11213 Winterburn Rd NW
Edmonton, AB T5S 2B2

Office (780) 809 8191
Fax (780) 809 8190
Site aspenlandgroup.com

March 4, 2026

Lac Ste. Anne County
Box 219, 56521 Range Road 65
Sangudo, AB T0E 2A0

Sent via email: tvanderwell@lsac.ca

Attention: Tanya Vanderwell
Senior Development Officer

Reference: Incomplete Development Letter
Bylaw 22-2017-04-2025
NW & NE 33-53-03 W5M & SW 34-53-03 W5M
Lac Ste. Anne County

Dear Ms. Vanderwell:

Aspen Land Group Inc. (Aspen) has been retained by 1531486 Alberta Ltd. to prepare a response to the Referral Comments Letter received on August 18, 2025, regarding the proposed aggregate extraction development within NW & NE 33-53-03 W5M & SW 34-53-03 W5M. We have prepared a response to the requested information following the Notice of Second Reading of Bylaw 22-2017-04-2025 below; with the requested information from your August 18, 2025, letter in italics and the corresponding information directly below.

A number of items requested had been provided in the April 2025 Development Permit Renewal Application. Some of the responses to items requested in your August 18, 2025, letter have resulted in some revisions to the April 2025 Development Permit Renewal Application Package. These revisions based on the revised information have been integrated into the revised Development Permit Renewal Application package which has been enclosed with this letter. A revision table is available on Page vii of the package to easily reference the revisions that have been made to the April 2025 application. If a section or appendix is not referenced in the revision table, it remains the same as the April 2025 Development Permit Renewal Application submission. 1531486 Alberta Ltd. and Aspen give permission to Lac Ste. Anne County (LSAC) to use the enclosed revised Development Permit Application Package to inform the Land Use Bylaw Amendment Application.

1. *An Environmental Impact Assessment report prepared by a qualified professional*

The revised Development Permit Renewal Application enclosed meets the requirements of the environmental impact assessment as per LSAC Land Use Bylaw No. 2017-22.

2. *Traffic Impact Assessment*

A Traffic Impact Assessment (TIA) was completed in 2010, which recognized the need for portions of Range Road 33 to be upgraded to both Parkland County and LSAC standards. Since receipt of the Development Permit in 2011, portions of Range Road 33 have been upgraded within Parkland County. Additionally, it is understood that LSAC has completed the engineered road design to upgrade Range Road 33 from Parkland County to the Village of Alberta Beach, and it is understood that the road design accounted for aggregate development and production in the area. While the date of construction of Range Road 33 upgrade is uncertain, completion of another TIA at this time is redundant. 1531486 Alberta Ltd. understands that the conditions of any Development Permit would require an Industrial Haul Route Agreement from both Parkland County and Lac Ste. Anne County prior to operations. 1531486 Alberta Ltd. requests that if a TIA is warranted that it be imposed as a condition of the Development Permit that would require the TIA to be completed, if warranted, before operations commence. This would ensure that the TIA is reflective of the road conditions at the time of development.

3. *Proposed haul route: including but not limited to: Range Road 33 and capacity to handle proposed increase in traffic/loads*

There have been no changes to the previously permitted haul route. The haul route will be south from the pit entrance along Range Road 33 to Highway 16. No traffic is proposed to travel north along Range Road 33.

Details regarding the haul route and the 2010 TIA have been provided in Sections 2.4, 4.12, 5.4, 5.5 and Appendix G of the enclosed Development Permit Renewal Application.

4. *Extraction plans, and the anticipated increase/decrease in annual extracted volume versus the current operation*

Extraction areas remain relatively the same from the previously permitted operations plan, however, the total volume of material anticipated to be extracted has been reduced due to the installation of the West Inter Lake district (WILD) Water Commission water pipeline that was installed in the undeveloped road allowance of Township Road 540 and Range Road 34. With that said, hours of operations, annual production, and life of the pit remain the same and are discussed within the enclosed Development Permit Renewal Application.

5. *A list of all other approvals required (which may include: Provincial water diversion licence for pit de-watering, Federal requirements)*

1531486 Alberta Ltd. has received all other authorizations required for the operation. A summary of all other authorizations required are included within Section 3.0 Provincial Requirements while copies of the physical authorizations are included within Appendix C of the enclosed Development Permit Renewal Application.

6. *Reclamation plan shall be prepared by a qualified professional*

The details and drawings of the revised reclamation plan that incorporate the removal of the WILD Water Commission water pipeline and applicable setbacks are included within the enclosed Development Permit Renewal Application, which was prepared and signed by Lesley Foy, Professional Agrologist.

7. *Operations, safety and emergency response plan*

A copy of the Emergency Response Plan was included in the initial Development Application. The Emergency Response Plan has been revised and is included in Appendix M of the enclosed Development Permit Renewal Application.

8. *Site plans showing the storm drainage plan including surface and groundwater management measures, and direction of drainage*

Site plans that depicting storm drainage, and direction of drainage are provided in Appendix L of the enclosed Development Permit Renewal Application, while details about the pre-disturbance conditions and management measures are described in Sections 4.4, 4.8, 4.9, 5.6.2, 5.12, 5.18, and 6.3.

9. *A hydrogeology report prepared by a qualified hydrogeologist*

1531486 Alberta Ltd. retained Hydrogeological Consultants Ltd. (HCL) in 2012 to complete a groundwater review. HCL has been conducting annual monitoring of the local groundwater regime since they first assessed the site. A memo completed in 2025 confirms that through their monitoring data, no changes have occurred to the state of the local groundwater table since the original assessment. A copy of the Original 2012 Groundwater Review Report and HCL's 2025 Memo are included in Appendix E of the enclosed Development Permit Renewal Application.

10. *Noise study and description of measures to be taken to minimize noise to neighboring properties*

A copy of Patching Associates Acoustical Engineering Ltd. 2011 Noise Impact Assessment is provided in Appendix H of the enclosed Development Permit Renewal Application. As there have been no major changes to the proposed operations, the noise assessment remains relevant. Noise mitigations remain

consistent with the mitigations previously permitted; however, the additional noise mitigations that were discussed during the public hearing and open house were included in Section 5.17 of the Development Renewal Application and include:

- Strategic placement of the crusher (either in low spots and/or strategic placement of product piles.
- When permissible under Occupational Health and Safety Legislation and Standards, long-term equipment on site will be outfitted to white noise back up beepers instead of conventional back up beepers.
- To limit cumulative effects of equipment noise, 1531486 Alberta Ltd. will reduce the number of pieces of equipment to the minimum number required to do the given task or activity and where possible, smaller pieces of equipment will be utilized where large equipment is not necessary. 1531486 Alberta Ltd. has chosen to use rock trucks instead of tandem trucks in their operation to mitigate noise generated from tailgates opening and closing.
- Additional efforts to limit noise travelling to residents located east of the pit by orienting mining, stripping and reclamation material replacement to be primarily travelling in a forward direction while facing east and backward while facing west, away from the residents to the east. Directionality of stationary equipment will also be considered and where possible, be positioned facing away from the most impacted residents.
- Use of WhisperWatt style generators when generators are required at night (colder temperatures or during pit dewatering activities)
- House water pump for dewatering activities in a silent pack and/or behind a berm or stockpile.

11. Dust control measures

Dust control measures are outlined within Section 5.15 of the enclosed Development Permit Application.

12. Open house hosted and submitted documentation with mitigation

1531486 Alberta Ltd. held an Open house in 2010 ahead of their initial Development Permit Application. Feedback and comments were incorporated into the proposed operation plan in 2011.

In order to renew Development Permit 193193-13-D0019 under Land Use Bylaw No 2017-22, an amendment to the Land Use Bylaw was required to re-district the lands. While LSAC Administration originally indicated that the previous public consultation in 2010 was adequate, Counsel requested additional consultation following second reading of the Land Use Bylaw Amendment. 1531486 Alberta Ltd. mailed 206 invitations and project information, and the Open House was held on December 2, 2025 from

2:00 to 4:00 pm. A summary of the 2025/2026 consultation has been provided in Appendix J of the enclosed Development Permit Application.

If you require further information, please contact the undersigned.

Sincerely,

This information redacted as per Protection of Privacy Act (FOIP Act)

Lesley Foy, P.Ag.
Senior Agrologist
Aspen Land Group Inc.

cc: Peter Wall, 1531486 Alberta Ltd.
Lucas Bodnar, 1531486 Alberta Ltd.
Greg Edwards, Lac Ste Anne County

Attachment A: Development Permit Application Package (Revised March 2026)

Alberta Beach Pit

Development Permit Application

Development Permit No. 193193-13-D0019

N 33 and SW 34-053-03 W5M

April 2025 (Revised March 2026)

Revision 1

Prepared for

1531486 Alberta Ltd.

Aspen LAND GROUP

11213 Winterburn Rd NW
Edmonton, AB T5S 2B2

Office (780) 809 8191
Fax (780) 809 8190
Site aspenlandgroup.com

Executive Summary

1531486 Alberta Ltd. is applying to renew Development Permit No. 193193-13-D0019 under Lac Ste. Anne County Land Use Bylaw No. 22-2017 for the development and operation of the Alberta Beach Pit, located within the N 33 and SW 34-053-03 W5M in Lac Ste. Anne County. In addition to submission of the renewal application, a change in the Land Use Bylaw following the issuance of the original Development Permit has resulted in 1531486 Alberta Ltd. to redistricting the land to the AR – Aggregate Resource Extraction and Aggregate Resource Processing District.

The Alberta Beach Pit is a previously permitted aggregate operation involving soil salvage, extraction of sand, gravel, and clay, aggregate processing (crushing, screening, washing, and asphalt production), hauling, and progressive reclamation. Aggregate products will be hauled south along Range Road 33 to Highway 16.

The development will disturb approximately 127.84 hectares over the life of the pit, including approximately 63.61 hectares of extraction area and 64.24 hectares for processing, stockpiling, and infrastructure. Operations will proceed in three phases with progressive reclamation implemented throughout the life of the pit. Environmental protection, groundwater monitoring, traffic management, dust control, noise mitigation, and weed management measures have been incorporated to minimize potential impacts.

All required provincial approvals for the operation are in place, including registration under the *Code of Practice for Pits* and multiple *Water Act* approvals and licences for dewatering, aggregate washing, wetland disturbance, and construction of end-pit waterbodies. While site access has been developed, no mining has occurred since issuance of the original permit due to economic conditions and administrative delays, including impacts associated with the COVID-19 pandemic.

1531486 Alberta Ltd. seeks to renew the development permit as previously presented with minor changes. This application package consolidates the additional information requested throughout the previous permitting process, ensures alignment with Lac Ste. Anne County Land Use Bylaw No. 22-2017, the additional request following the 2025 Public Hearing to redistrict the land, and addresses changes to the conditions of the proposed operations along with making adjustments based on current market conditions and best practices.

The project is expected to provide economic benefits to Lac Ste. Anne County through employment, support of regional construction needs, and Community Aggregate Payment Levy contributions. With appropriate mitigation and regulatory compliance, the Alberta Beach Pit is expected to operate compatibly with surrounding land uses while ensuring responsible resource development and successful reclamation.

Table of Contents

Executive Summary i

1.0 Introduction 1

1.1 Overview 1

1.2 Location and Land Ownership 1

1.3 History 2

2.0 Municipal Requirements 2

2.1 Zoning 2

2.2 Development Permit 3

2.3 Intermunicipal Development Plan 3

2.4 Road Use Agreements and Development Agreement 3

2.5 Public Consultation 4

3.0 Provincial Requirements 5

3.1 Alberta Environment and Protected Areas 5

3.1.1 Registration under the *Code of Practice for Pits* 5

3.1.2 Authorization under the *Water Act* 5

3.2 Alberta Culture, Multiculturism, and Status of Women 6

3.3 Alberta Transportation 7

3.3.1 Roadside Development Permit 7

3.3.2 Royalty Agreement 7

4.0 Existing Conditions 7

4.1 Existing Land Uses and Adjoining Land Use 7

4.2 Current Right of Way and Easements 7

4.3 Current Site Conditions 8

4.4 Topography and Drainage 8

4.5 Soils and Agricultural CLI 9

4.6 Geology 10

4.7 Stratigraphy 10

4.8 Surface Water 11

4.9 Groundwater 11

4.9.1 Neighbouring Water Wells 12

4.10 Vegetation 12
4.11 Wildlife 13
4.12 Traffic Impact Assessment 14
5.0 Project Operations 15
5.1 Intent and Need 15
5.2 Economic Benefit 16
5.3 Project Duration Timing 16
5.4 Transportation of Aggregate 16
5.4.1 Haul Route 16
5.4.2 Road Maintenance and Dust Control along Haul Route 17
5.4.3 Signage 18
5.5 Hours of Operation and Hauling 18
5.6 Project Development 19
5.6.1 Site Preparation and Infrastructure 19
5.6.2 Groundwater Recharge Pond 20
5.6.3 Sight and Sound Berms 21
5.6.4 Internal Haul Roads 22
5.7 Buffers and Setbacks 22
5.8 Vegetation Clearing 23
5.9 Soil Salvage 23
5.10 Extraction Sequence Plan 24
5.11 Importation of Fill Material 26
5.12 Water Management 27
5.12.1 Groundwater Water Management (Pit Dewatering) 27
5.12.2 Aquifer Restoration Plan 28
5.12.3 Groundwater Protection Plan 28
5.13 Surface Water Management 28
5.14 Aggregate Processing 29
5.15 Dust Control 29
5.16 Wind and Water Erosion Control 29

5.17 Noise Control....30
5.18 Environmental Management Practices....31
5.19 Waste Management....31
5.20 Fuel Storage....31
5.21 Complaint Response Policy....32
5.22 Site Security Plan....32
5.23 Weed Control....32
5.24 Clubroot Fungus Management....33
6.0 Conservation and Reclamation Plan....33
6.1 Proposed End Land Use....33
6.2 Direct Placement of Reclamation Material....33
6.3 Soil Replacement and Contouring....34
6.4 Revegetation....34
6.5 End Pit Waterbody Design Details....35
7.0 Reclamation Liability....36
8.0 References....37
9.0 Limitations....38

List of Tables

Table 1. Stratigraphy of the Alberta Beach Pit
Table 2. Landowners Along Haul Route
Table 3. Summary of Infrastructure Construction
Table 4. Summary of Mine Sequence Plan – Phase I
Table 5. Summary of Mine Sequence Plan – Phase II
Table 6. Summary of Mine Sequence Plan – Phase III
Table 7. Pasture Seed Mix for Agricultural Portion of Site

List of Appendices

Appendix A	Lac Ste. Anne County Development Permit Application
Appendix B	Certificates of Title &
Appendix C	EPEA Registration and *Water Act* Authorizations
Appendix D	Preliminary Development and Reclamation Plan (September 2011) Prepared by RoJaS Management Ltd.
Appendix E	Groundwater Review (December 2012) & Addendum to 2012 Groundwater Review (October 2025) Prepared by Hydrogeological Consultants Ltd.
Appendix F	Environmental Impact Assessment in Support of the Alberta Beach Granular Pit (November 2012) Prepared by Spencer Environmental management Services Ltd
Appendix G	Traffic Impact Assessment (December 2010) Prepared by EBA Engineering Consultants Ltd.
Appendix H	Noise Impact Assessment (July 2011) Prepared by Patching Associates Acoustical Engineering Ltd.
Appendix I	Alberta Beach Granular Pre-Disturbance Soil Characterization (June 2011) Prepared by Navus Environmental Inc.
Appendix J	Public Open House Report (October 2011) Prepared by Marcomm Work Public Consultation Public Consultation Summary (February 2026) Prepared by Aspen Land Group Inc.
Appendix K	Question and Responses from Lac Ste. Anne County
Appendix L	Conservation and Reclamation Drawings
Appendix M	Emergency Response Plan (February 2026)
Appendix N	ACIMS & FWMIT Search Results
Appendix O	Importation Management Plan

List of Drawings

Drawing No. 1-16	Location Plan
Drawing No. 2-16	Adjacent Land Uses
Drawing No. 3-16	Existing Features Showing Contours
Drawing No. 4-16	Soil Capability (CLI)
Drawing No. 5-16	Mine Sequencing Plan (Phases I-III)
Drawing No. 6-16	Mine Sequencing Plan (Phase I)
Drawing No. 7-16	Mine Sequencing Plan (Phase II)
Drawing No. 8-16	Mine Sequencing Plan (Phase III)
Drawing No. 9-16	Proposed Haul Route & Improvements
Drawing No. 10-16	Cross Section A-A – Existing & Reclaimed Conditions
Drawing No. 11-16	Cross Section B-B – Existing & Reclaimed Conditions
Drawing No. 12-16	Cross Section C-C – Existing & Reclaimed Conditions
Drawing No. 13-16	Cross Section D-D – Existing & Reclaimed Conditions
Drawing No. 14-16	Cross Section E-E – Existing & Reclaimed Conditions
Drawing No. 15-16	Cross Section F-F – Existing & Reclaimed Conditions
Drawing No. 16-16	Reclamation Plan

Revision History for 1531486 Alberta Ltd – Development Permit Renewal Application			
Revision No.	Date	Section No.	Details
1	March 3, 2026	Executive Summary	Inclusion of an Executive Summary.
1	March 3, 2026	1.1 Overview	Removal of redundant information now included in Executive Summary.
1	March 3, 2026	2.1 Zoning	Additional background for Redistricting Application. Minor editorial changes.
1	March 3, 2026	2.2 Development Permit	Reference to applicability of previously completed environmental studies. Minor editorial changes.
1	March 3, 2026	2.4 Road Use Agreements and Development Agreement	Inclusion of information regarding County Road Design for Range Road 33.
1	March 3, 2026	2.5 Public Consultation	Inclusion of 2025 Open House Information.
1	March 3, 2026	3.1.1 Registration under the *Code of Practice for Pits*	Additional permitting information. Update on current reclamation security.
1	March 3, 2026	3.1.2.4 Wetland Disturbance and Compensation	Confirmation no further assessments are required.

Revision History for 1531486 Alberta Ltd – Development Permit Renewal Application			
Revision No.	Date	Section No.	Details
1	March 3, 2026	4.4 Topography and Drainage	Reference to applicability of previously completed study.
1	March 3, 2026	4.5 Soils and Agricultural CLI	Reference to applicability of previously completed study.
1	March 3, 2026	4.8 Surface Water	Reference to applicability of previously completed study.
1	March 3, 2026	4.9 Groundwater	Inclusion of monitoring history and reference to 2025 Groundwater Addendum.
1	March 3, 2026	4.10 Vegetation	Reference to applicability of previously completed study.
1	March 3, 2026	4.11 Wildlife	Reference to applicability of previously completed study.
1	March 3, 2026	4.12 Traffic Impact Assessment	Inclusion of information regarding County Road Design for Range Road 33.
1	March 3, 2026	5.6.3 Sight and Sound Berms	Editorial changes to clarification berm construction.
1	March 3, 2026	5.6.4 Internal Haul Roads	Inclusion of use of reclamation material for sight and sound berms.

Revision History for 1531486 Alberta Ltd – Development Permit Renewal Application			
Revision No.	Date	Section No.	Details
1	March 3, 2026	5.17 Noise Control	Inclusion of additional measures committed to at the Public Hearing and during Public Consultation.
1	March 3, 2026	7.0 Reclamation Liability	Updated current financial security posted with AEPA.
1	March 3, 2026	8.0 References	Inclusion of HCL 2025 Addendum.
1	March 3, 2026	Appendix C	Inclusion of the 2025 Five Year Report
1	March 3, 2026	Appendix F	Inclusion of HCL 2025 Addendum.
1	March 3, 2026	Appendix L	Replacement of Drawing No. 6-16, 7-16, and 8-16, showing modified visual sound berms as per public consultation.
1	March 3, 2026	Appendix M	Updated to be consistent with LSAC LUB Requirements.

1.0 Introduction

1.1 Overview

1531486 Alberta Ltd. is applying to renew Development Permit 193193-13-D0019 under Land Use Bylaw No. 22-2017 for the development of the Alberta Beach Pit, an aggregate pit located within the N 33 and SW 34-053-03 W5M (the Site) within Lac Ste. Anne County. Aspen Land Group Inc. (Aspen) has been retained by 1531486 Alberta Ltd. to prepare this application to support the renewal. Pit operations at the Site will include soil salvage and stockpiling, mining of aggregate (i.e., sand, gravel, and clay), crushing, screening and washing of aggregate, asphalt production, hauling of product, and reclamation activities. Aggregate products (i.e., sand, gravel, clay, and asphalt) will be hauled south on Range Road 33 to Highway 16 and then to market. Sight and sound berms will be constructed along the pit boundary to maintain area aesthetics and minimize noise impact to adjacent residents.

An area of approximately 63.61 ha will be mined over the life of the pit and an additional 64.24 ha is required for associated operations such as processing and stockpiling of both aggregate and reclamation material. As a result, a total area of approximately 127.84 ha will be disturbed to develop and mine the Site. Due to the installation of the West Inter Lake District (WILD) Water Commission water pipeline in the undeveloped road allowance of Township Road 540 and Range Road 34, the Site boundary has been reduced from the previously permitted boundary to remove and to ensure an appropriate setback from the water pipeline. The area removed is shown on Drawing No. 3-16 located within Appendix L. All sand and gravel material will be processed on location at the wash plant or crushing plant sites located within the Site. The Site is anticipated to operate for approximately 23 years and will be reclaimed back to agriculture land use with two end pit waterbodies and one seasonal low area.

Since the issuance of Development Permit No. 1931393-13-D0019, 1531486 Alberta Ltd. has received all required authorizations from Alberta Environment and Protected Areas (AEPA) for the operation. This includes *Code of Practice for Pits* Registration No. 00325413-00-00 and *Water Act* authorizations – Approval No. 0325508-00-00, Approval No. 00325510-00-00, and Licence No. 00325507-00-00. The registration and *Water Act* authorizations were issued on October 21, 2015 and March 8, 2018, respectively. Aside from development of the Site access, no mining activity has been initiated at the Site since receipt of the development permit.

1.2 Location and Land Ownership

The Site is located within Lac Ste. Anne County within the N 33 & SW 34-053-03-W5M as shown in Drawing No. 1-16 and 2-16. The NW 33 and SW 34-053-03-W5M are owned by 1531486 Alberta Ltd. and the NE 33-053-03-W5M is owned by Donald, Joyce, and Duane Drews. The Site is located on private land,

approximately five kilometers south of Alberta Beach, adjacent to Township Road 540 and Range Road 33. Copies of the Certificates of Titles for the project are located in Appendix B.

