the Quaternary to the top of the Lea Park Formation would improve the 3D seismic interpretation. AER also notes that there is a large area of the Lindbergh Lease (southwest) shown on Figure A.15-2, where several residence locations have been identifed (Figure A.3-1) where 3D seismic has not been interpreted.

a) Discuss whether Pengrowth can attain a downhole sonic log during the construction of D08 Pad, or another SAGD pad, in order to improve the 3D seismic interpretation in this Noisy Seismic Data area (shown on Figure A.15-2).

Response:

The Garnier Lake valley surface erodes down to an elevation of about 590 m, which is only 40 m above the bedrock. This is too shallow for the 3D seismic to image any reflectors because of low seismic fold. Acquiring a sonic log would not improve the 3D seismic data quality - it would only help improve the accuracy of the depth conversion in other areas of the 3D where the data quality is good enough to image the bedrock.

b) If Pengrowth can commit to attaining a downhole sonic log, provide an estimated time for submitting an improved top of bedrock interpretation to the AER. If Pengrowth cannot commit to attaining a downhole sonic log, discuss how Pengrowth will proceed with groundwater monitoring at pads within or in close proximity to the Noisy Seismic Data area shown on Figure A.15-2.

Response:

A sonic log would not help in improving the seismic interpretation of the bedrock in the Garnier Lake valley. In order to improve the interpretation of the top of bedrock within this region, Pengrowth will obtain four additional top of bedrock data points within the noisy seismic data area. These data points will be obtained from one or more of the following sources:

- groundwater monitoring wells in proximity of any future pads within the noisy seismic area;
- shallow evaluation wells with mud logging and gamma-ray and/or electric well logs; and/or
- open hole logs obtained on OSE wells prior to setting surface casing in the subject area.

Pengrowth will obtain this data and provide an updated interpretation of the top of bedrock in the Noisy Seismic Data area prior to drilling any SAGD wells within this area.

c) Discuss any obstacles to interpreting 3D seismic data in the southernmost area of the Lindbergh Lease. If an interpretation can be undertaken, provide a timeline for submitting the interpretation to AER.

Response:

The initial 1989 and 1996 legacy 3D seismic programs at Lindbergh were designed to image the Lloydminster sands. These sands occur at a greater depth than typical McMurray sands (*i.e.* depth of 500 m for the Lloydminster *vs.* 200 m for the McMurray). This means that the shallow Quaternary section of the Lindbergh 3D's have a lower fold than typical McMurray seismic programs.

The newer 2012 and 2014 seismic programs shot by Pengrowth over the north east portion of the Lindbergh lease and over the Muriel Lake lease were designed with higher fold than the previous programs. This resulted in the shallow section data being of sufficient quality to image the Quaternary. In these new 3D regions, a sonic log would be useful to increase the accuracy of the bedrock time to depth conversion where the seismic data quality is better.

The older 1989 and 1996 legacy 3D over the southernmost area of the Lindbergh lease have very low fold over the Quaternary, resulting in poor data quality over this shallow interval. A sonic log would not help in improving the seismic interpretation of the Quaternary on these older programs. Acquisition parameters are summarized in Table 5-1 for the legacy 1989 and 1996 3D along with the newer 3D for comparison purposes.

Table 5-1 3D Seismic Acquisition Parameters

Parameter	1989 3D	1996 3D	2012 3D	2013 Muriel Lake 3D
Name	Lindbergh 89-H-3D	Lindbergh 96-P-3D	Lindbergh 2012-3D	Muriel Lake 3D
Size	14.2 km^2	24.9 km^2	23.6 km^2	35 km^2
Source	Vibroseis	Vibroseis	Dynamite	Dynamite
Source Parameters	1 vibe 12-120hz, 8 sweeps x 8sec	2 vibes 12-120hz, 4-8 sweeps x 8 sec	0.25 kg @ 6 m	0.25 kg @ 6 m
Source Spacing	30 m	30 m	30 m	30 m
Source Line Interval	180 m	150 m	125 m	105 m
Receiver Spacing	30 m	30 m	30 m	30 m
Receiver Line Interval	150 m	180 m	100 m	105 m
Fold at Lloyd	900%	900%	2,200%	1,500%

6) **SIR A.20 Response – Clarification on the depth of surface casing**

In the response, Pengrowth states *"Pengrowth determines the setting depth of the surface casing based on the Alberta Energy Regulator – Base of Ground Water Protection (BGWP) Tool."* However, the BGWP query tool is based on a regional interpretation of the top of bedrock. The regional interpretation has been significantly improved by Pengrowth, as is shown in Figure A.15-2, especially where new buried channels have been identified.

a) Clarify how Pengrowth will determine the setting depth of surface casing. In the response, also consider the uppermost fresh zone observed in the Lea Park Formation.

Response:

Pengrowth will utilize the most accurate data available to determine the top of bedrock. Pengrowth utilizes the BGWP query tool as a starting point in determining the depth of the top of bedrock. Data obtained from drilled wells is also utilized to ensure the surface casing is landed below the base of the groundwater.

7) **SIR A.21 Response – Groundwater Monitoring Program (Appendix A.21-1)**

This report was prepared prior to the improved 3D seismic interpretation. A new buried channel has been identified on the Muriel Lease, but groundwater monitoring well has not been proposed in this channel.

a) Discuss how Pengrowth will monitor groundwater in this channel prior to commencing and during operations at the Muriel Lease.

Response:

Since the proposed groundwater monitoring program was prepared for the Project, a draft regulatory document was released for groundwater monitoring of in situ operations (Alberta Government, 2014). As part of these requirements, the following will be included in the development of an updated groundwater monitoring program for the Project:

- Preliminary Risk Assessment;
- Groundwater Management Plan;
- Site-Specific Groundwater Management Response Plan; and
- Annual Groundwater Monitoring Reports.

Prior to operations commencing, a preliminary risk assessment will be completed to identify aquifers and well pads that may have a higher risk for the thermal mobilization of constituents. The locations of well pads in proximity to receptors will be assessed during the preliminary risk assessment. Based on the risk assessment, additional locations of monitoring wells may be proposed or current proposed locations may be modified.

Groundwater monitoring at the Pilot SAGD well pad (D01) that has been ongoing since 2011 will be used to determine the appropriate level of monitoring for thermal plume development in the vicinity of receptors. To date, the groundwater monitoring at Well Pad D01 does not indicate any thermal impacts to groundwater. The preliminary risk assessment will be used to ensure that an appropriate

groundwater monitoring plan is proposed. The groundwater monitoring program for the Project, once approved by the AER, will also be reassessed annually during operations to ensure that monitoring well placement, completions and sampling frequency are sufficient for the protection of receptors. Due to the staged progression of well pad construction proposed, groundwater monitoring well locations may also be altered to ensure appropriate placement.

The need for and extent of groundwater monitoring of the channel identified using 3D seismic data will be determined based on groundwater monitoring results collected as part of current and future groundwater monitoring by Pengrowth. Following the preliminary risk assessment, consideration will be given to the completion of additional monitoring wells within the channel for the collection of baseline and operational monitoring data.

Reference:

Alberta Government. 2014. Draft Guidance for Groundwater Management Plans for In Situ Operations: Assessing Thermally-Mobilized Constituents. February 2014.

Surface Water

8) **SIR1 Reponses, #A.36, Page 43.**

In response to SIR1 #A.36, Pengrowth stated "*…SAGD well trajectories are expected to be drilled beneath Garnier Lake, Garnier Creek, and the western portion of Reita Lake.*"

a) For the well pads proposed to go beneath Garnier Lake, Garnier Creek, and Reita Lake, provide the conceptual construction and production dates for those wells. Include a figure that identifies the surface location of these pads and the proposed well trajectories.

Response:

Figure 8-1 is a preliminary layout plan for the development of the reserves under Garnier Lake, Reita Lake, and under Garnier Creek. Further delineation work is planned in the future and this current layout is expected to change significantly. Table 8-1 indicates the current schedule for construction of these wells and well pads.

Table 8-1 Preliminary Schedule for Wells and Pads in Relation to Reserves under Garnier Lake, Garnier Creek, and Reita Lake

Well Pad	Estimated Construction Year
D08	2020
D34	2040
D35	2036
D39	2039
D40	2037
D45	After 2045
D46	After 2045

Table 8-1 Preliminary Schedule for Wells and Pads in Relation to Reserves under Garnier Lake, Garnier Creek, and Reita Lake	
Well Pad	**Estimated Construction Year**
D54	After 2045
D55	After 2045

b) If the toes of the proposed drill paths were ended before the lake bed and shoreline, provide an estimate of the stranded resource.

Response:

Table 8-2 indicates the amount of oil in place and estimated recoverable reserves beneath Garnier Lake, Reita Lake, and along a 50 m wide corridor following Garnier Creek within the region with net pay greater than 8 m. If not accessed with horizontal wellbores, these resources will be stranded. Further delineation under these regions is planned in the future.

Table 8-2 Oil In Place and Recoverable Reserves Beneath Garnier Lake, Garnier Creek, and Reita Lake		
Region	**Oil In Place (MMbbls)**	**Estimated Recoverable Oil (MMbbls)**
Garnier Lake	23.3	11.7
Garnier Creek	9.2	4.6
Reita Lake	3.1	1.6

c) Provide an expanded discussion on the reduced overburden associated with these lakes in terms of the potential risks associated with steaming activities beneath the lakes.

Response:

Garnier Lake and Garnier Creek are situated within a valley (Garnier Valley) which runs north-south through the Lindbergh lease. There is up to 100 m of topographical relief between the base of the valley and the top of the offsetting hills.

The base of the caprock overlying the Lloydminster Formation beneath Garnier Valley is at a depth of 445 mKB and deeper. The maximum depth of Garnier Lake is 10 m and Garnier Creek is 1.5 m based on available data. These means the minimum overburden thickness underneath Garnier Lake and Garnier Creek is 430 m.

Mini-fracs previously completed within the caprock on three wells indicated the minimal stress gradient is 14.0 kPa/m. Multiplying the minimal stress gradient and the minimum overburden thickness results in a minimum fracture pressure of 6,020 kPa.

The approved operating pressure for the scheme in the region with the thicker overburden (outside of Garnier Valley) is based on the following:

- during the initial 2 week period of the circulation start up of a new well, the maximum allowable bottom hole operating pressure is 90% of the determined minimum frac pressure (6,200 kPa); and
- following this initial circulation start up period, the maximum allowable bottom hole pressure is decreased to less than 80% of the calculated minimum fracture pressure (5,500 kPa).

Pengrowth proposes to utilize this same methodology to determine the allowable maximum operating pressure in wells located under reduced overburden thickness regions. The allowable operating pressure would be based on the actual overburden depth of each well.

d) Provide a discussion on the effectiveness of current containment and mitigation measures used in the event of a fissure or fracture leading to a flow-to-surface oil event in one of the water bodies. Include in the discussion, an estimate for how quickly depressurization of the steam chamber could be accomplished.

Response:

Once the SAGD wells are placed in SAGD mode following the circulation phase, the normal operating pressure of the steam chamber is reduced to 3,000 to 3,300 kPa in order to mitigate losses to the underlying water zone that has an in situ pressure of 2,800 to 3,000 kPa. This normal operating pressure is less than the natural water gradient of 10 kPa/m. Depressurization of the steam chamber would not be required in the event of a flow-to surface oil event as surface water would flow into the steam chamber and kill it.

At the normal operating pressure and the depth of the steam chamber, a flow to surface of oil, steam, or emulsion is not possible.

e) Support with rationale, the proposed drill paths beneath the identified water bodies by providing a detailed risk assessment of the two scenarios; the currently proposed drill paths, and drill paths that do not extend beneath the lake/creek beds and shorelines.

Response:

The current drill paths under the identified water bodies are preliminary in nature only. As further delineation of the reserves is completed, a more detailed trajectory plan will be developed. The criteria that will be used in developing the final trajectories include:

- surface access constraints for the pads;
- minimizing the amount of stranded resources; and
- orienting the wells to run parallel with the oil-water contact deviation where possible.

The risk of drilling and producing from beneath these water bodies is no different from the risk anywhere else on the Lindbergh lease. Pengrowth will utilize the same drilling and operating procedures to ensure safe operations.

2.2 WATER ACT FILE NO. 00346828

9) **Supplemental Information Request Responses 1, #A.63, Page 79.** Pengrowth states *"the area of permanent wetland loss depends on the effective implementation of mitigation strategies and on final reclamation and will thus be less than the reported area of wetlands disturbed by the project"*. Losses of wetlands are subject to the Water Act.

a) Confirm Pengrowth's plans to apply for a Water Act approval for the losses of wetlands.

Response:

Pengrowth plans to apply for a *Water Act* approval for the losses of permanent wetlands.

10) **Supplemental Information Request Responses 1, #B.37, Page 120.**

Pengrowth states *"Pengrowth is planning to apply under the Water Act for a licence to use the water collected in the runoff pond as part of the Phase 1 of the Project."* The storm pond within Pengrowth's main plant site collects runoff from a small portion of the Muriel Lake watershed, which is closed to water allocations.

a) Confirm whether Pengrowth's plan to apply for a Water Act licence includes the consumptive use of water within the Muriel Lake watershed.

Response:

As part of this Application, Pengrowth is not planning on using any water from the Muriel Lake watershed.

11) **Supplemental Information Request Responses 1, #A.62. Page 78.**

Pengrowth states *"Detailed engineering design will be completed prior to commencing construction of Well Pad D08."*.

a) Confirm if the proposal to construct the culvert crossing across the ephemeral stream meets the Water Act Code of Practice criteria.

Response:

Pengrowth confirms that the proposed culvert crossing across the ephemeral stream will meet the criteria outlined in the Code of Practice for Watercourse Crossings, under the *Water Act*.

3 GENERAL (EIA)

3.1 PUBLIC ENGAGEMENT AND ABORIGINAL CONSULTATION

B.1. **SIR1Response, #B.1, Page 82.**

SIR1 #B.1 requested Pengrowth to provide a table that identified by issue, the concerns raised by each First Nation, mitigation plans for each concern, and timelines for mitigation. Pengrowth responded with a list of topics of concern and general mitigations.

a) Provide a table identifying each First Nation consulted with; specific concerns raised by each respective First Nation, Pengrowth's proposed avoidance and/or mitigation along with timelines to implement; each First Nations response to proposed avoidance/mitigation, and any outstanding concerns that could not be avoided/mitigated.

Response:

A summary of specific concerns raised through the First Nations Consultation (FNC) process and their proposed mitigations are presented in Table B.1-1.

Table B.1-1 First Nations Consultation Specific Concerns and Responses			
Specific Concern(s) Identified	**Project Specific Concern(s)**	**Proposed Mitigation Strategy**	**First Nation's Response to Proposed Mitigation Strategy**
Cold Lake First Nation (CLFN)			
Traditional Land Use	Want to have a Traditional Land Use Study (TLUS) completed for the Project Area.	Working with CLFN to complete a TLUS for the Project.	To provide information on when TLUS will begin and provide comments to Pengrowth on completion of TLUS.
Business Opportunities		Work with CLFN to identify opportunities for Band/Member companies to participate.	Provided information on existing companies.
Education / Training / Employment		Would like Pengrowth to participate in CLFN programs aimed at helping members gain meaningful employment in the Industry.	The CLFN will bring any initiatives to Pengrowth's attention to help fund training programs and scholarships.
Frog Lake First Nation (FLFN)			
Impacts from Industry (in general) to the Treaty Rights and traditional uses. Other land impacts identified include ongoing cattle grazing on GRL lands, previous logging activities and the ubiquitous conventional oil and natural gas projects including pipelining on crown land adjacent to the communities.	Disturbing land that had been previously used for hunting and food gathering. Removing these lands from being used in future.	Long term agreements with communities outlining project initiatives including environmental factors and reclamation, traditional knowledge, education, training and employment, business opportunities, consultation and capacity.	Some members of First Nation communities agree that exchanging economic opportunities for land removed from traditional use is satisfactory but some do not. Signed impact agreements will indicate majority are in favour of development.
Industry and the crown have not fulfilled promises made to include FN community members in education and training programs aimed at employing more members in local projects.	If one reviews the number of Aboriginal employed or involved people at any industrial establishment off reserve in Alberta, it can be seen that there is minimal First Nation member involvement.	Pengrowth is offering scholarships and other training opportunities to the communities. Local Aboriginal community companies will be included in providing required services.	There is some concern expressed over commitments made but once again, communities are willing to give Pengrowth a chance.

Table B.1-1 First Nations Consultation Specific Concerns and Responses			
Specific Concern(s) Identified	**Project Specific Concern(s)**	**Proposed Mitigation Strategy**	**First Nation's Response to Proposed Mitigation Strategy**
Companies to use locally owned and operated businesses in all aspects of the operations not just those historically offered.		Each year, Pengrowth has significantly increased the number of locally owned companies involved at the SAGD project.	Communities are providing Pengrowth with information on locally owned companies or JVs for future involvement at the SAGD project.
Kehewin Cree First Nation (KCFN)			
Impacts from Industry (in general) to the Treaty Rights and traditional uses. Other land impacts identified include ongoing cattle grazing on GRL lands, previous logging activities and the ubiquitous conventional oil and natural gas projects including pipelining on crown land adjacent to the communities.	Disturbing land that had been previously used for hunting and food gathering. Removing these lands from being used in future.	Long term agreements with communities to outlining project initiatives including environmental factors and reclamation, traditional knowledge, education, training and employment, business opportunities, consultation and capacity.	Some members of First Nation communities agree that exchanging economic opportunities for land removed from traditional use is satisfactory but some do not. Signed impact agreements will indicate majority are in favour of development.
Industry and the crown have not fulfilled promises made to include FN community members in education and training programs aimed at employing more members in local projects.	If one reviews the number of Aboriginal employed or involved people at any industrial establishment off reserve in Alberta, it can be seen that there is minimal First Nation member involvement.	Pengrowth is offering scholarships and other training opportunities to local FN communities.	There is some concern expressed over commitments made but communities are again willing to give Pengrowth a chance.
Companies to use locally owned and operated businesses in all aspects of the operations not just those historically offered.		Each year, Pengrowth has significantly increased the number of locally owned companies involved with the Lindbergh SAGD Project.	The community will continue to provide names of community based companies to be included in tendering of SAGD project opportunities.

Table B.1-1 First Nations Consultation Specific Concerns and Responses			
Specific Concern(s) Identified	**Project Specific Concern(s)**	**Proposed Mitigation Strategy**	**First Nation's Response to Proposed Mitigation Strategy**
Onion Lake Cree First Nation			
Impacts from Industry (in general) to the Treaty Rights and traditional uses. Other land impacts identified include ongoing cattle grazing on GRL lands, previous logging activities and the ubiquitous conventional oil and natural gas projects including pipelining on crown land adjacent to the communities.	Disturbing land that had been previously used for hunting and food gathering. Removing these lands from being used in future.	Long term agreements with communities to outlining project initiatives including environmental factors and reclamation, traditional knowledge, education, training and employment, business opportunities, consultation and capacity.	Some members of First Nation communities agree that exchanging economic opportunities for land removed from traditional use is satisfactory but some do not. Signed impact agreements will indicate majority are in favour of development.
Industry and the crown have not fulfilled promises made to include FN community members in education and training programs aimed at employing more members in local projects.	If one reviews the number of Aboriginal employed or involved people at any industrial establishment off reserve in Alberta, it can be seen that there is minimal First Nation member involvement.	Pengrowth is offering scholarships and other training opportunities to local FN communities.	There is some concern expressed over commitments made but communities are again willing to give Pengrowth a chance. Onion Lake will participate in a committee that will review annual programs
Companies to use locally owned and operated businesses in all aspects of the operations not just those historically offered.		Each year, Pengrowth has significantly increased the number of locally owned companies involved with the Lindbergh SAGD Project.	Onion Lake and Pengrowth will meet four times annually to review experience during previous months of operation

Table B.1-1 First Nations Consultation Specific Concerns and Responses			
Specific Concern(s) Identified	**Project Specific Concern(s)**	**Proposed Mitigation Strategy**	**First Nation's Response to Proposed Mitigation Strategy**
Saddle Lake Cree First Nation			
Impacts from Industry (in general) to the Treaty Rights and traditional uses. Other land impacts identified include ongoing cattle grazing on GRL lands, previous logging activities and the ubiquitous conventional oil and natural gas projects including pipelining on crown land adjacent to the communities.	Disturbing land that had been previously used for hunting and food gathering. Removing these lands from being used in future.	Long term agreements with communities to outlining project initiatives including environmental factors and reclamation, traditional knowledge, education, training and employment, business opportunities, consultation and capacity.	Some members of First Nation communities agree that exchanging economic opportunities for land removed from traditional use is satisfactory but some do not. Signed impact agreements will indicate majority are in favour of development.
Industry and the crown have not fulfilled promises made to include FN community members in education and training programs aimed at employing more members in local projects.	If one reviews the number of Aboriginal employed or involved people at any industrial establishment off reserve in Alberta, it can be seen that there is minimal First Nation member involvement.	Pengrowth is offering scholarships and other training opportunities to local FN communities.	There is some concern expressed over commitments made but once again, communities are willing to give Pengrowth a chance. Pengrowth has begun to hire members with applicable skills.
Companies to use locally owned and operated businesses in all aspects of the operations not just those historically offered.		Each year, Pengrowth has significantly increased the number of locally owned companies involved with the Lindbergh SAGD Project.	Saddle Lake will be informed of all opportunities for business at the SAGD project. Saddle Lake will continue to give Pengrowth a list of contractors from the Nation.

3.2 SOCIOECONOMIC

B.2. **SIR1 Response, #B.9, Page 89.**

In the SIR1 response question B.9, Pengrowth states, *"The construction phase of the Project will be made up completely by temporary workers, both skilled and unskilled. In the construction phase, 92% of the workers are considered to be local workers that will drive to site… These workers will fly in to Edmonton and fly or drive to Bonnyville and proceed to the Project site. In the operations phase of the Project, approximately 70% of the workers are expected to fly in and out."*

a) Identify how shifts will be staggered to avoid the traffic impacts on the 92% of the workers that will drive to site. Include a description of the shift rotations (i.e. length and frequency of rotations) and its influence on local traffic.

Response:

Daily shift staggering will not be mandated by Pengrowth. The vast majority of the 92% local workers driving to site during construction of the Project (noted in SIR1 Response #B.9), will be staying in the Construction Camp proximal to the Central Processing Facility where the majority of construction activities will be occurring (Figure B.2-1). The Construction and Operations Camps are located in LSDs 12 &13-24-058-05 W4M and LSD 9-23-058-05 W4M, respectively. Workers daily driving will be generally contained to within the Project site area (from Camp to Field Office/work area and return). These workers will arrive at various times during the day and evening prior to their "days on" and will be leaving at various times during the day or evening at the end of their rotation.

Actual shift rotations of various consultants and contractors will vary from company to company dependent on their duties. Within companies themselves, it is conceivable that shift durations may vary anywhere from one to three weeks. Although Pengrowth will not be mandating the staggering of daily shifts or shift rotations, they will inadvertently be staggered just the same, thus local traffic influence will be minimized.

b) Of the 70% of the workers that are expected to fly in and out during operations, clarify whether they will be flying directly to the Bonnyville Airport. If not, identify how they will be transported to the site.

Response:

Workers who fly in are expected to arrive at the Bonnyville Airport, and possibly the Elk Point Airport. Occasionally workers will fly commercially into Lloydminster. These workers either will be shuttled to site, or may have rental vehicles awaiting them at their respective airports. Workers will then be staying in the Camps proximal to the CPF. Local traffic will not be impacted during their time on site.

Although there may be some minimal impacts to local traffic on flight day, it should be recognized that the numbers of workers flying in and out are not large (six to fifteen). Impacts to local traffic are not expected to be tangible.

B.3. **Application, Consultant Report #8, Section 1.1.1, Page 1 SIR1 Response, #B.7, Page 88.**

In the original application, Pengrowth anticipates that, *"by 2023, the Project will be tied in to the larger regional pipeline network and the trucking of bitumen and diluent will cease."*

In the SIR response, Pengrowth updates that *"the pipeline construction commenced in Q1 of 2015 and is anticipated to be operational by end Q2 of 2015"*. This appears to be a large discrepancy in time estimates.

a) Confirm that the pipeline that ties Pengrowth into the larger network will be complete by Q2 of 2015.

Response:

The pipeline construction is complete, and it is now tied in.

i. If so, discuss whether this will affect the volume of Heavy Vehicles (Including Tankers & Transport Trucks) anticipated in operations (listed as 240 Average AADT).

Response:

The pipeline tie in reduces heavy vehicle traffic. In the original application Pengrowth anticipated tying into the regional pipeline much later, however, market conditions and favorable negotiations with the pipeline operator allowed for the opportunity to tie in much sooner than originally anticipated. This mode of transportation greatly reduces the demand for heavy trucks. Occasionally, as market conditions dictate, transportation of products may be supplemented by alternate modes such as trucks or rail. During an upset condition (*i.e.* maintenance turn-around or shut-down), product may be shipped from the facility by truck.

3.3 TRANSPORTATION

B.4. **SIR1 Response, Section 3.3, Transportation, Page 93-94**

Pengrowth stated that any further TIA (Traffic Impact Assessment) work is unnecessary. However, there are a number of clarifications required.

In regards to trip generation, Section 3.2 of the TIA stated that 200 trucks will access the Project daily. It is not clear whether that is during construction or operation phase, since it is expected that construction traffic would be significantly higher than operation traffic. Also, the number of trucks and number of trips generated by those trucks are not the same. As a minimum, a truck would generate two trips, to work and back.

The TIA also assumed 40/60 north south split for the development generated traffic, the same distribution as the existing traffic on Range Road 50. Not enough discussion was provided to justify such an assumption. It is not clear where the construction workers will come from, whether there will be a camp site to house construction workers, and if so, where it would be located.

The Town of Bonnyville is located 24 km to the north, not far from the Project site, making it possible that there may be more traffic travel to and from the north. The intersection capacity of Highway 659/657 intersection should be confirmed, and whether it has adequate capacity to safely accommodate the traffic generated by the Project in addition to the background traffic should be discussed. The same question also applies to the Hwy 646/Range Road 50 to the south.

a) Provide clarifications and justifications for TIA assumptions regarding trip generation and trip distribution.

Response:

The 200 trucks projected to be accessing the Project daily will be associated with the operations phase. It is anticipated that there will be 120 additional workers for Phase 2 expansion construction, over and above the 330 workers peaked at Phase 1 construction. There is an existing Construction Camp on site (Figure B.2-1) and it is anticipated that the additional workers will not be commuting off site every day.

With only a small amount of the additional workers that will commute off site, the existing Type IIIa intersection built for the expansion will be adequate to handle the additional Project traffic, and thus, no additional intersection improvement is deemed necessary.

The 40/60 north and south trip distribution split is based on the existing traffic pattern as well as Pengrowth's expectation, and is deemed appropriate for the Phase 2 expansion.

b) Confirm the intersection capacity of Hwy 659/657 and Hwy 646/Range Road 50 as required.

Response:

According to Alberta Transportation's *TIA Guideline*, for any development or subdivision that is more than 800 m from Provincial highways, Alberta Transportation will not be referred at the time of development. It is up to the Municipality to address the infrastructure requirements triggered by the proposed development. As this development is at least 10 km away from the closest Provincial highway, per the *TIA Guideline*, this is to be addressed with the local municipalities. During ongoing consultation with the local municipalities, no traffic related concerns have been raised to date.

Reference:

Alberta Infrastructure and Transportation. 2005. Traffic Impact Assessment Guideline. Prepared for Alberta Infrastructure & Transportation, Transportation & Civil Engineering Division Technical Standards Branch by Stantec Consulting Ltd. March 2005. Pp. 14

4 AIR (EIA)

4.1 EMISSIONS MANAGEMENT

B.5. **Volume 1, Section B.5.10.1, Page B-43**

Volume 1, Section B.5.10.2, Page B-43

SIR1 Responses, #B.18, Page 99.

In response to B.18(b), Pengrowth states, *"Production vapour returns from the well pads are in excess of 80% water by mass and thus noncombustible and would extinguish any flare in a relief scenario. For this reason a vent stack, sized in accordance with API 521 (API 2008) Section 7.3.4 (Vent Stacks), is used when relieving vapours".*

a) Indicate whether the vented gas will contain odourous compounds.

Response:

The vented gas will contain trace quantities of H_2S. The H_2S content of the vented gas is expected to be less than 0.1 mol/kmol, which is a small fraction (one one-hundredth) of the H_2S content threshold specified by AER *Directive 060* (10 mol/kmol) for which short-term venting is permitted. Venting will only occur under an emergency situation and will only be for a short duration (less than one hour). The gas will be vented from an elevated stack at a temperature above ambient in order to assist in dispersion. No off-lease odours are expected due to the negligible H_2S content of the vented gas and the short venting duration.

b) Discuss whether the operation of the vent stacks will meet the requirements of Alberta Energy Regulator's *Directive 060: Upstream Petroleum Industry Flaring, Incinerating, and Venting.*

Response:

The operation of the vent stacks will meet the requirements of the AER's *Directive 060*.

B.6. **Volume 2, Consultant Report #1, Section 4.1.1, Table 4.1-2, Page 40 SIR1 Responses, #A.40, Page 45.**

In response to A.40(a), Pengrowth states, *"Phase 1: HP Boiler 1 and HP Boiler 2 – the steam output duty (96 MW) was listed in CR#1, Table 4.1-1 instead of the fired input duty (115 MW)".* It appears the same typographical error was made in Table 4.1-2.

a) Reproduce Table 4.1-2 and indicate whether the power rating is referring to input or output.

Response:

A corrected version of Table 4.1-2 is presented as Table B.6-1, with the corrections highlighted. A summary of the typographical errors are listed below.

- Phase 2: HP Boiler 3, HP Boiler 4, and HP Boiler 5 – the steam output duty (96 MW) was listed in Table 4.1-1 instead of the fired input duty (115 MW). The stack and emission parameters for these two sources are correct otherwise.
- Phase 2: Utility Boiler 2 – again, the output duty (4.4 MW) was listed instead of the fired input duty (5.8 MW). The stack and emission parameters for this source are correct otherwise.

These errors were typographical in nature and have no effect on the modelling results.

Table B.6-1 Combustion Emissions – Lindbergh SAGD Expansion Project (Phase 2)

Emission Source	Power Rating (MW)	UTM E	UTM N	Elevation	Stack Height	Stack Diameter	Exit Velocity	Exit Temp	SO_2	NO_X	CO	VOC	$PM_{2.5}$
		(m)	(m)	(m ASL)	(m)	(m)	(m/s)	(K)	(t/d)				
HP Boiler 3	115	524,898	5,988,010	700	36.0	1.98	17.5	450	0.283	0.398	0.352	0.037	0.032
HP Boiler 4	115	524,879	5,988,010	700	36.0	1.98	17.5	450	0.283	0.398	0.352	0.037	0.032
HP Boiler 5	115	524,848	5,988,010	700	36.0	1.98	17.5	450	0.283	0.398	0.352	0.037	0.032
Utility Boiler 2	5.8	524,907	5,988,232	700	10.0	0.51	17.3	589	0.000	0.013	0.018	0.002	0.002
Cogeneration Unit 3	7.5	524,827	5,988,027	700	25.0	1.83	14.5	500	0.000	0.120	0.014	0.002	0.006
Cogeneration Unit 4	7.5	524,811	5,988,027	700	25.0	1.83	14.5	500	0.000	0.120	0.014	0.002	0.006
Cogeneration Unit 5	7.5	524,799	5,988,027	700	25.0	1.83	14.5	500	0.000	0.120	0.014	0.002	0.006
LP Flare	n/a	525,035	5,987,732	700	12.0	0.15	0.77	1273	0.017	0.013	0.073	0.002	0.001
HP Flare (evaporator vent condenser)	n/a	525,021	5,988,291	700	40.0	0.36	0.1	1212	0.345	0.006	0.031	8.7E-04	0.001
Total Emissions									**1.21**	**1.59**	**1.22**	**0.12**	**0.12**

4.2 AIR QUALITY ASSESSMENT

B.7. **Volume 1, Section A.10.1, Page A-17**

SIR1 Responses, #A.31, Page 36.

In response to A.31(b), Pengrowth states, *"As an active participant in the Lakeland Industry and Community Association (LICA) Air Quality Monitoring Program (in conjunction with the Joint Alberta | Canada Implementation Plan for Oil Sands Monitoring), Pengrowth has not identified a specific plan to conduct passive monitoring."* However, in Volume 1, Section A.10.1, Page A-17, Pengrowth states, *"Therefore Pengrowth proposes to conduct passive monitoring associated with emissions of its central processing facility near the Project for SO2, NO2, and H2S."*

a) Clarify and discuss Pengrowth's position on ambient air monitoring that should be conducted around the Lindbergh project.

Response:

Pengrowth is committed to conducting passive monitoring near the Project for SO_2, NO_2, and H_2S as described in the original application, with locations to be determined at a future date in consultation with the Alberta Energy Regulator. Pengrowth is also amenable to additional passive monitoring near the Project if LICA (the Lakeland Industry and Community Association) feels such monitoring is warranted, particularly if odour complaints are received regularly from the public in the vicinity of the Project.

5 WATER (EIA)

5.1 WATER MANAGEMENT

B.8. **Volume 1, Section B.7.2.2, Page B-55**

Volume 2 Consultant Report #6, Figure 20

Volume 3 Consultant Report #10, Figure 5-3

Volume 1, Section A.10.6, Page A-28

Volume 1, Section D.6.2.3, Page D-74

Volume 2, Consultant Report #6, Section 5.3.1, Page 24

Volume 2, Consultant Report #6, Section 8.1, Page 35

SIR1 Responses, #B.42, Page 124

SIR1 Responses, #B.61, Page 154.

In SIR B.42(a), Pengrowth was asked to explain the intended sparse culvert placement in an extensive wetland region. In its response, Pengrowth stated, "*Figure 20 in CR#6 is not meant to show the total number of culverts that will be required. As this area represents future development, the details of the exact well pad locations and road routing will not be finalized until the appropriate level of exploration work has been completed. The details for the culverts and crossings will be designed after the road routing has been finalized*". This view is inconsistent with the Lindberg Project EIA Terms of Reference which states, "*Describe the surface water management strategy for all stages of the Project*."

In SIR B.61(a), Pengrowth was asked to provide a Baseline Case equivalent to Figure 20. Figure 20 presents Pengrowth's estimate of the Application Case overland drainage pattern in regions of the LSA proximal to the Lindberg Project. In SIR B.61(d), Pengrowth was asked to also update Figure 20 to include the entire LSA drainage pattern and not just the pattern proximal to the Lindberg Project footprint.

Instead of providing a Baseline Case version of Figure 20 as requested, Pengrowth provides in its response B.61(a) a revision of Figure 20 only. This revision (Figure B.61-1) appears to be a low-resolution photocopy of Figure 20, with (presumed) manual addition of existing linear features, flow-direction vectors proximal to infrastructure, and color-coded culverts. As such, Figure B.61-1 is difficult to decipher. Furthermore, since B.61-1 is intended to support Pengrowth's response to the B.61(d) for the Application Case, it can't effectively provide the Baseline Case LSA flow field as requested in B.61(a) in any case.

Also in its response to B.61(a), Pengrowth states that the Digital Elevation Model used to estimate drainage was based on LiDAR data supplemented with 1:50K GeoBase data.

a) Provide a map showing the distribution of the LSA LiDAR data and describe the horizontal and vertical precision of these data and of the GeoBase data used to fill gaps in the LiDAR survey coverage.

Response:

A map showing the distribution of LiDAR data in the LSA is shown in Figure B.8-1. The LiDAR data has a resolution of 1 m with a horizontal precision of 0.45 m and a vertical precision of 0.30 m. The 1:50K GeoBase data has a horizontal precision of 10 m and a vertical precision of 5 m.

b) Using standard GIS procedures generate clear and appropriately scaled figures, one for the Baseline Case and one for the Application Case that details the entire topographically-driven drainage pattern (i.e. flow field) in the LSA watersheds. Include in these figures topographic contour intervals, natural drainage channels, and project-infrastructure overlays.

Response:

The existing hydrography in the LSA is shown in Figure B.8-2. Figure B.8-3 shows the drainage patterns and culverts required to accommodate Project disturbances. Also shown in Figure B.8-3 are new culverts through existing roads required to accommodate the Project drainage.

c) Describe any ground-truthing undertaken to verify the estimated LSA drainage field. Discuss future plans in this regard.

Response:

Existing roads in the immediate vicinity of proposed Project development were inspected to determine the locations of existing culverts to verify drainage pathways. Proposed crossings of identified drainages were also inspected to verify drainage pathways. Future plans include placing additional culverts if additional drainage requirements are identified during construction. Monitoring of drainage will also occur during or after large runoff events to ensure that adequate drainage has been provided. If drainage problems are identified, culvert capacity can then be increased as necessary.

d) Clarify whether culvert placements along existing infrastructure are themselves existing or are being proposed.

Response:

The culvert placements through existing roads identified in Figure B.8-3 are new culverts required to maintain drainage due to drainage alterations caused by proposed Project development.

e) Discuss the reliability of the proposed culvert placements presented in the requested Application Case figure.

Response:

Culverts are a standard method to pass drainage water through linear disturbances. These culverts must be sized adequately to pass the expected flows. This sizing will be done during the detailed

design phase. Monitoring of drainage will also occur during or after large runoff events to ensure that adequate drainage has been provided. If drainage problems are identified, culvert capacity can then be increased as necessary.

B.9. **Volume 1, Section B.7.2.2, Page B-55**

Volume 2, Consultant Report #6, Figure 20

Volume 3, Consultant Report #10, Figure 5-3

Volume 2, Consultant Report #6, Section 8.1, Page 35

SIR1 Responses, #B.42, Page 124

SIR1 Responses, #B.73, Pages 168-169.

In response to B.42(a), Pengrowth states that equalization culverts will be installed at approximate 250 m intervals in low-grade and wetland areas. In response to B.73(b), Pengrowth stated, "*Pengrowth will inspect all culverts and drainage pathways, as described in part a, to ensure that natural drainage is maintained in drainage areas that lack identifiable drainage channels*." In response to B.73(d), Pengrowth stated, "*As described in part a, Pengrowth will inspect all culverts and drainage pathways to ensure the access road drainage culverts are maintaining the natural surface drainage patterns…*" Pengrowth's part (a) stated, "*Pengrowth's inspections would include all culverts and drainage pathways to ensure the access road drainage culverts are maintaining the natural surface drainage patterns…*"

Pengrowth's response suggests that drainage-maintenance in low-lying and wetland areas is a function primarily of surface run-off with no surficial groundwater flow. Pengrowth's primary mitigation measure in low-lying and wetland areas is culverts, and Pengrowth's response suggests that monitoring the effectiveness of culverts in maintaining low-flow drainage is the same conveyance issue surrounding storm-water management.

First principles and the history of at least one in-situ oil-sands operation (e.g. Imperial Oil's Cold Lake Project) indicate it is unlikely that reliance on culverts, as the preferred mitigation measure, and checking for obstruction and visible ponding will be able to effectively guard against the potential of deleterious surficial drainage alteration.

In response to B.42(b), Pengrowth states that rock drains will be considered if *analysis deems them to be necessary*. No details are provided, while Pengrowth's response to B.73(e) does not answer the question being asked which is a requested explanation of how Pengrowth's monitoring program problem will address drainage issues that have no drainage-channel conveyance component signalling a problem.

a) Outline and describe the analysis that would be used to inform the decision to use culverts or rock drains as the drainage-flow mitigation measure.

Response:

Culverts are more effective than rock drains for conveying surface water flow because they provide more flow area and less resistance for a given size and slope. As well, during spring runoff rock drains are more likely to be frozen and ineffective. Pengrowth will provide culverts where surface drainage is required across a roadway and will excavate shallow ditches parallel to the roadway to facilitate lateral

transport of water to the culverts on the upstream side and away from the culverts on the downstream side.

b) Outline and describe a monitoring program that would be effective in determining whether the placed culverts and rock drains are effective in maintaining natural surficial flow patterns in low-lying and wetland areas.

Response:

Pengrowth will visually inspect the ditches and wetlands on the upstream and downstream sides of the roadway for any water accumulations indicating a disruption to the natural flow patterns and remediate with additional ditching or culverts as required. Pengrowth does not intend to use rock drains in wetlands as they are not effective in this application as described in the response to SIR B.9, part a).

5.2 HYDROGEOLOGY

B.10. **Volume 2, Consultant Report #5, Section 4.3.3, Page 20 & 21**

Volume 2, Consultant Report #5, Figure 5

SIR1 Responses, #B.45, Pages 127-128

SIR1 Responses, Figure A.18-3.

In response to B.45(a), Pengrowth states, "*Within the Beaver River basin, the Sand River Formation equivalent was only encountered at two locations (12-34-059-04 W4M and 01-20-059-04 W4M). Groundwater flow characteristics cannot be determined with only two locations and there is also a possibility that the Sand River Formation equivalent is not continuous within the Beaver River basin as this unit was not consistently encountered during the drilling programs and is not regionally mapped.*"

Figure A.18-3 shows that a well screen was set and static water level was measured in the Sand River Formation equivalent in well 01-08-059-03 W4M (map location shown on Figure A.18-1). Figure B.45-1 shows that the corresponding monitoring well (MW14- 29-11; *incorrectly shown on the map as MW-13-29*) is located inside the Beaver River Basin.

a) Based on the demonstrated occurrence of groundwater-bearing Sand River Formation equivalent in well 01-08-059-03 W4M, provide a revised interpretation regarding the continuity and groundwater flow characteristics of the Sand River Formation equivalent in the Beaver River basin.

Response:

Consistent with the conceptual flow model, the highest groundwater elevations in the Sand River Formation equivalent and the Ethel Lake Formation are encountered at 01-08-059-03 W4M and at the Pilot facility, both in proximity to the basin boundary. At 01-08, MW14-29-11 completed within the Sand River Formation equivalent has a water level of 636.43 m above sea level (m asl). The monitoring well is located within the Beaver River basin based on the regional drainage basin boundary; however, the water level in MW14-29-11 is approximately 20 m higher than the water level elevations observed at the monitoring wells further into the Beaver River Basin (in 12-34 and

01-20-059-04 W4M). The Sand River Formation is discontinuous within the Beaver River Basin (Parks *et al.*, 2005) and this discontinuity is supported by the absence of the formation at 03-32-058-04 W4M.

Regional mapping, hydrogeological drilling and the substantial water-level elevation difference between locations indicate that the Sand River Formation materials encountered at 12-34 and 01-20-059-04 W4M are likely not hydraulically connected to those encountered at 01-08-059 03 W4M. It is expected that the Sand River Formation within the Beaver River Basin consists of isolated permeable materials that are not continuous throughout the basin.

In the event that the unit is continuous however, the water levels suggest a northwest flow direction driven by the high groundwater elevation at 01-08 near the basin boundary. An approximate flow rate of five metres per year within the Sand River Formation was calculated using the geometric mean hydraulic conductivity for the formation (2.5×10^{-5} m/s), the hydraulic gradient (approximately 0.002 m/m) and an assumed effective porosity of 30%.

Reference:

Parks, K., L.D. Andriashek, K. Michael, T. Lemay, S. Stewart, G. Jean and E. Kempin. 2005. Regional Groundwater Resource Appraisal, Cold Lake – Beaver River Drainage Basin, Alberta. Alberta Energy and Utilities Board and Alberta Geological Survey. Special Report 74. February 2005.

B.11. **Volume 2, Consultant Report #5, Section 4.3, Page 12**

Volume 2, Consultant Report #5, Section 4.3.1.3, Pages 14-15

SIR1 Responses, #B.46, Pages 129-130

SIR1 Responses, #A.12, Pages 13-15.

In response to SIR B.46(a), Pengrowth states that the low permeability and significant thickness of the Lea Park Formation, together with consistently saline groundwater in underlying Colorado and Mannville Group permeable units provides confidence in the likelihood that groundwater becomes saline within the Lea Park Formation beneath the project area. In response to SIR A.12(b,c), Pengrowth indicates that the upper 5 m of the Lea Park Formation comprises a weathered contact zone with non-saline water (TDS of 898 to 1,920 mg/L). However, Pengrowth also indicates that all of the Lea Park Formation monitoring wells were completed within this upper region (i.e. upper 4 m) of the formation. Even though Pengrowth has thus apparently not yet estimated the depth to base of fresh water in the Lea Park Formation, it has indicated in its response to SIR A.12(e) that no additional investigation is planned that would provide the required information.

The chemical similarity of groundwater from the Lea Park Formation and overlying Quaternary formation aquifers indicates that they are most likely in hydraulic communication, suggesting that degradation of Lea Park Formation groundwater could impact Quaternary aquifers. Therefore, determination of the base of fresh water within the Lea Park Formation is important to ensure that surface casing is set deep enough to protect all fresh water zones.

With regard to an alternative to this end, Pengrowth has not indicated whether there are borehole geophysical logs (e.g., resistivity, neutron, density, sonic, etc.), from existing wells or drillholes that penetrate the Lea Park Formation in the project area, that could be evaluated to potentially identify and determine the vertical and lateral extent of the weathered contact zone and non-saline formation water beneath the project area.

a) Compile and analyze existing subsurface data, including but not necessarily restricted to borehole geophysical logs, to provide a better estimate of the base of fresh water beneath the project area.

Response:

Geophysical logs spanning the Lea Park Formation are largely unavailable as most of the formation is typically obscured by surface casing when the logging occurs. Pengrowth has completed gamma ray analyses at several area wells and determined that the Lea Park Formation is composed of shale. The interpretation also concluded that no sand intervals are present within the Lea Park Formation in the area. As indicated in SIR1 Response #12, the Lea Park Formation is a thick shale aquitard unit. Hydrogeological drilling has explored to a maximum depth of 42.7 m into the Lea Park Formation and encountered shale with no permeable zones. Hydraulic conductivity testing within the upper four metres of the Lea Park Formation indicates values in the order of 10^{-9} m/s.

All available information indicates that the Lea Park Formation is an aquitard and groundwater transitions from non-saline to saline within the thick shale unit. Surface casing of wells as part of the Project will be set below the top of the Lea Park Formation, essentially isolating the Quaternary aquifer units from Project activities. Further assessment of the low permeability Lea Park Formation is not warranted.

B.12. **Volume 2, Consultant Report #5, Section 4.3.1.2, Page 14**

Volume 1, Part A, Section A.4.2.3, Page A-6

SIR1 Responses, #B.47, Pages 132-134.

In response to SIR B.47(a,b), Pengrowth summarizes the results of a desktop study determining if sand zones within the Grand Rapids Formation represent potential saline water sources for the Lindbergh Project. The desktop study was based on published maps, reports, water well records, drill-stem test results and production/injection data within 50 km of the project area. The study identified a small number of Grand Rapids sand wells with TDS concentrations in the acceptable range of 4,000 to 10,000 mg/L. Pengrowth concluded that these well results are anomalous to the generally much higher TDS concentrations found in the majority of the wells. However, without maps showing the wells with TDS concentration labels, it is not possible to determine whether the lower TDS concentration wells represent localized anomalies or occur within lower TDS concentration areas of regional TDS trends.

a) Discuss the considerations, including direction and distance from the Lindberg Project, that establish the feasibility of a localized area of the Grand Rapids aquifers with acceptable TDS concentrations, serving as a source of saline water.

Response:

The main considerations regarding the acceptable distance of a source of saline water are economic impact, sustainability of the source, suitability of the source, and environmental protection.

The greater the distance from the central processing facility the higher the cost due to the cost of additional and longer pipeline, the need for use of remote storage tanks and transfer pumps at distances greater than 5 km, and an increase in the number of creek/river/road crossings. In addition to this, an adequate number of wells will be required at the source to ensure redundancy in case of a well failure. A source of electricity to power the pumps in the wells and the transfer pumps would also be required. For Lindbergh, this would all be additional cost as the infrastructure is currently in place for the source water system.

In addition to the cost of the above infrastructure and wells, additional equipment in the central processing facility would be required to ensure an adequate supply of water to meet the steam boiler specifications is available. Additional processing of saline water would be required resulting in an increase in capital costs, operating costs, and waste disposal costs.

Transporting saline water via pipeline is generally a safe and efficient operation. However, pipeline leaks do occur and, depending on the location and size of a failure, can cause an environmental impact (*i.e.* contamination of a water body or farmland). Additional environmental impact considerations relate to the disturbance required to construct a pipeline.

Any remote source of saline water for use in a SAGD operation must have an appropriate quality, high enough capacity, deliverability, and accessibility to meet the requirements for the full life span of the Project. In addition to distance, the degree of confidence in the data is a critical consideration when making the decision to pursue a saline groundwater source. The findings from the desktop study indicate that the occurrence of TDS concentrations within the acceptable range of 4,000 to 10,000 mg/L is inconsistent and typically occurs in areas with many more records that indicate high TDS concentrations (Figure B.12-1). The small number and irregular distribution of low TDS concentrations reported from the Grand Rapids Formation are likely to be anomalous when compared to the large number of high TDS concentrations in the same areas.

b) Provide maps covering the area within 50-km of the Lindbergh Project for each of the Grand Rapids sands included in the desktop study, showing well locations and TDS concentrations. Identify areas with confirmed lower TDS (by existing wells) or predicted lower TDS (on trend with the confirmed lower TDS wells) and discuss the feasibility of sourcing saline water from these areas, taking into account the considerations provided in response to part a).

Response:

The requested map is included as Figure B.12-1. There are insufficient data to predict areas of lower TDS concentration and the indication of lower TDS concentrations from existing wells is sufficiently contradictory to prevent a feasibility evaluation.

B.13. **Volume 2, Consultant Report #5, Section 5.2.2, Page 26-28**

Volume 2, Consultant Report #5, Appendix D, Figure D-1

Volume 3, Consultant Report #10, Figure 5-3

Volume 2, Consultant Report #5, Section 2.5, Page 3-4

Volume 2, Consultant Report #5, Section 4.3.2.5, Page 17

Volume 2, Consultant Report #5, Section 4.3.3, Page 20

Volume 2, Consultant Report #5, Section 4.3.5, Page 22

Volume 2, Consultant Report #5, Appendix E, Table E1-4 & Figure E2-18 Volume 2, Consultant Report #5, Appendix E, Figure E2-2

Volume 2, Consultant Report #5, Appendix E, Figure E2-21 SIR1 Responses, # B.53, Pages 138 – 142.

In response to SIR B.53(a), and as shown in Table B.53-1, Pengrowth indicates that a Reita Lake impact pathway for thermal arsenic migration does not exist. This conclusion is based on the lake being hydraulically upgradient of the Ethel Lake Formation, which is the only formation considered as a possible thermal-plume pathway. However, this assessment does not consider the possibility that the Sand River Formation equivalent, or other possible shallow aquifers within the Grand Centre Formation, is (are) present in the area between well pad D46 and the lake. Figures A.18-1, A.18-2 and A.18-3 show that well screens were set and static water levels were measured in the Sand River Formation equivalent in three Beaver River Basin wells: 12-34-059-04 W4M (4.7 km to west of Reita Lake), 01-20-059-04 W4M (7 km west-southwest of Reita Lake) and 01-08-059-03 W4M (5.3 km south of Reita Lake). These wells are the closest Lindberg Project wells to the lake. The Sand River water level elevations shown on Figures A.18-2 and A.18-3 are approximately 618, 616 and 638 masl (for 12-34-059-04 W4M, 01-20-059-04 W4M and 01-08-059-03 W4M, respectively), which all appear to be higher than the elevation of Reita Lake shown on Figure E2-2.

The location of proposed well pad D46 monitoring well MW-1 (Figure E2-18) is topographically higher than Reita Lake (Figure E2-2). Groundwater flow in a shallow groundwater-bearing zone between MW-1 and Reita Lake would most likely be towards the lake, consistent with the observed regional pattern of shallow groundwater contours generally conforming to surface topographic contours. It is noted that groundwater flow in the Sand River Equivalent at the pilot-project development area is towards the southwest (Figure E2-21), in conformance with the local topography.

The available data suggest the following:

- Sand River Formation equivalent is more likely than not to be present in the area of Reita Lake;
- Sand River Formation equivalent groundwater elevation is probably higher than Reita Lake;
- Groundwater flow in the Sand River Formation equivalent or other possible shallow groundwater-bearing zone between well pad D46 and Reita Lake would most likely be towards the lake.

In response to SIR B.53(b), Pengrowth states that the greatest uncertainties related to the thermal arsenic plume assessment are the thermal properties of the formations. However, there are also significant hydrogeological uncertainties. In response to SIR B.53(a), Pengrowth also states that Reita Lake (and Cushing Lake) are expected to be hydraulically upgradient from Quaternary aquifers. However, this expectation does not account for the presence of Sand River Formation equivalent groundwater in the three monitoring wells closest to these lakes, nor does it account for the uncertainty inherent in the small number of monitoring wells in the Beaver River Basin (four in total). In the case of Reita Lake, uncertainty regarding the possible presence of shallow groundwater zones (including the Sand River) and surface groundwater interaction between well pad D46 and the lake will be only partially addressed when MW-1 is installed.

In response to SIR B.53(g), Pengrowth states that a single monitoring well (MW-3 at pad D16) is sufficient because the monitoring well will be constructed in a nested fashion in order to monitor all Quaternary aquifer units present. While the nested well screens will address the vertical component of groundwater flow and quality in Quaternary units near pad D16, they do not address the issue raised regarding the close proximity of field- verified water wells situated near pads D17 and D24, which are located approximately 1 kilometer east and 1.5 kilometers north of pad D16, respectively.

In response to SIR B.53(h), Pengrowth indicates that a Groundwater Response Plan will be initiated as a result of any verified arsenic thermal plume impact at a monitoring well. However, Pengrowth does not provide any details of the Groundwater Response Plan.

a) Perform an impact assessment for thermal arsenic plume migration from well pad D46 to Reita Lake via the Sand River Formation equivalent pathway. Update Table B.53-1 with the results.