1.3 History

On May 26, 2011, Lac Ste. Anne County's Subdivision and Development Appeals Board upheld the Appeal of Development Permit No. 193193-13-D0019 with conditions. Following this, 1531486 Alberta Ltd. received the necessary authorizations from Alberta Environment and Parks (now Alberta Environment and Protected Areas (AEPA)). However, operational constraints, including administrative delays stemming from disruptions caused by the COVID-19 pandemic, prevented 1531486 Alberta Ltd. from initiating mining of the Site following the issuance of registration. As a result, the proposed development of the Site remains relatively consistent from those documented at the time of the initial issuance of Lac Ste. Anne Development Permit No. 193193-13-D0019.

The Site has received *Code of Practice for Pits* Registration No. 00325413-00-00, on October 21, 2015, and multiple *Water Act* authorizations on March 8, 2018. *Water Act* Approval No. 00325508-00-00, permits the disturbance of 5.51 hectares of wetlands within the project area. *Water Act* Licence No. 00325507-00-00, allows for the diversion of up to 2,970,000 cubic meters of groundwater annually from an aquifer associated with the project for aggregate washing. Further, *Water Act* Approval No. 00325510-00-00, permits the construction of a temporary recharge pond hydraulically connected to the aquifer at the Site and the recirculation of up to 147,030 cubic meters of groundwater annually. *Water Act* Approval No. 00325511-00-00, authorizes the construction of end pit water bodies upon project completion. These approvals remain in effect until March 7, 2028. Refer to Appendix C for copies of the authorizations.

2.0 Municipal Requirements

2.1 Zoning

Sand and gravel extraction and processing activities to be located within the "AR -Aggregate Resource Extraction and Aggregate Resource Processing District" under the current Lac Ste. Anne County Land Use Bylaw. Under the current Land Use Bylaw, the N 33 and SW 34-053-03-W5M associated with the Site are zoned as Agricultural District (AG1). At the time of issuance of Development Permit No. 193193-13-D0019, the land was zoned Agricultural District 'A', where natural resource extraction and processing was considered a discretionary use. Changes to the requirement in the Land Use Bylaw to redistrict the land to AR – Aggregate Resource Extraction and Aggregate Resource Processing District followed the decision to issue Development Permit No. 193193-13-D0019. After the initial submission of the Development Permit renewal application, Lac Ste. Anne County administration advised that a redistricting application was required. As a result, a redistricting application was submitted on May 23, 2025. Following the second reading to Bylaw 22-2017-04-2025, additional information was requested by Lac Ste. Anne County Council

to support the redistricting application, which included the request for information provided in this development permit renewal application.

2.2 Development Permit

A valid development permit for aggregate resource extraction and processing is required, as outlined in Land Use Bylaw No. 22-2017. While 1531486 Alberta Ltd. currently holds Development Permit No. 193193-13-D0019, the permit specifies an expiry date of May 2025 (marking ten years from issuance). An application for a development permit for the continued operation is included in Appendix A. Information requirements set out in Land Use Bylaw No. 22-2017 for the application are included in this report, including the environmental assessment information. A majority of the assessments remain relevant to the operations and do not require updates, where applicable, updates have been included within in this package.

Given the scope and anticipated duration of the proposed operations, 1531486 Alberta Ltd. requests that the development permit be issued for a term of 10 years, in order to provide stability and continuity for long-term planning for the project.

As per the Land Use Bylaw a pre-application meeting was held with the Development Authority on December 1, 2024, to discuss the application.

2.3 Intermunicipal Development Plan

The Site is located within 800 m of the municipal boundary between Lac Ste. Anne County and Parkland County. As a result, the Intermunicipal Development Plan (IDP) outlines the shared objectives of both municipalities as it pertains to the development. The IDP indicates that both municipalities acknowledge that natural resources are an integral part in development of their Counties and they will ensure the development of natural resource areas while ensuring transportation networks are not unduly restricted.

Under the IDP, Lac Ste. Anne County will oversee Site operations along with managing haul routes and road maintenance on their municipal roads while Parkland County will manage the haul route and road maintenance on their municipal roads. The Site will be developed in accordance with all standards stipulated by the IDP and fulfill requirements outlined by both Lac Ste. Anne and Parkland County. Given the haul route to the Site is through Parkland County, a road use agreement will be required with Parkland County in addition to Lac Ste. Anne County.

2.4 Road Use Agreements and Development Agreement

Prior to commencement of operations, 1531486 Alberta Ltd. will enter into a development agreement with Lac Ste. Anne County, under separate cover.

As outlined in Section 5.4 and shown on Drawing No. 9-16 of this report, aggregate material will be hauled south along Range Road 33 to Highway 16. The proposed haul route will pass through both Lac Ste. Anne and Parkland County. 1531486 Alberta Ltd. does not currently hold any aggregate haul agreement or a road use agreement with either Lac Ste. Anne County or Parkland County as such, a haul or road use agreement will be obtained from both Lac Ste. Anne County and Parkland County prior to operations.

As per Lac Ste. Anne County Policy No. 313-8: Road Upgrades Regarding Natural Resource Extraction and Processing Development Permit, a developer is to "base and pave all roads that have been approved as the Haul Route". However, it is understood that Lac Ste. Anne County has completed the engineered road design to upgrade Range Road 33 from Parkland County to the Village of Alberta Beach, and that the road design accounted for aggregate development and production in the area. While the date of construction of Range Road 33 upgrade is uncertain, 1531486 Alberta Ltd. is prepared to enter into a Road Use Agreement and/or Development Agreement that would address Policy No. 313-8 accordingly.

2.5 Public Consultation

Marcomm Works was retained by 1531486 Alberta Ltd. to develop information material and organize and facilitate an open house for local residents regarding the project. A copy of Marcomm Works' Public Open House Report (2011) is located in Appendix J. The scope of the consultation was to include any area residents who may be interested in knowing more about the development application. Consultation was conducted by holding an open house and distributing information materials. The result of consultation revealed that while a few people objected to the development proceeding, most were simply seeking more information or had specific issues that they wanted addressed as part of the development going ahead. Most of the concerns were related to groundwater and truck traffic to and from the proposed Site.

In order to renew Development Permit 193193-13-D0019 under Land Use Bylaw No 22-2017, an amendment to the Land Use Bylaw was required to re-district the lands. While Lac Ste. Anne County Administration originally indicated that the previous public consultation in 2010 was adequate, Counsel requested additional consultation following second reading of the Land Use Bylaw Amendment. 1531486 Alberta Ltd. mailed 206 invitations and project information, and the Open House was held on December 2, 2025, from 2:00 to 4:00 pm. Similar to the initial open house most were simply seeking more information or had specific issues that they wanted addressed as part of the development going ahead. Most of the concerns were related to groundwater and the use and condition of Range Road 33 proposed for the haul route to and from the proposed Site. A summary of the 2025/2026 consultation has been provided in Appendix J.

3.0 Provincial Requirements

3.1 Alberta Environment and Protected Areas

3.1.1 Registration under the *Code of Practice for Pits*

Under the *Code of Practice for Pits* (the Code), all pits that result in a disturbance of 5.0 ha or larger require a registration. The Site is currently registered under Registration No. 00325412-00-000, issued on October 21, 2015 for the construction, operation and reclamation of the pit. No portions of the project are located on public lands. Areas subject to the registration include the sections to be disturbed and utilized for aggregate extraction (sand, gravel and clay), stockpiling, and infrastructure development.

As part of the Code, a Five Year Report is to be submitted every five years from the date of registration. The Five Year Report for the reporting period of 2020-2025, was submitted on September 9, 2025. A copy of the Five Year Report has been included within Appendix C.

Reclamation security in the amount of $836,728.62 was posted to AEPA (formerly Alberta Environment and Parks) in fall of 2025, following the review of the Five Year Report.

3.1.2 Authorization under the *Water Act*

3.1.2.1 Pit Dewatering

To facilitate mining, there will be a need to divert pit water from the individual mining blocks (MB) during mining operations. Current authorizations allow for pit water to be managed on site. Based on a groundwater review conducted by Hydrogeological Consultants Ltd. (HCL) in support of the proposed Alberta Beach Pit (Appendix E), it has been concluded that pumping water at the Site may impact the available drawdown for three water wells located on the Franczak property in the SE 33-053-03 W5M, within 200 metres of the nearest mining area. To mitigate this impact, authorization to construct an on-site temporary recharge pond, *Water* Act Approval No. 00325510-00-00, was issued on March 8, 2018 (Appendix C). For further details with respect to dewatering methodology please refer to Section 5.11.

Should dewatering methodology change to include off-site dewatering, an application under the *Water Act* will be made. No water will be diverted off-site without the appropriate authorization.

3.1.2.2 Aggregate Washing

Approximately 25% of the extracted aggregate will initially be washed onsite at a stationary wash plant in the NW 33-053-03 W5M. *Water Act* Licence No. 00325507-00-00 was issued on March 8, 2018 to provide groundwater to the wash plant for aggregate washing. A copy of this licence is included in Appendix C.

3.1.2.3 Waterbodies

Once operations are complete the Site will be reclaimed back to an agriculture land use with two waterbodies and one seasonal low area. *Water Act* Approval No. 00325511-00-00 was issued on March 8, 2018 under the *Water Act* to construct the two waterbodies; a copy of this approval is included in Appendix C. It is estimated that the seasonal low area will have a capacity of approximately 2,450 m^3 and therefore a seasonal low area of this size does not require *Water Act* approval.

3.1.2.4 Wetland Disturbance and Compensation

An Environmental Impact Assessment was conducted in support of the project by Spencer Environmental Management Services Ltd. (Spencer). As a result of Spencer's assessment, a total of 47 wetland plant community sites covering an area of 67.05 ha were identified within the N 33 and SW 34-053-03 W5M. Approximately 5.51 ha consisted of mineral wetlands located within the Site boundary. Therefore, 1531486 Alberta Ltd. is responsible for 5.51 ha of wetland compensation. A copy of Spencer's Environmental Impact Assessment report (2011) is located in Appendix F.

1531486 Alberta Ltd. has compensated for the loss of wetland with the in-lieu wetland replacement fee process in the amount required for the disturbance of 5.51 ha of wetlands. *Water Act* Approval No. 00325508-00-00 was issued on March 8, 2018 under the *Water Act* for the disturbance of 5.51 ha of wetlands; a copy of this Approval is included in Appendix C.

Since there is a valid authorization issued under the *Water Act* for disturbances to wetlands, further assessment of wetlands is not required.

3.2 Alberta Culture, Multiculturism, and Status of Women

The Listing of Historical Resources identifies lands that contain or are believed to contain historical resources, and primarily include archaeological and paleontological sites, Aboriginal traditional use sites of a historic resource nature, and historic structures. The Alberta Historical Resources Act (HRA) may require proposed activities likely to threaten the integrity of a historical resource to be preceded by a Historical Resources Impact Assessment (HRIA). Based on the Listing of Historic Resources (Fall 2024 Edition) there are no historical resources listed for the Site or surrounding lands but HRA clearance is required for all surface material operations that are larger than 5.0 ha.

Since the submission of the original development permit application, Alberta Culture, Multiculturism, and Status of Women released the Online Permitting and Clearance (OPAC) to obtain clearance. 1531486 Alberta Ltd. will submit an application for clearance prior to development. 1531486 Alberta Ltd. will follow the recommendations issued in their Letter of Clearance. A copy of the letter will be provided to Lac Ste. Anne County upon receipt.

3.3 Alberta Transportation

3.3.1 Roadside Development Permit

An Alberta Roadside Development Permit (RSDP) is required for operations located within 300 metres of a provincial highway or within 800 metres of a highway intersection. As the Site is situated 4.24 km from Highway 633, it falls outside these regulated boundaries and an RSDP is not required for the operation.

3.3.2 Royalty Agreement

The previously permitted boundary included activities for the extraction of material beneath the undeveloped portion of Township Road 540 and disturbance of the undeveloped portion of Range Road 34. 1531486 Alberta Ltd. had entered into a royalty agreement with Alberta Transportation for the aggregate within the undeveloped road allowances, that expired in December 2025.

It should be noted that a water pipeline operated by the WILD Water Commission was installed in 2021 after the 1531486 Alberta Ltd. received the development permit for the Site. The water pipeline runs parallel to Township Road 540 and south along Range Road 34. As shown on Drawing No. 3-16, the pit boundary has been adjusted to avoid impacting the pipeline. As a result, extraction activities will no longer be proposed within the Township Road 540 allowance, therefore a royalty agreement with Alberta Transportation is no longer required.

4.0 Existing Conditions

4.1 Existing Land Uses and Adjoining Land Use

The Site is currently used primarily for pasture and annual crops with forested areas located in patches throughout the Site. The land surrounding the Site for 3.2 km within Lac Ste. Anne County is primarily within the Agricultural '1' District (AG1), other lands fall within Agriculture '2' District (AG2) and various country residential districts such as the County Land District (CL), Existing County Residential District (CRX), Country Residential Ranch District (CRR), and/or Country Living Residential District (CLR). Land surrounding the Site for 3.2 km within Parkland County is located within the Agriculture General District (AGG), Country Residential District (CR) and Resource Extraction District (RE). There are a number of farmsteads and small holdings in addition to one country residential development (Greentree Estates) located within 3.2 km of the Site. Existing and adjoining land uses within Lac Ste. Anne County is shown on Drawing No. 2-16.

4.2 Current Right of Way and Easements

There is one easement located on the Site. A Ste. Anne Natural Gas Co-op (Co-op) pipeline located within the N 33-053-03 W5M provides natural gas to rural dwellings in the close vicinity and is shown on Drawing

No. 3-16. Prior to encroaching the pipeline, 1531486 Alberta Ltd. will approach the Co-op and establish the required agreements, as portions of the pipeline may be relocated prior to any encroachment.

Since the Site was permitted, WILD Water Commission installed a water pipeline within the undeveloped right-of way of Township Road 540 and Range Road 34 (as shown on Drawing No. 3-16). Through discussions with WILD Water Commission, they view the undeveloped road allowance as the water pipeline's right-of-way. Given this, the pit boundary has been adjusted to avoid impact to the pipeline; all operations will be setback 10 m from right of way Township Road 540 and Range Road 34 (as shown on Drawing No. 3-16). A proximity agreement is not anticipated to be required given the 10 m setback; however, if required, 1531486 Alberta Ltd. will enter into one under separate cover.

There is also a communication tower located in the northeast corner of the NE 33-053-03 W5M outside of the Site boundary.

4.3 Current Site Conditions

As outlined in Section 1.3, due to economic constraints and delays following the registration of the pit, no mining has occurred within the boundary since the original issuance of Development Permit No. 193193-13-D0019. The previous studies and technical reports prepared remain relevant to the Site and proposed operations. Summaries of these reports are provided in the following sections and copies of these reports are located in the attached appendices. Additional information communicated through the previous permitting process has been incorporated into the following sections and is provided in Appendix K.

4.4 Topography and Drainage

A pre-disturbance soil survey conducted by Navus Environmental Inc. (Navus) between May 31 and June 1, 2011, confirmed that the site is predominantly level, with slopes ranging from 0.5% to 2%. Some areas were identified as gently undulating, with slopes of 2% to 5%. No evidence of erosion, such as rills or gullies, was noted at any of the assessment points, and ponding was observed in low-lying areas with organic soils. Contours of the Site are shown on Drawing No. 3-16.

The surface of the Site is generally sloped toward the north with an elevation difference of seven metres across the Site. The only clearly defined drainage channel on the Site appears to originate from the permanent waterbody located within the southeast corner of the NE 33-053-03 W5M from which surface water flows toward the dugout and continues north within a ditch that has been constructed/improved to the northeast corner of the NE 33-053-03-W5M.

As there has been no major disturbances to the landscape since the assessment or acquisition of the data, Navus's findings remain relevant.

4.5 Soils and Agricultural CLI

The soil survey conducted by Navus implemented a survey intensity level of one assessment point per hectare for topsoil and a survey intensity level of one assessment point per two hectares for subsoil. A copy of Navus' Pre-Disturbance Soil Characterization Report is included in Appendix I.

A total of 192 sample locations were assessed. 115 sample locations contained mineral topsoil. Mineral topsoil was dominantly loam textured, had a friable consistence and granular structure and was moist, with depths ranging from 10 cm to 50 cm with a mean of 22 cm. The dominant color of the mineral topsoil was very dark brown (10YR 2/2). Mineral topsoil depths were generally deeper in low lying areas, near fence lines and edges of the forested areas. Shallower mineral topsoil depths were observed on hill tops and on the sides of hills.

Organic soil was found at 75 sample locations. Organic soils were found in relatively level areas that were forested (black spruce and tamarack) or used for pasture. The depth of organic soil varied from 30 cm to 200 cm. 21 sample points had depths recorded to only 120 cm; at these sample point locations the actual depth would vary between 120 cm and 200 cm. The average organic soil depth was 102 cm, calculated using 120 cm as the total depth for assessment points with depth ranges recorded as 0 to 120+.

Subsoil (the B-horizon) was dominantly clay loam textured, had a friable consistence and subangular blocky structure and was moist with depths ranging from 10 cm to 110 cm with a mean of 61 cm. The dominant color of the subsoil ranged between light brownish gray to dark grayish brown (10 YR 6/2 to 10YR 4/2, respectively).

The Canada Land Inventory (CLI) soil capability for agriculture for the Site consists of three different classes. Portions of the Site is classified as Class 0 which consist of organic soils and are not placed in a capability class. Portions of the Site is classified as Class 3, which have moderately severe limitations that restrict the range of crops or require special conservation practices. The remainder of the Site is classified as Class 4, which have severe limitations that restrict the range of crops or require special conservation practices or both.

The proposed development area is mapped within two AGRASID units, identified as COA19/H1I and GSUC6/U1h under the AGRASID model (ASIC 2019). These units encompass the northern and southern extents of the pit area and are composed of low-relief upland hummocky Dark Gray Luvisol soils on medium-textured (L, CL) till, noted to be well-drained.

As there has been no major disturbances to the landscape since the assessment or acquisition of the data, Navus's findings remain relevant.

4.6 Geology

Surficial deposits within the area are primarily composed of till, although pockets of sand or gravel deposits are present. The thickest sequences of sand or gravel deposits are typically associated with thalwegs of linear bedrock lows. One such linear bedrock low, identified as the Buried Beverly Valley, trends southwest to northeast and is located approximately 20 km southeast of the proposed development (Carlson, 1971). A second linear bedrock low, the Onoway Buried Valley, is located approximately 10 km north to northwest of the proposed development.

The upper bedrock at the Site is of the Upper Cretaceous Scollard Formation of the Edmonton Group, which consists mainly of non-marine sandstone, mudstone and coal units. The partially eroded Scollard Formation is typically less than five metres thick in the area of proposed development and overlies two minor units, the Battle Formation and the Whitemud Formation. The Kneehills Zone of the Battle Formation was used by Green (1982) as a marker bed for contouring the surface of the Edmonton Group. The mainly non-marine sandstones, mudstones and shales of the Horseshoe Canyon Formation underlie the Whitemud Formation at the Site.

4.7 Stratigraphy

The stratigraphy of the Site is shown in Table 1 and on Drawing No. 10-16 to Drawing No. 15-16. A total of 43 test holes were advanced at the Site to determine the extent of overburden and gravel. Surface soil stratigraphy shown in Table 1 is based on the soil survey conducted by Navus. A copy of Navus' Pre-Disturbance Soil Characterization report is included in Appendix I.

The Site is underlain by an aggregate deposit, but in many locations the aggregate is covered with too much overburden to be economically extracted in the foreseeable future. To determine the areas on the Site from which aggregate can economically be extracted, an overburden to aggregate ratio of 3:1 was used, meaning that any area with an overburden to aggregate ratio of greater than 3:1 was deemed uneconomical to extract and was not included in the mining plan.

Table 1. Stratigraphy of the Alberta Beach Pit

Soil Layer	Average Depth (m)	Minimum Depth (m)	Maximum Depth (m)
Topsoil (Mineral)	0.22	0.10	0.50
Topsoil (Organic)	1.02	0.30	2.00
Subsoil	0.61	0.10	1.10
Overburden	13.00	9.00	20.00
Sand and Gravel	6.00	4.00	7.00

4.8 Surface Water

Based on the Environmental Impact Assessment report prepared by Spencer (Appendix F), there are no permanent watercourses or waterbodies present within the Site. Two permanent waterbodies are located immediately adjacent to the Site, one in the southeast corner of NE 33-053-03 W5M and another in the northwest corner of SW 34-053-03 W5M.

A total of 47 wetland plant community Sites covering an area of 67.05 ha were identified by Spencer within N 33 and SW 34-053-03 W5M. Of this, 5.03 ha consists of mineral wetlands within the Site boundary. Depending on climatic conditions and annual precipitation totals, wetlands may contain surface water for as little as two weeks following spring snowmelt, or may hold surface water into the fall and even through to winter freeze up. Wetlands within the Site receive their water either from surface water flow within individual local catchments and/or groundwater sources.

As there has been no major disturbances to the landscape since the assessment or acquisition of the data, Spencer's findings remain relevant.

4.9 Groundwater

HCL was retained to conduct a Groundwater Review at the Site, since the completion of their initial 2012 groundwater review, HCL has been monitoring the groundwater regime at the Site. No changes have occurred in the state of the local groundwater table or drainage patterns since the initial permitting of the Site. HCL prepared an addendum to their 2012 Groundwater Review in 2025 which includes analysis of the monitoring data collected over the years. A copy of the initial Groundwater Review Report and their Addendium have been included in Appendix E.

The objective of the initial report was to determine:

- The expected quantity of groundwater to be removed from mining pits;
- The most probable impacts the proposed gravel mining will have on the local hydrogeology; and
- Any local groundwater users who may be adversely affected by the proposed gravel extraction.

The proposed gravel mining operation involves dewatering of the pits. A portion of the diverted groundwater will be used for gravel washing. Excess groundwater will flow back into the aquifer through recharge pits, as shown in Drawing No. 5-16. Dewatering is expected to divert approximately 60,000 m^3/year to 150,000 m^3/year of groundwater. On average, 22 m^3/day of groundwater is expected to be lost due to evaporation and adhesion to gravel product, with the remainder returned to the aquifer via recharge pits. This net loss of groundwater is not anticipated to adversely affect the aquifer or nearby water wells.

Groundwater at the Site flows from the southeast to the northwest. Once the sand and gravel aquifer is removed and replaced with less permeable material, groundwater flow through the area will be reduced, potentially causing localized mounding of groundwater upgradient from the mined area. However, this mounding is not expected to cause adverse effects outside the development area.