Response:

As described in the response to SIR B.10.a, including the Sand River Formation monitoring well in 01-08-059-03 W4M in the conceptual flow model results in a northwest groundwater flow direction within the unit. This would suggest that Reita Lake will not be impacted as it is not located downgradient along the flow path.

Assuming that the groundwater flow within the Sand River Formation will generally mimic topography between Well Pad D46 and Reita Lake and that there is hydraulic connectivity between the formation and the lake, the quantitative assessment is updated in Table B.13-1. If a thermal arsenic

plume originating from Well Pad D46 were to develop, it is estimated that it would take over 200 years for the groundwater to reach Reita Lake. It should be noted that as a thermal plume moves, thermally mobilized arsenic is expected to attenuate through various processes such as dispersion, adsorption and mineral precipitation (SIR1 Response #B.53.c). Additionally, each well pair is planned to exist for a lifetime of seven years, following which, temperature conditions will return to baseline. Therefore, arsenic concentrations are expected to return to background concentrations before the groundwater reaches Reita Lake. Groundwater monitoring downgradient of Well Pad D46 is discussed in SIR1 Response #B.56.a. Monitoring will target all permeable Quaternary units and will be implemented in accordance with the draft regulatory document for the groundwater monitoring of in situ operations (Alberta Government, 2014).

The overall impact rating due to steaming activities at Well Pad D46 is determined to be low.

Table B.13-1 Revised Thermal Arsenic Plume Migration Assessment

Receptor	Basin	Pathway	Groundwater Flow Rate (m/yr)	Distance from Nearest Well Pad to Receptor (m)	Time Required for Arsenic Plume to Reach Receptor (years)[1]
Reita Lake	Beaver River	Sand River Formation	5	654	209
Garnier Lake	Beaver River	Ethel Lake Formation	5	498	159
Bluet Lake	Beaver River	Ethel Lake Formation	5	1,740	557
Cushing Lake	Beaver River	-	-	5,250	-
Water Wells in the SW[2]	North Saskatchewan	Ethel Lake Formation	20	214	17
		Sand River Formation equiv.	30	214	11

Retardation factor = 1.6
[1] Time = (Distance/Groundwater Flow Rate) x Retardation Factor
[2] Distance is from Well Pad D24 to field verified water well 20 on CR #5, Figure D-1

Reference:

Alberta Government. 2014. Draft Guidance for Groundwater Management Plans for In Situ Operations: Assessing Thermally-Mobilized Constituents. February 2014.

b) Provide a more complete discussion regarding the assumptions, uncertainties and limitations of the thermal plume impact analysis with respect to hydrostratigraphy (including porosity), hydraulic gradients (lateral and vertical) and surface- groundwater interaction.

Response:

In order to evaluate and better understand the uncertainties in porosity and hydraulic gradients, a sensitivity analysis was completed. The Ethel Lake Formation in the Beaver River Basin was used as the test aquifer for consistency.

The calculated range of lateral hydraulic gradient is from 0.0007 m/m to 0.0013 m/m with an average gradient of 0.001 m/m. The effective porosity of sand and gravelly material ranges from 10% to 35% (Johnson, 1967).

Using the equation:

$$v = \frac{K \times i}{n_e}$$

where:

v = Groundwater Velocity

K = Hydraulic Conductivity

i = Horizontal Hydraulic Gradient

n_e = Effective Porosity

the groundwater flow velocity was calculated while varying the gradient and porosity to the extremes of their ranges. It was determined that varying the hydraulic gradient does not substantially alter the groundwater flow velocity. Adjusting the effective porosity however does affect the groundwater flow velocity (±10 m/yr); therefore, the uncertainty related to the effective porosity may result in changes in the calculated flow rate. This uncertainty could result in travel times being three times faster than estimated but would still allow sufficient time for the Groundwater Response Plan to be activated once a change is detected at a monitoring well location prior to changes to a receptor.

Reference:

Johnson, A.I. 1967. Specific Yield – Compilation of Specific Yields for Various Materials. Hydrologic Properties of Earth Materials. Geological Survey Water-supply Paper 1662-D. U.S. Department of the Interior. U.S. Geological Survey.

c) Further explain the adequacy of the single proposed monitoring well (MW-3 at pad D16) for monitoring thermal plume development and migration near the field-verified water wells proximate to pads D17 and D24.

Response:

As indicated in SIR1 Response #B.53, at the location of MW3, nested monitoring wells are planned in order to monitor all Quaternary aquifer units present.

The groundwater monitoring approach outlined in the response to SIR #7a will also be applied with respect to the field-verified water wells near Well Pads D17 and D24. The preliminary risk assessment will be used to ensure that an appropriate groundwater-monitoring plan is proposed, which could include additional monitoring locations at Well Pad D17 or D24 or both. Pengrowth will also offer groundwater monitoring of private water wells within one kilometer of any well pad (SIR1 Response #A.22).

d) Describe the response in the event of a verified arsenic thermal plume impact on a water well.

Response:

The groundwater monitoring program and groundwater response plan for the Project will be in compliance with the draft regulatory document for the groundwater monitoring of in situ operations (Alberta Government, 2014). Groundwater monitoring wells will be installed within aquifers at well pads that are determined to be higher risk by the preliminary risk assessment and require long-term monitoring. The monitoring well(s) will be located within 10 m down gradient of the steam injection well. Sufficient groundwater monitoring will then be conducted to demonstrate baseline conditions; defined by upper and lower control limits (UCL and LCL).

During operations, parameter concentrations that change from baseline conditions at the heat source monitoring well will be considered indicator parameters. Once a change is detected, which could include a parameter concentration reaching or exceeding an UCL or the demonstration of a trend in concentration, the site-specific groundwater management response plan will be implemented. In accordance with the Draft Guidance, this will include the development of a heat/transport/fate model and may include the installation of additional monitoring wells.

Two monitoring locations are included as part of the management response: the "point of management" (POM) and the "point of compliance" (POC). The location of the POM will be based on the amount of time it will take for a change in groundwater conditions to move downgradient and monitoring at this location will be triggered as a result of the management response to a change at the heat source monitoring location. The POC will be determined based on the most conservative of the following: the predicted down gradient extent of the plume, the location of significant receptors down gradient of the well pad and a 1 km distance from the well pad. Therefore, the POC could be identified as the nearest active water well when existing closer than 1 km from the well pad.

If changes in groundwater conditions occur at the POM, additional analysis and interpretation of the indicator parameters and the overall plume characteristics will be initiated as appropriate. Several actions that may be implemented are listed in Section 4 of the Draft Guidance (Alberta Government, 2014). The most appropriate, site-specific action will be taken based on the data analysis. Actions could include, but are not limited to, the addition of groundwater monitoring wells, increased monitoring frequency, risk assessment, operations modification or termination of operations. Ultimately, the Draft Guidance indicates that all necessary measures should be undertaken by the approval holder to ensure baseline conditions are maintained at and beyond the POC.

Reference:

Alberta Government. 2014. Draft Guidance for Groundwater Management Plans for In Situ Operations: Assessing Thermally-Mobilized Constituents. February 2014.

B.14. **Volume 2, Consultant Report #5, Section 5.2.2, Page 26 – 28**

Volume 2, Consultant Report #5, Appendix D, Figure D-1

Volume 3, Consultant Report #10, Figure 5-3

Volume 2, Consultant Report #5, Section 2.5, Page 3-4

Volume 2, Consultant Report #5, Section 4.3.2.5, Page 17

Volume 2, Consultant Report #5, Section 4.3.3, Page 20

Volume 2, Consultant Report #5, Section 4.3.5, Page 22

Volume 2, Consultant Report #5, Appendix E, Table E1-4 & Figure E2-18 Volume 2, Consultant Report#5, Appendix A, Table 2

SIR1 Responses, #B.54, Pages 146-147.

In response to B.54(b), Pengrowth refers to threshold Arsenic concentrations of 0.0107 mg/L and 0.0192 mg/L for the Ethel Lake and Bonnyville Formations, respectively.

These differ from the corresponding thresholds of 0.007 mg/L and 0.013 mg/L presented in Table 2.

a) Reconcile the referenced incongruence.

Response:

Monitoring well MW11-19-67 in 11-13-058-05 W4M was interpreted as being completed within the Bonnyville Formation in 2011 and 2012. Threshold values were calculated for the Bonnyville Formation which included results from MW11-19-67. In 2013, additional data from hydrogeological drilling and monitoring well completion indicated that MW11-19-67 was completed within the Ethel Lake Formation. In 2013, the threshold values were updated to reflect the completion of MW11-19-67 within the Ethel Lake Formation therefore changing the previously calculated thresholds for both the Ethel Lake Formation and the Bonnyville Formation. Table 2 included the original values that were not updated. Based on the reinterpretation, the threshold arsenic concentration in the Ethel Lake Formation is 0.0107 mg/L and 0.0192 mg/L in the Bonnyville Formation.

B.15. **Volume 2, Consultant Report #5, Section 5.2.2, Page 26**

Volume 2, Consultant Report #5, Appendix A, Table 5

SIR1 Responses, #B.54, Pages 146-147.

In response to B.54(a), Pengrowth included five of 18 Sand River Formation monitoring wells, sampled from June to November 2011, in establishing that the existing Arsenic concentration in this formation exceeds both the aquatic life and human consumption guideline. Pengrowth does not explain why the monitoring well subset is appropriate.

Pengrowth does not include wells completed in the Grand Centre and Marie Creek Formations in the baseline Arsenic analysis.

a) Describe and explain the well-selection process, supporting the discussion with a location map as appropriate.

Response:

The five groundwater monitoring wells completed within the Sand River Formation equivalent considered to be representative of baseline were selected because they were completed and data was collected prior to steaming by Pengrowth, in areas not utilized or impacted by previous operations. The Pengrowth Lindbergh SAGD Pilot Project is located at the site of the former Lindbergh Enhanced Recovery In-Situ Oil Sands Processing Plant that was previously owned and operated by Murphy Oil Company Ltd. (Murphy). Thirteen of the eighteen monitoring wells completed within the Sand River Formation equivalent are located in the vicinity of Murphy's historical operations, therefore making them inappropriate for the determination of baseline conditions.

b) Discuss why an estimate of baseline conditions in the Grand Centre and Marie Creek Formations was not presented.

Response:

There is only one monitoring well completed within the Grand Centre Formation (P10-12A) at the Pilot CPF which is also in the area of the former Murphy operations. The groundwater monitoring results from P10-12A are, therefore, not appropriate for the determination of baseline conditions. Nine groundwater monitoring wells were installed within the Grand Centre Formation in the vicinity of the Phase 1 CPF in 2014. Baseline groundwater monitoring data from the Phase 1 CPF monitoring wells are being collected biannually and well-specific arsenic control limits will be calculated once sufficient data are available.

There is only one monitoring well completed within the Marie Creek Formation (P02-5) as the formation is considered to be an aquitard and is therefore not the target of monitoring well installation for the Project. Monitoring well P02-5 is located near the Pilot Project CPF in an area formerly operated by Murphy; therefore, baseline groundwater conditions cannot be determined.

B.16. **Volume 2, Consultant Report #5, Section 5.2.2, Page 26 – 28**

Volume 2, Consultant Report #5, Appendix D, Figure D-1 Volume 3, Consultant Report #10, Figure 5-3

Volume 2, Consultant Report #5, Section 2.5, Page 3-4

Volume 2, Consultant Report #5, Section 4.3.2.5, Page 17

Volume 2, Consultant Report #5, Section 4.3.3, Page 20

Volume 2, Consultant Report #5, Section 4.3.5, Page 22

Volume 2, Consultant Report #5, Appendix E, Table E1-4 & Figure E2-18 SIR1 Responses, #B.53, Pages 138-141.

In response to B.53(a), Pengrowth declines to account for uncertainty in the Arsenic retardation factor in its calculation, stating, *"A retardation factor of 1.6 was applied as this has been determined to be representative in the Cold lake area…"* According to Pengrowth's response to B.53(b), the retardation factor value is based on Fennell (2008). However, it is noted that Fennell (2008) is a thesis dissertation that has gone missing from the University of Calgary library and could not be located on *ProQuest* or *PRISM*, two standard thesis-dissertation databases. Its research has apparently also not been published in the peer-reviewed literature. However, a short abstract located on the internet (Fennell 2015) and attributed to Fennell (2008) infers that the retardation process is not fully understood, attested by a reported field-measured Arsenic attenuation factor that is an order of magnitude lower than expected from related laboratory studies.

(Reference: Fennell, J. (2015). Abstract of Effects of Aquifer Heating on Groundwater Chemistry with a Review of Arsenic and its Mobility. http://eurekamag.com/research/037/041/037041289.php, accessed on June 5, 2015).

a) Summarize the pertinent findings of Fennell (2008) and discuss why the confidence in the selected retardation factor is high compared to other uncertainties such as porosity.

Response:

Fennell (2008) evaluated the fate and transport of arsenic due to steam injection at a well pad to determine the effects of distance from the source on arsenic concentrations. Potential concentration changes down gradient of the source well were determined using transport model equations compared to field measurements. Down gradient groundwater transport of arsenic from the source well was simulated using WinTran Version 1.07 (ESI, 1995). A retardation factor (R_f) of 1.6 was used in the WinTran simulation, in order to best fit the movement of arsenic through the test aquifer with the field measured values. Simulated and measured arsenic concentrations were compared in order to test the model suitability using a 95% confidence interval. It was concluded that the simulated values mimic the actual conditions of the test aquifer "with a reasonable degree of accuracy".

Laboratory testing indicated retardation factors ranging from approximately 8.4 to 31 which are notably higher than the R_f determined based on field observations.

Fennel used two separate approaches to determine a retardation factor: transport modelling as compared to field measurements and laboratory analysis. Laboratory results indicated a range in retardation factors that do not align with field observations and if applied to groundwater velocity calculations would result in substantially slower movement of arsenic concentrations through the aquifer. The R_f determined based on modelling and field observations is conservative compared to the laboratory results which provides confidence that the value of 1.6 is an appropriate variable to apply in the absence of additional or more site-specific data.

Reference:

Environmental Simulations Inc. (ESI). 1995. WinTran Version 1.07. Steady State Groundwater Flow and Finite Element Contaminant Transport Model. J. Rumbaugh and D. Rumbaugh (developers).

Fennell, J. W. 2008. Effects of Aquifer Heating on Groundwater Chemistry with a Review of Arsenic

and its Mobility; A thesis submitted to the faculty of graduate studies in partial fulfillment of the requirements for the degree of Doctor of Philosophy; Department of Geoscience, University of Calgary, Calgary, AB, March, 330 pages.

b) Discuss why the uncertainty in a site-specific retardation factor for arsenic was not managed by appealing to a conservative (i.e. worst-case) thermal plume transport calculation that assumes a retardation factor of unity.

Response:

In the absence of other site-specific retardation factors, the most conservative R_f of 1.6 from Fennell's work was used to estimate the downgradient movement of arsenic. A retardation factor of unity would not change the impact assessment rating of low. The reduction of the retardation factor does not substantially alter the calculated time for an arsenic plume to reach a receptor as shown in Table B.16-1.

Table B.16-1 Thermal Arsenic Plume Migration Assessment - Example using R_f = 1.0

Receptor	Basin	Pathway	Groundwater Flow Rate (m/yr)	Distance from Nearest Well Pad to Receptor (m)	Time Required for Arsenic Plume to Reach Receptor if R_f = 1.6 (years)[2]	Time Required for Arsenic Plume to Reach Receptor if R_f = 1.0 (years)[2]
Reita Lake	Beaver River	-	-	654	-	-
Garnier Lake	Beaver River	Ethel Lake Formation	5	498	159	100
Bluet Lake	Beaver River	Ethel Lake Formation	5	1,740	557	348
Cushing Lake	Beaver River	-	-	5,250	-	-
Water Wells in the SW[1]	North Saskatchewan	Ethel Lake Formation	20	214	17	11
		Sand River Formation equiv.	30	214	11	7

R_f = Retardation Factor

[1] Distance is from Well Pad D24 to field verified water well 20 on CR #5, Figure D-1

[2] Time = (Distance/Groundwater Flow Rate) x R_f

5.3 HYDROLOGY

B.17. **Volume 2, Consultant Report #2, Section 5.3.1, Page 25**

Volume 2, Consultant Report #2, Section 6.2.1, Page 32

Volume 2, Consultant Report #2, Table 16, Page 26

SIR1 Responses, #B.64, Page 161.

In B.64(a), Pengrowth stated, "*The time to peak in the smallest watersheds is about 10 hours, so the model is only able to detect changes in timing of 10% or more of these watersheds.*" The meaning of the referenced statement is unknown.

a) Discuss the extent to which a one-hour time step limits the usefulness of the HSPF model in predicting peak flows.

Response:

The use of one-hour time steps limits the resolution of the model for small basins. With the smallest time-to-peak of about 10 hours, there are ten time steps so the resolution of the time to peak is about 10%. There may also be some numerical delay in the runoff calculation due to the time it takes to transfer the rainfall into runoff in the model. Most of the runoff response during rainfall events is derived from surface runoff, so this numerical delay is not expected to be substantial. The use of smaller time steps is not practical due to the resolution of rainfall and runoff data and due to the increased computational effort for continuous simulations. The accuracy of the predictions in the smallest basins is reduced but the comparison of pre- and post-disturbance values will eliminate some of the errors since similar errors are expected to occur in both scenarios.

B.18. **Volume 2, Consultant Report #6, Section 5.3.1, Page 25**

Volume 2, Consultant Report #6, Table 15, Page 22

Volume 2, Consultant Report #6, Table 16, Page 26

Volume 2, Consultant Report #6, Table 18, Page 29

Volume 2, Consultant Report #6 Section 5.3.2, Page 37

Volume 1, Table D.6.2-2, Page D-75

Volume 1, Table D.6.3-2, Page D-79 SIR1 Responses, #B.62, Page 156.

In B.62(a), Pengrowth states that LSA land-disturbance consisted of clearing and soil compaction and that these effects were represented in HSPF by adjusting evapotranspiration (ET) and upper zone storage capacity (UZSN). ET is a composite volume flux from five sources (dimensioned L T^{-1}), while UZSN is a soil storage volume capacity (dimensioned L). Also, the parameter adjustments were based on the results of combined clearing and plowing experiments conducted during the Tri-Creeks Experimental watershed Study of clear cutting practices.

a) Discuss the conceptual basis for attributing half of the increase in clear-cut watershed runoff to plowing.

Response:

The combination of clearcutting and plowing produced the results measured in the study, however, it was expected that clearcutting alone would have produced a lower impact because plowing destroyed all of the vegetation not just the trees. Assigning half of the increase to clearcutting was assumed to be more appropriate than assigning all or none, especially when the longer term data showed a reduction in runoff as the ground vegetation re-established itself.

b) Given that UZSN is one of several soil-moisture storage compartments, discuss the simple attribution of the 35% reduction in annual discharge prescription to a 75% reduction in UZSN.

Response:

Upper zone storage (UZSN) was thought to be the parameter most affected by soil compaction due to surface disturbances. While other parameters may also be affected to some degree, the greater complexity of calibrating multiple parameters for a single effect was not considered to be warranted.

c) Discuss the contributions that the other macro-pore storage compartments represented in HSPF make to the calibration solution (i.e. discuss the proportional contribution of interflow and active groundwater flow to annual discharge)?

Response:

Surface runoff produces most of the runoff during peak flow events with interflow and active groundwater contributing more during dry weather. The relative contributions vary depending on whether the period is wet or dry.

d) Discuss how it was confirmed that a 75% reduction in UZSN resulted in a 35% reduction in runoff.

Response:

Test PERLINs with normal and reduced UZSN were developed and compared to test the effects of different UZSN reductions.

e) Discuss how the 25% reduction in ET was effected.

Response:

The ET values input into the model were reduced to 75% of their normal values for the affected PERLINs.

B.19. **Volume 2, CR#6, Section D.6.2.3, Table D.6.2-2, Page D-74 & D-75**

Volume 2, CR #6, Section D.6.3.4, Table D.6.3-2, Page D-78 & D-79

SIR1 Responses, #B.64, Page 161.

In response to the requested comparison of the HSPF and run-off coefficient calculations, Pengrowth responds in B.64(a) with only a discussion of model differences.

a) Explain the purpose of presenting two sets of run-off predictions in the EIA.

Response:

As stated previously, the runoff coefficient calculations and the HSPF modeling apply two very different approaches. The runoff coefficient approach is a simplified empirical method which provides an understanding of the relative effects of various disturbances and is expected to provide estimates of worst case conditions used to screen the all the basins for relative effects. The HSPF model is a process based hydrological model that utilizes the entire historical record to provide statistical measures of flows rates and was used to provide more detailed results for selected basins.

b) Discuss the results of the two calculations and explain the reason for the differences and the consequence to the hydrology effects assessment and associated uncertainty.

Response:

The runoff coefficient approach was expected to provide estimates of worst-case conditions. This method is useful in providing an understanding of the relative effects of various disturbances but does not evaluate runoff over the entire range of historical conditions. The HSPF model is a process based hydrological model that utilizes the entire historical record to provide statistical measures of flow rates. The effects of disturbances are evaluated by adjusting process rates based on perceived changes to the landscape. While these effects may be the same as for the runoff coefficients at a local scale, the effects may be reduced at a larger scale due the damping effects of other downstream processes. The runoff coefficient approach is expected to be less accurate than the HSPF model but the combined approach was considered to provide a better understanding of the hydrological effects and should not be considered to increase uncertainty.

B.20. **Volume 2, CR #6, Section 4.4, Page 18**

Volume 2, CR #6, table 4, Page 8

SIR1 Responses #B.67, Page 163.

In response to a request for information on how differences in elevation between the climate stations, the Moosehills Creek watershed, and the various LSA watersheds were taken into account, Pengrowth states in B.67(a) that elevation differences were minimal and not accounted for. However, the 130 m elevation difference between the climate station and the watersheds, given a typical precipitation lapse rate, may not be minimal and should therefore be accounted for in some way.

a) Explain how the elevation differences were accounted for in the model calibration and validation process.

Response:

The LSA was centred in 058-05 W4M, which has an elevation 671.1 m. The average elevation for the Moosehills watershed is 672.5 m. The elevations are very similar so no adjustment was made between calibration and validation. Both these locations were transferred from the climate stations using an interpolated dataset obtained from Alberta Agriculture. This data was not adjusted for elevation changes.

b) If this difference was not taken into account, discuss the consequences to run-off prognostication and to the hydrology assessment for the Baseline Case, Application Case, and Planned Development Case.

Response:

Most of the climate data was based on data from Elk Point and Cold Lake climate stations. The elevation of the Elk Point station is 605 m and the elevation of the Cold Lake station is 541 m, a difference of 64 m. Table 5 of the Hydrology Report (CR#6) shows a comparison of the 1971 to 2000 climate normals for Cold Lake and Elk Point. The normal annual precipitation at Elk Point is less than 4% higher than that at Cold Lake for this period. However, for the entire period of overlapping records from 1953 to 1997, the average monthly precipitation is less than 1% lower at Elk Point than at Cold Lake. Given these small differences, the consequence of not accounting for the effect of elevation on precipitation rates was not considered significant, especially considering that the model was calibrated for a basin at the same elevation as the LSA and the main use of the model results was to evaluate differences in flow rates between the various cases rather than quantifying the absolute values of the flow rates.

6 TERRESTRIAL (EIA)

6.1 CONSERVATION AND RECLAMATION

B.21. **Volume 1, Section E.3.6, Page E-77**

Volume 1, Section E.3.6, Table E.3.6-1, Page E-79

Volume 1, Section E.5.3, Page E-89

SIR1 Responses, #B.80, Page 179-180.

In response to SIR1 #B.80, Pengrowth provides six material balance scenarios. Scenarios 5 and 6 illustrate the material balance with no volume losses, yet subsoil volumes show a negative material balance. The original material balance provided in Table E.3.6-1 does not show a subsoil deficit.

a) Explain the subsoil deficit illustrated in Scenarios 5 and 6 (Table B.80-1).

Response:

The original material balance did not account for the volume of subsoil required to create upland and transitional ecosites on well pads built on wetlands. Table E.3.6-1 was updated for SIR 1 Response #B.83 and the details of the subsoil volumes were discussed there.

7 HEALTH (EIA)

B.22. **SIR1 Response, Part B, Section 7 Health (EIA), Page, 270.**

Pengrowth provides a list of six chemicals emitted by the Project that were not included in the HHRA and scientific discussion supporting their exclusion.

a) Provide a discussion of Aliphatic Aldehydes and C7-C8 Aromatics that were also included in the list of COPC evaluated for the project but not listed as being carried through into the HHRA.

Response:

Aliphatic aldehydes and C7-C8 aromatics were listed as COPCs in the air quality assessment (CR#1, Section B.2.2, Tables B2-8 and D1-1), but were not included in the human health risk assessment for the following reasons:

- Aliphatic aldehydes – While aliphatic aldehydes were listed as a COPC in the air quality report, they were not modelled as a group. Rather, specific aliphatic aldehydes were considered in the air quality assessment and human health risk assessment including formaldehyde and acetaldehyde (assessed for inhalation, with insufficient toxicity information for the multimedia assessment). There are no data available on emissions of other individual aliphatic aldehydes; however, generally these compounds are less prevalent and less toxic than the assessed aldehydes.
- C7-C8 aromatics – The only aromatic compounds that fall into the C7-C8 range are benzene and toluene, which were included in the human health risk assessment as individual compounds. It should be noted that the carbon ranges for aromatic and aliphatic groups are based on equivalent carbon numbers, not actual carbon numbers, and other C8 alkyl benzenes are included in the C>8-C10 aromatic subfraction (Gustafson *et al.*, 1997).

References

Gustafson, J.B., J.G. Tell and D. Orem. 1997. Total Petroleum Hydrocarbon Working Group Series Volume 3: Selection of Representative TPH Fractions Based on Fate and Transport Considerations. Amherst Scientific Publishers, Amherst, Massachusetts.

B.23. **SIR1 Response, Part B, Section 7 Health (EIA), Page, 277.**

Appendix B.117-1 Human Health Vegetation and Soils Samples Analytical Result Table.

Pengrowth provides a summary of analytical results on soil and vegetation samples for 2012 and 2013 in Appendix B. Table 117-1.

a) Provide units and detection limits for the results of chemical analyses presented in Table 117-1 or reference this information if it is presented elsewhere within the document.

Response:

All metals and PAH analyses were reported in units of mg/kg, with vegetation samples reported as dry weight. Detection limits varied by COPC and media and are listed below:

Table B.23-1 Detection Limits for Background Samples		
Parameter	**Soil Detection Limit (mg/kg)**	**Vegetation Detection Limit (mg/kg dw)**
Mercury	0.01	0.003
Aluminum	20	1
Antimony	0.2	0.5
Arsenic	0.2	0.2
Barium	1	0.03
Beryllium	0.1	0.01
Bismuth	0.5	0.5
Boron	-	0.5
Cadmium	0.01	0.05
Chromium	0.5	0.04
Calcium	200	-
Cobalt	0.1	0.05
Copper	1	0.05
Iron	100	-
Lead	0.1	0.3
Lithium	-	0.1
Magnesium	100	1
Manganese	10	0.3
Molybdenum	1	0.05
Nickel	0.5	0.1
Phosphorus	30	1
Potassium	-	5
Selenium	0.3	0.3
Silicon	50	1
Silver	0.1	0.2
Silver	-	0.2
Strontium	1	0.02
Thallium	0.05	0.3
Tin	1	0.2
Titanium	0.5	0.05
Vanadium	0.1	0.1
Zinc	1	0.1
Naphthalene	0.01	0.01
Acenaphthylene	0.05	0.05
Acenaphthene	0.05	0.05

Table B.23-1 Detection Limits for Background Samples		
Parameter	**Soil Detection Limit (mg/kg)**	**Vegetation Detection Limit (mg/kg dw)**
Fluorene	0.05	0.05
Phenanthrene	0.01	0.01
Anthracene	0.003	0.003
Fluoranthene	0.01	0.01
Pyrene	0.01	0.01
Benzo(a)anthracene	0.01	0.01
Chrysene	0.05	0.05
Benzo(b+j)fluoranthene	0.05	0.05
Benzo(k)fluoranthene	0.05	0.05
Benzo(a)pyrene	0.05	0.05
Indeno(1,2,3-c,d)pyrene	0.05	0.05
Dibenzo(a,h)anthracene	0.05	0.05
Benzo(g,h,i)perylene	0.05	0.05

B.24. SIR1 Response, Part B, Section 7 Health (EIA), Equations 1-29, Pages 277-288.

It became evident during review of equations 1-29 and the associated worked example that adequate quality assurance/quality control (QA/QC) was not applied during development of the response to this SIR1 question.

Examples include but are not limited to (up to equation 17 was reviewed):

- Equation 3 appears to be incorrect. The result presented for DTot (44.1 mg/m^2/yr) cannot be obtained by multiplying DWet × DDry.
- It is not clear what the "B" in the denominator in the worked example for equations 4 and 5 denotes.
- The result of equation 6 (concentration in surface soil) appears to have changed from 2.8×10-8 mg/kg in the original HHRA appendices to 7.47×10-8 mg/kg in the revised submission with no change in the input values for the worked example. Please confirm that the result provided in the SIR1 response is correct as it could not be replicated by the reviewer.
- The result of equation 7 (concentration in soil) appears to have changed from 2.8×10-9 mg/kg in the original HHRA appendices to 7.47×10-9 mg/kg with no apparent change in the input values for the worked example. Please confirm that the result provided in the SIR1 response is correct as it could not be replicated by the reviewer.
- In equations 6 and 7, the units for soil loss constant for biotic and abiotic degradation are different in the definitions sections and in the worked examples. Confirm whether the units for this term are yrs-1 or m/yr.

- The parameter definitions for equation 9 still appear to be incorrect. DTot is defined as concentration in surface soil (mg/kg) yet the value used in the worked example is DTot (Total Deposition) from equation 3 with units of mg/m2.
- Equation 13 has a value (1.26×10-4 mg/L) in the equation rather than the term (CSw) and there is no worked example for this equation.
- The worked example for equation 14 worked contains a value of FV (fraction of COPC that is volatile) = 1. If an FV value of 1 is used in the equation, the DDry and DWet are both multiplied by 0 and the final result would also therefore be 0. It is not clear how the result presented (2.85 mg/kg) was obtained if FV=1.
- FV is not defined in equation 15.
- The values of the COPC in plants and air used to derive the air to plant biotransfer factor (µg/g plant / µg/g air) in equation 15 (i.e., 0.148) are not clear.
- Please confirm that the result provided in the worked example for equation 16 is correct. The reviewer could not obtain the result provided in the worked example using the equation and input values provided.
- In equation 17, the parameter definitions do not match the equation. Cgame is listed in the parameter definition list 6 times but 5 of these should have been labelled as Csoil, Cwater, Cair, Cplant and Cprey. IRmeat is defined but not used in the equation. IRprey is used in the equation but not defined. Also, in the worked example, it is not clear if 2.6910-3 mg/kg is supposed to be 2.69×10-3 mg/kg. Finally, the units of the air concentration are inconsistent between the parameter definition list (mg/m3) and the worked example (µg/m3). A unit conversion may be required somewhere within the worked example to obtain the result presented. The reviewer could not obtain the result provided in the worked example using the input values to the worked example as they are currently presented.

a) Provide a revised, thoroughly QA/QC'd version of Pages 277-288 (i.e., equations 1-29) with a worked example for one COPC.

Response:

The errors in the worked example from SIR 1 were noted and checked against the original modelling performed for the HHRA. The errors have been corrected to be consistent with the multimedia exposure model, and no changes to the HHRA results are required. A revised version of the worked example is provided below for toddler receptors exposed to formaldehyde at the RSA-MPOI.

Edits based on the specific comments above include:

- Equation 3 was corrected (should be Dwet + Ddry).
- The "B" in the example calculation for Equations 4 and 5 was a copy/paste error now removed.
- The correct result for Equation 6 is 2.8e-8.
- The correct result for Equation 7 is 2.8e-9.
- The soil loss constants for Equations 6 and 7 have units of yr^{-1}.
- DTot in Equation 9 is deposition.

- The worked example for Equation 13 has been added, and the value replaced with the variable for Csw.
- Equation 14 has a result of 0 in the worked example.
- The definition for FV has been added to Equation 15.
- The calculation for plant biotransfer factor in Equation 15 has been added.
- The BCF in the worked example for Equation 16 has been corrected; the answer was previously correct.
- The parameter definitions in Equation 17 have been corrected.

In addition to addressing those specific comments, a detailed review of all equations and calculations was conducted.

Dry Deposition *(Equation 1)*

$$D_{Dry} = C_{air} \times V_D \times UC1 \times UC2$$

Where:

D_{Dry}= Dry deposition rate (mg/m^2/yr)

C_{air} = Modelled air concentrations of COPC (µg/m^3)

V_D = Dry deposition velocity (m/s)

UC1 = Unit conversion (3156000 s/yr)

UC2 = Unit conversion (0.001 mg/µg)

Sample Calculation:

$$D_{Dry} = 0.177\mu g/m\text{^}3 \times 0.005 m/s \times 31536000 s/yr \times 0.001 mg/\mu g = 27.9 mg/(m^2 \cdot yr)$$

Wet Deposition *(Equation 2)*

$$D_{Wet} = C_{air} \times V_W \times UC1 \times UC2$$

Where:

D_{Wet} = Wet deposition rate (mg/m^2/yr)

C_{air} = Modelled air concentrations of COPC (µg/m^3)

V_W = Wet deposition velocity (m/s)

UC1 = Unit conversion (31536000 s/yr)

UC2 = Unit conversion (0.001 mg/µg)

Sample Calculation:

$$D_{Wet} = 0.177\mu g/m^3 \times 0.00289 m/s \times 31536000 s/yr \times 0.001 mg/\mu g = 16.1 mg/m^2 \cdot yr$$

Total Deposition *(Equation 3)*

$$D_{Tot} = D_{Wet} + D_{Dry}$$

Sample Calculation:

$$D_{Tot} = 27.9 mg/m^2 \cdot yr + 16.1 mg/m^2 \cdot yr = 44.1 mg/m^2 \cdot yr$$

Deposition to Surface Soil *(Equation 4)*

$$D_{s0} = \frac{D_{Tot}}{Z_{s0} \times \rho_B}$$

Where:

D_{s0} = Deposition to surface soil (mg/kg/yr)

Z_{s0} = Surface soil mixing depth (m)

ρ_B = Soil bulk density (kg/m^3)

Sample Calculation:

$$D_{s0} = \frac{44.1 mg/m^2 \cdot yr}{0.02 m \times 1500 \text{kg/m}^3} = 1.47 mg/\,kg/yr$$

Deposition to Soil *(Equation 5)*

$$D_s = \frac{D_{Tot}}{Z_s \times \rho_B}$$

Where:

D_s = Deposition to soil (mg/kg/yr)

Z_s = Soil mixing depth (m)

ρ_B = Soil bulk density (kg/m^3)

Sample Calculation:

$$D_s = \frac{44.1 mg/m^2 \cdot yr}{0.2m \times 1500 \text{kg/m}^3} = 0.147 mg/kg/yr$$

Concentration in Surface Soil *(Equation 6)*

$$C_{s0} = D_{s0} \frac{1 - e^{(-kt \times t_D)}}{kt}$$

Where:

C_{s0} = Concentration in surface soil (mg/kg)

D_{s0} = Deposition to surface soil (mg/kg/yr)

kt = soil loss constant for biotic and abiotic degradation (yrs^{-1})

t_D = time period over which deposition occurs (80 years)

Sample Calculation:

$$C_{s0} = (1.47 mg/kg/yr) \frac{1 - e^{(-5.16 \times 10^7 yr^{-1} \times 80 yrs)}}{5.16 \times 10^7 yr^{-1}} = 2.85 \times 10^{-8} mg/kg$$

Concentration in Soil *(Equation 7)*

$$C_s = D_s \frac{1 - e^{(-kt \times t_D)}}{kt}$$

Where:

C_s = Concentration in soil (mg/kg)

D_s = Deposition to soil (mg/kg/yr)

kt = soil loss constant for biotic and abiotic degradation (yrs^{-1})

t_D = time period over which deposition occurs (80 years)

Sample Calculation:

$$C_s = (0.147 mg/kg/yr)\frac{1 - e^{(-5.16\times10^{7} yr^{-1}\times 80 yrs)}}{5.16\times10^{7} yr^{-1}} = 2.85\times10^{-9} mg/kg$$

Concentration in Airborne Dust *(Equation 8)*

$$C_{Dust} = C_{s0} \times DL \times UC$$

Where:

C_{Dust} =Concentration in dust ($\mu g/m^3$)

C_{s0} = Concentration in surface soil (mg/kg)

DL = Dust Level (kg/m^3)

UC = Unit conversion (1000 µg/mg)

Sample Calculation:

$$C_{Dust} = 2.85\times10^{-8} mg/kg \times 7.6\times10^{-10}\, kg/m^3 \times 1000 \mu g/mg = 2.16\times10^{-14} \mu g/m^3$$

Concentration in Surface Water *(Equation 9)*

$$C_{SW} = D_{Tot} \times LA \times B$$

Where:

C_{SW} =Concentration in surface water (mg/L)

D_{TOT} = Total deposition to soil ($mg/m^2/yr$)

LA = Lake area (m^2)

B = Calculated COPC loss rate (yr/L)

Sample Calculation:

$$C_{SW} = 44.1 mg/m^2 \cdot yr \times 82{,}120{,}000 m^2 \times 3.48 \times 10^{-14} yr/L = 1.26 \times 10^{-4} mg/L$$

$$B = \frac{0.001 m^3/L}{(FR \times f_{mix} + K_{sw} \times V)}$$

Where:

B = Calculated COPC loss rate (yr/L)

FR = water body flow rate (m^3/yr)

f_{mix} = fraction of total water body for mixing (assumed 1)

K_{sw} = COPC surface water loss constant (yr^{-1})

V = water body volume (m^3)

Sample Calculation:

$$B = \frac{0.001 m^3/L}{(1{,}702{,}944 m^3/yr \times 1 + 70 yr^{-1} \times 410{,}600{,}000 m^3)} = 3.48 \times 10^{-14} yr/L$$

Concentration in Aquatic Organisms (Equation 10)

Concentrations in aquatic plants, aquatic invertebrates, and fish were determined based on the surface water concentration and a chemical specific bioconcentration factor:

$$C_{Organism} = C_{SW} \times BCF$$

Where:

$C_{Organism}$ =Concentration in organism (mg/kg DW)

C_{SW} =Concentration in surface water (mg/L)

BCF = Bioconcentration factor (L/kg)

Sample Calculation (aquatic plants):

$C_{Organism} = 1.26 \times 10^{-4} mg/L \times 0.79 L/kg = 9.94 \times 10^{-5} mg/kg\ DW$

Bioconcentration Factor for Aquatic Organisms (if literature value unavailable) (Equation 11)

$BCF = 10^{(0.819 \times logKow - 1.146)}$

Where:

BCF = Bioconcentration factor

K_{ow} =Octanol-water partition coefficient

Bioconcentration Factor for Fish (if literature value unavailable) (Equation 12)

$BCF = 10^{(0.77 \times logKow - 0.07)}$

Where:

BCF = Bioconcentration factor

K_{ow} = Octanol-water partition coefficient

Concentration in lake sediment (Equation 13)

$$C_{sed} = C_{sw} \times \frac{Kd}{\theta_{bs} + Kd \times p_{sed}} \times \frac{d_{wc} + d_{bs}}{d_{bs}}$$

Where:

C_{sed} = concentration in sediment (mg/kg)

C_{sw} = concentration in surface water (mg/L)

f_{bs} = fraction tot CIOC concentration in benthic sediment (unitless)

Kd = Sediment partition coefficient (L/kg)

θ_{bs} = bed sediment porosity (unitless)

p_{sed} = sediment bulk density (1 kg/L)

d_{wc} = depth of water column (m)

d_{bs} = depth of benthic sediment (m)

Sample Calculation:

$$C_{sed} = 1.26\times10^{-4} mg/L \times \frac{0.11L/kg}{0.6L/L + 0.11L/kg \times 1.0kg/L} \times \frac{1.0m + 1.0m}{1.0m} = 3.90\times10^{-5} mg/kg$$

Concentration in plants due to direct deposition (Equation 14)

$$C_{plantsD} = \left[D_{Dry} \times (1 - FV) + D_{Wet} \times (1 - FV)\right] \times 0.6 \times A$$

$$A = R_p \frac{\left[1 - e^{(-kp \times Tp)}\right]}{Y_P \times kp}$$

Where:

$C_{plantsD}$ = concentration in plants due to deposition (mg/kg DW)

D_{Dry}= overall dry deposition rate (mg/m^2/yr)

D_{Wet} = overall wet deposition rate (mg/m^2/yr)

FV = fraction of COPC that is volatile (unitless)

Rp= intercept fraction of edible portion of plants (0.5 forage, 0.39 human consumption)

kp = plant surface loss coefficient (yr^{-1})

Tp= length of plant exposure (0.12 yr forage, 0.16 yr human consumption)

Yp = productivity (0.24 kg/m^2 forage, 2.24 kg/m^2 human consumption)

Sample Calculation (wildlife forage):

$$A = 0.5 \frac{\left[1 - e^{(-18yr^{-1} \times 0.12yr)}\right]}{0.24kg/m^2 \times 18yr^{-1}} = 0.102\ m^2 \cdot yr \cdot kg^{-1}$$

$C_{plantsD} = [27.9mg/m^2/yr \times (1 - 1) + 16.1mg/m^2/yr \times (1 - 1)] \times 0.6 \times 0.102m^2 \cdot yr \cdot kg^{-1}$ =0 mg/kg

Concentration in plants due to vapour uptake (Equation 15)

$$C_{plantsV} = \frac{C_{air} \times (Bv/Rf) \times FV}{\rho_{air} \times UC}$$

Where:

$C_{plantsV}$ = concentration in plants due to vapour uptake (mg/kg DW)

C_{air} = concentration in air (µg/m^3)

Bv= air to plant biotransfer factor (µg/g plant / µg/g air)

RF = reduction factor (100)

FV = fraction of COPC that is volatile (unitless)

Pair = density of air (1.2 g/L)

UC = unit correction (1000 µg/mg × 1000 L/m^3 × 1 kg/1000 g = 1000)

Sample Calculation (wildlife forage):

$$C_{plantsV} = \frac{0.177\mu g/m^3 \times (15[\mu g/g\ DW\ plant]\ /\ [\mu g/g\ air]/100) \times 1}{\frac{1.2g}{L} \times 1000\mu g/mg \cdot L/m^3 \cdot kg/g} = 2.20 \times 10^{-5} mg/kg$$

$$B_v = \frac{\rho_{air} \cdot 10^{\left(1.065 \log K_{ow} - \log\left(\frac{H}{RT}\right) - 1.654\right)}}{(1 - f_{water}) \cdot \rho_{plant}}$$

Where:

Bv= air to plant biotransfer factor (µg/g plant / µg/g air)

P_{air} = density of air (1.2 g/L)

P_{plant} = density of plants (770 g/L; McCrady and Maggard 1993)

f_{water} = fraction of forage that is water

= 0.85 for human intake (Macrady and Maggard, 1993)

=0.62 for wildlife based on Site-specific data from AOSC, 2009 and Dover, 2010

H = Henry's law constant (atm m^3/mol)

R = gas constant (0.000082 atm m^3/K mol)

T = temperature (288K)

Sample Calculation (plants for wildlife uptake):

$$B_v = \frac{1.5 g/L \cdot 10^{\left(1.065(0.35) - \log\left(\frac{3.37\times10^{-7} atm\ m^3/mol}{8.2\times10^{-5} atm\ m^3/K\ mol \cdot 288K}\right) - 1.654\right)}}{(1-0.62)\cdot 770 g/L} = 15$$

Concentration in plant roots consumed by humans (Equation 16)

$$C_{root} = C_{soil} \times BCF \times (1 - WC)$$

C_{root} = concentration in plant roots (mg/kg)

C_{soil} = concentration in soil (mg/kg)

BCF = bioconcentration factor (unitless)

WC = water content (kg water/ kg plant)

Sample Calculation (wildlife forage):

$$C_{root} = 2.85 \times 10^{-9} mg/kg \times 305 \times (1 - 0.85) = 1.30 \times 10^{-7} mg/kg$$

Concentration in wild game (Equation 17)

$$C_{game} = \left(C_{soil} IR_{soil} + C_{sed} IR_{sed} + C_{water} IR_{water} + C_{air} IR_{air} + \sum C_{plant} IR_{plant} + \sum C_{prey} IR_{prey}\right) \times \mathrm{BTF_a}$$

Where:

C_{game} = Concentration in wild game (mg/kg DW)

C_{soil} = Concentration in soil (mg/kg)

IR_{soil} = wildlife soil ingestion rate (mg/kg soil/kg BW/d)

C_{sed} = Concentration in sediment (mg/kg)

IR_{sed} = wildlife sediment ingestion rate (mg/kg soil/kg BW/d)

C_{water} = Concentration in water (mg/L)

IR_{water} = wildlife water ingestion rate (mg/L water/kg BW/d)

C_{air} = Concentration in air (µg/m^3)

IR_{air} = wildlife air inhalation rate (m^3 air/kg BW/d)

C_{plants} = Concentration in plants (mg/kg DW)

IR_{plant} = wildlife plant ingestion rate (mg/kg soil/kg BW/d)

C_{prey} = Concentration in prey (mg/kg DW)

IR_{prey} = wildlife prey ingestion rate (mg/kg soil/kg BW/d)

BTF_a = adjusted biotransfer factor (unitless

Sample Calculation (moose):

$$C_{game} = \{(2.85 \times 10^{-9}\text{mg/kg})(51.2\text{kg/d}) + (3.90 \times 10^{-5}\text{mg/kg})(12.8\text{kg/d}) + (1.26 \times 10^{-4}\text{mg/L})(20\text{L/d}) + (0.177\mu\text{g/m}^3)(65.87\text{m}^3\text{/d})(1\text{mg}/1000\mu\text{g}) + [(2.20 \times 10^{-5}\text{mg/kg})(6.4\text{kg/d}) + (9.94 \times 10^{-5}\text{mg/kg})(1.6\text{kg/d})] + (0)\} \times 1.2 \times 10^{-6} = 1.79 \times 10^{-8} mg/kg\ ww$$

$$BTF_a = BTF \times FC \times MF$$

BTF_a = adjusted biotransfer factor ([mg/kg tissue] / [mg/d])

BTF = chemical specific biotransfer factor ([mg/kg tissue] / [mg/d])

FC = fat content (unitless)

MF = modification factor (0.01 for PAHs, 1 for VOCs)

$$BTF_a = 0.0000063 \times 0.19 \times 1 = 0.0000012$$

Human exposure soil ingestion (Equation 18)

$$E_{SI} = \frac{C_{s0} \times SIR}{BW}$$

Where:

E_{SI} = Exposure from soil ingestion (mg/kg BW/d)

C_{s0} = concentration of COPC in surface soil (mg/kg)

SIR = soil ingestion rate (kg/d)

BW =body weight (kg)

Sample Calculation :

$$E_{SI} = \frac{2.85 \times 10^{-8} mg/kg \times 0.00008 kg/d}{16.5 kg} = 1.38 \times 10^{-13} mg/kgBW/d$$

Human exposure from water ingestion (Equation 19)

$$E_{WI} = \frac{C_{sw} \times WIR}{BW}$$

Where:

E_{WI} = Exposure from water ingestion (mg/kg BW/d)

C_{sw} = concentration of COPC in surface water (mg/L)

WIR = soil ingestion rate (L/d)

BW =body weight (kg)

Sample Calculation :

$$E_{WI} = \frac{1.26 \times 10^{-4} mg/L \times 0.6 L/d}{16.5 kg} = 4.58 \times 10^{-6} mg/kgBW/d$$

Human exposure from dust inhalation (Equation 20)

$$E_{DI} = \frac{C_{Dust} \times AIR}{BW}$$

Where:

E_{DI} = Exposure from dust inhalation (mg/kg BW/d)

C_{Dust} = concentration of COPC in dust (mg/kg)

AIR = air ingestion rate (m^3/d)

BW =body weight (kg)

Sample Calculation :

$$E_{DI} = \frac{2.16 \times 10^{-14} \mu g/m^3 \times 8.3 m^3/d}{16.5 kg} = 1.09 \times 10^{-14} \mu g/kg BW/d$$

Human exposure from food (Equation 21)

$$E_{food} = \frac{\sum C_{plant} IR_{plant} + \sum C_{wild\ game} IR_{wild\ game}}{BW}$$

E_{food} = Exposure from food ingestion (mg/kg BW/d)

C_{Plant} = concentration of COPC in plants (mg/kg)

$C_{Wild\ game}$= concentration of COPC in wild game (mg/kg)

IR_{plant}= ingestion rate of plant type (kg/d)

$IR_{wild\ game}$= ingestion rate of wild game (kg/d)

BW =body weight (kg)

Sample Calculation :

$$E_{food} = \frac{\left[\left(8.36 \times 10^{-6} \frac{mg}{kg}\right)\left(\frac{0.067 kg}{d}\right) + \left(1.30 \times 10^{-7} \frac{mg}{kg}\right)\left(\frac{0.105 kg}{d}\right) + \left(1.11 \times 10^{-5} \frac{mg}{kg}\right)\left(\frac{0.005 kg}{d}\right) + \left(2.56 \times 10^{-5} \frac{mg}{kg}\right)\left(\frac{0.001 kg}{d}\right) + \left(5.49 \times 10^{-9} \frac{mg}{kg}\right)\left(\frac{0.001 kg}{d}\right)\right] + \left[\left(1.79 \times 10^{-8} \frac{mg}{kg}\right)\left(\frac{0.023 kg}{d}\right) + \left(4.52 \times 10^{-11} \frac{mg}{kg}\right)\left(\frac{0.006 kg}{d}\right) + \left(1.64 \times 10^{-10} \frac{mg}{kg}\right)\left(\frac{0.012 kg}{d}\right) + \left(6.77 \times 10^{-9} \frac{mg}{kg}\right)\left(\frac{0.044 kg}{d}\right) + \left(6.92 \times 10^{-3} \frac{mg}{kg}\right)\left(\frac{0.095 kg}{d}\right)\right]}{16.5 kg}$$

$$= 3.99 \times 10^{-5} \frac{mg}{kg\ BW\ d}$$

Human exposure from contact with surface water (Equation 22)

$$E_{SwimC} = \frac{C_{SW} \times Kpw \times SEF \times SAT}{BW}$$

E_{SwimC} = Exposure from contact with surface water (mg/kg BW/d)

C_{SW} = concentration of COPC in surface water (mg/L)

Kpw = Dermal permeability coefficient (cm/h)

SEF = swimming exposure factor (h/d)

SAT = Surface area exposed (cm^2)

BW =body weight (kg)

Sample Calculation :

$$E_{SwimC} = \frac{1.26 \times 10^{-4} mg/L \times 0.11 cm/h \times 0.255 hr/d \times 6130 cm^2 \times L/1000 cm^3}{16.5 kg}$$
$$= 1.31 \times 10^{-6} mg/kgBW/d$$

Human exposure from ingestion of surface water while swimming (Equation 23)

$$E_{SwimI} = \frac{C_{SW} \times SEF \times SWIR}{BW}$$

E_{SwimI}= Exposure from ingestion while swimming (mg/kg BW/d)

C_{SW} = concentration of COPC in surface water (mg/L)

SWIR = water ingestion rate while swimming (L/h)

SEF = swimming exposure factor (h/d)

BW =body weight (kg)

Sample Calculation :

$$E_{SwimI} = \frac{1.26 \times 10^{-4} mg/L \times 0.255 h/d \times 0.05 L/h}{16.5 kg} = 9.74 \times 10^{-8} mg/kgBW/d$$

Human exposure from contact with surface soil (Equation 24)

$$E_{SoilContact} = \frac{C_{s0} \times (SAH \times SLH + SAO \times SLO) \times EF \times RAF}{BW}$$

$E_{Soil\ Contact}$= Exposure from contact with surface soil (mg/kg BW/d)

C_{s0} = concentration of COPC in surface soil (mg/kg)

SAH = surface area of hands (m^2)

SAO = surface area of other exposed skin (m^2)

SLH = soil loading to hands ($kg/m^2/d$)

SLO = soil loading to other exposed skin ($kg/m^2/d$)

EF= exposure frequency (events/day) = 1

RAF = relative dermal absorption factor (dimensionless)

BW =body weight (kg)

Sample Calculation :

$$E_{SoilContact} = \frac{2.85 \times 10^{-8} mg/kg \times (430 cm^2 \times 0.0001 g/cm^2 + 2580 cm^2 \times 0.00001 g/cm^2) \times 1 \times kg/1000 g \times 0.15}{16.5 kg}$$

$$= 1.78 \times 10^{-14} mg/kgBW/d$$

Human exposure from breast milk ingestion (Equation 25)

$$E_{BM} = \frac{C_{bm} \times MIR}{BW}$$

Where:

E_{BM} = Exposure from ingestion of breast milk (mg/kg BW/d)

C_{bm} = concentration of COPC in breast milk (mg/L)

MIR = milk ingestion rate (L/d)

BW =body weight (kg)

Sample Calculation (infant) :

$$E_{BM} = \frac{7.96 \times 10^{-10} mg/kg \times 0.664 kg/d}{8.2 kg} = 6.44 \times 10^{-11} mg/kgBW/d$$

Concentration in breast milk *(Equation 26)*

$$C_{bm} = EDI \times BTF$$

Where:

C_{bm} = concentration of COPC in breast milk (mg/L)

EDI = estimated daily intake of adult receptor (mg/d)

BTF = breastmilk biotransfer factor (mg/kg milk / mg/d intake)

Sample Calculation :

$$C_{bm} = 1.78 \times 10^{-3} mg/d \times 4.48 \times 10^{-7} d/kg = 7.97 \times 10^{-10} mg/kg$$

Total estimated exposure *(Equation 27)*

$$E_{total} = E_{SI} + E_{WI} + E_{DI} + E_{food} + E_{SwimI} + E_{swimC} + E_{soil\ contact} + E_{bm}$$

Where:

E_{total}= total exposure (mg/kg bW/d)

E_{SI} = soil ingestion exposure (mg/kg bW/d)

E_{WI} = water ingestion exposure (mg/kg bW/d)

E_{DI} = dust inhalation exposure (mg/kg bW/d)

E_{food} = food ingestion exposure (mg/kg bW/d)

E_{SwimI}= swimming ingestion exposure (mg/kg bW/d)

E_{swimC} = swimming contact exposure (mg/kg bW/d)

$E_{soil\ contact}$= soil contact exposure (mg/kg bW/d)

Sample Calculation :

$$E_{total} = 1.38 \times 10^{-13} + 4.58 \times 10^{-6} + 1.09 \times 10^{-17} + 3.99 \times 10^{-5} + 1.31 \times 10^{-6} + 9.74 \times 10^{-8} + 1.78 \times 10^{-14} = 4.59 \times 10^{-5} mg/kg\ BW/d$$

Predicted hazard from non-carcinogenic COPC exposure (Equation 28)

$$Hazard = E_{total}/RfD$$

Where:

Hazard = predicted hazard from exposure to non-carcinogens

E_{total} = total exposure (mg/kg /d)

RfD = reference dose (mg/kg/d)

Sample Calculation :

$$Hazard = 4.59 \times 10^{-5} mg/kg\ BW/d\ /\ 0.000150 mg/kg\ BW/d = 0.31$$

Predicted risk from carcinogenic COPC exposure (Equation 29)

$$Risk = \sum_i (E_{total} \times D_i)/(RsD \times LE)$$

Risk = predicted risk from exposure to carcinogens

E_{total}= total exposure for lifestage (mg/kg/d)

RsD= risk specific dose (mg/kg/d)

D_i = duration of exposure during lifestage i (y)

LE = life expectancy (y)

Sample Calculation (3-Methylcholanthrene):

$$Risk = \left(\frac{2.09 \times 10^{-8} mg/kg/d \times 0.5y}{4.5 \times 10^{-7} mg/kg/d \times 80y}\right) + \left(\frac{1.21 \times 10^{-8} mg/kg/d \times 4.5y}{4.5 \times 10^{-7} mg/kg/d \times 80y}\right) + \left(\frac{8.58 \times 10^{-9} mg/kg/d \times 7y}{4.5 \times 10^{-7} mg/kg/d \times 80y}\right) + \left(\frac{6.86 \times 10^{-9} mg/kg/d \times 8y}{4.5 \times 10^{-7} mg/kg/d \times 80y}\right) + \left(\frac{7.26 \times 10^{-9} mg/kg/d \times 60y}{4.5 \times 10^{-7} mg/kg/d \times 80y}\right) = 1.7 \times 10^{-2}$$

References:

Athabasca Oil Sands Corporation (AOSC). 2009. Application for approval of the MacKay River Commercial Project. Submitted to: Alberta Energy Resources Conservation Board and Alberta Environment. Submitted by: Athabasca Oil Sands Corp. December 2009.