As previously mentioned, HCL has been monitoring the groundwater regime since receiving authorization under the *Water Act* and monitoring efforts will continue throughout the operation's lifespan. Groundwater diversions will be monitored as per the *Water Act* Authorizations and HCL recommendations.

4.9.1 Neighbouring Water Wells

The nearest water wells to the Site are located on the Franczak property in SE 33-053-03 W5M within 200 metres of the nearest mining area. The available drawdown in these wells ranges from 7.9 to 12.7 metres and a temporary drawdown of up to four metres represents a maximum decline of 50% of the available drawdown. 1531486 Alberta Ltd. has committed to supplying the Franczak's with water should their well be temporarily impacted by dewatering operations.

Should water well supply be negatively impacted, 1531486 Alberta Ltd. will provide a temporary alternate supply of water within 24 hours and hire an external consultant within 14 days to determine the cause of the problem. 1531486 Alberta Ltd. will provide an alternate water supply if the problem is identified to be due to the mining operation. Further information regarding the impact of dewatering on surrounding water users is discussed in the HCL Groundwater Review report located in Appendix E.

4.10 Vegetation

The Site is located within the Dry Mixedwood Subregion of Alberta; the dominant native vegetation of the Dry Mixedwood Subregion is aspen forests with fens commonly occurring in low-lying areas (Natural Regions Committee, 2006). Sites of average moisture and nutrients in the southern portion of the Dry Mixedwood Subregion typically support understories of beaked hazelnut, prickly rose, wild sarsaparilla, cream-coloured vetchling, purple peavine and bluejoint. Poorly drained sites support a variety of bog and fen communities with treed and shrubby fens being the most common. Moist, rich sites typically host balsam poplar, aspen poplar and white spruce stands, either as pure or mixed stands. Cultivated landscapes are typical throughout this region.

The majority of the Site is currently used for pasture and annual crops with forested areas and wetlands occurring throughout the Site. Five deciduous woodlands and one mixed woodland were identified as a part of Spencer's biophysical and wetland assessment. Woody vegetation within these woodlands consisted of aspen poplar, balsam poplar, white spruce and Alaskan birch. Common shrub species noted included prickly rose, red-osier dogwood, northern gooseberry and wild raspberry. Further information

regarding woodlands and wetlands species found within the Site is discussed in Spencer's report (Appendix F).

Wetlands are noted to support 192 plant species as described in Spencer's biophysical and wetland assessment; of those, 23 were non-native species including orange hawkweed, which is designated as Prohibited Noxious and Canada thistle, tall buttercup and white cockle, which are designated as Noxious by Alberta's Weed Control Act Regulations (2010). Common dandelion was also prevalent throughout the study area. Further information regarding non-native plant species found within the Site is discussed in Spencer's report (Appendix F).

As there has been no major disturbances to the landscape since the assessment or acquisition of the data, Spencer's findings remain relevant.

A search of Alberta Parks' Alberta Conservation Information Management System (ACIMS) was conducted in January of 2025, to identify any known sensitive vegetation species within the N 33 and SW 34-053-03 W5M. No element occurrences were identified since the site was previously permitted. A copy of the search results is provided in Appendix N.

4.11 Wildlife

Wildlife was also assessed as a part of Spencer's biophysical and wetland assessment. A total of 30 bird species were identified; the more common species being the chipping sparrow, Swainson's thrush, song sparrow, red-eyed vireo, clay-coloured sparrow and savannah sparrow. Mammals likely found at the Site include coyotes, white-tailed deer, moose, snowshoe hare, porcupine, northern pocket gopher, deer mouse, meadow vole and Richardson's ground squirrel. Surveys recorded three species of amphibians including the wood frog, boreal chorus frog and western toad

Four special status species were observed during the course of fieldwork completed by Spencer in support of the biophysical and wetland assessment. These species included one amphibian, the western toad, and three bird species, including the barn swallow, common yellowthroat and sora. The western toad is listed provincially as Sensitive and federally as a species of Special Concern. The barn swallow is listed provincially as Sensitive and federally as Threatened. The common yellowthroat is listed provincially as Sensitive and is not listed federally. The sora is listed provincially as Sensitive and is not listed federally. As noted in Spencer's report two of the four special status species, common yellowthroat and sora were located outside the proposed impact area. Although the barn swallow and western toad were found within the proposed impact area, the habitat quality within impacted areas is mostly rated as low due to agricultural activities in the area. Further information regarding wildlife and special status species is outlined in Spencer's report located in Appendix F.

A search on the Fish and Wildlife Internet Mapping Tool (FWIMT) was completed in January of 2025, in order to determine the presence of any known and/or sensitive wildlife species in the area. The tool identified the fish inventory as Arctic Grayling, Longnose Sucker, and Mountain Whitefish in the area. As no fish habitat will be disturbed by operations, no impacts to fish are anticipated. No sensitive, at risk, or endangered species were identified for the Site. A copy of the search results is provided in Appendix N.

As there has been no major disturbances to the landscape since the assessment or acquisition of the data, Spencer's findings remain relevant.

4.12 Traffic Impact Assessment

EBA Engineering Consultants Ltd. (EBA) was retained by 1531486 Alberta Ltd. to prepare a Traffic Impact Assessment (TIA) to determine the impact traffic generated from the proposed gravel pit operation is expected to have on roads within Lac Ste. Anne County and Parkland County. The TIA also considers the cumulative impact of an adjacent development operated by Heidelberg Materials Canada Limited, formerly Inland Aggregates Limited (Inland), is expected to have on the roadway network. A copy of EBA's TIA report (2010) is located in Appendix G.

The results of the TIA revealed the following expected traffic impacts as a result of traffic generated from the proposed gravel pit operation and the adjacent Inland gravel pit operation:

- On the westbound approach at the intersection of Highway 16 and Range Road 33, the right turn parallel deceleration lane is warranted for 2023 traffic from either of the gravel pit operations, by 1531486 Alberta Ltd., or Inland, combined with the background traffic independently as well as for 2032 traffic from both gravel pit operations combined with background traffic. The existing right turn parallel deceleration lane tapers are below the requirements for this warranted treatment according to Alberta Transportation's (AT) Highway Geometric Design Guide.
- After commencement of the gravel pit operations, the critical movement at the intersection of Highway 16 and Range Road 33 is predicted to operate at a Level of Service B on the southbound approach in 2012. This considers additional traffic from both 1531486 Alberta Ltd. and Inland developments combined with the background traffic.
- The operation of this intersection is predicted to deteriorate to a Level of Service C with average approach delays over 15 seconds per vehicle on the southbound approach of the intersection in the 2032 horizon year with the addition of traffic from the gravel pit operation by 1531486 Alberta Ltd. or from the Inland gravel pit operation, independently or with the additional traffic from both the developments combined with the background traffic. This slight increase in delay is attributed to the additional southbound traffic from the gravel pit operations accessing the intersection to turn left and travel in the eastbound direction, as well as the higher volumes on Highway 16 which is expected to reduce the number of gaps available in the traffic flow.

Based on the TIA, the following improvements were required at the time:

- It is recommended that the right turn and left turn parallel lanes and tapers on the eastbound and westbound approaches on Highway 16 at the intersection with Range Road 33 be repaired to meet appropriate AT guidelines. This could be achieved within the existing pavement width and could be completed within AT's regular maintenance program.
- In order to permit hauling operations along Range Road 33 within Lac Ste. Anne County, Range Road 33 is required to have a minimum width of 8.0 m. As the existing width is below this requirement, this road should be widened.
- Parkland County requires a minimum width of 9.0 m along local roads to permit hauling operations. As portions of the existing width is below this requirement, this road should be widened.

Since the Development Permit was received, portions of Range Road 33 were upgraded. In addition to these upgrades, it is understood that Lac Ste. Anne County has completed the engineered road design to upgrade Range Road 33 from Parkland County to the Village of Alberta Beach, and that the road design accounted for aggregate development and production in the area. Therefore the previous prepared TIA is outdated. However, with the date of construction of Range Road 33 upgrade is uncertain, completion of another TIA is redundant. 1531486 Alberta Ltd. understands that the conditions of any Development Permit would require an Industrial Haul Route Agreement from both Parkland County and Lac Ste. Anne County prior to operation. 1531486 Alberta Ltd. requests that if a TIA is warranted prior to operations, it be written as a condition to be completed before operations commence, this would ensure that the TIA is reflective of the road conditions and uses at the time of development.

As per Lac Ste. Anne County's Policy 'Road Upgrades Regarding Natural Resource Extraction and Processing Development Permits'; prior to operations 1531486 Alberta Ltd. is prepared to enter into a Industrial Road Use Agreement that includes the required upgrades, along the approved haul route outlined on Drawing No. 9-16, as required.

5.0 Project Operations

5.1 Intent and Need

1531486 Alberta Ltd. intends to develop a 127.84 ha area for aggregate extraction and processing that is located approximately 55 km west of Edmonton.

The operation is planned to proceed in three mining phases, covering approximately 63 ha of extraction area, with an estimated total sand and gravel resource of 6.1 million tonnes. The pit is expected to operate for approximately 23 years, with anticipated production rate averaging 300,000 tonnes annually. In recent years, there has been an increase in demand for high quality clean clay material, as such, 1531486 Alberta

Ltd. is proposing to include clay extraction from the 63 ha extraction area to sell as product and import fill material to off-set the extraction of clay for reclamation. Site activities will include topsoil and subsoil stripping, overburden removal, extraction of sand, gravel, and/or clay, processing of sand and gravel (crushing, washing, and sorting), and reclamation. Sight and sound berms will be constructed as a visual and noise buffer.

Extraction will occur progressively, with active mining phases and areas kept to a minimum, ensuring that no portion of the Site remains inactive and un-reclaimed for extended periods. Progressive reclamation will be implemented throughout operations. Final reclamation will result in the land being returned to agricultural use with the creation of two end pit waterbodies and a seasonal low area.

5.2 Economic Benefit

Through the Community Aggregate Payment Levy Regulation, Lac Ste. Anne County could receive up to $120,000 per year (300,000 tonnes at $0.40/tonne) or approximately $2.44 million over the life of the project. This levy is over and above property taxes and subject to the requirements within the *Municipal Government Act*.

5.3 Project Duration Timing

Once the Site is opened, aggregate is anticipated to be extracted and processed from the Site for approximately 23 years, based on market demand. Despite receiving EPEA Registration No. 00325413-00-00 and Lac Ste. Anne County DP No. 193193-13-D001, operational constraints, including administrative delays stemming from disruptions caused by the COVID-19 pandemic, prevented 1531486 Alberta Ltd. from initiating operations. Site operations are highly dependent on market need within the area.

5.4 Transportation of Aggregate

5.4.1 Haul Route

Product aggregate will be hauled from the property first along internal haul roads and will then exit the Site on to Range Road 33, as shown on Drawing No. 5-16 and 9-16. The product will be hauled south to Highway 16 and the majority of trucks will proceed east to the Edmonton area. The proposed haul route will pass through both Lac Ste. Anne and Parkland County. A haul or industrial road use agreement will be obtained from both Lac Ste. Anne County and Parkland County prior to operations.

A truck scale will be installed in the southeast corner of the NE 33-053-03 W5M along the internal haul road and near the approach onto Range Road 33. Adequate space for truck parking or staging will be provided on the Site so trucks will not have to stop and park on municipal roads. Based on current production values it is estimated that an average of 67 trucks will be hauling daily over the course of the

year; however, it is anticipated truck numbers will increase during periods of peak demand. As market demand in the area increases, it is anticipated the number of trucks hauling daily will increase. The landowners located along the haul route are shown in Table 2.

Table 2. Landowners Along Haul Route	
Location	**Landowner**
Lac Ste. Anne County	
NE 33-053-03 W5M	D. & E. Drews
NW 34-053-03 W5M	1531486 Alberta Ltd.
SE 33-053-03 W5M	D. Franczak
SW 33-053-03 W5M	D. Franczak
SW 34-053-03 W5M	1531486 Alberta Ltd.
Parkland County	
NE 28-053-03 W5M	L. Astleford
NW 27-053-03 W5M (N 1/2)	L. Astleford
NW 27-053-03 W5M (S 1/2)	B & F. Stell
SE 28-053-03 W5M	Lehigh Hanson Materials Ltd.
SW 27-053-03 W5M	Lehigh Hanson Materials Ltd.
NE 21-053-03 W5M	Lehigh Hanson Materials Ltd.
NW 22-053-03 W5M	MWC Investments Inc.
SE 21-053-03 W5M	Tricycle Lane Ranches Ltd.
SW 22-053-03 W5M	Tricycle Lane Ranches Ltd.
NE 16-053-03 W5M	Tricycle Lane Ranches Ltd.
NW 15-053-03 W5M	Tricycle Lane Ranches Ltd.
SE 16-053-03 W5M	Tricycle Lane Ranches Ltd.
SW 15-053-03 W5M	M. Agostini

5.4.2 Road Maintenance and Dust Control along Haul Route

In order to control dust, all internal haul roads will be watered prior to activity and as required. Given the proposed haul route is currently paved, watering to control dust will not be required. Drivers will ensure that all loose gravel is removed from hitches, bumpers, sideboards and tailgates prior to leaving the Site and the speed limit set for Range Road 33 will be strictly followed. Trucks hauling for 1531486 Alberta Ltd. will also be responsible for cleaning any spilled gravel, clay or other debris along Range Road 33 that is a result of truck traffic associated with the gravel operation.

5.4.3 Signage

Appropriate signage will be installed at the Site entrance and along the haul route to inform local traffic of the project. The signs will be legible and designed professionally. All signs will be checked regularly to ensure they are legible and in good condition. 1531486 Alberta Ltd. will discuss signage design and placement with Lac Ste. Anne County upon approval of the project.

5.5 Hours of Operation and Hauling

Pit Operations (site preparation, stripping and stockpiling, extraction activities, and reclamation)

- Monday through Saturday – 6:00 AM to 7:00 PM.
- No Activity on Sunday or Statutory Holidays.

The current development permit stipulates pit operations to be 7:00 AM – 7:00 PM, six days a week. 1531486 Alberta Ltd. is requesting an earlier start time of 6:00 AM, maintaining the closing time of 7:00 PM.

Passive Pit Operations (dewatering, pump maintenance, and equipment maintenance)

- 7 days a week 24 hours a day.

Operations will require activities to occur outside of the normal hours of operation. Examples of these activities include the running of pumps to dewater and maintain water levels within open excavations, running generators to power equipment block heaters during freezing temperatures, and conducting manual maintenance of equipment and/or fuelling equipment. Efforts to reduce noise during these periods are highlighted in Section 5.17.

Aggregate Processing (gravel washing, crushing and screening, and asphalt production)

- Monday through Saturday – 24 hours, 6 days per a week.

The current development permit outlines 24 hour processing only for one month per year. 1531486 Alberta Ltd. has requested the removal of this restriction to allow for more flexibility to respond to market demand. Based on current demand, it is estimated crushing could occur twice yearly for a period of 30-45 days per a mining block.

1531486 Alberta Ltd. will provide a one week notice to Lac Ste. Anne County prior to commencing processing activities.

Product Hauling (including loading trucks)

- Monday through Saturday – 6:00 AM to 7:00 PM.
- No hauling activity on Sunday or Statutory Holidays.

5.6 Project Development

The total site area encompasses approximately 127.84 ha, divided across three separate quarter sections. Mining activities have been planned in three phases, each corresponding to one of the quarter sections. Phase I is located within NW 33-053-03 W5M, Phase II will occur within NE 33-053-03 W5M, and Phase III will take place within SW 34-053-03 W5M, as outlined in Drawing No. 5-16 in Appendix L.

5.6.1 Site Preparation and Infrastructure

Prior to mining, the Site will be prepared to facilitate wet pit excavation while maintaining the aesthetics of the area. Site preparation and infrastructure are shown on Drawing No. 5-16 to Drawing No. 8-16 and a summary of the infrastructure to be constructed is outlined in Table 3.

Table 3. Summary of Infrastructure Construction		
Location	Area (ha)	Activity
Mineral Topsoil Stockpile Area	3.15	This area will be used to stockpile mineral topsoil salvaged from the overburden area A, the subsoil stockpile area, the processing areas, the internal haul road, the sight and sound berms, and MBs 1, 2 and 3.
Organic Topsoil Stockpile Area	0.67	This area will be used to stockpile organic topsoil salvaged from the groundwater recharge pond.
Subsoil Stockpile Area	1.91	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area. The area will then be used to stockpile subsoil salvaged from overburden Area A, the wash plant site, the internal haul road, the sight and sound berms and MBs 1 and 2.
Overburden Area A	10.47	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area and subsoil will be stripped and stockpiled in the subsoil stockpile area.
Internal Haul Road	1.09	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile areas and subsoil will be stripped and stockpiled in the subsoil stockpile areas.
Recharge Pond	2.77	Organic soil will be stripped and stockpiled northwest of Area A. Overburden will be stripped and used to construct sight and sound berms, the internal haul road, and the berms around the recharge pond. Any remaining overburden will be direct placed in Area A.
Wash Plant Site	6.22	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area and subsoil will be stripped and stockpiled in the subsoil stockpile area.
Sight and Sound Berms (NW 33)	2.3	Topsoil will be stripped stockpiled in the mineral topsoil stockpile area and subsoil will be stripped and stockpiled in southeast corner of the Phase II. Note topsoil and subsoil stripped from the permanent sight and sound berm location will be replaced on top of the berm once it is constructed.

5.6.2 Groundwater Recharge Pond

A 2.77 ha groundwater recharge pond will be built in the northeast corner of the Phase I to a depth of approximately 12 m as shown on Drawing No. 5-16 and 6-16. Organic soil and overburden from the area where the recharge pond will be constructed will be stripped separately and stockpiled south of the recharge pond. This overburden will be removed until contact is made with the underlying gravel to ensure the constructed recharge pond is hydraulically connected to the aquifer. The overburden removed will be used to build a berm around the perimeter of the recharge pond. The berm will be approximately 3.5 metres high with a four metre wide top and 3:1 side slopes. Berms around the recharge pond will be constructed to increase hydraulic head and provide further assurance that the recharge pond can contain the volume of water being removed from mining blocks. As the pond will be used for a number of years, a

thin layer of topsoil may be placed on the top and outer sides of the berms and will be seeded to a grass mix.

The excess overburden removed from construction of the groundwater recharge pond will be used to construct the sight and sound berm along the west side of Phase I and to construct the internal haul road. The remaining overburden from the area where the recharge pond will be constructed will be direct placed to Overburden Area A in order to create a permanent landscaped feature that will meet or exceed equivalent land capability sloping requirements.

Test hole logs and piezometer completion information at the location of the proposed recharge pond indicate saturated conditions above the top of the gravel deposit. It is anticipated that groundwater will infiltrate into the excavation and will need to be dewatered to allow for the excavation of the full thickness of overburden. During the construction of the recharge pond, groundwater that is encountered will be diverted to a temporary sump constructed within a corner of the recharge pond. If required, water within the sump will be pumped to the dugout located within the Phase I to allow sediment to settle out. Once the sediments have settled, the water will be able to travel northeast along the existing drainage ditch connected to a naturally occurring drainage course.

5.6.3 Sight and Sound Berms

Operations in the Phase I and II will be directly adjacent to residences. A sight and sound berm will be constructed along the perimeter of the pit area to act as a visual and sound barrier at all locations where the public could reasonably access or view the property, to mitigate the potential disturbance to the adjacent residences and public. The western sight and sound berm will remain as a permanent feature whereas the remaining berms will be removed and reclaimed once all mining and processing within the Site is complete. The outside toe of the berm will be placed at least ten metres from the western property line in Phase I, while the remaining berms will be placed three metres back from the property lines in Phase II as shown on Drawing No. 5-16 to 7-16.

Prior to the construction of the berm, topsoil and subsoil from the areas where the berm is to be constructed will be salvaged and stockpiled. Topsoil and subsoil will be stripped and stockpiled for future reclamation of the berm areas, aside from a small amount of topsoil which will be replaced over the western berm to promote vegetation growth.. The permanent berm will then be seeded with a seed mixture containing grasses, trees, and shrubs native to the area to prevent erosion and improve the aesthetics of the area. This upland habitat will eventually be integrated with the end pit lake proposed within the northwest corner of the NW 33-053-03 W5M.

A portion of the berm within the NW 33-053-03 W5M will be constructed with overburden excavated from groundwater recharge pond, whilef the berm within the NE 33-053-03 W5M will be constructed with either

topsoil or subsoil . The sight and sound berms will be constructed four metres in height with a four metre wide top and 3:1 side slopes. A 600 mm culvert will be placed under the berm running from the east side of the NE 33-053-03 W5M to the ditch adjacent to Range Road 33, to accommodate any surface drainage issues in the NE 33-053-03-W5M. A break in the berm will be constructed in the southeast corner of the NE 33-053-03 W5M to accommodate surface drainage from the waterbody located south of the berm.

5.6.4 Internal Haul Roads

An internal haul road will be constructed through the centre of the Site to provide access to all portions of the Site, specifically the wash plant and crushing plant sites, as shown on Drawing No. 5-16. Topsoil and subsoil will be stripped from the haul road within the N 33-053-03 W5M and stockpiled at the nearest stockpile location or used for the sight and sound berms. The clay excavated from the recharge pond will be used to construct the haul road within the N 33-053-03 W5M.

Abandoned Roadway 5026 ET will be used to access Phase III as shown on Drawing No. 8-16. Vegetation along this roadway will be removed and the surface will be upgraded as necessary to provide a temporary driving surface. The internal haul road will be approximately 1,100 m long within Phases I and II and 750 m long within Phase III. The portion of road within the N 33-053-03 W5M will be constructed without ditches and will be one metre in height with 3:1 side slopes and a 10 metre wide top. A 600 mm culvert will be installed where appropriate to accommodate any surface water drainage.

5.7 Buffers and Setbacks

To minimize any risk of operations affecting adjacent landowners, a three metre undisturbed property line buffer will be maintained along all property boundaries with the exception of the north and west Site boundary of the N 33-053-03 W5M and the common property boundary between the NW and NE 33-053-03 W5M. As referenced in Section 4.2, the water pipeline ROW operated under the WILD Water Commission runs within the undeveloped road allowance of Township Road 540 and Range Road 34. The pit boundary and activities have been adjusted ten metres from the property line adjacent to the water pipeline ROW; therefore, a 10 metre undisturbed property line buffer will be applied between the property line and pit boundary adjacent to the water pipeline. These setbacks are outlined in Drawings No. 5-16 and 6-16.