Dover Operating Corporation (DOC). 2010. Application for Approval for the Dover Commercial Project.

Macrady, J.K., and S.P. Maggard. 1993. "Uptake and Photodegradation of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Sorbed to Grass Foliage." *Environmental Science and Technology*. 27:343-350.

B.25. **SIR 1 Response, Part B, Section 7 Health (EIA), Equations 1-29, Pages 277-288.**
Pengrowth states, *"Revised air dispersion modelling was conducted for the Pilot, but not for the proposed Project facility."*

a) Confirm that any new air dispersion modelling and resultant changes in predicted concentration data did not impact the results or conclusions of the human health risk assessment.

Response:

There were no changes to the air dispersion modelling or predicted concentration data for the proposed Project. The re-modelling was completed for the (separate) Pilot facility located roughly 3.5 km south of the Project, which was not subject to a human health risk assessment. The modelling conducted for the Pilot utilized a substantially smaller study area and a different receptor grid than the proposed Project facility and therefore results are not directly comparable. However, predicted concentrations of criteria air pollutants were all below Alberta Ambient Air Quality Objectives (AAAQOs) and no impact on the results or conclusions of the human health risk assessment is expected.

8 ERRATA

B.26. **Volume 3, Consultant Report #9, Section 4.4, Table 17, Page 65-67.**

In response to SIR B.87, Pengrowth provides several tables that present baseline wind and water erosion risk; however, Tables B.87-2 through B.87-4 mistakenly include LCCS Rating Classes in the headings.

a) Update the tables using the correct headings.

Response:

Tables B.87-2 through B.87-4 from the SIR 1 Response have been revised and are presented below as Tables B.26-1 through B.26-3, respectively.

Table B.26-1 Extent of Wind Erosion Risk Ratings in the LSA and Project Footprint

Wind Erosion Risk	LSA		Project Footprint	
	Area (ha)	% of LSA	Area (ha)	% of Footprint
High	320.8	1.7	-	-
Moderate-High	1,044.9	5.5	67.5	8.3
Moderate	12,561.6	66.6	552.4	68.0
Moderate-Low	410.9	2.2	11.1	1.4
Low	2,897.4	15.4	110.8	13.6
Not Rated	1,617.6	8.6	70.9	8.7
TOTAL[1]	**18,853.3**	**100**	**812.7**	**100**

[1] Due to rounding of values, totals may not equal the sum of the individual values presented in the table.

Table B.26-2 Extent of Water Erosion Risk Ratings (Bare Soil) in the LSA and Project Footprint

Water Erosion Risk	LSA		Project Footprint	
	Area (ha)	% of LSA	Area (ha)	% of Footprint
Severe	684.5	3.6	8.5	1.0
High	820.2	4.4	47.5	5.8
Moderate	5,458.9	29.0	162.4	20.0
Low	6,764.0	35.9	351.6	43.3
Very Low	3,508.0	18.6	171.8	21.1
Not Rated	1,617.6	8.6	70.9	8.7
TOTAL[1]	**18,853.3**	**100**	**812.7**	**100**

[1] Due to rounding of values, totals may not equal the sum of the individual values presented in the table.

Table B.26-3 Extent of Water Erosion Risk Ratings (Current Vegetative Cover) in the LSA and Project Footprint				
Water Erosion Risk	**LSA**		**Project Footprint**	
	Area (ha)	**% of LSA**	**Area (ha)**	**% of Footprint**
Severe	-	-	-	-
High	-	-	-	-
Moderate	-	-	-	-
Low	-	-	-	-
Very Low	17,235.6	91.4	741.8	91.3
Not Rated	1,617.6	8.6	70.9	8.7
TOTAL[1]	**18,853.3**	**100**	**812.7**	**100**

[1] Due to rounding of values, totals may not equal the sum of the individual values presented in the table.

B.27. Consultant Report #10, Section 4.4.1.1, Page 65.

This section provides the descriptions of the rare plants listed in Table 4-10 that were recorded within the local study. The plant descriptions include 23 of the 25 plants listed in the table.

a) Provide the descriptions for the remaining two species: Conardia compacta and Cornicularia normoerica.

Response:

***Conardia compacta* – Moss**

Conardia compacta is a small, very slender green to yellowish moss that forms dense to loose mats (eFloras 2008). Stems are erect-ascending or creeping and irregularly branched up to 2 cm long (Ireland 1982). Stem leaves are lance-shaped, 0.5-1.5 mm long, gradually tapering to a sharp point with concave sides. The leaves are smooth with minute to saw-like forward pointing teeth along the margin (Ireland 1982). A single nerve or prominent mid-vein extends to or nearly to the leaf tip and rhizoids (when present) grow from the back of the nerve. Pale, elongated gemmae are rarely detectible in the field, but sometimes grow from the back of the leaf tip (Atherton *et al.* 2010). Conarda compacta can be found on Damp cliffs, limestone, in swamps on logs, stumps, humus, and bark at the base of trees, occurring at low to high elevations (eFloras 2008). It is ranked imperiled (S2) in Alberta, vulnerable to apparently secure (S3S4) in British Columbia, it is not ranked (SNR) in Saskatchewan and is apparently secure (G3G5) globally (NatureServe 2015). *Conardia compacta* was found in one location in the LSA, within a treed poor fen (J1).

***Cornicularia normoerica* – Bootstrap Lichen**

Cornicularia normoerica is a small fruticose lichen with minute tufts of very dark red-brown to black, flattened strap like lobes dichotomously branched, barely 0.5mm wide and rarely exceeding 10mm long (Brodo 2001). The cortex is thick and tough; and the medulla is dense and solid (Brodo 2001).

The lichens are often fertile, producing black or dark brown lecanorine apothecia close to the tips of the lobes. The spores are colorless, one celled and ellipsoid in shape with eight per ascus (Brodo 2001). *Cornicularia normoerica* can generally be found on boulders at high elevations. It is ranked critically imperiled (S1) in Alberta; and globally secure (G4G5) (NatureServe 2015).

References:

Atherton, I., Bosanquet, S. and Lawley, M. 2010. Mosses and Liverworts of Britain and Ireland a field guide. British Bryological Society. Plymouth, United Kingdom. p. 840. Available at http://www.bbsfieldguide.org.uk/sites/default/files/pdfs/mosses/Conardia_compacta.pdf [Accessed July 27, 2015].

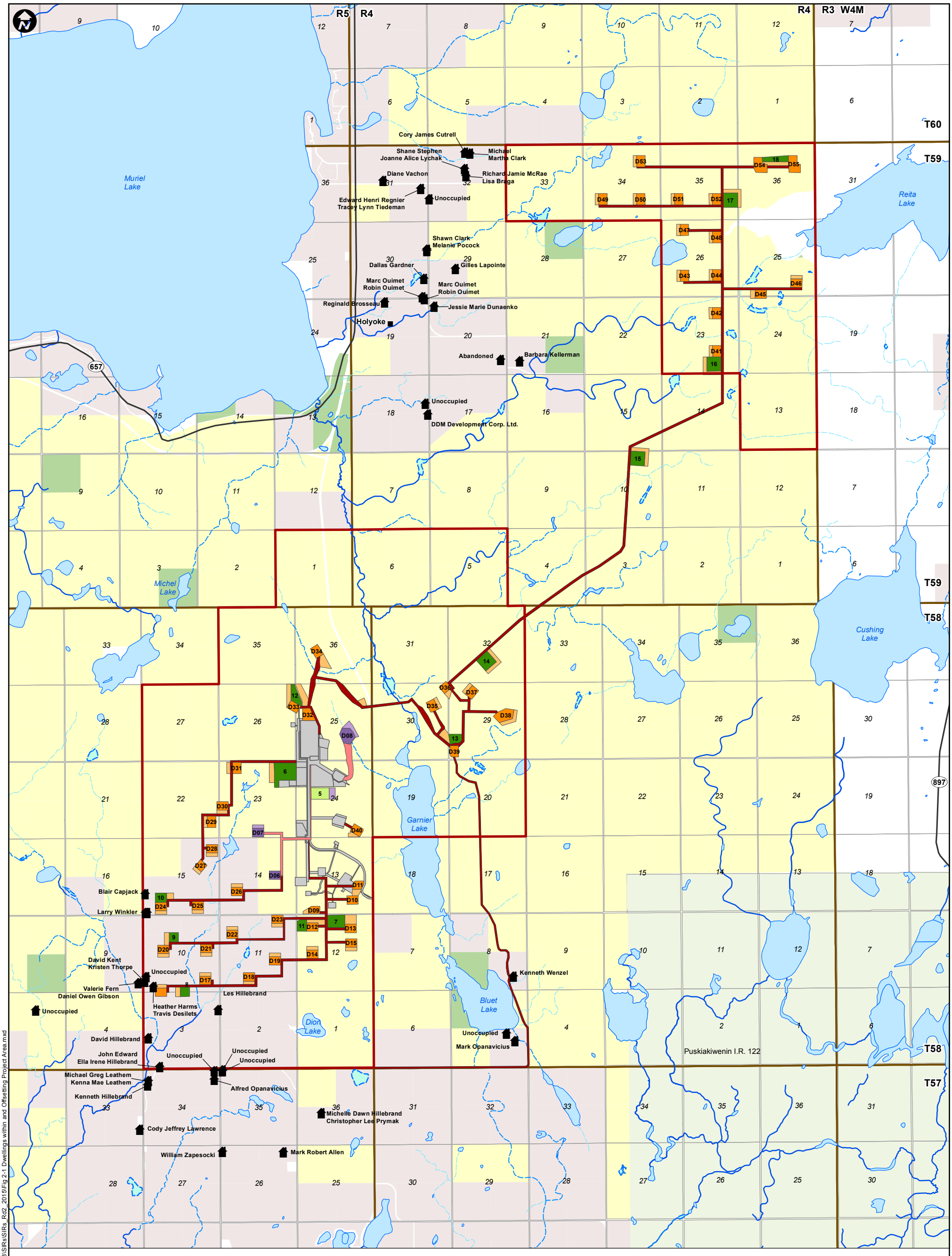
Brodo, Irwin M., Sharnoff, Sylvia D. and Stephen Sharnoff. 2001. Lichens of North America. Yale University Press. New Haven and London. 795 pp.

eFloras. 2008. Flora of North America. Published on the Internet http://www.efloras.org Missouri Botanical Garden, St. Louis, MO & Harvard University Herbaria, Cambridge, MA. Available at http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250099071 [Accessed July 27, 2015].

Ireland, Robert M. 1982. Moss Flora of the Maritime Provinces. Ottawa, Canada: National Museum of Canada. 568. Print.

NatureServe 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.NatureServe.org/explorer. (Accessed: July 27, 2015).

Figures



Legend

- Dwelling Location
- Freehold Lands
- Crown
- Grazing Lease
- AER Project Area

Initial Development

- Access/Utility Corridor
- Well Pad
- Soil Storage
- Borrow Pit

Future Development

- Access/Utility Corridor
- Well Pad
- Soil Storage
- Borrow Pit
- Existing and Approved Development
- First Nations

- Secondary Highway
- Permanent Stream
- Ephemeral Stream
- Drainages without Defined Channels
- Lakes and Ponds
- Beaver Ponds

0 0.75 1.5 3
Kilometres

PROJECT: PENGROWTH Lindbergh SAGD Expansion Project

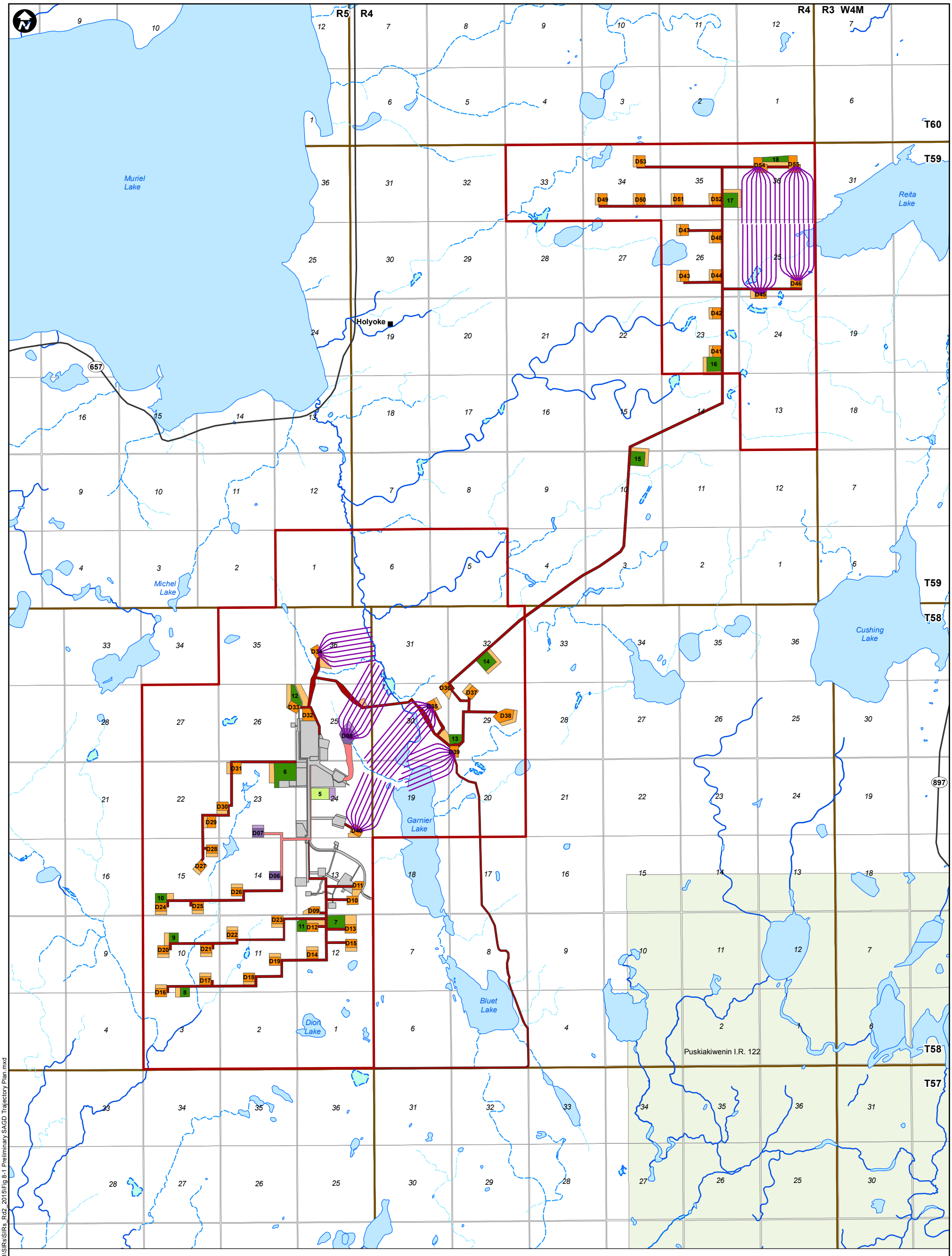
TITLE: **Dwellings within and Offsetting Project Area**

DRAWN: SL
CHECKED: KK
DATE: Sep 21/15
PROJECT: 11-00033

FIGURE: **2-1**

REF: Lornel, 2015; NHC hydrology Oct 2013; Pengrowth, 2015.

Document Path: K:\Active Client\Pengrowth Lindbergh\Final Docs\11-033\SIRs\SIRs_Rd2_2015\Fig 2-1 Dwellings within and Offsetting Project Area.mxd



Legend

- AER Project Area

Initial Development

- Access/Utility Corridor
- Well Pad
- Soil Storage
- Borrow Pit

Future Development

- Access/Utility Corridor
- Well Pad
- Soil Storage
- Borrow Pit
- Existing and Approved Development
- First Nations

- Trajectory
- Secondary Highway
- Permanent Stream
- Ephemeral Stream
- Drainages without Defined Channels
- Lakes and Ponds
- Beaver Ponds

0 0.75 1.5 3
Kilometres

PROJECT: PENGROWTH Lindbergh SAGD Expansion Project

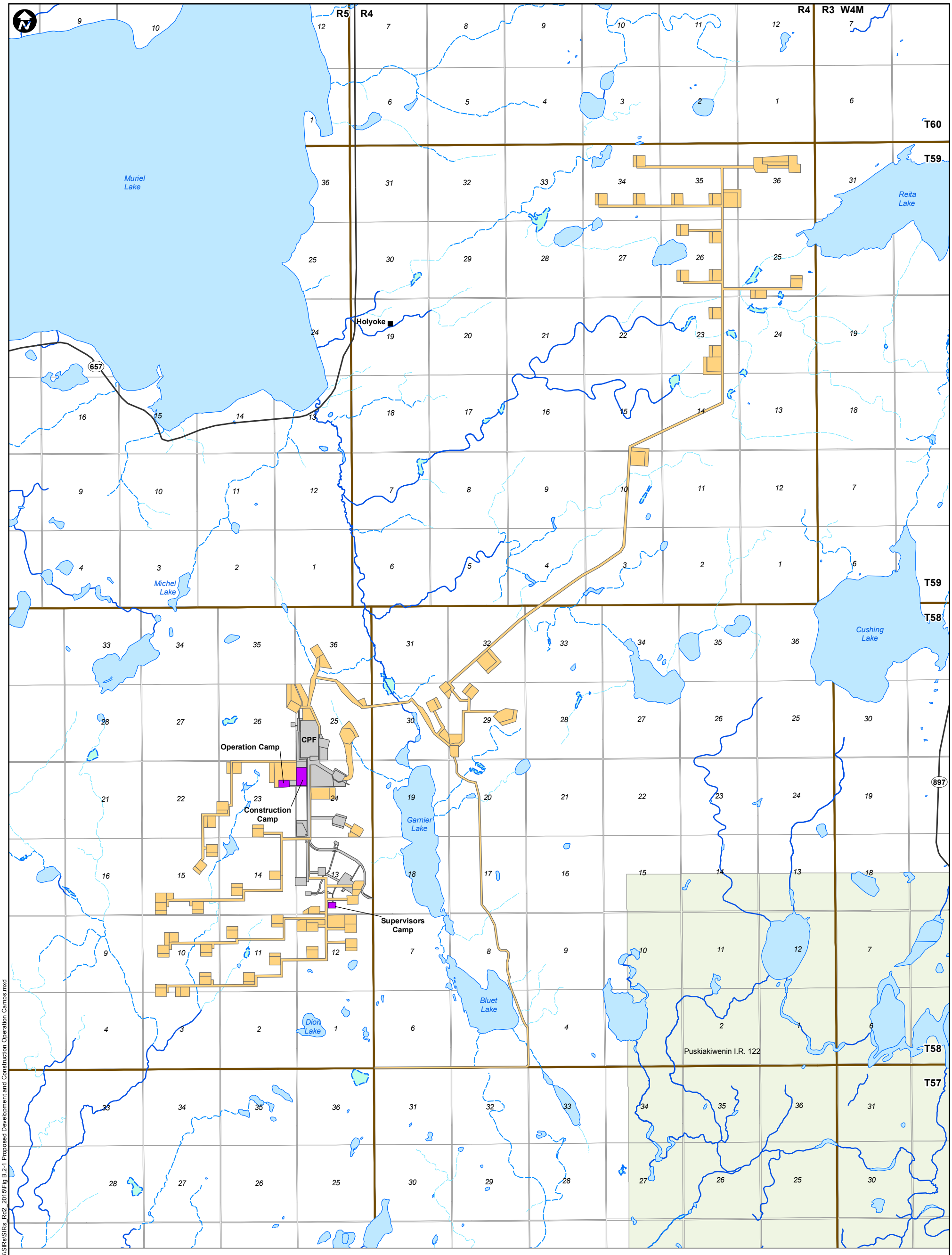
TITLE: **Preliminary SAGD Trajectory Plan**

DRAWN: SL/JG
CHECKED: KK
DATE: Sep 28/15
PROJECT: 11-00033

FIGURE: **8-1**

REF: Lornel, 2015; NHC hydrology Oct 2013; Pengrowth, 2015.

Document Path: K:\Active Client\Pengrowth Lindbergh\Final Docs\11-033\SIRs\SIRs_Rd2_2015\Fig 8-1 Preliminary SAGD Trajectory Plan.mxd



REF: Lornel, 2015; NHC hydrology Oct 2013; Pengrowth, 2015.

PROJECT: PENGROWTH Lindbergh SAGD Expansion Project

TITLE: **Proposed Development and Construction/Operation Camps**

DRAWN: SL/JG
CHECKED: KK
DATE: Sep 24/15
PROJECT: 11-00033

FIGURE: **B.2-1**

Document Path: K:\Active Client\Pengrowth Lindbergh\Final Docs\11-033\SIRs\SIRs_Rd2_2015\Fig B.2-1 Proposed Development and Construction Operation Camps.mxd

Landry Lake
Beartrap Lake
Beav
nking Lake
Muriel Lake
Reita Lake
Holyoke
657
Kehewin I.R. 123
Jerome Lake
Michel Lake
Cushing Lake
897
Garnier Lake
Bluet Lake
Dion Lake
Gadois Lake
Middle Creek
Puskiakiwenin I.R. 122
Moosehills Lake
Mooswa Creek
Unipouheos I.R. 121
Moosehills Creek
Mitchell Lake
Simmo Lake
Lindbergh
Saskatchewan River
Borden Lake
Whitney Lakes Prov. Park
R6
R5
R4
R3 W4M

Legend

- Hydrology LSA
- Extent of LiDAR Coverage
- Development Footprint
- Existing and Approved Development
- Primary Highway
- Secondary Highway
- Railway
- First Nations
- Provincial Park

0 1.5 3 6
Kilometres

REF: Drifter Projects Ltd., EIA Footprint REV 3.dwg; NHC hydrology Oct 2013.

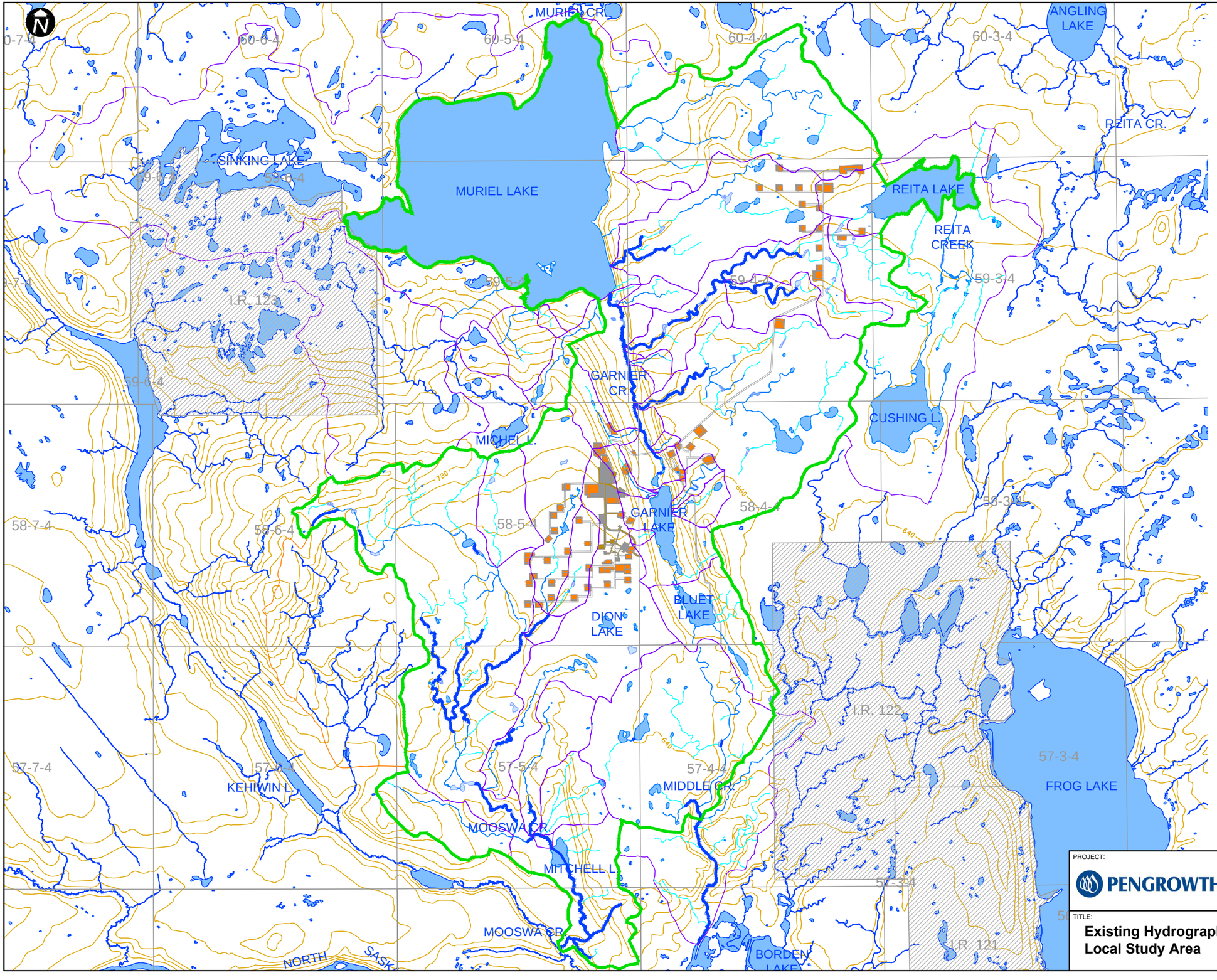
PROJECT: **Lindbergh SAGD Expansion Project**

TITLE: **LiDAR Coverage within the Hydrology Local Study Area**

DRAWN: JG
CHECKED: KK
DATE: Sep 21/15
PROJECT: 11-00033

FIGURE: **B.8-1**

Document Path: K:\Active Client\Pengrowth Lindbergh\Final Docs\11-033\SIRs\SIRs_Rd2_2015\Fig B.8-1 LiDAR within the Hydrology Local Study Area.mxd



LEGEND

- LOCAL STUDY AREA
- WATERSHED BOUNDARIES
- STREAMS - PERMANENT
- STREAMS - EPHEMERAL
- DRAINAGE WITHOUT DEFINED CHANNELS
- LAKES & PONDS
- BEAVER POND
- ALBERTA TOWNSHIP GRID
- CONTOURS (20m INTERVAL)
- PROJECT FOOTPRINT

0 1.5 3 6
Kilometres

REF: Northwest Hydraulic Consultants, September 9, 2015.

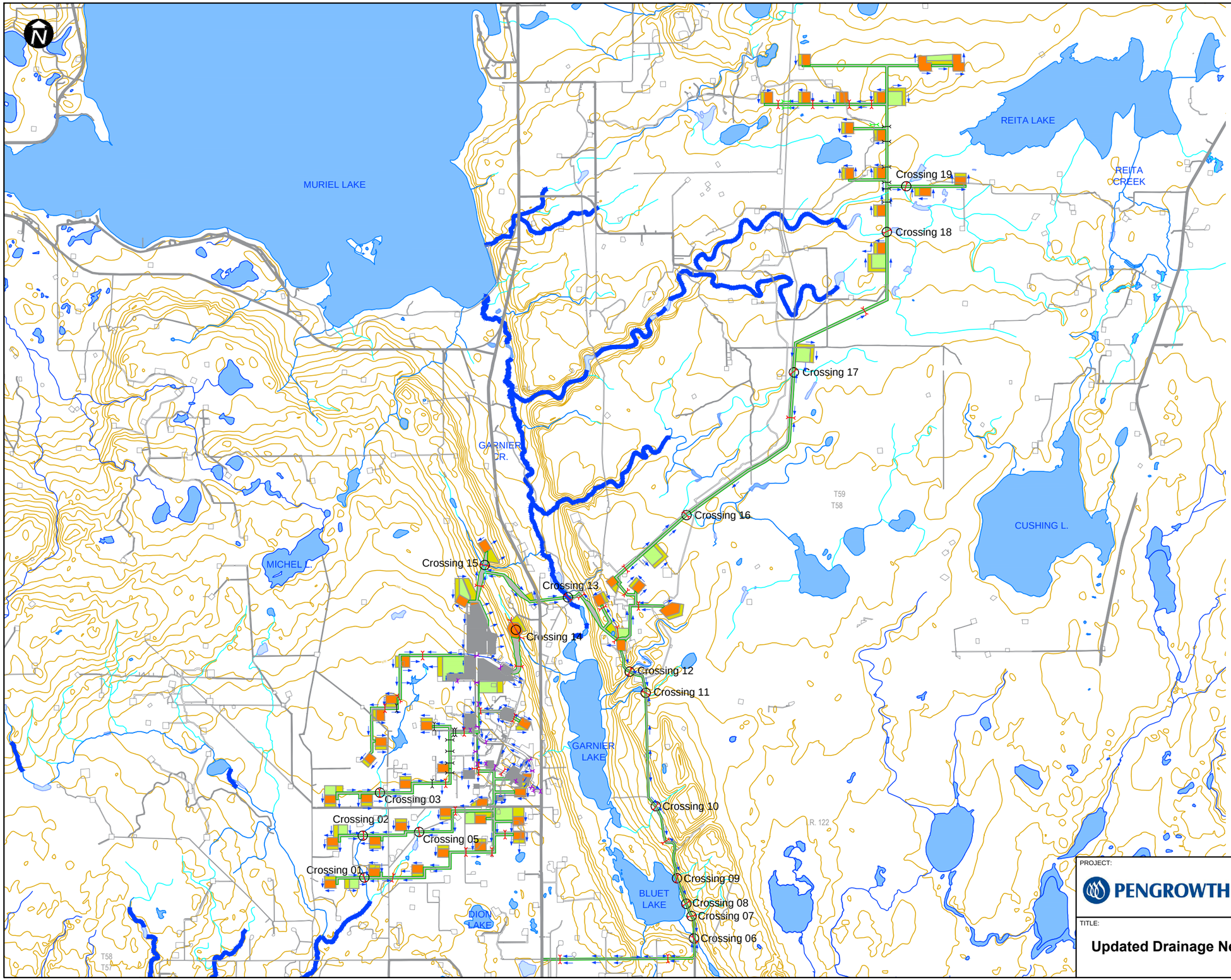
PROJECT: PENGROWTH — Lindbergh SAGD Expansion Project

MILLENNIUM EMS Solutions Ltd.

TITLE: **Existing Hydrography within the Local Study Area**

FILE: B.8-2 Existing Hydrography.dwg

DRAWN: JG	FIGURE: B.8-2
CHECKED: JN	
DATE: Sep 28/15	
PROJECT: 11-00033	



LEGEND

- STREAMS - PERMANENT
- STREAMS - EPHEMERAL
- DRAINAGE WITHOUT DEFINED CHANNELS
- LAKES & PONDS
- BEAVER POND
- DRAINAGE DIRECTION
- CULVERTS FOR NEW ROADS
- NEW CULVERTS FOR EXISTING ROADS
- EQUALIZATION CULVERTS
- PHASE 1 (EXISTING) CULVERTS
- CROSSINGS OF MAPPED STREAMS AND DRAINAGES
- CPF
- WELL PAD
- CAMP
- BORROW PIT
- SOIL STORAGE
- ACCESS/PIPE CORRIDOR
- EXISTING ROADS AND WELL PADS
- EXISTING FOOTPRINT
- CONTOURS (10m INTERVAL)

0 0.5 1.5 3
Kilometres

REF: Northwest Hydraulic Consultants, September 9, 2015.

PROJECT: PENGROWTH — Lindbergh SAGD Expansion Project

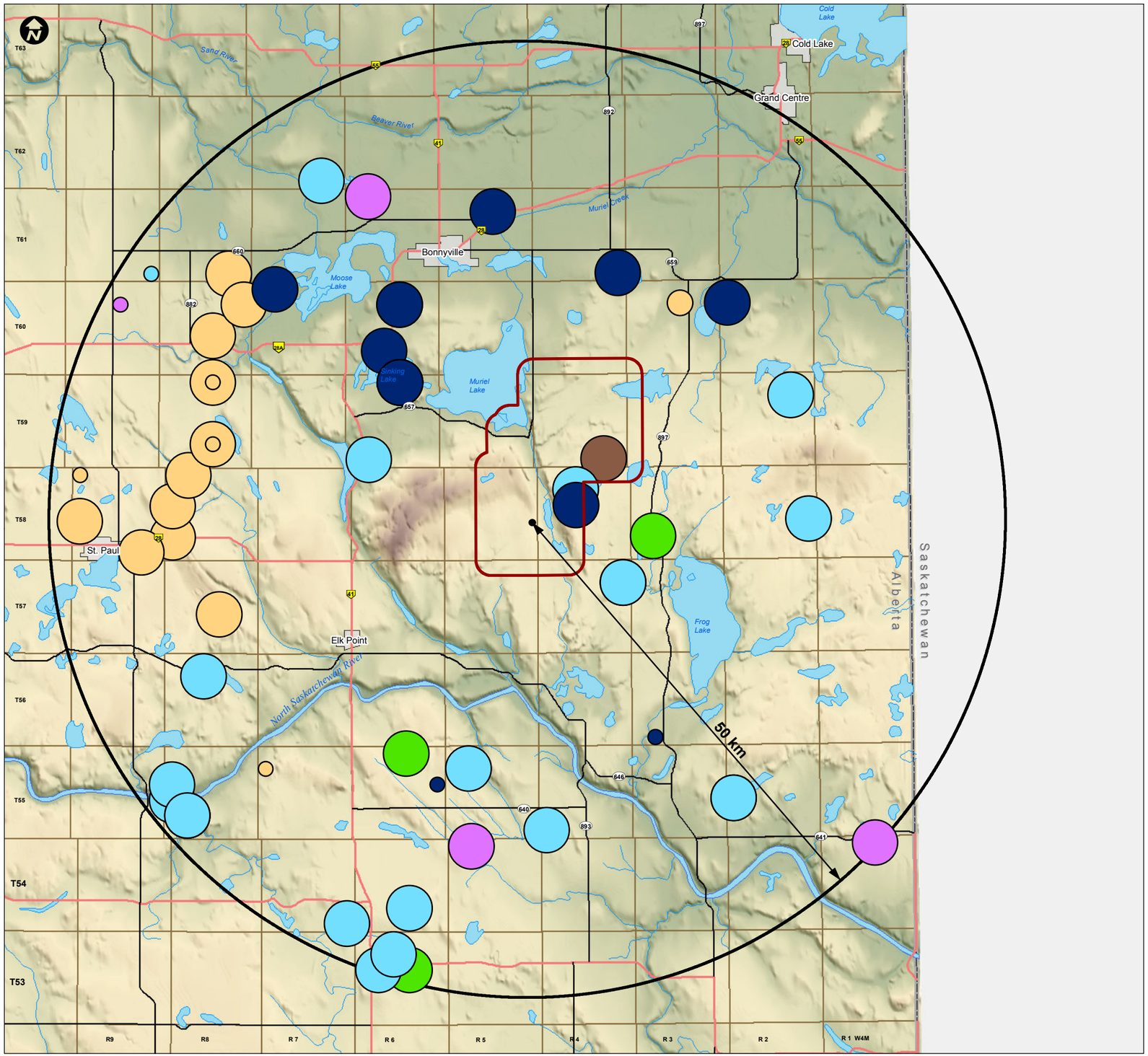
MILLENNIUM EMS Solutions Ltd.

TITLE: Updated Drainage Near Project Area

FILE: B.8-3 Updated Drainage.dwg

DRAWN: JG
CHECKED: JN
DATE: Sep 28/15
PROJECT: 11-00033

FIGURE: B.8-3



Legend

Unit

- Grand Rapids Undefined
- General Petroleum
- Lloydminster
- Rex
- Sparky
- Waseca

TDS (mg/L)

- 4,000 - 10,000
- 10,000 - 20,000
- > 20,000

- Hydrogeology Local Study Area
- Railway
- Primary Highway
- Secondary Highway
- Watercourse
- Waterbody

Topography (m asl)

- High : 800
- Low : 500

0 4 8 16
Kilometres

REF: AltaLIS,2015; Geobase, 2015.

PROJECT: PENGROWTH **Lindbergh SAGD Expansion Project**

TITLE: **TDS Concentration by Unit in the Grand Rapids Formation**

DRAWN:	SL
CHECKED:	JD
DATE:	Aug 13/15
PROJECT:	11-00033

FIGURE: **B.12-1**

Document Path: K:\Active Client\Pengrowth Lindbergh\Final Docs\11-033\SIR\SIRs_Rd2_2015\Fig B.12.1 TDS Concentrations Grand Rapids.mxd

Appendices

Appendix 2-1: Summary of Personal Consultation

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
Freehold – NE 16-59-4 W4M Containing 4.29 ha (10.6 ac) Lot 1 Title No.:132091541 Area #1	**Ref # 1306 –01** **Ref # 1306 - 02**	**Calvin Tully** **Darren Tully**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold – NE 19-59-4 W4M Containing 1.54 ha (3 ac) Title No.: 072506466 Area #2	**Ref # 1306 – 03**	**Marc & Robin Ouimet**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold – NE 30-59-4 W4M Containing 4.04 ha (9.98 ac) Plan # 1020808, Block 1, Lot 1 Title No.: 132087383 Area #2	**Ref # 1306 - 04**	**Beverly Omilusik**	25-Apr-2014	25-Apr-2014		X		25-Apr-2014	For safety reasons they would prefer if Range Road 45 was deemed a no fly road for oilfield traffic as many residences and children are present. Concerns with oilfield water usage & water shed shortages in the area. Would like to be notified and consulted with again as activities increase in the area. **Pengrowth has noted concerns and will provide requested consultation.**
Freehold – NE 32-59-4 W4M Containing 0.889 ha (2.2 ac) Plan # 8520682 Block D Title No.: 132038534 Area #2	**Ref # 1306 - 05**	**Reginald G Kirkham & Dallas Lebendynski**	3-Apr-2015	3-Apr-2015			X	20-Mar-2015	3-Apr-2015 Concerned with increased traffic in the area, and increased development that is pushing wildlife onto their property. Concerns over the usage of ground water and adverse environmental effects at Rita Lake. Would like additional consultation as the Rita Lake are is developed. 20-Mar-2015 Sent follow up consultation package.

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006

Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
									Pengrowth has noted concerns and will provide requested consultation.
Freehold – NE 32-59-4 W4M Containing 1.08 ha (2.67 ac) Plan # 8520682 Block C Title No.: 092219073 Area #2	**Ref # 1306 – 06**	**Richard Jamie McRae & Lisa Braga**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold – NW 32-59-4 W4M Containing 2.49 ha (6.15 ac) Plan #9822479, Lot A Title No.: 002311447 Area #2	**Ref # 1306 – 07**	**Shane Stephen & Joanne Alice Lychak**	29-May-2014	29-May-2014		X		29-May-2014	Concerns with their water table as it is only 50ft down; CNRL drilled nearby and went through the underground river, which they don't want to happen again. Also concerned with increased dust from traffic. Safety concerns with increased traffic due to little children in the area. **Pengrowth has indicated that no wells are being drilled within close proximity and further consultation will occur for future projects.**
Freehold – SE 30-59-4 W4M Containing 3.36 ha (8.3 ac) Plan #0820226, Block 1, Lot 1 Title No.: 082205434 Area # 2	**Ref # 1306 – 08**	**Timothy Andrew Koshykar**	15-May-2014	15-May-2014		X		15-May-2014	**No concerns identified but expressed interest in employment hauling oil for Pengrowth.**
Freehold – SW 3-58-5 W4M Containing 27.76 ha (68.6 ac) Plan #0023740, Lot 1 Title No.: 002296524 Area #3	**Ref # 1306 – 09**	**David Hillebrand**	23-Apr-2014	23-Apr-2014		X		23-Apr-2014	Concerns with the increase in noise from truck traffic, Jake brake's and steel beam pounding operations; lives close to the plant. Bedroom faces the plant so increased light pollution has become a concern. Temporary fencing may be required during road widening, David will advise us. David would like to meet the construction manager prior to entry to discuss fencing and gating. Requested a detailed map of road widening operation.

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006

Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
									Pengrowth provided requested map; Project has been completed without additional concerns.
Freehold – SW 10-58-5 W4M Containing 4 ha (9.88 ac) Plan #0825126, Block 1, Lot 1 Title No.: 082549031 Area #3	**Ref # 1306 - 10**	**Travis Donal Desilets & Heather Harms**	25-Apr-2014	25-Apr-2014	X	X	X	25-Apr-2014	If large amounts of mud are dropped on the Highway, would like it cleaned up for safety purposes. Have noticed increased noise and would like to see large moves scheduled around prime driving times rather than from 5-8am so as to avoid causing traffic issues. Request a copy of personal consultation to be emailed to them. **Statement of Concern No. 29059 filed on June 11, 2014. Pengrowth handling internally towards a common resolution.**
Freehold – SW 29-59-4W4M Containing 2.45 ha (6.05 ac) Plan #0728707, Block 1, Lot 1 Title No.: 112338131 Area #2	**Ref # 1306 – 11**	**Keith Bordeleau & Becky Duggan**	30-Oct-2014	30-Oct-2014		X		30-Oct-2014	Issues with access running north on Range Road 445 rather than heading south due to impacts to more residences. Concerns about long range future plans for SAGD west of Reita Lake and requests Pengrowth to consult each summer relating to following winter activities. **Pengrowth has noted concerns and will provide requested consultation.**
Freehold – SW 29-59-4 W4M Containing 60.6 ha (148.62 ac) Title No. 072593195 +1 Area #2	**Ref # 1306 – 12**	**Gilles LaPointe**	8-Nov-2014	8-Nov-2014		X		8-Nov-2014	Request further consultations to take place far in advance of project. Concerns regarding footprint to existing land use that holds potential for subdivision. **Pengrowth has noted concerns and will provide requested consultation.**
Freehold – NW 30-59-4 W4M Containing 63.89 ha (158 ac)	**Ref # 1306 – 13**	**Scott Edward Regnier**	28-May-2014	28-May-2014		X		28-May-2014	**No concerns received.**

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006

Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
Title No.: 072033549 Area #2									
Freehold – NE 30-59-4 W4M- Containing 0.95 ha (2.34 ac) Title No.: 092454596 (Acreage) Area #2	**Ref # 1306 – 14**	**Florent & Tracy Dubeau**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold – NE 30-59-4 W4M- Containing 59.61 ha (147.3 ac) Title No.: 102027871+1 Area #2	**Ref # 1306 - 49**	**Shawn David Clark**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold - SE 30-59-4 W4M- Containing 2.03 ha (5.02 ac) Title No.: 122412125 Area #2	**Ref # 1306 – 15**	**Dallas Gardner**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold – SE 30-59-4 W4M- Containing 58.7 ha (145.05 ac) Title No.: 082018997+1 Area #2	**Ref # 1306 – 16**	**Donald C Cameron & Carol-Ann T Cameron**	31-Mar-2015	3-Apr-2015	X	X	X	20-Mar-2015	3-April-2015 Hand delivered project info, discussed project, no concerns or objections at this time. 31-March-2015 Shai spoke to on phone, had received and reviewed consultation package 20-March-2015 Sent follow up consultation package. **No concerns received.**
Freehold – SE 31-59-4 W4M Containing 1.21 ha (3 ac) Title No.: 842245594 Area #2	**N/A**	**Canadian Worldwide Energy Limited**	See Comments	See Comments	N/A	N/A	N/A	N/A	**Cannot confirm contact details, an extensive effort has been made to obtain.** **Notification covered under open house & newspaper advertisements.**

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
Freehold – SE 31-59-4 W4M Containing 4.05 ha (10 ac) Title No.: 922007542+3 & Containing 58.35 ha (144.20 ac) Title No.: 942085777 Area #2	**Ref # 1306 – 17**	**Edward Henri Regnier & Tracey – Lynn Tiedeman**	28-May-2014	28-May-2014		X		28-May-2014	Concerns with Pengrowth expanding east of their lands and increased traffic and utilization of existing access or proposed access. **Pengrowth indicated as project development starts moving east that additional consultation will occur.**
Freehold – NW 32-59-4 W4M Containing 58.76 ha (145.32 ac) Title No.: 102324835 Area #2	**Ref # 1306 - 18**	**Cory James Cutrell & Melanie Rhonda Guthrie**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold - S ½ 6-58-4 W4M Containing 64.7 ha (160 ac) Title No.: 872090926 & Containing 64.3 ha (159 ac) Title No.: 912215997 Area #3	**Ref # 1306 - 50**	**Randy Melvin Ockerman** **Myles Ockerman** 315 Eminview Bay North Lethbridge, AB T1H 6G5	30-Aug-2014	30-Aug-2014		X		30-Aug-2014	Want fair distribution of well sites; share sites, water access and land spreading around the community. **Pengrowth has indicated they would keep this under consideration.**
		George Bendixen (Occupant)					X	24-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold - LSD's 13 &14- 3-58-5 W4M (Glenn & Cathy) Containing 32.4 ha (80 ac) Title No.: 932362149 +2 & S ½ 12-59-5 W4M (Glenn) Containing 65.2 ha (161 ac) Title No.: 972106461,	**Ref # 1306 – 19**	**Glen Marvin Ockerman & Cathy Dawn Ockerman**	11-Sep-2014	11-Sep-2014		X		11-Sep-2014	Concerns around excessive lighting from the plant site and potential damage to moose hill road from hauling large loads. Would like to see Pengrowth support the local community and local organizations as much as possible. **Pengrowth indicated if any lighting issues**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006

Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
972106461 +1 Area #2 &3									**occur to contact Pengrowth immediately to try resolve.**
Freehold – NW 8-58-4 W4M Containing 64.3 ha (159 ac) Title No.: 092046873 Area #3&4	**Ref # 1306 - 20**	**Lane Lorenson**	12-May-2014	12-May-2014		X		12-May-2014	If Pengrowth will be utilizing existing fences, he is interested in the use of the new hot wire fences. **Pengrowth indicated that they will investigate this further.**
Freehold - SE 8-58-4 W4M Containing 53.8 ha (133 ac) Title No.: 112253228 Area #3&4	**Ref # 1306 – 21**	**Kenneth H Wenzel**	14-May-2014	14-May-2014	X			20-May-2014	Kenneth is too busy to meet, discussed expansion project over the phone and dropped off project info. No concerns or objections identified at this time, he will re-contact after reviewing the project info if any concerns come up. **No concerns received.**
Freehold – NE 17, E ½ 20, SW 21-59-4 W4M Containing 65.2 ha (161 ac) Title No.: 772120997 & Containing 62.01 (153.35 ac) Title No.: 822250491 **Freehold** – NW 20-59-4 W4M Containing 58.08 ha (143.52 ac) Title No.: 832189054 Area #1&2	**Ref # 1306 – 22**	**Erwin Hugo Kellerman (Deceased) c/o Barb Kellerman**	12-May-2014	12-May-2014		X		12-May-2014	Fence needs to be fixed this year, interested in the possibility of an electric fence. Not sure which wells were and were not drilled, and she has not received any money. **Compensation has been provided.**
Freehold – S ½ 18-59-4 W4M Containing 64.7 ha (160 ac) Title No.: 882174815A Area #2	**Ref # 1306 – 23**	**DDM Development Corp. Ltd. c/o Peter Davy**	27-May-2014	27-May-2014		X		27-May-2014	Not in favor of activities on his lands at this time but will consider all activities if Pengrowth consults far in advance and during all stages of development. Is happy that consultation is taking place in advance. **Pengrowth has noted concerns and will provide requested consultation.**

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006

Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
Freehold – NW 19-59-4 W4M Title No.: 118D133 Area #2	**Ref # 1306 – 24**	**Le Diocese De Saint Paul c/o Michelle de Moissac**	12-Jun-2014	12-Jun-2014		X		12-Jun-2014	Land use is for a cemetery. **No concerns received.**
Freehold – NW 20-59-4 W4M Containing 1.53 ha (3.79 ac) Title No.: 012142207 (Acreage) Area #2	**Ref # 1306 – 25**	**Jessie Marie Dunaenko & Ernest Dunaenko**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold – NE 10-58-5 W4M (south half) Containing 32.4 ha (80 ac) Title No.: 062010996 **Freehold**–NW 10-58-5 W4M (south half) Containing 32.4 ha (80 ac) Title No.: 832047814 Area #3	**Ref # 1306 - 26**	**Ernest Lau, Dave Chan, Roger Woo & Loretta Ling-Yee Woo**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold - SW 10-58-5 W4M- Containing 32.4 ha (80 ac) of the South Half Title No.: 112352148 Area #3	**Ref # 1306 – 27**	**David Kent & Kristen Thorpe**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold – SW 15-58-5 W4M- Containing 32.4 ha (80 ac) of the South Half Title No.: 122076798 Area #3	**Ref # 1306 - 28**	**Larry Winkler**	17-Apr-2015	17-Apr-2015			X	20-Mar-2015	Larry along with his neighbor Blair Capjack has provided a sketch plan regarding a preferred possible pad site location. **No concerns received.**

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006

Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
Freehold - SW 13-59-5 W4M Containing 60.0 ha (156.1) Title No.: 48Y251 Area #2	**Ref # 1306 – 29**	**Municipal District of Bonnyville No.87**	6-May-2014	6-May-2014		X		06-May-2015	Town and council meeting held to discuss project in detail. **No concerns received.**
Freehold – NE 14-59-5 W4M Containing 34.24 ha (84.6 ac) Title No.: 112040218 Area #2	**Ref # 1306 – 30**	**Kevin Karle & Samantha Karle**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold – N ½ 31, SW 32-59-4 W4M Containing 62.678 ha (155 ac) Title No.: 112219655 Containing 63.473 ha (156.97ac) Title No.: 112219654 Containing 55.13 ha (136.11 ac) Title No.: 112219652 Area #2	**Ref # 1306 – 31**	**Diane Vachon & Philippe Vachon**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold – W ½ 17, SW 20-59-4 W4M Containing 64.94 ha (160.35 ac) Title No.: 902069523 Area #2	**Ref # 1306 – 32**	**Helen Bernadette Vachon**	08-May-2014	08-May-2014		X		08-May-2014	Requested a tour of the facility and to be consulted with when any activities on or near her lands. May be digging 2 large dugouts on her lands in the summer and may want to be signed up for water access for the winter program. **No concerns received.**
GRL 35922– E ½ 1, E ½ 12-59-4 W4M Area #1	**Ref # 1306 – 33**	**Arthur W Kathan & Karen Kathan (GRL 35922)**	14-May-2014	15-May-2014		X		15-May-2014	Concerned the access roads will increase Hunter/ATV traffic and trespassers on crown land. Okay with development on their GRL and would like all consultation in advance. **No concerns received.**