It is estimated that sufficient overburden will be available to achieve the reclamation objectives described in Section 6.0 and an extraction setback typically required in cases where limited reclamation material is present will not be required. If the pit or a portion of the pit should become inactive for more than two years, pit faces will be re-sloped to 2:1 slopes to ensure public safety and avoid the potential loss of reclamation material due to erosion or slumping.

Unless constrained by undisturbed buffer zones, a minimum pre-stripped buffer of five metres will be maintained in front of all pit faces. The integrity of the topsoil, subsoil, and overburden stockpiles will be maintained by leaving a three metre separation distance between the reclamation material and the product stockpiles.

5.8 Vegetation Clearing

Vegetation must be cleared prior to soil stripping in a manner that reduces erosion and topsoil loss. Clearing will be limited to the areas vegetated with trees or brush. The trees or brush shall be cleared and mulched or burned during the winter months; a burn permit will be obtained from Lac Ste. Anne County prior to commencement of the burn. Brush clearing will be conducted between August 31 and April 15 as required by the Alberta *Wildlife Act* and the federal *Migratory Birds Convention Act*. If clearing is required during the restricted period of April 15 to August 31, the area will be surveyed by a biologist to determine presence of nesting birds, including raptors.

5.9 Soil Salvage

Mineral topsoil, organic soil, subsoil and overburden will be salvaged from all areas disturbed by mining and pit operation activities. Based on the pre-disturbance soil survey conducted by Navus in support of the project, an average of 22 cm of topsoil will be stripped. In isolated areas where organic soil is present, stripping depths will be deeper at depths of approximately 1.02 m. Topsoil depths on the hilltops and side slopes will be shallower and more attention will be taken when stripping. Subsoil has an average depth of 61 cm but may not be suitable and/or present in areas with deep organic soils. Subsoil is distinguished from the C-horizon by a slight colour change.

To minimize the risk of compaction and admixing, soil will not be stripped during extremely dry, wet or frozen ground conditions. A minimum pre-stripped topsoil, organic soil and subsoil buffer of five metres and three metres respectively will be maintained in front of all pit faces during soil stripping operations, unless constrained by the undisturbed property line buffers or the setback from the inside toe of the sight and sound berm.

Reclamation material will be stockpiled in designated locations or adjacent to mining blocks throughout the Site as shown on Drawing No. 5-16 to 8-16. The integrity of mineral topsoil, organic soil, subsoil and overburden stockpiles will be maintained by leaving a minimum separation distance of three metres between the different types of reclamation material. Topsoil and organic soil stockpiles will be placed on un-stripped or replaced topsoil and organic soil. Subsoil stockpiles will be placed on un-stripped or replaced subsoil, and overburden stockpiles will be placed on overburden or aggregate material. Stockpiles will be placed in stable locations that are at least five metres from the edge of pit faces. Stockpile heights

will be varied depending on the volume of material required to be stockpiled, the maximum height expected is 12 m above original surface elevation.

Reclamation material stockpiles remaining in place longer than one year will be seeded to grass or hay to prevent erosion and encroachment of weeds. All other reclamation material will be direct placed during mining operations as described in Section 5.10.

5.10 Extraction Sequence Plan

The Site will be developed in three phases due to land ownership and location. The development and operation of each Phase is outlined in Tables 4, 5, and 6 and shown in Drawings No. 5-16 to 8-16. Marketable clay material is intended to be extracted in conjunction with the sand and gravel from each mining block. If material is not sold, it will be stockpiled or direct placed as outlined in Tables 3, 4, 5 and 6. The Site will be progressively reclaimed with an effort to ensure reclamation of previous mining blocks is completed as mining progresses. Infrastructure and processing areas will move throughout the site with mining to accommodate progressive reclamation.

Table 4. Summary of Mine Sequencing Plan for Phase I		
Location	Area (ha)	Activity
MB 1	3.01	Mineral topsoil will be stripped and stockpiled in the mineral topsoil stockpile area, subsoil will be stripped and stockpiled in the subsoil stockpile area. Overburden will be stripped and direct placed in Area A.
MB 2	4.00	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area, subsoil will be stripped and stockpiled in the subsoil stockpile area and overburden will be directly placed into MB 1.
MB 3	4.14	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area, subsoil will be direct placed into MB 1 and overburden will be directly placed into MB 2.
Direct placement of reclamation material continues from this point on.		

Table 5. Summary of Mine Sequencing Plan for Phase II		
Location	Area	Activity
Mineral Topsoil Stockpile Area	0.89 ha	This area will be used to stockpile mineral topsoil salvaged from overburden Area B, the subsoil stockpile area, the processing area and MB 1 and MB 2.
Organic Soil/ Topsoil Stockpile Area	1.04 ha	This area will be used to stockpile organic topsoil salvaged from MB 2.
Crushing Plant Site	3.94 ha	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area and subsoil will be stripped and stockpiled in the subsoil stockpile area.
Overburden Area B	3.96 ha	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area and subsoil will be stripped and stockpiled in the subsoil stockpile area.
Subsoil Area	2.00 ha	Subsoil will be stripped and stockpiled in the subsoil area.
MB 1	4.21 ha	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area, subsoil will be stripped and stockpiled in the subsoil stockpile area and overburden will be stripped and used to construct the sight and sound berm along the north, east and south sides of the NE 33-053-03 W5M; the remaining overburden will be stockpiled in Overburden Area B.
MB 2	3.54 ha	Organic soil will be stripped and stockpiled in the organic soil/topsoil area, subsoil will be stripped and stockpiled in the subsoil stockpile area and overburden will be directly placed into MB 1.
MB 3	4.06 ha	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area, subsoil will be direct placed into MB 1 and overburden will be directly placed into MB 2.
Direct placement of reclamation material continues from this point on.		

Table 6. Summary of Mine Sequencing Plan for Phase III		
Location	Area	Activity
Internal Haul Road	0.07 ha	Existing roadway, no topsoil or subsoil will need to be salvaged.
Processing Area	5.60 ha	Topsoil and subsoil from under the overburden and subsoil stockpiles will be stripped and stockpiled adjacent to the mining blocks.
MB 1	3.80 ha	Topsoil, subsoil, sandy overburden and other types of overburden will be stockpiled adjacent to the mining blocks area with portions of the processing area.
MB 2	4.12 ha	Topsoil and subsoil will be stockpiled adjacent to the mining blocks area with portions of the processing area. Sandy overburden will be directly placed into MB 1.
MB 3	4.15 ha	Organic soil will be directly placed into MB 1. Sandy overburden and all other types of overburden will be directly placed to MB 2.

5.11 Importation of Fill Material

1531496 Alberta Ltd. is committed to the intentions of the previous reclamation plan and intend to ensure they can meet the reclamation objectives of an agriculture end land use with two end pit waterbodies and one seasonal low area. Given their commitment, 1531496 Alberta Ltd. only proposes to import fill material to offset the quantity of clay material sold as product and/or top up the total replacement depth of topsoil.

A site-specific importation management plan (IMP) has been prepared on behalf of 1531486 Alberta Ltd. and is provided in Appendix O. The IMP outlines the definitions, expectations, and sampling requirements to be implemented, including:

- Source specific fill declaration requirements,
- Supporting documentation/source location pre-characterization requirements,
- Site controls such as record keeping, confirmation/due diligence sampling, and monitoring requirements,
- Load rejection process; and,
- Record keeping.

Acceptable fill material will consist of soils such as marginal material, topsoil, subsoil, and/or overburden material of various textures. All acceptable fill material will be characterized to ensure that the material meets the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (Alberta Tier 1 Guidelines) and will be tested for clubroot if the source location of the material was used for agriculture in the past 10 years.

Under no circumstances will fill material containing construction waste, rebar, asphalt, tires, rubber, plastic, garbage, sludge, peat, woody debris, or hydrovac material be accepted. No material will be imported to the Site until acceptance of the IMP has been received from AEPA.

5.12 Water Management

As a part of the proposed development, a meaningful groundwater monitoring program will be implemented to ensure that the impact of the groundwater diversions do not pose undo risk to the groundwater from local water wells or to the local hydrogeology. Also, 1531486 Alberta Ltd. will accept responsibility for any negative impacts to local user's groundwater supplies as a result of their operations, should any occur.

5.12.1 Groundwater Water Management (Pit Dewatering)

The aggregate deposit on the Site occurs below the water table and dewatering is necessary to extract the aggregate. Pit water will be diverted from individual mining blocks to facilitate mining. Pit water is intended to be retained onsite and diverted to the groundwater recharge pond, excavated mining blocks, or the 5.87 ha waterbody; all of which will be hydraulically connected to the groundwater aquifer as shown on Drawing No. 5-16, 6-16, and 16-16. Once mining reaches the area being used for the recharge pond, pit water from this area will be pumped into the reclaimed end pit waterbodies. It is anticipated that pit water within the SW 34-053-03 W5M will also be pumped to the reclaimed end pit waterbodies in the N 33-053-03 W5M to facilitate mining. Should dewatering methodology change to include off-site dewatering, an application under the *Water Act* will be made. No water will be diverted off-site without the appropriate authorization.

Given this method of handling pit water, HCL has determined that dewatering and re-introduction of groundwater would result in a localized cone of depression around the dewatering site and localized mounding around the recharge site. A temporary drawdown of approximately four metres at a distance of 200 metres from a dewatering pit and three metres of drawdown at a distance of 400 metres can be expected. The nearest water wells to the Site are located on the Franczak property in SE 33-053-03 W5M within 200 metres of the nearest mining area. The available drawdown in these wells ranges from 7.9 to 12.7 metres and a temporary drawdown of up to four metres represents a maximum decline of 50% of the available drawdown. 1531486 Alberta Ltd. will commit to supplying the Franczak's with water should their well be temporarily impacted by dewatering operations. Further information regarding the impact of dewatering on surrounding water users is discussed in HCL's Groundwater Review report located in Appendix E.

Dewatering activities are regulated under *Water Act* Approvals No. 00325510-00-00 and 00325507-00-00, which authorize the construction of a temporary recharge pond and the diversion of up to 2,970,000 cubic meters of groundwater per year, respectively.

5.12.2 Aquifer Restoration Plan

To ensure that groundwater continues to flow through the reclaimed mining area, 1531486 Alberta Ltd. will restore the aquifer with a minimum 1 m thick sand layer for the entire mining area, with the exception of the bottom of end pit waterbodies as they will be hydraulically connected to the groundwater aquifer. If there is not enough sand to satisfy the minimum depth requirement, reject material will be used.

5.12.3 Groundwater Protection Plan

To mitigate risks to local water wells and hydrogeology, five piezometers have been installed on the adjacent landowner's property. Monitoring efforts will continue throughout the operation's lifespan, and groundwater diversions will be measured daily as part of operational standards. Additionally, 1531486 Alberta Ltd. accepts responsibility for any negative impacts to local groundwater supplies caused by their operations, should such impacts occur. 1531486 Alberta Ltd. will suspend all dewatering and provide a temporary water source and will hire a qualified professional to investigate the reason for the adjacent water well impact. If it is determined that the impact to local water wells is a direct result of pit activities, 1531486 Alberta Ltd. will work with the user to determine an alternative source of water.

5.13 Surface Water Management

During operations, all surface runoff from the disturbed areas within the active pit area will, as much as possible, be maintained on site and redirected to waterbodies/low areas within the pit.

A drainage ditch will be constructed along the west and north sides of the NW 33-053-03 W5M outside of the Permanent Sight and Sound Berm to accommodate surface water drainage from the NE 32-053-03 W5M and areas upgradient of the Site, as shown on Drawing No. 3-16, 5-16 and 16-16. A drainage ditch will also be constructed from the existing dugout in the NE 33-053-03 W5M to the eastern property line to compensate for the removal of the drainage ditch that currently leads northeast from the dugout as shown on Drawing No. 3-16, 5-16 and 7-16. A 600 mm CSP culvert will be placed under the perimeter berm to the ditch on Range Road 33. Topsoil and subsoil will be salvaged prior to the construction of the ditch and will be replaced once construction is complete and seeded following construction with an appropriate mix to prevent erosion and weed emergence.

5.14 Aggregate Processing

The majority of the aggregate products will be produced by portable crushing and screening operations. Three processing areas will be used over the life of the pit; processing areas will move as mining progress through the phases. A stationary wash plant operation will be set up in the NW 33-053-03 W5M initially, the wash plant operation may be relocated as operations progress through the phases. The wash plant will recirculate the wash water and will use a series of settling ponds to remove the silt from the wash water. Approximately 495 m^3 of water per day will be used at the wash plant, approximately 10% of which will be lost to evaporation. Adsorption of water into the product will be minimal as the material comes from below the water table and the pores are already saturated. Source water for the wash plant will initially be taken from the groundwater recharge pond and then from the 5.8 ha waterbody once it is constructed to a point that it can supply water. No wash water will be reintroduced into the recharge pond or waterbodies nor will any wash water be released offsite.

Aggregate processing (crushing and washing) will occur at the wash plant site located in the NW 33-053-03 W5M while mining of Phase I occurs. Once mining progresses to Phase II and III, aggregate processing may move with the mining Phases. An estimated 25% of the products will be washed.

The crushing operation will use a conventional one stage crushing and screening process. Not many boulders needing a secondary crusher are expected to be extracted, so a primary crusher is not expected to be needed. These boulders will be separated from the remaining aggregate and sold as rock products.

5.15 Dust Control

Dust and erosion will be controlled within the Site by watering internal roads and vegetating the sight and sound berms and long-term reclamation material stockpiles. Pit run aggregate will be extracted in a damp to wet condition and therefore dust created by crushing will be minimal. Further, crushers will be situated at the lowest possible elevation where possible, all loads of aggregate will be properly enclosed, and that speed limits will be followed along the applicable haul routes. Progressive reclamation techniques will be employed as soon as possible to reduce the overall disturbance at any one time.

5.16 Wind and Water Erosion Control

1531486 Alberta Ltd. will implement mitigation measures to control wind and water erosion, including seeding long-term reclamation material stockpiles and berms composed of reclamation material to a grass mix, and employing progressive reclamation techniques as soon as possible to reduce the overall disturbance associated with the pit at any one time.

5.17 Noise Control

Patching Associates Acoustical Engineering Ltd. (Patching) was retained by 1531486 Alberta Ltd. to evaluate and predict the noise level from the Site once the project is operational. Patching's study assessed the sound data of typical equipment and operations at the Site and predicted the noise level from the most impacting operation, topsoil removal, at the potentially most affected receiver locations (i.e., residences) that are located west, northeast and southeast of the Site. The results of the assessment are shown in the tables and on the maps included in Patching's report. Although Lac Ste. Anne County does not have or specify noise criteria in their Land Use Bylaw or their Municipal Development Plan, they do require consideration of noise impacts. A copy of Patching's Noise Impact Assessment report (2011) is located in Appendix H.

To mitigate the impacts of noise at the Site, during operations the following measures will be implemented to minimize noise:

- Sight and sound berms will be strategically placed along the perimeter of the Site in the N 33-053-03 W5M across from residences to minimize noise.
- Equipment will be properly maintained.
- All processing will occur during permitted hours.
- Strategic placement of the crusher (either in low spots and/or strategic placement of product piles.
- When permissible under Occupational Health and Safety Legislation and Standards, long-term equipment on site will be outfitted to white noise back up beepers instead of conventional back up beepers.
- Strobe lights will be used during hours of darkness instead of backup beeper alarm systems.
- To limit cumulative effects of equipment noise, 1531486 Alberta Ltd. will reduce the number of pieces of equipment to the minimum number required to do the given task or activity and where possible, smaller pieces of equipment will be utilized where large equipment is not necessary. 1531486 Alberta Ltd. has chosen to use rock trucks instead of tandem trucks in their operation to mitigate noise generated from tailgates opening and closing.
- Additional efforts to limit noise travelling to residents located east of the pit by orienting mining, stripping and reclamation material replacement to be primarily travelling in a forward direction while facing east and backward while facing west, away from the residents to the east. Directionality of stationary equipment will also be considered and where possible, be positioned facing away from the most impacted residents.
- Use of WhisperWatt style generators when generators are required at night (colder temperatures or during pit dewatering activities)
- House water pump for dewatering activities in a silent pack and/or behind a berm or stockpile.

- All trucks hauling from the Site will be in good working order.
- The use of engine retarder brakes will be prohibited within the pit and along the haul route. Unnecessary engine activity will be reduced to the maximum extent possible. To additionally mitigate for noise, equipment will be shut off when not in use.

5.18 Environmental Management Practices

To minimize the impact on the environment, 1531486 Alberta Ltd. plans to strictly implement a number of environmental management practices during the operation and reclamation of the Site, in addition to adhering to all provincial and municipal legislation and guidelines. Some environmental management practices include:

- Installation of spill kits on all equipment being utilized for mining purposes.
- Utilization of double wall fuel storage tanks.
- Properly storing and regularly hauling any industrial waste generated at the pit to an approved municipal or Class II landfill.
- Properly collecting and regularly hauling all sanitary waste to an approved wastewater management treatment facility.
- Development of an active weed control program that will prevent the initial establishment of weeds.
- Proper application of herbicides.
- Ensuring that no herbicides, pesticides or any other hazardous substance will be stored onsite.
- Ensuring asphalt production will take place in designated areas over impervious material.
- Following the site-specific IMP for importation of fill material.

Following the issuance of a Development Permit and prior to disturbance, an Environment Management Plan will be provided to Lac Ste. Anne County as per Section 3.13.84 of the Land Use Bylaw No. 22-2017.

5.19 Waste Management

Portable sanitary waste facilities will be located onsite and all sanitary waste collected from these facilities will be hauled to an approved municipal wastewater treatment system. A domestic water supply will be hauled and stored onsite. All domestic waste will be collected and disposed of at an approved municipal landfill or recycled at an approved facility.

5.20 Fuel Storage

All petroleum products will be stored in approved double walled fuel vault containers per requirements outlined by the Canadian Standards Association. Spill containment products will be at the Site at all times and employees will be trained in their use.

Secondary containment of no less than 100% of the largest container shall be provided to all areas where lubricating oil is stored onsite. Double walled fuel storage tanks and a designated fueling/maintenance area will be used during mining operations to reduce the risk of any hydrocarbons contaminating the soils and groundwater aquifer. The designated fueling/maintenance area will be located within the processing area and constructed on overburden material. All fuel spills will be immediately contained, cleaned up, and hauled to a Class II landfill for proper disposal.

5.21 Complaint Response Policy

A Complaint Response Policy is in place to manage any environmental or operational grievances aired by the public throughout the operation on the pit. The Site Manager will respond to all complaints related to pit operations within 24 hours by contacting the complainant to inform them of status of the investigation or to update them with the findings of the investigation. If the information collected from the survey procedures indicates that the Site is not the source of the complaint, the complainant shall be notified of this finding in writing. Documentation supporting this response mechanism will be provided to the complainant.

5.22 Site Security Plan

The Site has been fenced along all sides where public access is possible and cattle gates will be installed and locked during non-operating times. “No Trespassing” advisories have been installed, which conform to municipal and provincial requirements. Signs will be installed which conform to municipal and provincial requirements.

5.23 Weed Control

The Alberta Weed Control Act requires owners and occupants to manage all prohibited noxious and noxious weeds on their land. Measures will be taken during the construction and operation of the pit to prevent and control these weeds on the Site. The following weed prevention and control measures will be undertaken to ensure weeds are properly managed in accordance with regulations.

- All equipment will be cleaned before arriving onsite to prevent the introduction of weeds.
- Topsoil, organic soil and subsoil stockpiles, sight and sound berms, and berms for the groundwater recharge pond will be vegetated to provide erosion control and prevent emergence of weeds.
- Operational and reclaimed areas will be passively inspected twice during the growing season; in the spring and late summer by onsite personnel for presence of prohibited noxious and noxious weeds.
- Identified weeds will be controlled immediately either through the use of herbicide or by mowing or as recommended by a qualified individual.

- Only individuals holding a Pesticide Service Registration will be contracted to use herbicide.
- Reclaimed mining blocks will be quickly revegetated to prevent non-native or invasive plant invasion.

5.24 Clubroot Fungus Management

To prevent the spread of clubroot to the pit, the preventative measures and best management practices detailed in the Alberta Clubroot Management Plan will be implemented.

6.0 Conservation and Reclamation Plan

6.1 Proposed End Land Use

The Site will be reclaimed to an agricultural end land use with a landscaped berm, two end pit waterbodies and one seasonal low area. The portion of the pit to be reclaimed to an agricultural end land use will be seeded back to pasture. The landscaped berm will be constructed and reclaimed along the western pit boundary to provide a visual-sound barrier to the adjacent neighbour for the life of the pit. The two waterbodies will be constructed within the NW 33-053-03 W5M during the operation of the pit and the seasonal low area will be constructed in the SW 34-053-03 W5M, as shown on Drawing No. 16-16.

6.2 Direct Placement of Reclamation Material

The pit will be mined implementing a direct placement reclamation technique once mining progresses into the fourth mining block of each Phase as discussed in Section 5.10. The western portion of the sight and sound berm will remain as a permanent feature, while the remaining portions will be removed and reclaimed once all mining and processing within the Site is complete. Once mining is completed within the mining blocks associated with the waterbodies, a minimum of one metre of reject material or sandy overburden will be placed in the bottom of these mined out blocks to tie the waterbodies into the aquifer associated with the adjacent un-mined gravel formation. It is essential that an effective hydraulic connection is maintained between the waterbodies and the aquifer as it will ensure the waterbodies can function as groundwater recharge ponds during dewatering operations. To reduce the amount of groundwater mounding that could potentially occur in areas that are upgradient, one metre of reject or sandy overburden material will also be placed throughout the bottom of the entire pit.

Overburden stripped from the recharge pond and MB 1 will be direct placed into Overburden Area A and contoured to create a landscape feature that will remain in place permanently with 10:1 side slopes as shown on Drawing No. 12-16. Overburden stripped from MB 4 in Phase I and stockpiled in Overburden Area B will be used to reclaim MB 7 and MB 8 in Phase II. All mining blocks in Phase II will be reclaimed with enough overburden to ensure no end pit lakes remain in the quarter section in which Phase II is

located upon reclamation. If any further overburden is required to prevent end pit lakes in Phase II, it will be stripped from the contoured hill in Overburden Area A, while ensuring 10:1 slopes are maintained.

Once all processing of material is complete and product has been removed from the Site, overburden used to construct the northern portion of the temporary sight and sound berm will be used to construct the edges of the 2.2 ha waterbody. If any additional overburden is required to finalize construction around the 2.2 ha waterbody it will be stripped from the contoured hill in Overburden Area A.