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006

Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
GRL 39272 – N ½ 21, 22, 23, W ½ & SE 26, 27-59-4 W4M Area #1&2	**Ref # 1306 - 34**	**Barbara A Kellerman (GRL 39272)**	12-May-2014	12-May-2014		X		12-May-2014	Fence needs to be fixed this year, interested in the possibility of an electric fence. Not sure which wells were and were not drilled, and she has not received any money. **Compensation has been provided.**
GRL 37886- NW 15, Sec(s). 22, 26, 27, 34, 35-58-5 W4M **Freehold** – W ½ 10-58-5 W4M (North half) Containing 32.4 ha (80 ac) Title No.: 932015928 SW 15-58-5 W4M (North half) Containing 32.4 ha (80 ac) Title No.: 902173324 Area #2&3	**Ref # 1306 – 35**	**Blair Capjack (GRL 37886)**	12-Jun-2014	12-Jun-2014		X		12-Jun-2014	Wants consultation for future projects as far in advance as possible to get right configuration for roads and site. If other area landowners do not want locations, verbal agreement in place that can move any SAGD or core holes off the objecting landowners land onto his land. **No concerns received.**
GRL 39439 – NW 25, NE 26, Sec. 28, N ½ & SE 29, Sec(s). 33, 34, 35, 36-59-4 W4M **GRL 820305** – Sec(s).13, 24, S ½ 25-59-4 W4M Area #1&2	**Ref # 1306 – 36**	**Bristow Ranching Ltd. c/o David Bristow (GRL 39439 and GRL 820305)**	01-May-2014	01-May-2014		X		01-May-2014	**No concerns received.**
GRL 36770 – NE 5, NE 8, E ½ 18, E ½ 19, Sec(s). 17, 20, 21, 22, 23, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35-58-4 W4M W ½ 1, Sec(s). 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, W ½ 12-59-4 W4M	**Ref # 1306 - 37**	**Garnier Lake Grazing Association c/o Milton Lorenson (GRL 36770)**	02-May-2014	02-May-2014		X		02-May-2014	**No concerns received.**

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006

Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
Area #1-4									
GRL 080006 – SW 31-59-4 W4M Area #2	**Ref # 1306 – 38**	**Lisa Richards (GRL 080006)**	08-May-2014	08-May-2014		X		08-May-2014	Would like to be notified and consulted with prior to any activities on or near land. **No concerns received.**
GRL 39289 – Sec(s). 1, 2, 11, **GRL 38858 –** S ½ 14-59-5 W4M Area #2&3	**Ref # 1306 - 39**	**Shane Franklin (GRL 39289 / GRL 38858)**	24-Apr-2014	24-Apr-2014		X		24-Apr-2014	**No concerns received.**
GRL 37925 - Sec(s). 25, 36-58-5 W4M & N ½ 12, SE 13-59-5 W4M Area # 2&3	**Ref # 1306 – 40**	**U & E Herde Ranch Ltd. c/o Ulf Herde (GRL 37925)**	07-May-2014	07-May-2014		X		07-May-2014	NE 25 access is dangerous as it is a blind spot. Would like to be notified prior to the move when move core hole locations. Does not know what wells were taken or how much water and has not been paid for water access agreements. Ulf sent an email to Al at the plant requesting outstanding issues of fencing repairs, and picking up leftover garbage be resolved. Requested permanent pass instead of visitor pass. Weed control needs to be kept up with on any disturbed area on the GRL, new plant site and non-disturbed adjacent areas. **Pengrowth has provided permanent pass, as well as provided compensation. No further concerns received.**
Freehold – SE 5-58-4 W4M Sec(s). 2, 11, W ½ 14 & E ½ 15 & LSD's 11 & 12 of Sec. 3-58-5 W4M **Freehold** – NE 10 58-5 W4M (North half) Containing: 32.4 ha (80 ac) Title No.: 092285940	**Ref # 1306 - 41**	**Alfred Kestutis Opanavicious & Loretta Opanavicious**					X	20-Mar-2015	Sent follow up consultation package **No concerns received.**

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006

Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
Area #3&4									
Freehold – NW 19-59-4 W4M Containing 4.05 ha (10.01 ac) Plan #1320596, Block 1, Lot 1 Title.: 132039470 **Freehold** – NW 19-59-4 W4M Containing 0.76 ha (1.88 ac) Title.: 132039470+1 **Freehold** - SW 30, NE 19-59-4 W4M **GRL 36989** - SW 19-59-4 W4M Area #2	**Ref # 1306 – 42** **Ref # 1306 - 51**	**Daniel Brosseau** **Wilfred Brosseau (GRL 36989)**	24-Apr-2014	24-Apr-2014		X		24-Apr-2014	Concerned that construction took water but has not been paid for water access for previous projects. In the future, they want to get paid for water/land spreading within 2 weeks of well completion. Expanded dugout this year, more water for water access. Concerned with increased traffic and why Pengrowth performed seismic on Sec. 30 but CNRL is now drilling under his land from adjacent quarter so gets no compensation. **Pengrowth has provided compensation. No further concerns received.**
GRL 090033- SE 32-59-4 W4M Area #1&2	**Ref # 1306 – 43**	**Michael Clark & Martha Clark (GRL 090033)**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
Freehold – NE 32-59-4 W4M Containing 6.25 ha(15.44ac) Plan 1324667 Block 1, Lot 1 Title No.: 132 401 102 Area #1		**Reginald King and Jennifer Bannon**			X		X	20-Mar-2015	Sent follow up letter and project information package. TJ has contacted them, Reginald King and Jennifer Bannon purchased the land from Michael Clark and Martha Clark. **No concerns received.**
Freehold – NW 18-59-4 W4M **GRL 16672** – Sec(s). 14 & 15-59-4 W4M Area #1&2	**Ref # 1306 – 44**	**George J. Vachon (GRL 16672)** **Gilles Vachon (GRL 16672)**	29-Apr-2014	29-Apr-2014		X		29-Apr-2014	Would like to discuss access and Texas gates in the future and would like to get paid prior to survey. **No concerns received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
			02-May-2014	02-May-2014		X		02-May-2014	Would like to obtain work hauling contamination and gravel for Pengrowth. **No concerns received.**
Freehold – NE 16, NE 18, SE 19-59-4 W4M **GRL 970058**– S ½ & NW 16, S ½ 17-59-4 W4M Area #1&2	**Ref # 1306 - 45**	**Victor Ringuette & Greta Ringuette (GRL 970058)**	23-May-2014	23-May-2014		X		23-May-2014	Has a few dugouts on land for water access on his GRL No issues or concerns identified. **No concerns received.**
Freehold – E ½ 3, SE 10-58-5 W4M **GRL 36782** – Sec(s). 1, 12, 13, E ½ 14, Sec(s). 23, 24-58-5 W4M Area #3	**Ref # 1306 – 46**	**Hillebrand Farms Ltd.** **c/o Nellie Hillebrand (GRL 36782)**	29-Apr-2014	29-Apr-2014		X		29-Apr-2014	Would like to discuss further fencing and requests payment before entry for dispositions and within 2 weeks of well completions for water/land spreading. Dugout locations a mess on Sec 12 & 1, cattle need to be on Sec. 13 if rainfall minimal. Requested air photos to see wet low areas. Want better communication between Landowners and Pengrowth. **Pengrowth has addressed fencing and dugout concerns directly. No further concerns.**
Freehold – NW 7-58-4 W4M & SW 3-58-5 W4M Area #3	**Ref # 1306 - 47**	**John Edward &** **Ella Irene Hillebrand** **Glen Ockerman (Occupant)**	23-Apr-2014	23-Apr-2014		X		23-Apr-2014	Deal with Glen as occupant with matters relating to fencing, gating & project scheduling. Concerned with increased traffic, brake noise, steel post pounding noise and light pollution. Occupant as per Sept 16, 2014.

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH

Lorrnel Consultants, as Agent for Pengrowth Energy Corporation
Personal Consultation Line List – Within EIA Boundary
Lindbergh SAGD Expansion Project Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006

Last Updated: September 11, 2015

Land Location	Ref #	Contact Name(s)	Date of Contact	Date of Non-Objection	Type of Contact			Date Project Description Distributed	Comments
					Phone	In Person	Express Post/ Regular Mail		
			11-Sep-2014	11-Sep-2014		X		11-Sep-2014	Concerns around excessive lighting from the plant site and potential damage to moose hill road from hauling large loads. Would like to see Pengrowth support the local community and local organizations as much as possible. **Pengrowth indicated if any lighting issues occur to contact Pengrowth immediately to try resolve.**
GRL 950007 – N ½ 18 & W ½ 19-58-4 W4M Area # 3		**John Leonard, Elsie Anne, John Wayne and Jesse James Hillebrand (GRL 950007)**					X	20-Mar-2015	Sent follow up consultation package. **No concerns received.**
GRL 36047 – Portion of W ½ 5, Portion of NW 6, NE 6, S ½ 7-58-4 W4M Area # 3&4	**Ref # 1306 - 48**	**Westman Farms Ltd. c/o Doug & Murray Westman (GRL 36047)**	23-May-2014	23-May-2014		X		23-May-2014	**No concerns received.**

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Appendix 2-2: Stakeholder Consultation Package

PENGROWTH ENERGYCORPORATION
2100, 222 – 3rd Avenue S.W., Calgary, Alberta T2P 0B4
Tel 403-233-0224 • Fax 403-265-6251 • Toll Free 1-800-223-4122 • website: www.pengrowth.com

April 17, 2014

Lorrnel File: 20130006

Via Hand Delivered

Barbara A Kellerman (GRL 39272)
PO Box 7924
Bonnyville, AB T9N 2J2

Stakeholder Interest: GRL 39272

Re: Pengrowth Energy Corporation
Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M
Project Information Letter

Pengrowth Energy Corporation (Pengrowth) is proposing to expand its existing Lindbergh Oil Sands Development located approximately 24km southeast of Bonnyville, Alberta. The currently approved 12,500 Lindbergh SAGD Expansion Project (6410i) will increase production to 30,000 barrels per day of bitumen for approximately 25 years. Over the life of the project a number of well pads, borrow pits and access roads will be required to maintain production. Pengrowth has submitted an Environmental Impact Assessment (EIA) application (under AEPEA # 008-1581) to the Alberta Energy Regulator for the Lindbergh SAGD Expansion Project.

As an affected stakeholder in the area, please consider this letter as formal notification further to the face to face consultation taking place with a Pengrowth Representative. For your convenience, you are also being provided with a project information summary along with a copy of the map referencing the project area. A copy of the EIA application is available online at www.pengrowth.com/operations/lindbergh. A CD or hard copy version of the EIA application is also available upon request.

Should you have questions or require further information regarding this project, or any Pengrowth activity, please contact Pengrowth at Lindbergh@pengrowth.com .

Yours truly,

Colleen Smith
Manager, Land Services
Lorrnel Consultants
On behalf of Pengrowth Energy Corporation

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH

PENGROWTH ENERGYCORPORATION
2100, 222 – 3rd Avenue S.W., Calgary, Alberta T2P 0B4
Tel 403-233-0224 • Fax 403-265-6251 • Toll Free 1-800-223-4122 • website: www.pengrowth.com

Lindberg SAGD Phase 2 Expansion and Environmental Impact Assessment (EIA) Project Information

Project Overview:

Pengrowth Energy Corporation (Pengrowth) is proposing to expand its existing Lindbergh Oil Sands Development located approximately 24km southeast of Bonnyville, Alberta. The currently approved 12,500 Lindbergh SAGD Expansion Project (6410i) will increase production to 30,000 barrels per day of bitumen for approximately 25 years. Over the life of the project, a number of well pads borrow pits and access roads will be required to maintain production. Pengrowth has submitted an Environmental Impact Assessment (EIA) application (#008-1581) to the Alberta Energy Regulator for the Lindbergh SAGD Expansion Project. An application to amend Oil Sands Conservation Act Approval No. 6410i was also submitted to the Alberta Energy Regulator (AER) and to Environment and Sustainable Resource Development (ESRD) on December 23, 2013.

Lindberg SAGD Expansion to 30,000 bbl/d – EIA and Scheme Application:

The amendment application to expand the Project to 30,000 bbl/d submitted to the AER and to AESRD includes the following:

- Phase 2 Expansion in order to increase current production by 17,500 barrels per day (bbl/d).
- Construction of additional facilities for Phase 2 (SAGD Pads, Utility Corridors, etc.).
- Usage of existing water sources.
- Drilling of up to an additional 32 well pairs on 4 pads.
- Expansion to the Central Processing Facility (CPF) within the current CPF footprint.
- Changes to the Resource Development Area (RDA) and Project Disturbance Area (PDA).
- For the life of the project, old, redundant facilities are being decommissioned, abandoned and reclaimed.

Project Timeline:

- Application Submission – December, 2013
- Approval Anticipated – Q4, 2015
- Construction Start – Q1, 2016
- First Production – Q2, 2017

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH

PENGROWTH ENERGYCORPORATION
2100, 222 – 3rd Avenue S.W., Calgary, Alberta T2P 0B4
Tel 403-233-0224 • Fax 403-265-6251 • Toll Free 1-800-223-4122 • website: www.pengrowth.com

Oil Sands Exploration:

- Pengrowth continues to delineate their resource with annual Oil Sands Exploration Programs. Approximately 42 wells were drilled in the 2013/2014 season and up to 60 wells may be drilled in the 2014/2015 season.
- Each well will be approximately 550 meters deep.
- Wells will be abandoned and no surface equipment will remain onsite.
- Each well will take approximately four (4) days to drill.
- Drill Pads will be constructed to 60 m x 90 m (1.33 acres) each.
- Some coreholes will be converted to Observation wells to monitor the resource during the life of the project.

Operations Philosophy:

Employment:

- Wherever possible Pengrowth will employ and train local community members. The workforce required to operate the Project is estimated to be 37 people in addition to those already in place for the operations of Phase 1.

Business Opportunities:

- Construction and operations business opportunities will be sourced locally whenever possible.

As a member of the communities within St. Paul County and the M.D. of Bonnyville, Pengrowth is committed to continue to improve their relationship with these communities throughout the life of the project. As plans move forward, additional refinements may occur to locations and timing. Pengrowth will continue to inform the communities of any changes that occur.

Copies of the application are available online at www.pengrowth.com/operations/lindbergh. In addition, a CD or hard copy version of the EIA application is also available upon request. Should you have questions or require further information regarding this project, or any Pengrowth activity, please contact Pengrowth at Lindbergh@pengrowth.com .

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

PENGROWTH ENERGY CORPORATION
2100, 222 – 3rd Avenue S.W., Calgary, Alberta T2P 0B4
Tel 403-233-0224 • Fax 403-265-6251 • Toll Free 1-800-223-4122 • website: www.pengrowth.com

Pengrowth is pleased to announce our

Open Houses

Join us for refreshments and the opportunity to learn about Pengrowth and our activities in the area.

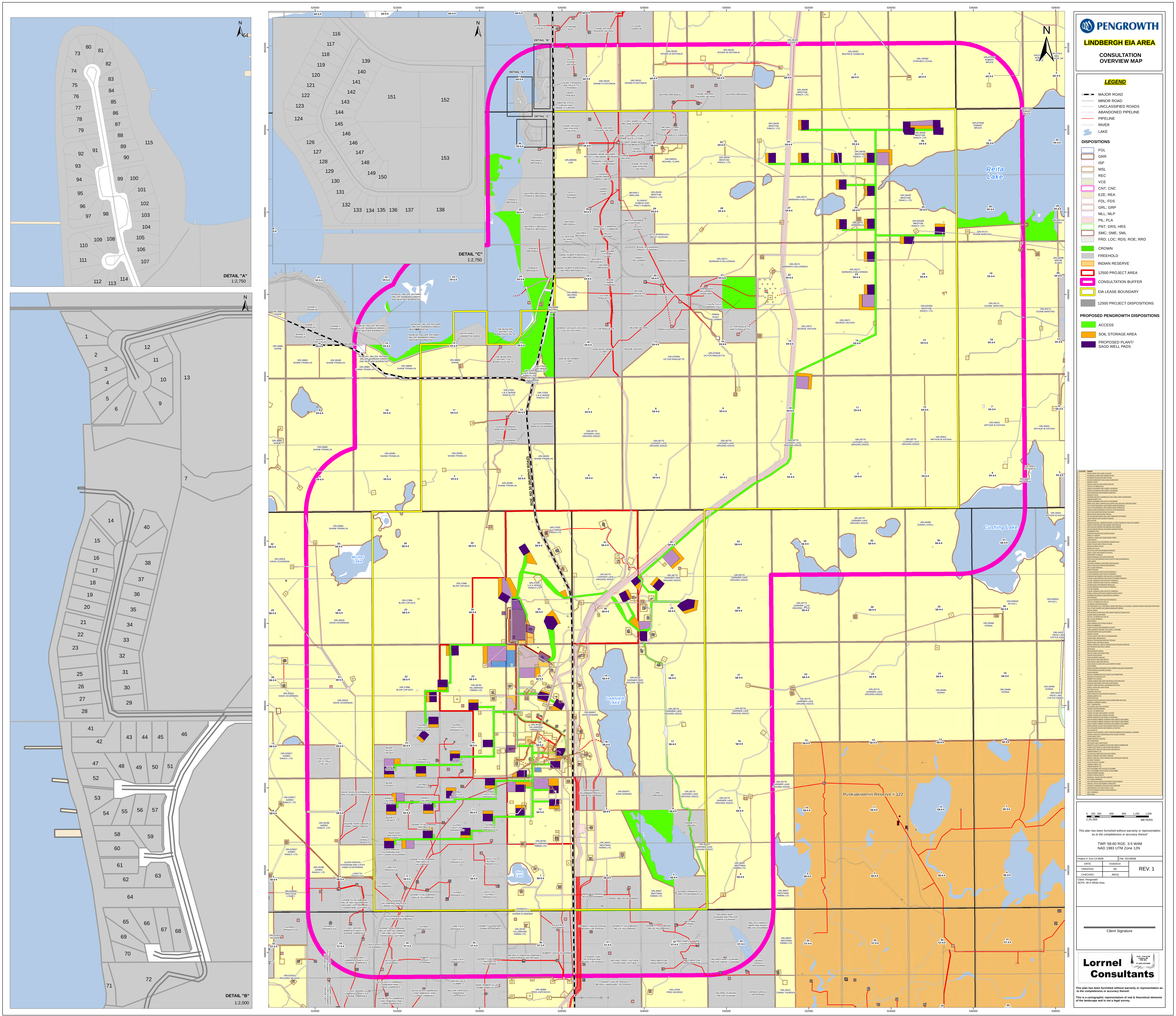
St. Paul
Flat Lake Community Hall
St. Paul, AB (SW 28-59-8 W4M)
May 23rd, 2014 between 5:00 pm and 8:00 pm

Elk Point
Senior's Center
5010–48th Street, Elk Point, AB
May 29th, 2014 between 5:00 pm and 8:00 pm

Ferguson Flats
Ferguson Flats Community Hall
(8km North of Elk Point, AB – NE 22-57-5 W4M)
June 2nd, 2014 between 5:00 pm and 8:00 pm

Bonnyville
Centennial Center
4313–50th Avenue, Bonnyville, AB
June 5th, 2014 between 5:00 pm and 8:00 pm

Pengrowth Energy Corporation is proposing to expand its existing Lindbergh Oil Sands Development from 12,500 barrels per day to 30,000 barrels per day. In order to learn more about this expansion project, we invite you to attend one of our Open Houses planned in your area.
Pengrowth's shares trade on both the Toronto Stock Exchange under the symbol "PGF" and on the New York Stock Exchange under the symbol "PGH".
To find out more about Pengrowth, how to join our team or how to partner with a company that delivers outstanding results, please visit: www.pengrowth.com


PENGROWTH
LINDBERGH EIA AREA
CONSULTATION OVERVIEW MAP
LEGEND
MAJOR ROAD
MINOR ROAD
UNCLASSIFIED ROADS
ABANDONED PIPELINE
PIPELINE
RIVER
LAKE
DISPOSITIONS
FGL
GRR
ISP
MSL
REC
VCE
CNT; CNC
EZE; REA
FDL; FDS
GRL; GRP
MLL; MLP
PIL; PLA
PNT; DRS; HRS
SMC; SME; SML
FRD; LOC; RDS; ROE; RRD
CROWN
FREEHOLD
INDIAN RESERVE
12500 PROJECT AREA
CONSULTATION BUFFER
EIA LEASE BOUNDARY
12500 PROJECT DISPOSITIONS
PROPOSED PENGROWTH DISPOSITIONS
ACCESS
SOIL STORAGE AREA
PROPOSED PLANT/ SAGD WELL PADS
0 150 300 600 900 1,200 1,500
1:25,000 METERS
This plan has been furnished without warranty or representation as to the completeness or accuracy thereof
TWP. 58-60 RGE. 3-5 W4M
NAD 1983 UTM Zone 12N
Project #: Evo-13-0008
File: 20130006
DATE: 4/16/2014
CREATED: WL
CHECKED: JMGQ
REV. 1
Client: Pengrowth
NOTE: All in White Area
Client Signature
Lorrnel Consultants
1915 - 11th St SE Calgary, AB T2G 3G5
P: (403) 233-0900
This plan has been furnished without warranty or representation as to the completeness or accuracy thereof.
This is a cartographic representation of real & theoretical elements of the landscape and is not a legal survey.
Reita Lake
Cushing Lake
Garnier Lake
Michel Lake
Puskiakiwenin Reserve # 122
DETAIL "A" 1:2,750
DETAIL "B" 1:2,000
DETAIL "C" 1:2,750

D:\Projects\2013\Lorrnel\EVO-13-0008 (20130006 Lindbergh EIA Project)\MXD\EVO-13--0008_EIA_Area_Stakeholders_Map_Book.mxd

530000

6000000

5990000

530000

N

GRL38239 ROGER W ANTONIUK

GRL36239 ROGER W ANTONIUK

GRL33239 ROGER W ANTONIUK

GRL40320 BEATRICE GAMACHE

GRL780380 STEPHEN LYCHAK

GRL870268 ROBERT BRUCE HANSON

WILFRED BROSSEAU

DIANE VACHON PHILIPPE VACHON

WILFRED BROSSEAU

GRL39439 BRISTOW RANCH. LTD.

MICHAEL CLARK MARTHA CLARK

REGINALD G KIRKHAM

GRL090033 MICHAEL CLARK

GRL39272 BARBARA A KELLERMAN

GRL820305 BRISTOW RANCH. LTD.

GRL40174 DUANE BARSTAD

Reita Lake

ERWIN HUGO KELLERMAN (RANCHER)

CALVIN TULLY DARREN TULLY

ERWIN HUGO KELLERMAN

VICTOR RINGUETTE GRETA RINGUETTE

GRL16672 GEORGE VACHON

GRL970058 VICTOR RINGUETTE

GRL35922 ARTHUR W KATHAN

GRL36770 GARNIER LAKE GRAZING ASSOC.

Cushing Lake

STAKE HOLDER NOTIFICATION MAP

Project # EVO-13-0008
File # 20130006

AREA 1

Scale: 1:37,500

Legend

- EIA Lease Boundary
- 12500 Project Dispositions
- Crown Land
- Freehold
- Consultation Buffer
- GRL
- FN Reservations

0 0.25 0.5 Kilometers

PROPOSED PENGROWTH DISPOSITIONS

- Soil Storage Area
- Proposed Plant / SagD Well Pads
- Access
- Lake/River
- Stream

Lorrnel Consultants

PENGROWTH

4/11/2014

This plan has been furnished without warranty or representation as to the completeness or accuracy thereof. This is a cartographic representation of real & theoretical elements of the landscape and is not a legal survey.

D:\Projects\2013\Lorrnel\EVO-13-0008 (20130006 Lindbergh EIA Project)\MXD\EVO-13--0008_EIA_Area_Stakeholders_Map_Book.mxd

530000

6000000

5990000

N

PHILIPPE VACHON

GILLES JOSEPH VACHON

GRL38239 ROGER W ANTONIUK

GRL39220 KENNETH ANTONIUK

CLAUDE J RONDEAU AND PAULETTE S RONDEAU

HENRY FRIESEN

DWAYNE STEVE YURKISH AND MARIE H YURKISH

WILFRED BROSSEAU

DIANE VACHON PHILIPPE VACHON

DIANE VACHON AND PHILIPPE VACHON

CORY JAMES CUTRELL MELONIE RHONDA GUTHRIE

MICHAEL CLARK MARTHA CLARK

REGINALD G KIRKHAM

SHANE STEPHEN LYCHAK JOANNE ALICE LYCHAK

RICHARD JAMIE MCRAE LISA BRAGA

DIANE VACHON

EDWARD HENRI REGNIER TRACEY-LYNN MARIE TIEDEMANN

EDWARD H REGNIER TRACEY L TIEDEMANN

GRL080006 LISA RICHARDS

GRL090033 MICHAEL CLARK

REGINALD BROSSEAU

CANADIAN WORLDWIDE ENERGY LIMITED.

SCOTT EDWARD REGNIER

SHAWN DAVID CLARK

BEVERLY OMILUSIK

FLORENT DUBEAU AND TRACY DUBEAU

GRL39439 BRISTOW RANCH. LTD.

WILFRED BROSSEAU TERENCE BROSSEAU

TERENCE BROSSEAU

WILFRED H BROSSEA TERENCE BROSSEAU

WILFRED BROSSEAU

TIMOTHY ANDREW KOSHYKAR

DONALD C CAMERON CAROL-ANN T CAMERON

GILLES LAPOINTE

LE DIOCESE DE SAINT PAUL

DALLAS GARDNER

KEITH BORDELEAU BECKY DUGGAN

JESSIE M DUNAENKO ERNEST DUNAENKO

MARC OUIMET % ROBIN OUIMET

DANIEL ALBERTA BROSSEAU WILFRED BROSSEAU

ERWIN KELLERMAN

GRL39272 BARBARA A KELLERMAN

JESSIE MARIE DUNAENKO

GRL36989 WILFRED HENRI BROSSEAU

HELENE BERNADETTE VACHON

ERWIN HUGO KELLERMAN

ERWIN HUGO KELLERMAN (RANCHER)

VICTOR J RINGUETTE

KENELM L MILLER. RICHARD MILLER. BARBARA GREEN AND HEATHER BJORNSTAD

KEVIN KARLE SAMANTHA KARLE

THE MUNICIPAL DISTRICT OF BONNYVILLE NO. 87.

GEORGE JACQUES VACHON GILLES VACHON

VICTOR RINGUETTE

HELENE VACHON

GRL39289 SHANE FRANKLIN

GRL38858 SHANE FRANKLIN

GRL36881 SHANE FRANKLIN

DDM DEVELOPMENT CORP. LTD..

GRL970058 VICTOR RINGUETTE

GRL37925 U & E HERDE RANCH LTD

GLEN OCKERMAN MARLON OCKERMAN

GRL36770 GARNIER LAKE GRAZING ASSOC.

RGE. RD. 50 (MURPHY ROAD)

GRL37886 BLAIR CAPJACK

GRL35919 DAVID OCKERMAN

GRL36782 HILLEBRAND FARMS LTD.