The overburden used to build the internal haul roads in Phase II will then be stripped and placed on the floor of the crushing plant site. Next, overburden used to construct the eastern and southern portions of the temporary sight and sound berm will be placed in the crushing plant site. The depth of additional overburden added to the crushing plant site is anticipated to be approximately two metres and will be contoured to ensure 10:1 slopes are achieved. Overburden used to construct the internal haul road within Phase I will also be stripped and placed in the bottom of the wash plant site at a depth of approximately 0.10 m. The portion of the haul road within Phase III will remain in place after confirmation that this is acceptable from Lac Ste. Anne County.

6.3 Soil Replacement and Contouring

The objective of the reclamation of the Site is to ensure that the disturbed lands associated with the Site are reclaimed to an equivalent land capability. The expected future reclaimed slopes within the Site are shown on Drawing No. 10 to 15. Internal slopes throughout the Site will be contoured to a minimum slope of 10:1 and slopes located along the property boundaries and permanent berm will be 3:1.

Organic soil, topsoil and subsoil will be replaced throughout all disturbed areas of the Site. Prior to soil placement of organic soil, topsoil and subsoil material, any areas exhibiting compaction will be alleviated. Organic soil, topsoil and subsoil will be replaced evenly throughout the entire Site. It is estimated that the average replacement depth of organic soil, topsoil and subsoil will be 86 cm, 19 cm and 52 cm, respectively and an average 20% loss due to material handling and movement.

As end-pit waterbodies are to be constructed, the grading will be completed to ensure drainage is directed toward the end pit waterbodies, as outlined in Drawing No. 16-16.

6.4 Revegetation

The majority of the Site will be reclaimed to a pasture end land use. The seed bed of the area to be reclaimed to pasture will be prepared by discing prior to seeding and a seed drill will be used to plant a seed mixture similar to the one in Table 6.

The reclaimed upland area around the waterbody and berms will be seeded to a grass mix, and trees and shrubs that are indigenous to the area such as trembling aspen, white spruce and willow sp. will be planted. To expedite the establishment of emergent vegetation around the shallow edges of the waterbody organic soil salvaged from the Site will be used to promote the establishment of native wetland species.

Table 7. Pasture Seed Mix for Agricultural Portion of Site (Hannas Seeds 2011)	
Species	Percent of Mix (%)
Smooth Bromegrass	40
Orchard grass	30
Climax Timothy	20
Alsike Clover	5
Red Clover	5

6.5 End Pit Waterbody Design Details

The western waterbodies within the NW 33-053-03 W5M will be approximately 5.87 ha and 2.20 ha and will allow continued hydraulic continuity of groundwater flow from southeast to northwest. They will be constructed with the standard sloping requirements of 5:1 one metre above and one metre below the full supply level (FSL) of approximately 766 masl for approximately 50% of the shoreline. The remaining 50% of the shoreline will be constructed to create an edge effect for emergent vegetation with 10:1 slopes one metre above and one metre below the FSL. Organic soil stockpiled northwest of Area A will be replaced within this transitional area and slightly below the FSL to encourage emergent vegetation growth of native wetland species. The north and west sides of the western waterbody including the permanent berm and north and east sides of the eastern waterbody will be reclaimed to upland habitat and trees and shrubs indigenous to the area such as trembling aspen, willow sp. and white spruce will be planted. A thinner band of land along the southern sides of these waterbodies will also be reclaimed to upland habitat using similar tree and shrub species to those outlined above.

The seasonal low area to be located within the SW 34-053-03 W4M will be approximately 0.49 ha and constructed with very gentle slopes. This low area is expected to hold approximately 50 cm of water and will have a total capacity of 2,450 m^3. Organic soil stockpiled from MB 3 in Phase II will be replaced in this low area and associated transitional area to promote native wetland species emergence.

The groundwater assessment conducted as part of the Hydrogeological Review by HCL evaluated groundwater movement and the long-term sustainability of these waterbodies. The assessment determined that the post-mining waterbodies will remain hydraulically connected to the local aquifer, maintaining groundwater exchange.

The waterbodies were assessed for their potential to function as net recharge or discharge areas. Based on the groundwater balance calculations, the larger 5.87 ha waterbody is expected to function as a net recharge area, allowing groundwater infiltration back into the aquifer, while the smaller 2.20 ha waterbody may exhibit seasonal discharge characteristics depending on precipitation and groundwater elevations. The seasonal low area in SW 34-053-03 W5M is expected to retain water intermittently, contributing minimal groundwater interaction due to its shallower depth.

7.0 Reclamation Liability

Reclamation security in the amount of $836,728.62 was posted to AEPA (formerly Alberta Environment and Parks) in fall of 2025, following the review of the Five Year Report.

8.0 References

Carlson, V. A. 1971. Bedrock Topography of the Wabamun Lake Map Area, Alberta, NTS 83G. Wabamun Lake Area. [AGS map 057] [L020396].

EBA Engineering Consultants Ltd. 2010. 1531486 Alberta Ltd. c/o G & J Parking Lot Maintenance LP Traffic Impact Assessment Gravel Pit Operation Range Road 33 Parkland County and Lac Ste. Anne County. Edmonton, Alberta.

Green, Robert. 1982. Geological Map of Alberta. [AGS map 27a] [L012286].

Hannas Seeds. 2011. Hannas Seeds Forage Seed Price List. Lacombe, Alberta.

Hydrogeological Consultants Ltd. (HCL). 2012. Groundwater Review Lac Ste. Anne Area Parts of Sections 28 and 32 to 34, Tp 053, R 03, W5M. Prepared for 1531486 Alberta Ltd. Edmonton, Alberta. Edmonton, Alberta.

Hydrogeological Consultants Ltd. (HCL). 2025. 2012 Groundwater Review Addendum. Prepared for 1531486 Alberta Ltd. Edmonton, Alberta. Edmonton, Alberta.

Marcomm Works. 2011. Gravel Pit Development near Alberta Beach Developer: 1531486 Alberta Ltd. Public Open House Report. Calgary, Alberta.

Natural Regions Committee. 2006. Natural Regions and Subregions of Alberta.

Navus Environmental Inc. 2011. Alberta Beach Granular Pre-disturbance Soil Characterization N1/2 33-53-03 W5M and SW1/4 34-53-03 W5M. Prepared for Spencer Environmental. Edmonton, Alberta.

Patching Associates Acoustical Engineering Ltd. 2011.

Noise Impact Assessment RoJaSs Management Ltd. Lac Ste. Anne Gravel Pit NE and NW Quarters of 33-53-3 W5M. Prepared for Bob Sanderson RoJaS Management Ltd. Canmore, Alberta. Calgary, Alberta.

RoJaS Management Ltd. 2011. 1531486 Alberta Ltd. Alberta Beach Gravel Pit Mining and Reclamation Plan. Canmore, Alberta.

Spencer Environmental Management Services. 2011. Environmental Impact Assessment in Support of Alberta Beach Granular Pit Draft Report. Prepared for RoJas Management Ltd. Canmore, Alberta. Edmonton, Alberta.

9.0 Limitations

This report has been prepared for the sole benefit of 1531486 Alberta Ltd. This document may not be used by any other person or entity, with the exception of Alberta Environment and Protected Areas and Lac Ste. Anne County without the express written consent of Aspen Land Group Inc. and 1531486 Alberta Ltd. Any use of this report by a third party, or any reliance on decisions made based on it, or damages suffered as a result of the use of this report are the sole responsibility of the user.

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted scientific practices current at the time the work was performed. The conclusions and recommendations presented represent the best judgment of Aspen Land Group Inc. based on the data obtained. Due to the nature of the data available, Aspen Land Group Inc. cannot warrant against undiscovered environmental liabilities. Conclusions and recommendations presented in this report should not be considered legal advice.

Prepared by:

Laura Hay, Environmental Specialist

Prepared and Reviewed by:

This information redacted as per Protection of Privacy Act (POPA)

Lesley Foy, P. Ag.
Senior Agrologist

Aspen Land Group Inc.
11213 Winterburn Road NW
Edmonton, AB, T5S 2B2

Appendix A

Lac Ste. Anne County Development Permit Application

LAC STE. ANNE COUNTY

Development Permit Application Aggregate

Planning & Development

APPLICATION REQUIREMENTS

If you are building in a subdivision, please check the Planning & Development section of the Lac Ste. Anne County website to review requirements. Some subdivisions may have different guidelines than others.

1. Applications are **NOT** considered complete until **ALL** of the required information has been provided. Please ensure that you have completed the application form accurately and clearly and enclosed payment. Lack of information may delay consideration of your application.
2. Modular, Manufactured (Mobile) Home — indicate size and year; include photographs of all four (4) sides and floor plan and must be no more than 20 years of age at the time of application.
3. Moved in House – indicate size and year; include photographs of all four (4) sides and floor plan.
4. Incomplete applications, including unpaid applications will be held for 30 days for submission of additional documentation. After 30 days the application will be disposed of.
5. Should additional information be required, you will be contacted directly by the Planning and Development Department via phone, email, fax or regular mail.
6. You will be notified of the decision by written notification letter including any conditions you must complete.
7. Fees can be paid by credit card via the County's secure payment portal at LSAC.ca/payments, or in person at the County Administration Office located at 56521 Rge Rd 65 (1.5km east of Sangudo).
8. If the property is owned by more than one landowner, **ALL** landowners must be listed on page 3 (Applicant/Agent Information) and must sign the application where indicated on page 7.
9. It is the applicant's responsibility to ensure all pages are received by the department. If sending by fax, please check your fax confirmation that the correct number of pages sent was received.
10. A current (within 14 days of today's date) Certificate of Title must be submitted with this application. If you are unable to supply a current title, an additional charge of $20 will apply.

Please note: Any documentation/information (including personal information) required for processing an application will become public once submitted to Municipal Planning Commission (MPC) or the Development Authority for review and processing.

NOTES

1. Developmental changes such as structural size, material quality, and completion of progressive homes under construction are just some factors that affect the market value and will cause assessments to increase. If this applies to your property, you may want to make higher monthly payments earlier in the year to accommodate for potential tax increases on your next tax notice.
2. Any development permit application for construction of an accessory building prior to the construction of the main building or use (residence) becomes a discretionary permit application. Therefore the application must be presented to Municipal Planning Commission (MPC) for approval. A detailed description of the building and use must accompany the permit application. The processing time for discretionary permit applications can be 3 to 6 weeks.
3. Please note all development permits issued by Lac Ste. Anne County will require a blanket drainage easement to be placed on title with exception to those parcels that have an approved stormwater plan. If a site specific easement is preferred, please note this preference in your application.

LAC STE. ANNE COUNTY

Development Permit Application
Aggregate

FOR OFFICE USE ONLY

Permit no.: _____ Tax roll no.: _____ Receipt no.: _____

I hereby make application for a development permit in accordance with the plans and supporting information submitted herewith.

Incomplete applications will not be accepted. If an incomplete application is submitted by mail, the application will be returned to the submitter for further information.

BUSINESS OPERATING NAME INFORMATION

Full name of Applicant: 1531486 Alberta Ltd.

This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)

Please note: By providing your email address above, you are hereby consenting to receiving correspondence (including decision) solely by email in relation to this application.

LANDOWNER/AGENT INFORMATION (if different from Applicant)

Name of registered owner 151486 Alberta Ltd. / Donald Drews Duane Drews and Joyce Drews

This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)

Cel:

LAND INFORMATION

Lot: _____ Block: _____ Plan: _____ Subdivision/Hamlet: _____

Rural address: _____ Division: ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

Quarter: N & SW Section: 33 & 34 Township: 53 Range: 3 West of 5th meridian

Zoning: Agricultural D Use: Aggregate Resource Extraction Parcel size: 127.84 Acres/Ha

PROPOSED DEVELOPMENT (Require ALL new building sizes and wall height)

- ◉ Natural Resource (Class I)
- ○ Natural Resource (Class II)
- ○ Extraction
- ○ Processing
- ○ Crushing
- ○ Washing
- ○ Preparation of asphalt

Existing building present use:

N/A

Estimated cost of project: $1,150,173 Start date: 5/1/25 Estimated completion date: 5/1/45

IS THE DEVELOPMENT WITHIN ½ MILE OF ANY OF THE FOLLOWING?

1. Is the subject property near a steep slope (exceeding 15%)? ○ YES ◉ NO
2. Is the subject property within 0.5 mile (0.8km) or bounded by a body of water (river, stream, watercourse, lake or other permanent body of water, or a canal or drainage ditch)? ◉ YES ○ NO

If **YES**, state its name Wetlands & Seasonal Low Area

3. Is the subject property within 0.5 mile (0.8km) of the right-of-way of a highway? ◉ YES ○ NO

If **YES**, the highway no. is Highway 16

4. Is the subject property within 0.5 mile (0.8km) of a sour gas facility? ○ YES ◉ NO
5. Is the subject property within 0.5 mile (0.8km) of a pipeline? ◉ YES ○ NO
6. Is the subject property within 0.5 mile (0.8km) of an oil facility? ○ YES ◉ NO
7. Is the subject property within 0.5 mile (0.8km) of land that is or has been used as a municipal landfill for the disposal of garbage or refuse? ○ YES ◉ NO
8. Is the subject property within 0.5 mile (0.8km) of land that is or has been used as a municipal sewage treatment facility or sewage lagoon? ○ YES ◉ NO
9. Has the land had a history of flooding? ○ YES ◉ NO
10. Is the subject property immediately adjacent to the municipal boundary? ◉ YES ○ NO

If **YES**, the adjoining municipality is Parkland County

REGULATORY REQUIREMENTS FOR SURFACE DEVELOPMENT IN PROXIMITY TO ABANDONED WELLS

New subdivision applications, except for lot line adjustments, must include documentation from the Energy Resources Conservation Board (ERCB) identifying the presence or absence of abandoned wells.

1. Obtain the information from ERCB's Abandoned Well Viewer available on the ERCB Website www.aer.ca
2. Abandoned well information included: ◉ **YES** ○ **NO**

If **NO**, why not: _____

If an abandoned gas or oil well is identified on the land that is subject (the quarter section) of the subdivision application, the applicant must include a map that shows the actual well location, as identified in the field, and the setback established in ERCB Directive 079 in relation to existing or proposed building sites.

To obtain clarification about the information provided by the Abandoned Well Viewer, or if you do not have internet access, contact ERCB Customer Contact Centre by Telephone at 1.855.297.8311 or by email at inquires@aer.ca. Alternately, you can contact Information Services by mail at ERCB, Suite 1000, 250 – 5 Street SW, Calgary, AB T2P 0R4.

SITE SKETCH

The following must be included on your sketch:

- North Indicated on sketch
- Dimensions of proposed building(s)
- Location of all structures on property (existing and proposed)
- Proposed locations of power poles
- Show any pipeline crossing the property
- Public roads servicing the property
- (approach) ***Your FRONT yard setback is the location of entrance (driveway) from a local road***
- Show the location of access to your property

Please see attached drawings in Development Permit Application package, Appendix G.

Draw your site sketch in the grid below. All setback from proposed buildings to property lines must be included. Please include a legend.

Setbacks in metres or feet: North: _____ South: _____ East: _____ West: _____

Quarter: _____ Section: _____ Township: _____ Range: _____ W of 5 Meridian

Brief description of the property, including any water bodies or steep embankments: _____

See Attached Drawings

AGGREGATE APPLICATIONS PROCESSING FORM

Do you plan on mining a roadway?: YES ○ NO ◉

If **YES**, Rge Rd to be mined: _____ **OR** Twp Rd to be mined: _____

Explanation or Intent of Project	Page / Appendix	Notes
The features of the project that make it desirable to the general public and Lac. Ste. Anne County. This is to include an evaluation of how the project may contribute to the present and projected need.	**Section** 5.2 - *Economic Benefit*	
An economic analysis of the proposal's anticipated economic impact on Lac Ste. Anne.	**Section** 5.2 - *Economic Benefit*	
An Environmental Impact Assessment report prepared by a qualified professional.	**Appendix F** *Environmental Impact Assessment*	
Information related to the source of Aggregate for processing, including projected volumes from on and off-site that will be processed on the Site.	**Sections** 5.1 - *Intent and Need* 5.2 - *Economic Benefit*	
Any other pertinent information or tests required by the Development Authority respecting the Site or adjacent lands.	**Section** 4.1 - *Existing & Adjoining Land*	
Such additional requirements as are determined necessary by the Development Authority having regard to the nature of the proposed development and the surrounding use(s), which may be affected.	**Appendix** D through Appendix O	
If your development permit application is for an extension for a discretionary use, ensure that the application information submitted with the original development permit application in whole or in part satisfies the application requirements for the development permit for the extension.	***Attached Report***	
Determine that additional information shall be submitted for the development permit for the extension, even if such information was not required for processing the original development permit application.	**Sections** *1.3 - History* *4.2 - Current Right of Way and Easements*	

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

An application for a development permit for an aggregate resource extraction shall be made to the Development Authority in writing, and shall:	Page / Appendix	Notes
a. Be submitted together with a re-districting application to re-district the subject lands to the Aggregate Resource Extraction and Processing (AR) district.	*N/A*	
b. Be signed by the registered owner or his or her agent where a person other than the owner is authorized by the owner to make application. The correctness of the information supplied shall, when required by the Development Authority, be verified by a statutory declaration.	**Appendix A**	
c. State proposed use or occupancy of all parts of the land and buildings.	**Sections** 1.2- *Location & Land Ownership* 4.1 - *Adjacent land*	**Appendix L** *Conservation and Reclamation Drawings*
d. Include the results of the information meeting, as required in above Section, with detailed descriptions of how the proposed development complies with the requirements of any relevant municipal policies and regulations.	**Sections** 2.3 - *Inter-Municipal Development Plan* 2.2- *Development Permit*	
e. Include an Environmental Impact Assessment completed in accordance with Section 3.4.13 and any additional terms of reference from the meeting described above.	**Sections** 5.12 - Groundwater Managment 4.10 - Vegetation 6.4 - Revegetation	**Appendix F** *Environmental Impact Assessment* 4.11 - *Wildlife*

GENERAL REQUIREMENTS

i. A completed application form;	**Appendix A**	*Lac Ste. Anne County DP Form*
ii. A written and graphical description of adjoining land uses within a minimum distance of 3.2 km (2.0 miles) of the legal property line of the subject site;	**Sections** 4.1 - *Existing Land & Adjacent Land*	**Appendix L** Conservation and Reclamation Drawings
iii. Maximum tonnes of aggregate to be extracted per year;	**Section** 5.0 - *Project Operations*	
iv. The proposed development area, including the total area that will be disturbed by the aggregate resource extraction use over the life of the development;	**Sections** 5.6 - *Project Development* 6.0 - *Conservation and Reclamation*	
v. A list of all other approvals required (which may include: Provincial water diversion licence for pit de-watering, Federal requirements);	**Sections** 1.1- *Overview* 3.0 - *Provincial Requirements*	
vi. A copy of any applications as well as a copy of any responses or approvals from other authorities such as Alberta Environment and Sustainable Resource Development (AESRD) and Alberta Transportation, to allow the County to maintain complete records and to ensure that all relevant land use criteria are being satisfactorily addressed;	**Appendix C** Authorizations **Sections** 3.0 - *Provincial Requirements* 3.2 - *Historical Resources Act*	
vii. A description of the gravel mining method;	**Section** 5.10 - *Sequence Plan*	**Appendix L** Conservation and Reclamation Drawings
viii. A description of the extraction process;	**Section** 5.6 - *Project Development*	**Appendix L** Conservation and Reclmation Drawings
ix. The type of crusher to be used; and	**Sections** 5.6 - *Project Development* 5.1 - *Intent and Need*	
x. Total amount of aggregate to be mined out.		

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

The applicant shall submit as part of the application one (1) or more parcel plans, at a scale satisfactory to the Development Authority (it is recommended that the scale drawings be developed and printed on 11" X 17" paper at a minimum), showing all of the following:	**Page / Appendix**	**Notes**
a. North point;	Drawing No. 1-16	**Appendix L** Conservation and Reclamation Drawings
b. Legal description of parcel;	Drawing No. 1-16	
c. Site dimensions and location with respect to parcel boundaries;	Drawing No. 2-16	
d. Pre-disturbance topographical map at a minimum of 1:5000 scale with a minimum contour index of 1.0 m;	Drawing No. 3-16	
e. Location of existing facilities (i.e., water wells, buildings and major landscaped area including buffering and screening area) and where the proposed activity is to be located within the property;	Drawing No. 5-16	
f. Location of existing drainage features, and significant natural features on and within 0.5 km (0.31 miles) of the site;	Drawing No. 3-16 and 16-16	
g. Access and egress points to and from the site;	Drawings No. 6-16, 7-16, 8-16.	
h. Extraction locations and final extraction elevation;	Drawings No. 10-16 to 15-16	
i. Stockpile locations (e.g.: for topsoil, subsoil overburden, and aggregate)	Drawing No. 5-16	
j. A phasing diagram showing phasing scheme for the pit;	Drawings No. 5-16 to 8-16	
k. Locations and extents of designated processing buffer areas containing production, washing, fueling, and crushing activities (including an explanation of the placement of such things as fuel storage, crushers, asphalt, and wash machines, as well as the orientation of the engines for such machines);	Drawings No. 5-16 to 8-16	
l. Line-of-sight data from the site to all residential uses within a minimum of 400.0 m (1312.34 ft) or as determined by the Development Authority;	Drawings No. 2-16 and 9-16	
m. Accompanying text to site plan explaining the sequence of mining, the placement of fuel storage areas, and the placement of the crusher (i.e., bottom of pit);	**Sections** 5.10 - *Sequence Plan* 3.1.2.2 - *Washing* Drawing No. 5-16	
n. The location of existing and proposed municipal and private local improvements as well as a time and engineering cost estimate of the installation of these improvements;	**Sections** 2.2 *Development Permit* 2.4 *Road Use*	
o. If there is a pipeline in the area and its location in conjunction with the proposed development; and	Drawing 5-16	
p. Estimated cost of the project, excluding land prices.	**Sections** 5.1 - *Intent and Need*	

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

For all applications within 0.5 km (0.31 miles) of a water body, the applicant shall provide the following as part of the application:	Page / Appendix	Notes
a. Identification of all upstream, downstream, and associated hydraulically connected water bodies.	Sections *5.11 Groundwater* *5.13 Surface Water*	**Appendix E** HCL Groundwater Review
b. Identification of surface water and groundwater flows, volumes, and directions to water bodies identified in Subsection (a).		**Appendix E** HCL Groundwater Review
c. Identification of natural in-stream flow requirements required for maintaining the health of water bodies identified in Subsection (a), as determined by a registered professional.		**Appendix E** HCL Groundwater Review **Appendix F** Environmental Impact Assessment
d. Itemized cost of establishing and maintaining the applicable environmental continuous monitoring of the items identified in Subsections (a), (b), and (c) for the life of the operation.		**Appendix F** Environmental Impact Assessment

PUBLIC CONSULTATION

Prior to submitting a redistricting and development permit application for an aggregate resource extraction use and prior to commencement of construction, the applicant must conduct at least the following two activities:	Page / Appendix	Notes
a. One (1) information meeting that provides details on the development and compliance with the requirements of any relevant municipal policies. Mitigation factors related to aggregate resource extraction activity must be addressed. Additional terms of reference for an Environmental Impact Assessment shall be determined during this meeting.	Sections *2.2 Development Permit* *2.5 Public Consultation*	**Appendix J** Marcomm Works Open House
b. One (1) open house to present details of the development and to gather public feedback. The applicant shall provide to the County notice of the open house in stamped envelopes to be addressed by the County for any affected parties.	**Sections** *2.5 - Public Consultation*	**Appendix J** Marcomm Works Open House

During the application review process, the applicant must conduct a regulated public hearing, including:	Page / Appendix	Notes
a. Notice of the public hearing, which shall: i. Include date, time, and place of event, purpose of proposal, and how to submit concerns; ii. Be published in at least two (2) issues of a newspaper circulating in the County, the publication date of the second issue being not less than five (5) days prior to the event; and iii. Be mailed to registered owners of the land, if not the applicant, registered owners of adjacent land, and any other affected parties.	**Sections** *2.5 - Public Consultation*	**Appendix J** Marcomm Works Open House
b. Presentation of details of the proposal to the public and provide means of representation for affected parties and the general public.		

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

PUBLIC CONSULTATION (CONT.)

The results of above Section, including a description of how the proposal addresses public concerns, must be submitted to the Development Authority during the application review process. **The Applicant shall keep records from the open house and submit a report to the Development Authority. These records shall include the location and time of open house, and shall address the following issues:**	Page / Appendix	Notes
a. The number of people that attended, and the issues that were brought forward.	2.5 - *Public Consultation*	Appendix J Marcomm Works Open House
b. How the pit operator plans to mitigate any legitimate concerns that were brought forward.		
c. Whether the proposed pit will affect any Site rights of way, i.e.: power lines, pipelines, gas co-ops, etc.	4.2 - *Right-of-Way and Easements*	
d. Location and hours of operation of a visitor's area, where visitors can visit the operation when it is operating and observe the operation for their own benefit.	*1.2 - Location and Land Ownership* *5.5 - Hours & Hauling*	
e. Whether the sand and gravel development conflicts with other land uses, long-term priorities for the community, and if so, what measures will be implemented to minimize these conflicts.	*5.4 Transportation of Aggregate* **Appendix L** *Drawing No 9-16*	
f. Confirmation on whether or not all residents directly affected by the proposed resource extraction use (those adjacent and within 2 kilometers (1.24 miles) of the resource extraction Site) have been personally interviewed and/or notified in writing of the intent to develop the Site.	*2.5 Public Consultation*	
g. Whether plans are laid out for directly affected residents to be notified prior to activation of pit operations.	*2.5 Public Consultation*	Appendix J *Marcomm Works Open House*
h. Whether one or more open houses have been held in the community.		Appendix J *Marcomm Works Open House*
i. Whether provisions exist for affected residents to be consulted (on an annual basis) throughout the lifespan of the sand and gravel operation.		Appendix J *Marcomm Works Open House*

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

RECLAMATION

The applicant shall include site plans in duplicate at a scale satisfactory to the Development Authority (it is recommended that the scale drawings be developed and printed on 11" X 17" paper at a minimum) showing the following:	Page / Appendix	Notes
a. Topsoil and subsoil salvage and replacement.	*6.3 - Soil Replacement*	
b. Cross-sections, including the slopes and the gradients prior to gravel mining and the reclaimed slopes once the reclamation is completed.	**Appendix L** Conservation and Reclamation Plan	
c. Contour elevations of the subject site before and after pit completion.	**Appendix L** Conservation and Reclamation Plan	
A reclamation plan shall be required for all aggregate resource extraction use approvals. A County approved reclamation plan shall be prepared by a qualified professional and shall include, but not be limited to:		
a. A description of the operational plan for the site.	*5.6 - Project Development*	
b. The location of all improvements, stockpiles, equipment, access, signage, and pits.;	*5.10 - Extraction Sequence Plan*	
c. A topographical map, at a minimum of 1:5000 scale with a minimum contour index of 1.0 m, showing the predicted contours of the site after completion of the reclamation, where the final contours shall be no steeper than 4:1.	*6.0 - Reclamation Plan* *6.1 - Proposed End Land Use*	
d. A phasing diagram, in accordance with the Provincial Guide, Progressive Reclamation, showing the phasing scheme for the pit including the time frame when reclamation will be completed.	**Appendix L** Drawing No. 5-16	
e. The amount of aggregate materials, in cubic metres (m3), located on the site to be extracted under this permit. This information is for internal use only.	*5.1 - Intent and Need* *5.6 - Project Development* *6.0 Reclamation Plan*	
f. For pits not utilizing a scale on-site, the estimated amount of aggregate material, in cubic metres (m3), for each phase.	*N/A*	
g. Estimated cost for reclamation including estimated costs for each phase.	*6.0 - Reclamation Plan*	
h. A description of the steepness of slopes.	Drawing No. 10-16	
i. Potential end land use (i.e., agricultural, country, residential).	*6.0 - Reclamation Plan*	
j. Use(s) that may be effected.	*5.7 - Buffers and Setbacks*	
k. Re-vegetation to be used on the reclaimed site.	*5.12 - Water Management*	
l. Details about pit reclamation, including subsoil and topsoil replacement and compaction.	*6.1 - Proposed End Land Use*	
m. Location of water bodies, if any.	Drawing No. 10-16	

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

RECLAMATION (CONT.)

The reclamation plan shall comply, at a minimum, with the following standards:	Page / Appendix	Notes
a. Drainage: Prior to re-contouring, the pit floor area should be sloped to a low point located at the bottom of the pit area.	5.13 - *Surface Water* 5.12 - *Water Management*	
b. Re-contouring: The slope must be developed in a manner similar to pre-disturbance topography.	5.12 - *Water Management* 6.1 - *Proposed End Land Use*	
c. Subsoil and Topsoil Replacement: The available subsoil and topsoil should be spread evenly across the recontoured areas of the site.	6.0 - *Reclamation Plan*	**Appendix L** Conservation and Reclamation Plan
d. Seed Bed Preparation: The re-contoured and reclaimed areas of the site should accommodate conventional tillage equipment and, as a result, the soil should be adequately prepared for seeding at the site with an approved species of vegetation.		Drawing No.10-16 **Table 7** Pasture Seed for [...] Site
e. Seeding and Vegetation Establishment: The site should be seeded in a manner suitable to the applicant in consultation and approval with Lac Ste. Anne County.		

OPERATIONS, SAFETY AND EMERGENCY RESPONSE PLAN

The applicant shall include the following information related to operations and safety at the aggregate extraction and processing site satisfactory to the Development Authority:	Page / Appendix	Notes
a. Days and hours of operation including a breakdown of hours of operation for: i. Aggregate extraction activities; ii. Reclamation activities; iii. Transportation of aggregate off-site iv. Aggregate resource processing activities; v. Stripping operations; vi. Mining/crushing/washing operations; vii. Asphalt production; viii. Concrete production; and ix. Hauling operations	*5.0 Project Operations*	
b. Descriptions of the extraction process including sequencing, stripping, and stockpiling details.	5.10 - Extraction *Sequence Plan*	
c. Type of crusher being used.	*5.14 - Aggregate Procesing*	
d. Total amount of sand and gravel to be mined out.	5.1 - *Intent and Need* 5.6 - *Project Development*	
e. The proposed number of years of operation and when reclamation will commence.	5.6 - *Project Development* 6.0 - *Reclamation Plan*	

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

OPERATIONS, SAFETY AND EMERGENCY RESPONSE PLAN (CONT.)	Sections
f. Access and haul roads.	**5.5 - *Hours and Hauling*** 5.4 - *Transportation of Aggregate*
g. Details on location, specifications and standards of construction of all main internal roadways located within the site	*5.4 - Transportation of Aggregate* *5.7 - Buffers and Setbacks*
h. Location of stockpiles.	*5.6 - Project Development* *5.7 - Buffers and Setbacks*
i. Provisions for loading and parking.	**Appendix L** Drawings No. 5-16 and 9-16
j. The garbage and storage area, fencing and screening proposed for this area, and methods of disposing of garbage.	5.0 Project Operations
k. Location of servicing, fueling, and rinsing of trucks, including fuel storage areas.	5.0 Project Operations
l. A plan to limit surface water from entering the site.	5.0 Project Operations
m. Location of any potential containers to collect used oil and filters.	*5.19 Waste Management*
n. A plan to prevent permeation of contaminants into the soil.	5.20 - *Fuel Storage*
o. Details about on-site sewage and garbage disposal:	
i. Method of effluent disposal;	*5.19 - Waste Management*
ii. Portable toilets;	
iii. Sewage hauling and removal protocols;	
iv. Garbage bins; and	
v. Any other important details.	
p. Details about the use of asphalt, wash, crush, or concrete plant part of the pit operation. If these materials are to be used as part of the pit operation, describe the type of equipment used in the asphalt, wash, crush, and/or concrete plant including its placement, the placement of the power source, the location of the water source, and where the source gravel will come from if it originates off-site.	5.0 Project Operations **Appendix L** *Conservation and Reclamation Drawings*
q. A written security plan that identifies:	**Appendix N** *Emergency Response Plan*
i. Potentially dangerous situations or areas;	
ii. Typical procedures to be used for monitoring the site during periods of activity;	*5.18 - Environmental Management*
iii. When activities are suspended;	*5.21 - Complaint Response Policy*
iv. Information access;	*5.22 - Site Security Plan*
v. Fencing;	
vi. Security features;	
vii. Signage; and	
viii. Emergency response procedures, including procedures for responding directly to a complainant, the County, or regulatory body, and procedures for documenting and keeping records of complaints.	

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

OPERATIONS, SAFETY AND EMERGENCY RESPONSE PLAN (CONT.)

	Page / Appendix	Notes
r. Methods to be used to restrict public access and to protect wildlife and neighbouring livestock.	5.22- *Site Security Plan* 4.11 - *Wildlife*	**Appendix L** Conservation and Reclamation Drawings Drawing No. 1-16 Drawing No. 2-16
s. Location of the nearest city, town, village, or summer village and its distance from the proposed pit.	2.2 - *Development Permit* 4.1 - *Adjacent Land Uses*	
t. The name, address, and telephone number of any landowners or occupants that are affected by the proposed development, which at a minimum includes those landowners or occupants within 2.0 km (1.24 miles) of the proposed development and those whose residences are located on a haul route.	4.1 - *Adjacent Land Use* 5.5 - *Hours and Hauling* 5.21- *Complaint Response Policy*	**Appendix L** Conservation and Reclamation Drawings Drawing No. 9-16
u. A list of emergency contact personnel to be used by the County for the pit operation, for active times, when the pit operation is suspended, and during final reclamation. An Emergency Management Plan, approved by the Director of Emergency Management, must be submitted.	**Appendix N** Emergency Response Plan	

SETBACK AND SCREENING

The applicant shall include the following information related to setbacks and screening at the aggregate extraction and processing site to the satisfaction of the Development Authority:	Page / Appendix	Notes
a. Written consent from all pipeline and right-of-way holders within the pit or within the vicinity of the pit.	4.2 - *Right of Ways and Easements*	
b. Details of the screening and landscaping to be undertaken by the applicant, to reduce the negative visual impact of the development. The details should include, but are not limited to, information related to:		**Appendix L** Conservation and Reclamation Drawings Drawing No. 10-16
i. The location and area of native vegetation that will remain undisturbed;	5.7- *Buffers and Setbacks* 5.8 - *Vegetation Clearing* 6.0 - *Conservation and Reclamation Plan*	
ii. The location, design, and staging of any visual barriers to be constructed by the applicant, such as fences or berms;		
iii. The location and area where the applicant will plant vegetation and trees; and		
iv. Details on any other measures to be taken by the applicant.		
c. Proposed setbacks or buffers related to protection of natural heritage features, ecological function, or rare and endangered species.	5.7 - *Buffers and Setbacks*	

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

TRANSPORTATION OF AGGREGATE ON OR OFF-SITE

The applicant shall include the following information related to transportation of aggregate to and from the proposed site to the satisfaction of the Development Authority:	Page / Appendix	Notes
a. A description of all haul routes that indicates the shortest and most desired route from the proposed pit to a processing area if off-site, or from another site to the processing area if being transported on-site. The description shall also indicate the shortest route to the nearest provincial roadway within a suitable access to accommodate projected traffic from the proposed development, and approximate gravel truck counts and frequency per day for both full and empty gravel trucks.	5.4 - *Transportation of Aggregate* 5.5 - *Hours and Hauling*	**Appendix G** Traffic Impact Assessment **Appendix L** Conservation and Reclamation Drawings Drawing No. 9-16
b. At the discretion of the Development Authority, details of alternate routes to the one being proposed.	N/A	
c. At the discretion of the Development Authority, site plans in duplicate at a scale satisfactory to the Development Authority (it is recommended that the scale drawings be developed and printed on 11" X 17" paper at a minimum) showing the proposed haul routes.		**Appendix L** Conservation and Reclamation Drawings Drawing No. 9-16
d. Description of plans for removal of internal roads, fences, and barriers or any internal roads that may be left.	6.0 - *Reclamation Plan*	
e. Details of the dust control measures to be implemented, including the suppressant materials or methods to be used on the haul roads and the estimated frequency for the application of these measures.	5.15 *Dust Control*	
f. A report on the proposed haul route or haul routes (if more than one route is proposed) that shall include and address the following:	5.4 - *Transportation of Aggregate* 5.5 - *Hours of Operation and Hauling*	**Appendix L** Conservation and Reclamation Drawings Drawing No. 9-16 **Appendix G** Traffic Impact Assessment
i. Anticipated daily/weekly/monthly motor vehicle traffic generation;		
ii. Number of vehicles that will be used in the hauling of materials and the proposed hauling route to and from site;		
iii. Access locations to and from the site, including municipal roads and highways;		
iv. A description of roads constructed within the site that are required for the operation of pit;		
v. A description of any road construction or road upgrading that is necessary to access the pit's working area;		
vi. Details on whether the haul route is on a school bus route;		
vii. Information on whether haul routes have been established and agreed upon;		
viii. Information on the number of gravel trucks that will be operating and whether the number has been agreed upon;		
ix. Details of any traffic impact assessment that has been undertaken and implemented to address potential traffic issues; and		
x. Details on moratoria to be placed on hauling during spring road bans.		

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

TRANSPORTATION OF AGGREGATE ON OR OFF-SITE (CONT.)

g.	A Traffic Impact Assessment (TIA) shall be prepared by a qualified professional and submitted to the County if determined necessary by the Development Authority. The TIA shall include traffic impact on all County roads to be accessed by the resource extraction use and all proposed haul routes to the nearest provincial highway, off-site processing area, and from another site to a processing use on-site. The TIA requirement may be waived by the Development Authority, but such waiver shall not cause an application for an aggregate resource extraction use to be deemed a discretionary use.		Appendix G Traffic Impact Assessment
h.	The TIA shall cite cumulative impacts by including anticipated traffic levels (incl. peak loading) from existing approved gravel operations; other resource extraction uses with an active but not yet decided development permit application; and approvals not in operation. The County can provide this information upon written request.		Appendix G Traffic Impact Assessment

SURFACE WATER

The applicant shall include the following information related to surface water to the satisfaction of the Development Authority:		**Page / Appendix**	**Notes**
a.	Site plans in duplicate at a scale satisfactory to the Development Authority (it is recommended that the scale drawings be developed and printed on 11" X 17" paper at a minimum) showing the storm drainage plan including surface and groundwater management measures, and direction of drainage.	5.13 - *Surface Water Management* 5.12 - *Water Management*	Appendix L Conservation and Reclamation Drawings
b.	A description of the current surface drainage patterns on the site and the anticipated drainage patterns once the reclamation is complete.		Drawing No. 2-16 Drawing No. 10-16 Drawing No. 16-16
c.	Consideration of the presence (including downstream) of commercial, recreational, or Aboriginal fisheries that may be affected by changes in the surface water drainage patterns, including but not limited to: i. Water quality and sediment transport; ii. Changes in flow and velocity; iii. Fish passage; and iv. Thermal regime, as described under the *Federal Fisheries Act*.	5.13 - *Surface Water Management* 5.12 - *Water Management*	
d.	An analysis of the potential for adverse impact on surface water as a result of the extraction and reclamation.		

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

GROUND WATER

The applicant shall include the following information related to groundwater to the satisfaction of the Development Authority:	Page / Appendix	Notes
a. An analysis of the potential for adverse impact on groundwater aquifers and water wells as a result of the extraction and reclamation.	4.9 - *Groundwater*	
b. The quantity and quality of well water for any water supply system that may be used in conjunction with the proposed development. Analysis and testing must be consistent with the *Water Act* and *Alberta Environment Guide to Groundwater Authorizations*;	5.12 - *Water Management*	
c. A hydrogeology report prepared by a qualified hydrogeologist with a P.Eng. or P.Geo. designation. Hydrogeology reports submitted to the County may be provided to, and shared with users of, the water portal. The report shall be consistent with the *Water Act* and *Alberta Environment Guide to Groundwater Authorizations*. Where extraction occurs below the water table, the report shall include: i. Location and description of existing water users (i.e.: water wells); ii. Description of the geology, hydrogeology, and surface water features on and surrounding the site; iii. Hydrogeological cross-sections showing hydrostratigraphy and groundwater levels; iv. Aquifers; v. Surface water and groundwater interactions; vi. Proposed dewatering plan and discharge locations; vii. Groundwater quality; viii. Water diversions; ix. Site water budget; x. Impact assessment including existing water uses and natural features; and xi. Mitigation and monitoring measures		**Appendix E** HCL Groundwater Review **Appendix C** Water Act Authorizations **Appendix L** Conservation and Reclamation Drawings Drawing No. 10, 12, 16-16
d. Any hydrogeology report prepared in support of a *Water Act* licence.		**Appendix E** HCL Groundwater Review

AGGREGATE APPLICATIONS PROCESSING FORM (CONT.)

NOISE

The applicant shall include the following information related to noise to the satisfaction of the Development Authority:	Page / Appendix	Notes
a. Site plans in duplicate at a scale satisfactory to the Development Authority (it is recommended that the scale drawings be developed and printed on 11" X 17" paper at a minimum) which provides the acoustic mapping of the site;.		**Appendix H** Patching Noise Assessment
b. A description of measures to be taken to minimize noise to neighboring properties;	5.17 - *Noise Control*	**Appendix H** Patching Noise Assessment
c. A written assessment including a description of mitigation measures that will be implemented as part of the overall resource extraction operation to reduce acoustic impacts on adjoining land uses; and	5.17 - *Noise Control*	**Appendix H** Patching Noise Assessment
d. Confirmation that any crusher located on the site shall be located at the bottom of the excavation area as soon as reasonably possible and shall be located so that any muffler located on the crusher is pointed towards the wall of the excavation area or any other structure or surface that may act as a noise barrier (e.g.: berm or on-site building).	5.0 *Project Operations*	

DUST

To the satisfaction of the Development Authority, the applicant shall include the following information on the details of the dust control measures to be implemented, including the suppressant materials or methods to be used on the pit floor and on stockpiles located on the site, and the estimated frequency for the application.	5.15 - Dust Control	

LAC STE. ANNE COUNTY

Development Permit Application
Aggregate

APPLICANT DECLARATION

I hereby make application for a Development Permit in accordance with the plans and supporting information submitted herewith.

I hereby give my consent to allow any authorized person, pursuant to Section 542 of the *Municipal Government Act*, the right to enter the land and/or building(s) with respect to this application or potential verification of permit conditions arising from this application.

I hereby acknowledge that if this permit is issued I may be required to place a drainage easement on my property.

This information redacted as per Protection of Privacy Act (POPA)

Applicant(s) signature

This information redacted as per Protection of Privacy Act (POPA)

Applicant(s) signature

April 24/25

Please note: The personal information provided will be used to process the Development Permit application and is collected under the authority of Section 642 of the *Municipal Government Act*. Personal information provided may be recorded in the minutes of the Municipal Planning Commission, or otherwise made public pursuant to the provisions of the *Freedom of Information and Protection of Privacy (FOIP) Act*, including Sections 39 through 42 therein.

Any documentation/information (including personal information) required for processing an application will become public once submitted to the Municipal Planning Commission or Development Authority for review and processing.

TIME EXTENSION AGREEMENT

I, Peter Wall agree to enter into an agreement with Lac Ste. Anne County to extend the legislated development permit processing time limit for a period for 20 days (60 days instead of 40 days) for decision.

This information redacted as per Protection of Privacy Act (POPA)

Applicant(s) signature

Applicant(s) signature

April 24/25
Application date

Please complete if there a

I, DUANE DREWS This information redacted as per Protection of Privacy — AFFIRM THAT I AM THE REGISTERED OWNER Apr. 24/25

I, DONALD DREWS This information redacted as per Protection of Privacy — AFFIRM THAT I AM THE REGISTERED OWNER Apr. 24/25

I, JOYCE DREWS This information redacted as per Protection of Privacy — AFFIRM THAT I AM THE REGISTERED OWNER Apr. 24/25

I, _____ This information redacted as per Protection of Privacy — AFFIRM THAT I AM THE REGISTERED OWNER _____

AUTHORIZATION FORM

Agent acting on behalf of a registered owner

I/We, 1531486 Alberta Ltd., being the registered owner(s) [illegible], do hereby authorize Lesley Foy of Aspen Land Group Inc. make application for subdivision on the above mentioned property.

This information redacted as per Protection of Privacy Act (POPA)

Registered landowner signature

This information redacted as per Protection of Privacy Act (POPA)

April 24/25
Application date

AGGREGATE DEVELOPMENT PERMIT FEE SCHEDULE

Gravel pit / granular extraction of any kind	$	50,000.00
Re-application of a gravel pit / granular extraction of any kind	$	15,000.00
Gravel pit / granular annual site inspection fee	$	2,000.00
Business licence *(new application)*	$	100.00
Business licence *(annual renewal)*	$	50.00

In addition to the development permit application fees specified in this schedule, the applicant is responsible for all reasonable fees and expenses incurred by the County in reviewing the development permit application, including but not limited to consultant fees.