Muriel Lake

Michel Lake

STAKE HOLDER NOTIFICATION MAP

Project # EVO-13-0008
File # 20130006

AREA 2

Scale: 1:37,500

0 0.25 0.5 Kilometers

Legend

- EIA Lease Boundary
- 12500 Project Dispositions
- Crown Land
- Freehold
- Consultation Buffer
- GRL
- FN Reservations

PROPOSED PENGROWTH DISPOSITIONS

- Soil Storage Area
- Proposed Plant / SagD Well Pads
- Access
- Lake/River
- Stream

Lorrnel Consultants

PENGROWTH

4/11/2014

PENGROWTH

STAKEHOLDER CONSULTATION INFORMATION
LINDBERGH SAGD EXPANSION

Consultation Reference #		**Date**	
Landowner Name(s)		**Occupant Name(s)**	
Affected Lands			
Landowner Address		**Occupant Address**	
Landowner Phone #		**Occupant Phone #**	
Land Interest(s)	☐ GRL ☐ Freehold L/O ☐ Other:	**Occupant Land Interest(s)**	☐ Renter ☐ Farmer ☐ Other:
Land Agent	☐ Shai Lisitza ☐ Terry (TJ) Ditchuk ☐ Other:		
Type of Consultation	☐ Phone Call ☐ Email ☐ In Person ☐ No Answer ☐ Left a Message		
Key Points of Discussion	☐ SAGD Expansion ☐ Information Package ☐ Operations Philosophy ☐ Project Timeline ☐ Oil Sands Exploration ☐ Community Involvement ☐ Health &Safety ☐ Noise & Traffic ☐ Project Historical Info ☐ Survey/Environmental Access Process ☐ PGF Fees Schedule ☐ Other:		
Items Delivered to Stakeholder	☐ Hand Delivery of Consultation Package ☐ Project Survey/Maps ☐ Payment:		
Additional Follow Up Required	☐ By Agent: ☐ By Lorrnel: ☐ By Pengrowth: ☐ By Other:		

Date of Consultation: ☐ **Additional Notes for Consultation Included** **Agent Signature:**	**Stakeholder is in agreement to the information above:** ☐ **Yes** ☐ **No** **Stakeholder Initials (voluntary):**

Lorrnel

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

STAKEHOLDER CONSULTATION NOTES – LINDBERGH SAGD EXPANSION

Consultation Reference #		**Date**	
Landowner Name(s)		**Occupant Name(s)**	
Affected Lands			

Summary of Meeting / Discussion

Witness: _____ Stakeholder: _____

Appendix 2-3: Stakeholder Consultation

(Stakeholders within 1 mile Buffer)

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 15 S ½ 1-60-5 W5M Plan 7720214 Blk 1, Lot 8 NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 20 Blk 3, Lot 31 & 32 Area A, B, C	**Freehold**	**1494530 Alberta Ltd.**	6-May-2014		Regular Mail	**No Concerns Received.**
Cannot Confirm Lands – lands held on Muriel Lake	**Freehold**	**Richard Gozjolko**	28-May-2014	28-May-2014	Regular Mail	*Not within 1 Mile Buffer, has requested notification. Rec'd phone call from Richard regarding project notification. He did not receive the original package sent. Has concerns regarding Muriel Lake water levels. Confirmed address and sending new package. **No Concerns Received.**
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 17 Area B	**Freehold**	**David Pelletier & Barbara McKenzie**	6-May-2014		Regular Mail	**No Concerns Received.**
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 14 Area B	**Freehold**	**Robert Dearborn & Phyllis Dearborn**	6-May-2014		Regular Mail	**No Concerns Received.**
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 13 Area B	**Freehold**	**Mary Joyce Smith** **Martin Leslie Smith** **Jocelyn Christine Stewart**	9-Jun-2014 6-May-2014		Regular Mail	*Mary Joyce Mailout returned – moved **Notification covered under open houses and advertisements.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 19 Area B	**Freehold**	**Roger Leo Vallee**	6-May-2014		Regular Mail	**No Concerns Received.**
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 10, 11, 12 Area B	**Freehold**	**Paul Peter Gondziola & Connie Marie Gondziola**	6-May-2014		Regular Mail	**No Concerns Received.**
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 20 Area B	**Freehold**	**Maurice Joseph Vallee**	6-May-2014		Regular Mail	**No Concerns Received.**
Freehold - NE 1-60-5 W4M Plan 0426701 Blk 4, Lot 1 Area B	**Freehold**	**Bonnyville General Contracting Ltd.**	6-May-2014		Regular Mail	**No Concerns Received.**
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 3, Lot A1 Area B	**Freehold**	**James Leipert & Sharron Leipert**	6-May-2014		Regular Mail	**No Concerns Received.**
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 21 Area B	**Freehold**	**Grant Taylor & Patricia Taylor**	6-May-2014		Regular Mail	**No Concerns Received.**
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 22 Area B	**Freehold**	**Kevin Gerald Field & Brenda Doreen Field**	6-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 9 Area B	**Freehold**	**David Williams** **&** **Joshua Williams**	6-May-2014		Regular Mail	**No Concerns Received.**
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 23 Area B	**Freehold**	**Sarah Miller**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold - NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 8 Area B	**Freehold**	**Bruce Miller & Beverley Miller**	11-Jun-2014 28-May-2014 7-May-2014		Regular Mail	*Mailout returned – moved *Mailout returned – moved, sent to new address **Notification covered under open houses and advertisements.**
Freehold – NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 24 Area B	**Freehold**	**Janessa K Ferris & James Daryn Ferris**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 7 Area B	**Freehold**	**Lee William Getzinger & Janet Margaret Getzinger**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 25 Area B	**Freehold**	**Rebecca A Wright**	2-Jun-2014 22-May-2014 7-May-2014		Regular Mail	*Mailout returned again – return to sender *Mailout returned – moved, sent to new address **Notification covered under open houses and advertisements.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 6 Area B	**Freehold**	**Todd Purdon & Elizabeth Purdon**	20-May-2014 7-May-2014		Regular Mail	*Mailout returned – Unclaimed **Notification covered under open houses and advertisements.**
Freehold – NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 26 Area B	**Freehold**	**Christian Walker & Coleen Walker**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 4 Area B	**Freehold**	**Rose M Kaplan**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 27 Area B	**Freehold**	**Charmaine Cote**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 3 Area B	**Freehold**	**Douglas Nielsen & Lorraine Nielsen** **Alfred Pomerleau & Judy Murray**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 2 Area B	**Freehold**	**Daniel Peter Mickler & Norma Lynn Mickler**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 28 Area B	**Freehold**	**Shane Edward Prazak & Irene Edward Prazak**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – NE 1-60-5 W4M Plan 3255TR Blk 2, Lot 1 Area B	**Freehold**	**John Walter Osborn & Brenda Mae Osborn**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 2, Lot 34 Area B	**Freehold**	**John C Leeds & Kenneth R Shalka**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 2, Lot 35 Area B	**Freehold**	**Hersendeep Chhokar**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – N ½ 1-60-5 W4M Plan 7620500 Blk 2, Lot 33 Area B	**Freehold**	**Ronald McGuire & Susan McGuire**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 2, Lot 32 Area B	**Freehold**	**Gary Leslie Nestorowich & Paulette Ann Nestorowich**	12-May-2014		Regular Mail	**No Concerns Received.**
Freehold – E ½ 1-60-5 W4M Plan 7620500 Blk 2, Lot 31 Area B	**Freehold**	**Jamie Smart**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 0425630 Blk 2, Lot 53 Area B	**Freehold**	**Lise Renee Rondeau & Rory Olsen Whaley**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – E ½ 1-60-5 W4M Plan 7620500 Blk 2, Lot 40 Area B	**Freehold**	**Travis Ladd & Jennifer Makarewicz**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Block 2, Lot 39, 36, 37, 42, 43, 44, 46, 47 & 52 & Plan 8721424 Blk 3, Lot 7 Area B, C NE 36-59-5 W4M Plan 0829716 Blk 3, Lot 36, 37, 38	**Freehold**	**Eric Claude Rondeau & Paulette Rondeau**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 2, Lot 38 Area B	**Freehold**	**Mark Stepenko**	9-Jun-2014 7-May-2014		Regular Mail	*Mailout returned – moved **Notification covered under open houses and advertisements.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 2, Lot 41 Area B	**Freehold**	**Charlene Rae Roberts & Walter Lyle Roberts**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 2, Lot 45 Area B	**Freehold**	**AB Mouallem & Monique Mouallem**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 2, Lot 48 Area B	**Freehold**	**Paul Blackburn**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 2, Lot 49 Area B	**Freehold**	**Russell B McAllister & Elizabeth M McAllister**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 2, Lot 50 Area B	**Freehold**	**Raymond M Campeau & Doris M Campeau**	12-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 2, Lot 51 Area B	**Freehold**	**Judy McEwan**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 3, Lot 1 Area B	**Freehold**	**Joshua Urban**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 3, Lot 2 Area B	**Freehold**	**Dale Stuart Moore & Debrah Margaret Moore**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 3, Lot 3 Area B	**Freehold**	**Dan Trepamier& Kelly Trepanier** **&** **Charles Dube & Marie Anita Bernadette Trepanier** **&** **Carmen Hansen**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
		& **Renee Trepanier**				
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 3, Lot 4 Area B	**Freehold**	**Lea Biddle & Bryan Biddle**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 3, Lot 5 Area B	**Freehold**	**Eric Michael Kowalachuk & Lindsey Michelle Kowalchuk**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7620500 Blk 3, Lot 6 Area B	**Freehold**	**Eugene Ronald Bartman**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – S ½ 1-60-5 W4M Plan 7720214 Blk 1, Lot 26 Area A	**Freehold**	**Michael Topham & Kristina Topham**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – S ½ 1-60-5 W4M Plan 7720214 Blk 1, Lot 27 Area A	**Freehold**	**Randy Kozak & Mary Kozak**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – S ½ 1-60-5 W4M Plan 7720214 Blk 1, Lot 28 NE 36-59-5 W4M Plan 1120006	**Freehold**	**Marcel Forcade & Adelele Forcade & Napleon Forcade**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Blk 2, Lot 40 & 41 Area A, C						
Freehold – S ½ 1-60-5 W4M Plan 7720214 Blk 1, Lot 29 Area A	**Freehold**	**Dale Wheeler & Holly Lussier**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – S ½ 1-60-5 W4M Plan 7720214 Blk 1, Lot 30 NE 36-59-5 W4M Plan 7720214 Blk 2, Lot D Area A, C	**Freehold**	**Irene Blais (Executrix for Roger R Chabot)**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – S ½ 1-60-5 W4M Plan 7720214 Blk 1, Lot 31 Area A	**Freehold**	**Brian Edward Siebold**	3-Jun-2014 7-May-2014		Regular Mail	*Mailout returned – moved **Notification covered under open houses and advertisements.**
Freehold – S ½ 1-60-5 W4M Plan 7720214 Blk 1, Lot 32 Area A	**Freehold**	**Mitchel Pord & Penny Pord**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – S ½ 1-60-5 W4M Plan 7720214 Blk 1, Lot 33 Area A	**Freehold**	**Vincent Beauchesne**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – S ½ 1-60-5 W4M Plan 7720214 Blk 1, Lot 34 Area A	**Freehold**	**Sarah Elizabeth Le Blanc**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – S ½ 1-60-5 W4M Plan 7720214 Blk 1, Lot 35 Area A	**Freehold**	**Michael Ott & Rita Ott**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7720214 Blk 1, Lot 31, 36 Area A	**Freehold**	**Herbert Otto Sierau**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7720214 Blk 1, Lot 37 Area A	**Freehold**	**Thomas Robert Macleod & Reneille Rae Macleod**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7720214 Blk 1, Lot 38 Area A	**Freehold**	**Douglas Mackenzie & Airilea Mackenzie**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7720214 Blk 1, Lot 39 Area A	**Freehold**	**Charles Lorne Mitchell & Brenda Mitchell**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7720214 Blk 1, Lot 40 Area A	**Freehold**	**Daniel Fedun & Cody Fedun**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – SE 1-60-5 W4M Plan 7720214 Blk 1, Lot 41 Area A	**Freehold**	**Heather Paluk**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7720214 Blk 1, Lot 42 Area A	**Freehold**	**Cameron Pelletier**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7720214 Blk 1, Lot 43 Area A	**Freehold**	**Deryk Fersovich & Kristine Fersovich**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Plan 7720214 Blk 1, Lot 1 NE 36-59-5 W4M & S ½ 1-60-5 W4M Plan 7720214 Blk 4, Lot A Area A, C	**Freehold**	**Thomas Arthur Roberge**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 1-60-5 W4M Title: 982 268 294 Area A	**Freehold**	**Dwayne Steve Yurkish & Marie H Yurkish**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – S ½ 1-60-5 W4M Plan 7720214 Blk 1, Lot 2 Area A	**Freehold**	**Les G Smith & Joyce M Smith**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 3 Area A	**Freehold**	**Neil V Turkington**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 4 Area A	**Freehold**	**Janadene L Knapton**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 5 Area A	**Freehold**	**Gordon Lawrence Highnell**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 6, 7 Area A	**Freehold**	**Randolph Wade Matlock & Eleanor Mary Matlock**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 9 Area A	**Freehold**	**Ronald S Robertson & Susan Ellen Robertson**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 10 Area A	**Freehold**	**Wayne Malone**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 11 Area A	**Freehold**	**Peter Chlebak & Anna Chlebak**	20-May-2014 7-May-2014		Regular Mail	*Mailout returned – moved **Notification covered under open houses and advertisements.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 12 Area A	**Freehold**	**Ronald Delmer Longworth & Carmen Aguillon Longworth**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 13 Area A	**Freehold**	**Julie Norrie**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 14 Area A	**Freehold**	**Louie (Lou) Louis Di Ciano & Lillian Mary Di Ciano**	7-May-2014	27-Jun-2014 12-May-2014	Regular Mail	*Rec'd phone call from Lou regarding Muriel Lake and Bonnyville open house that he was unable to attend. Lou will be emailing pictures of the lake from the 70's to Colleen Smith. Expressed concerns with previous Murphy project in the 90's and with CNRL's application in 2004 to drill under Murphy Lake (application was cancelled). *Phone call inquiry to Colleen Smith from Lou regarding Muriel Lake and water extraction. It was confirmed that water will only be taken from the North Sask. River only. Concerns about fracking; confirmed that the expansion project has no fracking operations.
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 15 & 16 Area A	**Freehold**	**Rudy Restau & Sheri Restau**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 17 Area A	**Freehold**	**Bennett Adams**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 18 Area A	**Freehold**	**Leonard Babyn & Susan Babyn**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 19 Area A	**Freehold**	**Terry Gordon Yackimec & Cheryl L Yackimec**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 20 Area A	**Freehold**	**Allan R Alcock & Margriete Alcock**	20-May-2014 7-May-2014		Regular Mail	*Mailout returned – moved **Notification covered under open houses and advertisements.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 21 Area A	**Freehold**	**Derek N Kubbernus**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 22 Area A	**Freehold**	**Shari M Boese & Patrick M Melia**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 23 Area A	**Freehold**	**Brent Grieve**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 24 Area A	**Freehold**	**Victor E Balla & Treva M Cunningham**	22-May-2014 7-May-2014		Regular Mail	*Mailout returned – moved, re-sent to new address **Notification covered under open houses and advertisements.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – SW 1-60-5 W4M Plan 7720214 Blk 1, Lot 24 Area A	**Freehold**	**Joann Marie Moorehead**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 1 & 2 Area C	**Freehold**	**Vilbon Vachon & Eugenia Vachon**	2-Jun-2014 7-May-2014		Regular Mail	*Mailout returned – moved **Notification covered under open houses and advertisements.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 3, Lot 34 Area C	**Freehold**	**Richard T Banner**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 3, Lot 33 Area C	**Freehold**	**David Philippe Vachon**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 3 Area C	**Freehold**	**George Johnston & Annella Johnston**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 4, 5 & 6 Area C	**Freehold**	**Joan Elizabeth Ebbers Carigan & Albert Dirk Ebbers**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 3, Lot 29 & 30 Area C	**Freehold**	**Roy E Coulombe & Pauline G Coulombe**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 7 Area C	**Freehold**	**Andre Gerard Aucoin & Simone Annette Aucoin**	**Cannot Confirm Postal Code**			**Notification covered under open houses and advertisements.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 8 Area C	**Freehold**	**Paul Williams Sakins & Rhonda Lee Kostick**	2-Jun-2014 7-May-2014		Regular Mail	*Mailout returned – moved **Notification covered under open houses and advertisements.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 9 Area C	**Freehold**	**Isaac Neufeld**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 3, Lot 28 Area C	**Freehold**	**Francis Morris Senger**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 3, Lot 27 Area C	**Freehold**	**Marshall Hasiuk & Gail Hasiuk**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 11 Area C	**Freehold**	**Michael Kellie Marren & Janet Christine Marren &** **Marlene A Marren**	2-Jun-2014 7-May-2014 30-May-2014 7-May-2014		Regular Mail	*Mailout returned – return to sender, wrong address *Mailout returned – moved **Notification covered under open houses and advertisements.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 12 Area C	**Freehold**	**Randall Michael Putnam & Kathy Louise Putnam**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 3, Lot 26 Area C	**Freehold**	**Kenneth Frank Hollett**	2-Jun-2014 7-May-2014		Regular Mail	*Mailout returned – moved **Notification covered under open houses and advertisements.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 13 Area C	**Freehold**	**Laurie Bruce Scott**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 14 Area C	**Freehold**	**Robert Reinholt Reschke**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 3, Lot 25 Area C	**Freehold**	**Ryan Dennis Simmons**	9-Jun-2014 7-May-2014		Regular Mail	*Mailout returned – unclaimed **Notification covered under open houses and advertisements.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 15 Area C	**Freehold**	**Eric Andrushuk**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 3, Lot 24 Area C	**Freehold**	**Jean Francois Gagnon & Marie Josee Gagnon**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 16 Area C	**Freehold**	**Rick Block** **&** **Laurie Block**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 3, Lot 23 Area C	**Freehold**	**Trevor J Critch & Robert D Ringuette**	26-May-2014 7-May-2014		Regular Mail	*Mailout Returned – moved **Notification covered under open houses and advertisements.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 17 Area C	**Freehold**	**Henriette Judith Sumner & Wayne Henry Fairthbrother**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 18 & 19 Area C	**Freehold**	**Aaron Scott Bentley & Elaine Ann Bentley**	9-Jun-2014 7-May-2014		Regular Mail	*Mailout returned – moved **Notification covered under open houses and advertisements.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 3, Lot 22 Area C	**Freehold**	**Richard D Lorenson & Rose Jean Lorenson**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 7720214 Blk 2, Lot 21 Area C	**Freehold**	**Steven Kallstrom**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 36-59-5 W4M Plan 0829716 Blk 3, Lot 35 Area C	**Freehold**	**Christopher R Fox & Janelle S fox**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – NE 25-59-5 W4M Plan 8323091 – Road Plan 9724411 – Descriptive Title: 032 098 430 **Freehold -** SE 5 & SE 4-60-4 W4M NE 24-59-5 W4M Title: 122 301 497 16-24-59-5 W4M Title: 972 225 306 NW 25-59-5 W4M Title: 122 303 995 SE 25-59-5 W4M Title: 032 093 128 Title: 932 042 954	**Freehold**	**Wilfred Brosseau** **&** **Terence Brosseau**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 36-59-5 W4M Title: 022 383 275	**Freehold**	**Reginald Brosseau**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NW 6-60-4 W4M Title: 792 270 482	**Freehold**	**Gilles Joseph Vachon**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 6-60-4 W4M Title No: 112 410 099	**Freehold**	**Henry Friesen**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
GRL 39220 – E ½ 6 & W ½ 5-60-4 W4M **GRL 38239 –** NE 5 & N ½ 4, N ½ 3-60-4 W4M	**GRL**	**Kenneth Antoniuk & Roger Antoniuk**	7-May-2014		Regular Mail	**No Concerns Received.**
GRL 39439 – S ½ 3-60-4 W4M (also inside 1 mile buffer) **Freehold – S ½ 32-57-4 W4M** Title: 992 075 291 +1	**GRL** **Freehold**	**Bristow Ranching Ltd.** **c/o Levi Bristow** **Fred Bristow & Mona Bristow**	7-May-2014		Regular Mail	**No Concerns Received.**
GRL 40320 – Sec. 2-60-4 W4M	**GRL**	**Beatrice Gamache**	7-May-2014		Regular Mail	**No Concerns Received.**
GRL 780380 – Sec. 1-60-4 W4M	**GRL**	**Stephen Lychak & Lorraine Lychak & Leonard Lychak**	7-May-2014		Regular Mail	**No Concerns Received.**
GRL 870268 – Sec. 6-60-3 W4M & Sec. 31-59-3 W4M	**GRL**	**Robert Bruce Hanson**	7-May-2014		Regular Mail	**No Concerns Received.**
GRL 40174 – Sec(s). 18 & 19-59-3 W4M & S ½ 30-59-3 W4M	**GRL**	**Duane Barstad & Arden Barstad**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
GRL 35922 – Sec(s). 6 & 7-59-3 W4M	**GRL**	**Arthur W Kathan**	7-May-2014		Regular Mail	**No Concerns Received.**
GRL 36466 – Sec. 36-58-4 W4M	**GRL**	**Donna Lovell & John Marsh**	7-May-2014		Regular Mail	**No Concerns Received.**
GRL 36770 – Sec(s). 35, 34, 33, 28, 21, 16 & 9-58-4 W4M (also inside 1 mile buffer)	**GRL**	**Garnier Lake Grazing Association**	7-May-2014		Regular Mail	**No Concerns Received.**
GRL 36047 – Sec. 4-58-4 W4M (also inside 1 mile buffer)	**GRL**	**Westman Farms Ltd.**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 33-57-4 W4M Title: 042 506 721	**Freehold**	**Melvin Charles Barr**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 33-57-4 W4M Title: 862 135 324	**Freehold**	**Dennis Gerald Heffernan**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – W ½ 33-57-4 W4M Title: 872 022 053 **& NE 32-57-4 W4M** Title: 972 335 747	**Freehold**	**Mildred Mary Dunham & Trevor Harvey Dunham** **Mildred Mary Dunham & Stacy Glen Dunham**	7-May-2014		Regular Mail	June 2, 2014 *Trevor Dunham hand delivered letter to Pengrowth Reps at Open House *Trevor Dunham Concerns: Clay that is deposited on the pavement at the entrance to the Pengrowth site north of Lindbergh. Last winter as trucks exited the site clay lumps froze on pavement

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
						throughout the winter *What will Pengrowth do to mitigate this concern? The traffic is to increase so will this problem **Meeting occurred with Trevor and all concerns were addressed. No further concerns presented.**
Freehold – NW 32-57-4 W4M Title: 102 357 004 **&** **NE 31-57-4 W4M** Title: 102357 553 **&** **SE 35-57-5 W4M** Title: 102 357 547 **GRL 36782 –** NW 36-57-5 W4M (also inside 1 mile buffer)	**Freehold** **GRL**	**Kenneth Hillebrand & Nellie Hillebrand** **Hillebrand Farms Ltd.**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 31-57-4 W4M Title: 102 317 218 **&** **NW 34-57-5 W4M** Title: 092 164 768	**Freehold**	**Michael Greg Leathem & Kenna Mae Leathem**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 31-57-4 W4M Title: 072 412 223 +1 **&** **NW 31-57-4 W4M** Title: 072 412 223	**Freehold**	**Stewart Ivan Peterson & Beverly Peterson**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NW 36-57-5 W4M Title: 902 117 879 **&** **SW 34-57-5 W4M** Title: 872 091 544	**Freehold**	**Myles Roy Ockerman**	30-Aug-2014		In Person	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – SE 36-57-5 W4M Title: 872 091 541 **&** **SE 34-57-5 W4M** Title: 872 091 543	**Freehold**	**Robert Leslie Ockerman**	30-Aug-2014		In Person	**No Concerns Received.**
Freehold – SW 36-57-5 W4M Title: 092 415 685	**Freehold**	**Michelle Dawn Hillebrand & Christopher Lee Prymak**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NE 35-57-5 W4M Title: 922 115 365	**Freehold**	**Kenneth L Sidener & Donna M Sidener**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – NW 35-57-5 W4M Title: 882 323 350 A **&** **SW 35-57-5 W4M** Title: 882 323 350 **Freehold –** NE 34-57-5 W4M Title: 92Z277 & **Freehold -** NW 33-57-5 W4M Title: 198R247 (also within 1 mile buffer)	**Freehold**	**Loretta R Opanavicius** **Alfred Opanavicius**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SW 33-57-5 W3M Title: 132 072 336 +2 & **NE 33-57-5 W4M** Title: 132 072 336 +3 & **SE 33-57-5 W4M**	**Freehold**	**Cody Jeffrey Lawrence & Kyla Joanne Lawrence**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Title: 132 072 336						
GRL 35296 – N ½ 4 & W ½ 9-58-5 W4M	**GRL**	**AARBO Ranching Ltd.**	7-May-2014		Regular Mail	**No Concerns Received.**
Freehold – SE 9-58-5 W4M Title: 982 173 159	**Freehold**	**Valerie Fern Gibson & Daniel Owen Gibson**				29-May-2014 *Val and Owen attended Elk Point May 29, 2014 Open House, filled out Open House survey *Within 1mile buffer and never received a mailout **All data and discussions were provided at open house.**
Freehold – SW 16-58-5 W4M Title: 972 165 946	**Freehold**	**The County of St. Paul No. 19**	7-May-2014		Regular Mail	**No Concerns Received.**
GRL 35919 – Sec(s). 21, 28-58-5 W4M	**GRL**	**David Ockerman** **&** **Glen Ockerman**	7-May-2014		Regular Mail	**No Concerns Received.**
GRL 36881 **GRL 38858** **GRL 39289 –** N ½ 33-58-5 W4M, Sec. 3, 4 & 10 & S ½ 15-59-5 W4M (also in 1 mile buffer)	**GRL**	**Shane Franklin**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Lorrnel Consultants, as Agent for
PENGROWTH ENERGY CORPORATION
Stakeholder Notification Line List – One Mile Radius to Lindbergh SAGD Expansion Project
Within Twp.(s) 57-60, Rge.(s) 3-5 W4M

Lorrnel File: 20130006 Last Updated: September 11, 2015

Land Location	Land Interest	Contact Information	Date of Contact	Date of Non-Objection	Method of Contact	Comments
Freehold – N ½ 15-59-5 W4M Title: 952 333 277	**Freehold**	**Kenelm L Miller** **&** **Richard Miller** **&** **Barbara Green** **&** **Heather Bjornstad**	7-May-2014		Regular Mail	**No Concerns Received.**

1915-11th Street SE
Calgary, AB T2G 3G5
Ph: (403) 233-0900
Fax: (403) 265-3874

Appendix 2-4: Open House Invitation (Newspaper Advertisement)

Magician John Kaplan thanks Eros Cueva for checking out the status of his sliced-in-three assistant, left, then gets locked in the stocks, bottom left. Above, Kaplan and his assistants thank all who attended Wednesday's 'AbracaDazzle' show.

KINDERGARTEN REGISTRATION

If your child is five years old, or will be five years old by February 28, 2015, they are eligible to attend Kindergarten for the 2014-2015 school year.

Please stop by the Elk Point Elementary School office for a registration form and/or attend the pre-registration meeting hosted by Mrs. Wood on May 14, 2014 at 7:00 p.m. in the Kindergarten classroom.

All new registrations must present a **birth certificate** and an **Alberta Health Care Card** number to the school office before school commencement in September 2014.

Education Week is May 5-9
"We Are Inspiring Education"