Fees can be paid by credit card via the County's secure payment portal at LSAC.ca/payments, or in person at the County Administration Office located at 56521 Rge Rd 65 (1.5km east of Sangudo).

The penalty for starting a development without a permit is **triple the regular fee.**

ADDITIONAL DOCUMENTATION, SCHEDULES OR REPORTS

Please note: You may be required to submit some or all of the following, depending on the nature of the application.

FOR OFFICE USE ONLY

	REQUIRED	SUBMITTED
Adjacent landowner notification	☐	☐
Area structure plan	☐	☐
Biophysical assessment	☐	☐
Environmental site assessment	☐	☐
Full/partial professional involvement	☐	☐
Geotechnical report	☐	☐
Hydrogeological report	☐	☐
Landscaping plan	☐	☐
Master sign plan	☐	☐
Parking plan	☐	☐
Stormwater management plan	☐	☐
Traffic impact assessment	☐	☐

The personal information you provide will be used to process this application, and is collected under the authority of Section 642 of the *Municipal Government Act*. Personal information provided may be recorded in the minutes of Municipal Planning Commission meetings, or otherwise made public pursuant to the provisions of the *Freedom of Information and Protection of Privacy (FOIP) Act*, including sections 39 through 42 therein. For details on the collection, use or disclosure of this information, please contact the County FOIP Coordinator at the address below.

Appendix B

Certificates of Titles

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0022 752 034	5;3;53;33;NE	072 693 611

LEGAL DESCRIPTION

MERIDIAN 5 RANGE 3 TOWNSHIP 53
SECTION 33
QUARTER NORTH EAST
CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS
EXCEPTING THEREOUT: 0.415 HECTARES (1.03 ACRES) MORE
OR LESS, AS SHOWN ON ROAD PLAN 8422070
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: LAC STE. ANNE COUNTY

REFERENCE NUMBER: 952 038 386

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
072 693 611	27/11/2007	TRANSFER OF LAND	$150,000	SEE INSTRUMENT

OWNERS

DONALD DREWS

AND
JOYCE DREWS

AND
DUANE DREWS

This information redacted as per Protection of Privacy Act

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
772 122 890	30/06/1977	UTILITY RIGHT OF WAY GRANTEE - STE ANNE NATURAL GAS CO-OP LIMITED.
072 022 612	12/01/2007	CAVEAT RE : LEASE CAVEATOR - NEVA AG VENTURES LTD. P.O. BOX 130 HUSSAR ALBERTA T0J1S0
082 002 555	03/01/2008	CAVEAT RE : LEASE INTEREST , ETC. CAVEATOR - 1531486 ALBERTA LTD. 2200, 10235-101 ST EDMONTON ALBERTA T5J3G1 AGENT - ERIC VAILLANT (DATA UPDATED BY: TRANSFER OF CAVEAT 102174344) (DATA UPDATED BY: TRANSFER OF CAVEAT 102174349)
102 132 368	22/04/2010	CAVEAT RE : PURCHASERS INTEREST CAVEATOR - 767452 ALBERTA LTD. C/O MCPHERSON LESLIE & TYERMAN LLP 2200 10235 101 STREET EDMONTON ALBERTA T5J3G1 AGENT - NEIL GOWER

TOTAL INSTRUMENTS: 004

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 23 DAY OF APRIL, 2025 AT 03:53 P.M.

ORDER NUMBER: 53499131

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

(CONTINUED)

THIS ELECTRONICALLY TRANSMITTED LAND TITLES PRODUCT IS INTENDED FOR THE SOLE USE OF THE ORIGINAL PURCHASER, AND NONE OTHER, SUBJECT TO WHAT IS SET OUT IN THE PARAGRAPH BELOW.

THE ABOVE PROVISIONS DO NOT PROHIBIT THE ORIGINAL PURCHASER FROM INCLUDING THIS UNMODIFIED PRODUCT IN ANY REPORT, OPINION, APPRAISAL OR OTHER ADVICE PREPARED BY THE ORIGINAL PURCHASER AS PART OF THE ORIGINAL PURCHASER APPLYING PROFESSIONAL, CONSULTING OR TECHNICAL EXPERTISE FOR THE BENEFIT OF CLIENT(S).

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0022 776 059	5;3;53;33;NW	102 174 334 +2

LEGAL DESCRIPTION
MERIDIAN 5 RANGE 3 TOWNSHIP 53
SECTION 33
QUARTER NORTH WEST
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME
AREA: 64.7 HECTARES (160 ACRES) MORE OR LESS

ESTATE: FEE SIMPLE

MUNICIPALITY: LAC STE. ANNE COUNTY

REFERENCE NUMBER: 082 304 093

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
102 174 334	21/05/2010	TRANSFER OF LAND		SEE INSTRUMENT

OWNERS

1531486 ALBERTA LTD.

This information is redacted as per the Protection of Privacy Act (POPA)

(DATA UPDATED BY: CHANGE OF ADDRESS 112260716)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
752 043 591	24/04/1975	UTILITY RIGHT OF WAY GRANTEE - STE ANNE NATURAL GAS CO-OP LIMITED.
082 224 745	29/05/2008	UTILITY RIGHT OF WAY GRANTEE - CENTRAL ALBERTA RURAL ELECTRIFICATION ASSOCIATION LIMITED.

TOTAL INSTRUMENTS: 002

(CONTINUED)

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 23 DAY OF APRIL, 2025 AT 03:53 P.M.

ORDER NUMBER: 53499131

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

THIS ELECTRONICALLY TRANSMITTED LAND TITLES PRODUCT IS INTENDED FOR THE SOLE USE OF THE ORIGINAL PURCHASER, AND NONE OTHER, SUBJECT TO WHAT IS SET OUT IN THE PARAGRAPH BELOW.

THE ABOVE PROVISIONS DO NOT PROHIBIT THE ORIGINAL PURCHASER FROM INCLUDING THIS UNMODIFIED PRODUCT IN ANY REPORT, OPINION, APPRAISAL OR OTHER ADVICE PREPARED BY THE ORIGINAL PURCHASER AS PART OF THE ORIGINAL PURCHASER APPLYING PROFESSIONAL, CONSULTING OR TECHNICAL EXPERTISE FOR THE BENEFIT OF CLIENT(S).

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0022 752 075	5;3;53;34;SW	102 174 334 +3

LEGAL DESCRIPTION

MERIDIAN 5 RANGE 3 TOWNSHIP 53
SECTION 34
QUARTER SOUTH WEST
CONTAINING 64.3 HECTARES (159 ACRES) MORE OR LESS.
EXCEPTING THEREOUT: A) 1.799 HECTARES 4.45 ACRES) MORE
OR LESS, AS SHOWN ON ROAD PLAN 5026ET
B) ALL THAT PORTION WHICH LIES WEST AND NORTH RESPECTIVELY
OF THE WESTERLY AND NORTHERLY LIMITS OF THE ROAD AS SHOWN
ON SAID ROAD PLAN 5026ET
CONTAINING 14.9 HECTARES (36.71 ACRES) MORE OR LESS.
C) 0.212 HECTARES (0.52 ACRES) MORE OR LESS, AS SHOWN ON
ROAD PLAN 8422070
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: LAC STE. ANNE COUNTY

REFERENCE NUMBER: 082 357 081

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
102 174 334	21/05/2010	TRANSFER OF LAND		SEE INSTRUMENT

OWNERS

1531486 ALBERTA LTD.

This information is redacted as per the Protection of Privacy Act (POPA)
This information is redacted as per the Protection of Privacy Act (POPA)

(DATA UPDATED BY: CHANGE OF ADDRESS 112260717)

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
882 217 461	15/09/1988	UTILITY RIGHT OF WAY GRANTEE - STE ANNE NATURAL GAS CO-OP LIMITED.

TOTAL INSTRUMENTS: 001

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 23 DAY OF APRIL, 2025 AT 03:53 P.M.

ORDER NUMBER: 53499131

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

THIS ELECTRONICALLY TRANSMITTED LAND TITLES PRODUCT IS INTENDED FOR THE SOLE USE OF THE ORIGINAL PURCHASER, AND NONE OTHER, SUBJECT TO WHAT IS SET OUT IN THE PARAGRAPH BELOW.

THE ABOVE PROVISIONS DO NOT PROHIBIT THE ORIGINAL PURCHASER FROM INCLUDING THIS UNMODIFIED PRODUCT IN ANY REPORT, OPINION, APPRAISAL OR OTHER ADVICE PREPARED BY THE ORIGINAL PURCHASER AS PART OF THE ORIGINAL PURCHASER APPLYING PROFESSIONAL, CONSULTING OR TECHNICAL EXPERTISE FOR THE BENEFIT OF CLIENT(S).

Appendix C

EPEA Registration and *Water Act* Authorizations

12-009

Alberta Environment and Parks

Operations
Regulatory Approvals Centre
Main Floor, Oxbridge Place
9820 – 106 Street
Edmonton, Alberta T5K 2J6
Canada
Telephone: (780) 427-6311
Fax: (780) 422-0154
www.environment.alberta.ca

EMAILED
Sept 17/15

September 17, 2015

Peter Wall
1531486 Alberta Ltd.
This information redacted as per Protection of Privacy Act (POPA)

Dear Mr. Wall:

RE: Application No. 001-325413
Code of Practice for Pits
Alberta Beach Pit N 33 & SW 34-053-03-W5M

We have completed our review of your estimate of reclamation costs for the purpose of determining the security deposit requirement. Your estimate in the amount of $798,720.45 is acceptable and you should submit this amount by October 16, 2015. For your convenience, I am enclosing a summary of the options available for security deposit.

We will complete our review of your application, however, we will not be able to recommend that a Registration be issued until receipt of security.

If we do not receive security by October 16, 2015, we will assume that you wish to withdraw your application and we will return it.

If you have any questions, please call me at (780) 427-9541.

Yours truly,

This information redacted as per Protection of Privacy Act (POPA)

Valerie Collins
Application & Security Coordinator

Encl.

cc: Derek Alexander, Upper Athabasca Region – Spruce Grove
Michele Corry, Aspen Land Group Inc.

Alberta Environment and Parks

Operations Division
Suite #1 250 Diamond Avenue
PO Box 4240
Spruce Grove AB T7X 3B4
Telephone: 780-960-8600
Fax: 780-960-8605
www.alberta.ca

REGISTRATION
PROVINCE OF ALBERTA

ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT
R.S.A. 2000, c.E-12, as amended

REGISTRATION NO.: 00325413-00-00

APPLICATION NO.: 001-00325413

EFFECTIVE DATE: October 21, 2015

REGISTRATION HOLDER: 1531486 Alberta Ltd.

Registration is issued for the following activity:

The construction, operation and reclamation of a pit located in N 33-053-03-W5M and SW 34-053-03-W5M as described in the Activities Plan submitted with the registration application.

Designated Director under the Act ..... This information redacted as per Protection of Privacy Act (POP A) ..... Eng.

Date Signed ..... October 21, 2015

GIS 12 007

Alberta Environment and Parks

Operations Division
Suite #1, 250 Diamond Avenue
PO Box 4240 (T7X 3B4)
Spruce Grove, Alberta T7X 4C7
Telephone: 780-960-8600
Fax: 780-960-8605
www.aep.alberta.ca

December 22, 2016

File No.: 00325507
Application No: 001-00325507

Michelle Corry, P. Ag.
Aspen Land Group Inc.
#201 18311 105 Avenue
Edmonton AB T5S 2K9
[This information redacted as per

Dear Ms. Corry:

RE: Application for an Authorization(s) under the *Water Act*
1531486 Alberta Ltd. - Alberta Beach Pit Operations at
N 33-053-03 W5M and SW 34-053-03 W5M

An application for authorization(s) under the *Water Act* concerning sand and gravel extraction works at N 33-053-03 W5M and SW 34-053-03 W5M (Alberta Beach Pit) was received in our office on February 04, 2013 and since then has been reviewed according to the Provincial guidelines and regulations.

Unfortunately, the Director's decision on the *Water Act* approval application has been postponed due to the fact that no confirmation letter from Ducks Unlimited Canada for 17.88 ha of wetland habitat restoration has been provided.

Since a significant period of time has elapsed we would like to know if you are still interested in pursuing authorization under the *Water Act*. If you are still interested please respond in writing by **January 31, 2017**, otherwise your application may be considered withdrawn.

Please call me at 780-960-8630 if you have questions.

Sincerely,

This information redacted as per Protection of Privacy Act (POPA)

Derek Alexander, P. Eng.
Senior Water Administration Engineer

Alberta Environment and Parks

APPROVAL
PROVINCE OF ALBERTA
WATER ACT, R.S.A. 2000, c. W-3, as amended

APPROVAL NO.: 00325508-00-00

FILE NO.: 00325507

WATERBODY: Aquifer Accessed through Alberta Beach Sand & Gravel Pit

ACTIVITY LOCATION: NW 33-053-03 W5M and SW 34-053-03 W5M

EFFECTIVE DATE: March 8, 2018

EXPIRY DATE: March 7, 2028

APPROVAL HOLDER: 1531486 Alberta Ltd.

Pursuant to the Water Act, R.S.A. 2000, c. W-3, as amended, an Approval is issued to the Approval Holder for the following activity:

disturbance of wetlands

subject to the attached terms and conditions.

Designated Director under the Act: This information redacted as per Protection of Privacy Act (POPA)

Muhammad Aziz, P. Eng.

Date Signed: March 8, 2018

DEFINITIONS

1.0 All definitions from the Act and the Regulations apply except where expressly defined in this Approval.

1.1 In all parts of this Approval:

(a) "Act" means the Water Act, RSA 2000, c. W-3, as amended;

(b) "Director" means an employee of the Government of Alberta designated as a Director under the Act;

(c) "Regulations" means the regulations, as amended, enacted under the authority of the Act.

GENERAL

2.0 The Approval Holder shall immediately report to the Director by telephone, any contravention of the terms and conditions of this Approval at 780-422-4505.

2.1 The terms and conditions of this Approval are severable. If any term or condition of this Approval is held invalid, the application of such term or condition to other circumstances and the remainder of this Approval shall not be affected thereby.

2.2 The Approval Holder shall retain a copy of:

(a) this Approval; and

(b) the plan(s)/report(s) referred to in Section 3.1

at the site of the activity at all times while conducting the activity.

PARTICULARS

3.0 This Approval is appurtenant to the undertaking as described as disturbance of 5.51 ha of wetland area located at NW 33-053-03 W5M and SW 34-053-03 W5M as per plans and reports listed in the table in Subsection 3.1.

3.1 The Approval Holder shall undertake the activity in accordance with the following plans/reports:

TITLE	PLAN/ REPORT NO.
1531486 Alberta Ltd., Alberta Beach Pit,, Pit Registration, Water Act Authorizations & Development Permit Application, N 33 & SW 34-053-03 W5M, Lac Ste. Anne County, Prepared by Aspen Land Group	00325507-R001

Inc., dated January, 2013	
Environmental Impact Assessment in Support Of Alberta Beach Granular Pit, Revised Final Report, Prepared by Spencer Environmental Management Services Ltd., for RoJaS Management Ltd., 28 November 2014	00325507-R002
Groundwater Review, Lac Ste. Anne Area, Parts of Sections 28 and 32 to 34, Tp 053, R 03, W5M, Prepared by hydrogeological consultants ltd. (HCL), dated December, 2012.	00325507-R003
Email from Rick Nutbrown to Richard Spencer, dated 2010-10-06 re: Peatlands and Wetland Compensation	00325507-R004
1531486 Alberta Ltd., Alberta Beach Gravel Pit, Development and Reclamation Plan for Aggregate Extraction and Processing by RoJaS management Ltd., September 2011	00325507-R005
Historical Aerial Photograph Record (1950 – 2010)	00325507-P002
Alberta Beach Granular Pre-Disturbance Soil Characterization N1/2 33-053-03 W5M and SW1/4 34-053-03 W5M by Navus Environmental Inc., June 2011	00325507-R006
1531486 Alberta Ltd – Alberta Beach Pit, Response to Supplemental Information Request ESRD #00325507, December 19, 2014	00325507-R007
April 2014 Revised Drawings by Aspen Land Group Inc. 1531486 Alberta Ltd – Alberta Beach Pit, Response to 2nd Supplemental; Information Request, December 19, 2014	00325507-P001
1531486 Alberta Ltd – Alberta Beach Pit, Response to Supplemental Information Request ESRD #00325507, August 8, 2014	00325507-R008
1531486 Alberta Ltd – Alberta Beach Pit, Response to Supplemental Information Request ESRD #00325507, April 7, 2015	00325507-R009
Revised Referral dated July 23, 2015 by the Regional Limnologist Regarding Wetland Compensation	00325507-R010
Invoice, Executed Proposal, and Confirmation Notice for Paid Compensation by DUC, January 22, 2018	00325507-R011

3.2 The Approval Holder shall not undertake the activity in any manner or use any material that causes or may cause an adverse effect on the aquatic environment, human health or public safety.

3.3 The Approval Holder shall not release water affected by the activity to any water body unless the quality of water is equal to or better than the quality of water in the receiving water body.

3.4 The Approval Holder shall not clear vegetation during the period of 01 May to 10 August to avoid disturbance to breeding wildlife.

3.5 The Approval Holder shall not disturb mineral wetlands supporting waterfowl broods during the period of 01 May to 10 August unless a registered wetland specialist confirms the areas do not support breeding of young birds and amphibians.

CERTIFICATE OF COMPLETION

4.0 Within 30 days following completion of the activity, the Approval Holder shall submit to the Director, a Certificate of Completion.

4.1 The Certificate of Completion shall include:

(a) a statement that the activity has been completed in accordance with the Approval; and

(b) any other information requested in writing by the Director.

March 8, 2018
Date Signed

This information redacted as per Protection of Privacy Act (POPA)

Designated Director under the Act
Muhammad Aziz, P. Eng.

Alberta Government

LICENCE TO DIVERT WATER
PROVINCE OF ALBERTA
WATER ACT, R.S.A. 2000, c.W-3, as amended

LICENCE NO.: 00325507-00-00

FILE NO.: 00325507

PRIORITY NO.: 2013-02-06-001

EFFECTIVE DATE: March 8, 2018

EXPIRY DATE: March 7, 2028

SOURCE OF WATER: Aquifer Accessed by Alberta Beach Pit at NW 33-053-03-W5M

POINT OF DIVERSION: NW 33-053-03-W5M

LICENSEE: 1531486 Alberta Ltd.

Pursuant to the *Water Act*, R.S.A. 2000, c.W-3, as amended, a licence is issued to the Licensee to:

divert up to 2,970.0 cubic meters of groundwater annually from the aquifer accessed through the works of the Alberta Beach Pit at NW 33-053-03-W5M for the purpose of Commercial (Aggregate Washing) usage

subject to the attached terms and conditions.

This information redacted as per Protection of Privacy Act (POPA)

Designated Director under the Act: _____
Muhammad Aziz, P. Eng.

Date Signed: March 8, 2018

DEFINITIONS

1.0 All definitions from the Act and the Regulations apply except where expressly defined in this licence.

1.1 In all parts of this licence:

(a) "Act" means the Water Act, RSA 2000, c. W-3, as amended;

(b) "Application" means the written submissions to the Director in respect of application number 001-00325507 and any subsequent applications for amendments of Licence No. 00325507-00-00;

(c) "Aquifer" means the underground water-bearing formation that is capable of yielding water, that is accessed by the works authorized by this licence'

(d) "Director" means an employee of the Government of Alberta designated as a Director under the Act;

(e) "Gravel Pit" means any pit from which water is diverted for the purpose of this licence;

(f) "Point(s) of diversion" means the location(s) where water is diverted from the source of water;

(g) "Regulations" means the regulations, as amended, enacted under the authority of the Act; and

(h) "Water Use Reporting System" means the secure internet website provided by Alberta Environment at http://www.environment.alberta.ca/1286.html for submitting measuring and monitoring results electronically to the Director

GENERAL

2.0 The Licensee shall immediately report to the Director by telephone any contravention of the terms and conditions of this licence at 1-780-422-4505.

2.1 The terms and conditions of this licence are severable. If any term or condition of this licence is held invalid, the application of such term or condition to other circumstances and the remainder of this licence shall not be affected thereby.

2.2 The Licensee shall not deposit or cause to be deposited any substance in, on or around the source of water that has or may have the potential to adversely affect the source of water.

DIVERSION OF WATER

3.0 This licence is appurtenant to the following:

(a) The aquifer accessed through the works of Alberta Beach Pit at NW 33-053-03 W5M;

3.1 The Licensee shall divert water only for the purpose specified in this licence: Commercial (Aggregate Washing).

3.2 The Licensee shall divert water only from the source of water specified in this licence.

3.3 The works used to divert the water authorized by this licence shall include, at a minimum, the gravel pit referred to as Alberta beach Pit as described in the following reports::

TITLE	PLAN/ REPORT NO.
1531486 Alberta Ltd., Alberta Beach Pit,, Pit Registration, Water Act Authorizations & Development Permit Application, N 33 & SW 34-053-03 W5M, Lac Ste. Anne County, Prepared by Aspen Land Group Inc., dated January, 2013	00325507-R001
Environmental Impact Assessment in Support Of Alberta Beach Granular Pit, Revised Final Report, Prepared by Spencer Environmental Management Services Ltd., for RoJaS Management Ltd., 28 November 2014	00325507-R002
Groundwater Review, Lac Ste. Anne Area, Parts of Sections 28 and 32 to 34, Tp 053, R 03, W5M, Prepared by hydrogeological consultants ltd. (HCL), dated December, 2012.	00325507-R003
Email from Rick Nutbrown to Richard Spencer, dated 2010-10-06 re: Peatlands and Wetland Compensation	00325507-R004
1531486 Alberta Ltd., Alberta Beach Gravel Pit, Development and Reclamation Plan for Aggregate Extraction and Processing by RoJaS management Ltd., September 2011	00325507-R005
Historical Aerial Photograph Record (1950 – 2010)	00325507-P002
Alberta Beach Granular Pre-Disturbance Soil Characterization N1/2 33-053-03 W5M and SW1/4 34-053-03 W5M by Navus Environmental Inc., June 2011	00325507-R006
1531486 Alberta Ltd – Alberta Beach Pit, Response to Supplemental Information Request ESRD #00325507, December 19, 2014	00325507-R007
April 2014 Revised Drawings by Aspen Land Group Inc. 1531486 Alberta Ltd – Alberta Beach Pit, Response to 2nd Supplemental; Information Request, December 19, 2014	00325507-P001
1531486 Alberta Ltd – Alberta Beach Pit, Response to Supplemental Information Request ESRD #00325507, August 8, 2014	00325507-R008
1531486 Alberta Ltd – Alberta Beach Pit, Response to	00325507-R009

Supplemental Information Request ESRD #00325507, April 7, 2015	
Revised Referral dated July 23, 2015 by the Regional Limnologist Regarding Wetland Compensation	00325507-R010
Invoice, Executed Proposal, and Confirmation Notice for Paid Compensation by DUC, January 22, 2018	00325507-R011

3.4 The Licensee shall not exceed any of the limits specified in Table 3-1.

Table 3-1

WORKS IDENTIFCATION	LEGAL LAND DESCRIPTION of LOCATION	PRODUCTION INTERVAL (metres below grade)	MAXIMUM PUMP INTAKE DEPTH (metres below grade)	LIMITS	
				MAXIMUM RATE OF DIVERSION (cubic metres per day)	MAXIMUM ANNUAL DIVERSION (cubic metres)
Sand and Gravel Pit (Alberta Beach Pit)	NW 33-053-03-W5M	0 – 10.0	N/A	N/A	2,970

3.5 Prior to diverting any water from the source of water, the Licensee shall equip the pump with a measuring device, which cumulatively measures the quantity of all water diverted during the term of this licence:

3.6 The Licensee shall maintain the measuring device referred to in 3.5 at all times.

MONITORING AND REPORTING

4.0 Unless otherwise authorized in writing by the Director, the Licensee shall:

(a) monitor the total number of cubic metres of water diverted;

(b) measure the total number of cubic metres of water diverted, and

(c) record the total number of cubic metres of water diverted;

from the gravel pit on a weekly basis while pumping water.

4.1 The Licensee shall report to the Director the results of the measuring and monitoring required in 4.0 using the "Water Use Reporting System" and any other information required in writing by the Director.

4.2 The Licensee shall, when requested in writing by the Director, submit the report required in 4.0 on or before the end of each week in which the information is based upon was collected.

COMPLAINT INVESTIGATION

5.0 The Licensee shall:

(a) provide to all water users, within a distance specified in writing by the Director from the point of diversion, the contact name(s) and telephone numbers of the licensee or representative(s);

(b) investigate all written complaints accepted by the Director relating to allegations of surface water and groundwater interference as a result of the diversion of the water or operation of the works; and

(c) provide a written report to the Director, within a time specified in writing by the Director, detailing the results of the investigation relating to the complaint accepted by the Director in 5.0(b) including:

a. recommendations to remediate and/or mitigate the impact(s) such as:

i. lowering the intake of the pump to compensate for a drop in water level in Mr. Dave Franczak, or

ii. re-drilling Mr. Dave Franczak water well to an increased depth so as to allow the pump to be installed at a lower depth, or

iii. drilling a new water well for Mr. Dave Franczak or

iv. providing a temporary alternate water supply until the problem is permanently resolved; and

b. any other information required by the Director.

5.1 The Licensee shall satisfy the Director that the report submitted pursuant to 5.0 has identified remedial and/or mitigative measures relating to the alleged interference.

This information redacted as per Protection of Privacy Act (POPA)

March 8, 2018
Date Signed

Designated Director under the Act
Muhammad Aziz, P. Eng.

Alberta Environment and Parks

APPROVAL
PROVINCE OF ALBERTA
WATER ACT, R.S.A. 2000, c. W-3, as amended

APPROVAL NO.: 00325510-00-00

FILE NO.: 00325507

WATERBODY: Aquifer Accessed Through Aggregate Extraction Pit

ACTIVITY LOCATION: NE 33-053-03-W5M, NW 33-053-03-W5M & SW 34-053-03-W5M

EFFECTIVE DATE: March 8, 2018

EXPIRY DATE: March 7, 2028.

APPROVAL HOLDER: 1531486 Alberta Ltd.

Pursuant to the Water Act, R.S.A. 2000, c. W-3, as amended, an Approval is issued to the Approval Holder for the following activity:

to construct a temporary recharge pond hydraulically connected to the aquifer at the site and to recirculate up to 147,030 cu meters of ground water yearly

subject to the attached terms and conditions.

This information redacted as per Protection of Privacy Act (FOIP Act)

Designated Director under the Act: This information redacted as per

Muhammad Aziz, P. Eng.

Date Signed: March 8, 2018

DEFINITIONS

1.0 All definitions from the Act and the Regulations apply except where expressly defined in this Approval.

1.1 In all parts of this Approval:

(a) "Act" means the Water Act, RSA 2000, c. W-3, as amended;

(b) "Director" means an employee of the Government of Alberta designated as a Director under the Act;

(c) "Regulations" means the regulations, as amended, enacted under the authority of the Act.

GENERAL

2.0 The Approval Holder shall immediately report to the Director by telephone, any contravention of the terms and conditions of this Approval at 780-422-4505.

2.1 The terms and conditions of this Approval are severable. If any term or condition of this Approval is held invalid, the application of such term or condition to other circumstances and the remainder of this Approval shall not be affected thereby.

2.2 The Approval Holder shall retain a copy of:

(a) this Approval; and

(b) the plan(s)/report(s) referred to in Section 3.2

at the site of the activity at all times while conducting the activity.

PARTICULARS

3.0 This Approval is appurtenant to the undertaking at NE 33-053-03 W5M, NW 33-053-03 W5M and SW 34-053-03 W5M

3.1 The Approval Holder shall undertake the activity in accordance with the following plans/reports:

TITLE	PLAN/ REPORT NO.
1531486 Alberta Ltd., Alberta Beach Pit,, Pit Registration, Water Act Authorizations & Development Permit Application, N 33 & SW 34-053-03 W5M, Lac Ste. Anne County, Prepared by Aspen Land Group Inc., dated January, 2013	00325507-R001
Environmental Impact Assessment in Support Of Alberta Beach Granular Pit, Revised Final Report,	00325507-R002

Prepared by Spencer Environmental Management Services Ltd., for RoJaS Management Ltd., 28 November 2014	
Groundwater Review, Lac Ste. Anne Area, Parts of Sections 28 and 32 to 34, Tp 053, R 03, W5M, Prepared by hydrogeological consultants ltd. (HCL), dated December, 2012.	00325507-R003
Email from Rick Nutbrown to Richard Spencer, dated 2010-10-06 re: Peatlands and Wetland Compensation	00325507-R004
1531486 Alberta Ltd., Alberta Beach Gravel Pit, Development and Reclamation Plan for Aggregate Extraction and Processing by RoJaS management Ltd., September 2011	00325507-R005
Historical Aerial Photograph Record (1950 – 2010)	00325507-P002
Alberta Beach Granular Pre-Disturbance Soil Characterization N1/2 33-053-03 W5M and SW1/4 34-053-03 W5M by Navus Environmental Inc., June 2011	00325507-R006
1531486 Alberta Ltd – Alberta Beach Pit, Response to Supplemental Information Request ESRD #00325507, December 19, 2014	00325507-R007
April 2014 Revised Drawings by Aspen Land Group Inc. 1531486 Alberta Ltd – Alberta Beach Pit, Response to 2nd Supplemental; Information Request, December 19, 2014	00325507-P001
1531486 Alberta Ltd – Alberta Beach Pit, Response to Supplemental Information Request ESRD #00325507, August 8, 2014	00325507-R008
1531486 Alberta Ltd – Alberta Beach Pit, Response to Supplemental Information Request ESRD #00325507, April 7, 2015	00325507-R009
Revised Referral dated July 23, 2015 by the Regional Limnologist Regarding Wetland Compensation	00325507-R010
Invoice, Executed Proposal, and Confirmation Notice for Paid Compensation by DUC, January 22, 2018	00325507-R011

3.2 The Approval Holder shall not undertake the activity in any manner or use any material that causes or may cause an adverse effect on the aquatic environment, human health or public safety.

3.3 The Approval Holder shall not release water affected by the activity to any water body unless the quality of water is equal to or better than the quality of water in the receiving water body.

SILTATION AND EROSION CONTROL

4.0 The Approval Holder shall minimize:

(a) siltation; and

(b) erosion

of the water body as a result of the activity.

4.1 The Approval Holder shall:

(a) develop a written Siltation and Erosion Control Plan prior to commencing the activity;

(b) implement the Siltation and Erosion Control Plan; and

(c) retain a copy of the Siltation and Erosion Control Plan at the site of the activity at all times while conducting the activity.

4.2 The Siltation and Erosion Control Plan shall specify measures to minimize and avoid siltation and erosion of the water body and shall include, at a minimum, the following information:

(a) measures to ensure no removal or disturbance of bank vegetation outside the site of the activity;

(b) site preparation practices to be used on erodible soils;

(c) measures for the management of surface and subsurface water flow to minimize siltation and erosion of any water body;

(d) measures for the stabilization of all disturbed areas until vegetation or other long-term erosion control methods are fully established and functioning; and

(e) measures for the management of excavated material..

MONITORING AND REPORTING

5.0 On or before July 1, 2018, the Approval Holder shall install a groundwater monitoring well at a point between the well privately owned by George Astleford located NE 28-53-03-W5M and the active mining area to monitor water levels in the gravel aquifer.

5.1 Unless otherwise authorized in writing by the Director, the Approval Holder shall:

(a) monitor the water levels;

(b) measure the water levels; and

(c) record the water levels

in the monitoring well in 5.0 on monthly basis while water is being diverted.

5.2 Unless otherwise authorized in writing by the Director, the Approval Holder shall:

(a) monitor the total number of cubic metres of water diverted;

(b) measure the total number of cubic metres of water diverted; and

(c) record the total number of cubic metres of water diverted

to the recharge pond on a monthly basis while water is being diverted.

5.3 The Approval Holder shall record and retain all of the following information for a minimum of 5 years after being collected:

(a) the place, date and time of all monitoring, measuring and sampling;

(b) the results obtained pursuant to (5.1), and (5.2), and

(c) the name of the individual who conducted the monitoring, measuring and sampling stipulated in (a) and (b).

5.4 Unless otherwise authorized in writing by the Director, the Approval Holder shall submit records in 5.1 and 5.2 to the Director:

(a) On or before end of the month following the month the information was collected; or

(b) within a time period specified in writing by the Director.

COMPLAINT INVESTIGATION

6.0 The Approval Holder shall:

(a) provide to all water users, within a distance specified in writing by the Director from the point of diversion, the contact name(s) and telephone numbers of the licensee or representative(s);

(b) investigate all written complaints accepted by the Director relating to allegations of surface water and groundwater interference as a result of the diversion of the water or operation of the works; and

(c) provide a written report to the Director, within a time specified in writing by the Director, detailing the results of the investigation relating to the complaint accepted by the Director in 5.0(b) including:

a. recommendations to remediate and/or mitigate the impact(s) such as:

i. lowering the intake of the pump to compensate for a drop in water level in Mr. Dave Franczak, or

ii. re-drilling Mr. Dave Franczak water well to an increased depth so as to allow the pump to be installed at a lower depth, or

iii. drilling a new water well for Mr. Dave Franczak or

iv. providing a temporary alternate water supply until the problem is permanently resolved; and

b. any other information required by the Director.

6.1 The Approval Holder shall satisfy the Director that the report submitted pursuant to 6.0 has identified remedial and/or mitigative measures relating to the alleged interference.

CERTIFICATE OF COMPLETION

7.0 A Certificate of Completion is not required for this activity.

This information redacted as per Protection of Privacy Act (POPA)

March 8, 2018
Date Signed

Designated Director under the Act
Muhammad Aziz, P.Eng.

Alberta Environment and Parks

APPROVAL
PROVINCE OF ALBERTA
WATER ACT, R.S.A. 2000, c. W-3, as amended

APPROVAL NO.: 00325511-00-00

FILE NO.: 00325507

WATERBODY: Aquifer Accessed by Aggregate Extraction Site (Alberta Beach Pit)

ACTIVITY LOCATION: NW 33-053-3-W5M and SW 34-053-03 W5M

EFFECTIVE DATE: March 8, 2018

EXPIRY DATE: March 7, 2028

APPROVAL HOLDER: 1531486 Alberta Ltd

Pursuant to the Water Act, R.S.A. 2000, c. W-3, as amended, an Approval is issued to the Approval Holder for the following activity:

constructing end-pit water bodies at sand and gravel extraction site

subject to the attached terms and conditions.

Designated Director under the Act: This information redacted as per Protection of Privacy Act (POPA)
Muhammad Aziz, P. Eng.

Date Signed: March 8, 2018

DEFINITIONS

1.0 All definitions from the Act and the Regulations apply except where expressly defined in this Approval.

1.1 In all parts of this Approval:

(a) "Act" means the Water Act, RSA 2000, c. W-3, as amended;

(b) "Director" means an employee of the Government of Alberta designated as a Director under the Act;

(c) "Maintenance" means the routine repair, upkeep and preservation of the activity authorized under this approval; and

(d) "Regulations" means the regulations, as amended, enacted under the authority of the Act.

GENERAL

2.0 The Approval Holder shall immediately report to the Director by telephone, any contravention of the terms and conditions of this Approval at 780-422-4505.

2.1 The terms and conditions of this Approval are severable. If any term or condition of this Approval is held invalid, the application of such term or condition to other circumstances and the remainder of this Approval shall not be affected thereby.

2.2 The Approval Holder shall retain a copy of:

(a) this Approval; and

(b) the plan(s)/report(s) referred to in Section 3.2

at the site of the activity at all times while conducting the activity.

PARTICULARS

2.3 This Approval is appurtenant to NW 33-053-3-W5M and SW 34-053-03 W5M.

2.4 The Approval Holder shall undertake the activity in accordance with the following plans/reports:

TITLE	PLAN/ REPORT NO.
1531486 Alberta Ltd., Alberta Beach Pit,, Pit Registration, Water Act Authorizations & Development Permit Application, N 33 & SW 34-053-03 W5M, Lac	00325507-R001

Ste. Anne County, Prepared by Aspen Land Group Inc., dated January, 2013	
Environmental Impact Assessment in Support Of Alberta Beach Granular Pit, Revised Final Report, Prepared by Spencer Environmental Management Services Ltd., for RoJaS Management Ltd., 28 November 2014	00325507-R002
Groundwater Review, Lac Ste. Anne Area, Parts of Sections 28 and 32 to 34, Tp 053, R 03, W5M, Prepared by hydrogeological consultants ltd. (HCL), dated December, 2012.	00325507-R003
Email from Rick Nutbrown to Richard Spencer, dated 2010-10-06 re: Peatlands and Wetland Compensation	00325507-R004
1531486 Alberta Ltd., Alberta Beach Gravel Pit, Development and Reclamation Plan for Aggregate Extraction and Processing by RoJaS management Ltd., September 2011	00325507-R005
Historical Aerial Photograph Record (1950 – 2010)	00325507-P002
Alberta Beach Granular Pre-Disturbance Soil Characterization N1/2 33-053-03 W5M and SW1/4 34-053-03 W5M by Navus Environmental Inc., June 2011	00325507-R006
1531486 Alberta Ltd – Alberta Beach Pit, Response to Supplemental Information Request ESRD #00325507, December 19, 2014	00325507-R007
April 2014 Revised Drawings by Aspen Land Group Inc. 1531486 Alberta Ltd – Alberta Beach Pit, Response to 2nd Supplemental; Information Request, December 19, 2014	00325507-P001
1531486 Alberta Ltd – Alberta Beach Pit, Response to Supplemental Information Request ESRD #00325507, August 8, 2014	00325507-R008
1531486 Alberta Ltd – Alberta Beach Pit, Response to Supplemental Information Request ESRD #00325507, April 7, 2015	00325507-R009
Revised Referral dated July 23, 2015 by the Regional Limnologist Regarding Wetland Compensation	00325507-R010
Invoice, Executed Proposal, and Confirmation Notice for Paid Compensation by DUC, January 22, 2018	00325507-R011

2.5 The Approval Holder shall not undertake the activity in any manner or use any material that causes or may cause an adverse effect on the aquatic environment, human health or public safety.

2.6 The Approval Holder shall monitor for and repair any erosion that occurs due to the operation until a Reclamation Certificate under the Environmental Protection and Enhancement Act is obtained.

2.7 The Approval Holder shall ensure that the side slopes of the constructed water bodies are 5:1 or shallower for at least 1 meter below and 1 meter above the full supply level.

2.8 The Approval does not authorize the consumptive use of water from the waterbodies.

2.9 The Approval Holder shall not discharge any water from the end pit waterbody to any off site watercourses unless otherwise authorized in writing by the Director

SILTATION AND EROSION CONTROL

3.0 The Approval Holder shall minimize:

(a) siltation; and

(b) erosion

of the water body as a result of the activity.

CERTIFICATE OF COMPLETION

4.0 Within 30 days following completion of the activity, the Approval Holder shall submit to the Director, a Certificate of Completion.

4.1 The Certificate of Completion shall include:

(a) a statement that the activity has been completed in accordance with the Approval; and

(b) any other information requested in writing by the Director.

March 8, 2018
Date Signed

This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)

Designated Director under the Act
Muhammad Aziz, P. Eng.

Regulatory Assurance Division
Capital District, North Region
Suite #1, 250 Diamond Avenue
PO Box 4240 (T7X 3B4)
Spruce Grove AB T7X 4C7
Telephone: 780-960-8600

www.aep.alberta.ca

November 9, 2020

File No.: 325413

Mr. Peter Wall
peter@gjparking.com
1531486 Alberta Ltd.
11610 151 St. NW
Edmonton, AB T5M 4E9

Dear Mr. Wall

RE: Alberta Beach Pit 5 Year Report N33 & SW 34-053-03-W5M

Thank you for submitting the 5 Year Report (Schedule 4 – Part 1) for the Alberta Beach Pit. The information provided on October 8, 2020 comprises the complete report.

The next 5 year report (Schedule 4) will be required in October of 2025.

If you have any questions, please call me at 780-960-8660.

Sincerely,

This information redacted as per Protection of

John Augustyn, RPF
Reclamation Approval Coordinator

cc: Keira Nystrom knystrom@aspenlandgroup.com

11213 Winterburn Rd NW
Edmonton, AB T5S 2B2

Office (780) 809 8191
Fax (780) 809 8190
Site aspenlandgroup.com

October 10, 2025

Environment and Parks
Regulatory Approvals Centre
5th Floor Petroleum Plaza
9915 – 108 Street
Edmonton, AB T5K 2G8

Sent via email: epa.epeaapplications@gov.ab.ca

Reference: **Five Year Report (2020-2025)**
1531486 Alberta Ltd.
Alberta Beach Pit - N 33 & SW 34-053-03-W5M

Aspen Land Group Inc. has been retained by 1531486 Alberta Ltd. to prepare and submit a Five Year Report as required under the *Code of Practice for Pits* (the Code) for the Alberta Beach Pit (the pit), located within the N 33 & SW 34-053-03-W5M. EPEA Registration No. 325413-00-00 was issued on October 15, 2015 and the following information is submitted for the reporting period of 2020 to 2025. A copy of Schedule 4, Part 1 of the Code is included in this report.

Currently, the registered pit boundary is 132.68 ha; all of which remains undisturbed. No activity has occurred at the pit since the original registration of the pit. A scale drawing of current pit conditions is included for your review. Given that no activity has occurred at the pit since it was registered, security has only been updated to reflect the current 2025 rates for a total of $836,728.62.

If you should have any questions or concerns, or require any further information regarding this report, please contact the undersigned at (780) 809-8191 or alternatively at ddunbar@aspenlandgroup.com.

Sincerely,

Prepared by:

This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)

Dana Dunbar, BIT
Aspen Land Group Inc.

Reviewed by:

This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)

Lesley Foy, P.Ag.
Aspen Land Group Inc.

cc: Peter Wall, 1531486 Alberta Ltd.

Attachment A:

Table 1
Schedule 3 and 4 under the *Code of Practice for Pits*

Table 1.0 Security Estimate for Alberta Beach Pit			
Maximum Disturbance			37.1
Activity	Rate ($)	Amount	Total
Mobilization and Demobilization			$6,000.00
Soil Replacement ($/m3)			
Topsoil Replacement utilizing a Scraper	$2.50	84,288	$210,720.00
Subsoil Replacement utilizing a Scraper	$2.50	138,470	$346,175.00
Overburden Replacement utilizing a Scraper	$2.50	54,527	$136,317.50
Total Soil Replacement			**$693,212.50**
Contouring and Decompaction Activities ($/hour)			
Overburden contouring utilizing a D7 Crawler Tractor (Group 8)	$248.00	40	$9,920.00
Overburden ripping utilizing a D7 Crawler Tractor (Group 8) w/ ripper	$310.00	20	$6,200.00
Total Contouring and Decompaction Activities			**$16,120.00**
Final Landscaping and Seedbed Preparation ($/hour)			
Tractor (Group 4) w/ disc attachment	$138.00	20	$2,760.00
Total Landscaping and Seedbed Preparation			**$2,760.00**
Seeding and Fertilizer ($/hectare)			
Tractor (Group 4) w/ seeder attachment	$128.00	37.1	$4,748.80
Tractor (Group 4) w/ fertilizer attachment	$128.00	37.1	$4,748.80
Total Seeding and Fertilizer			**$9,497.60**
Subtotal Security at Third Party Costs			**$727,590.10**
Administration @ 15% of Total Reclamation Costs			**$109,138.52**
Total Security at Third Party Costs			**$836,728.62**
Security Currently Posted with AEP			**$798,720.45**
Additional Security Balance			**$38,008.17**

*All rates are per the Alberta Roadbuilders and Heavy Construction Association 2025 Equipment Rental Rates Guide and Membership Roster in combination with AEPA's standard rate of $2.50/m3 for the movement of reclamation material.

Security Estimate (Schedule 3)

Acres of land sanctioned at $250/acre: 0 acres

Acres x $250 = $0(a)

☒ Detailed full-cost security calculation attached

Total full-cost = $ 836,728.62(b)

Area of land at full-cost= 37.1 ha

Cost/hectare or acre = $ 22,553.33/ha

Total Security (a + b): $ 836,728.62

Proposed method of payment: ☒ Letter of Credit ☐ Cash ☐ Other (explain)_____

Signature and title of person submitting estimate:

This information redacted as per Protection of Privacy Act

Dana Dunbar, BIT

Junior Environmental Specialist

Aspen Land Group Inc.

Five-Year Report (Schedule 4, Part 1)

Pit Registration Number: 325413-00-00 Date: October 10, 2025

Name of registration holder: 1531486 Alberta Ltd.

This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)

Pit Location
LSD-Sec-Twp-Rge-Mer
N 1/2 33 & SW 34-053-03-W5M

Pit size:

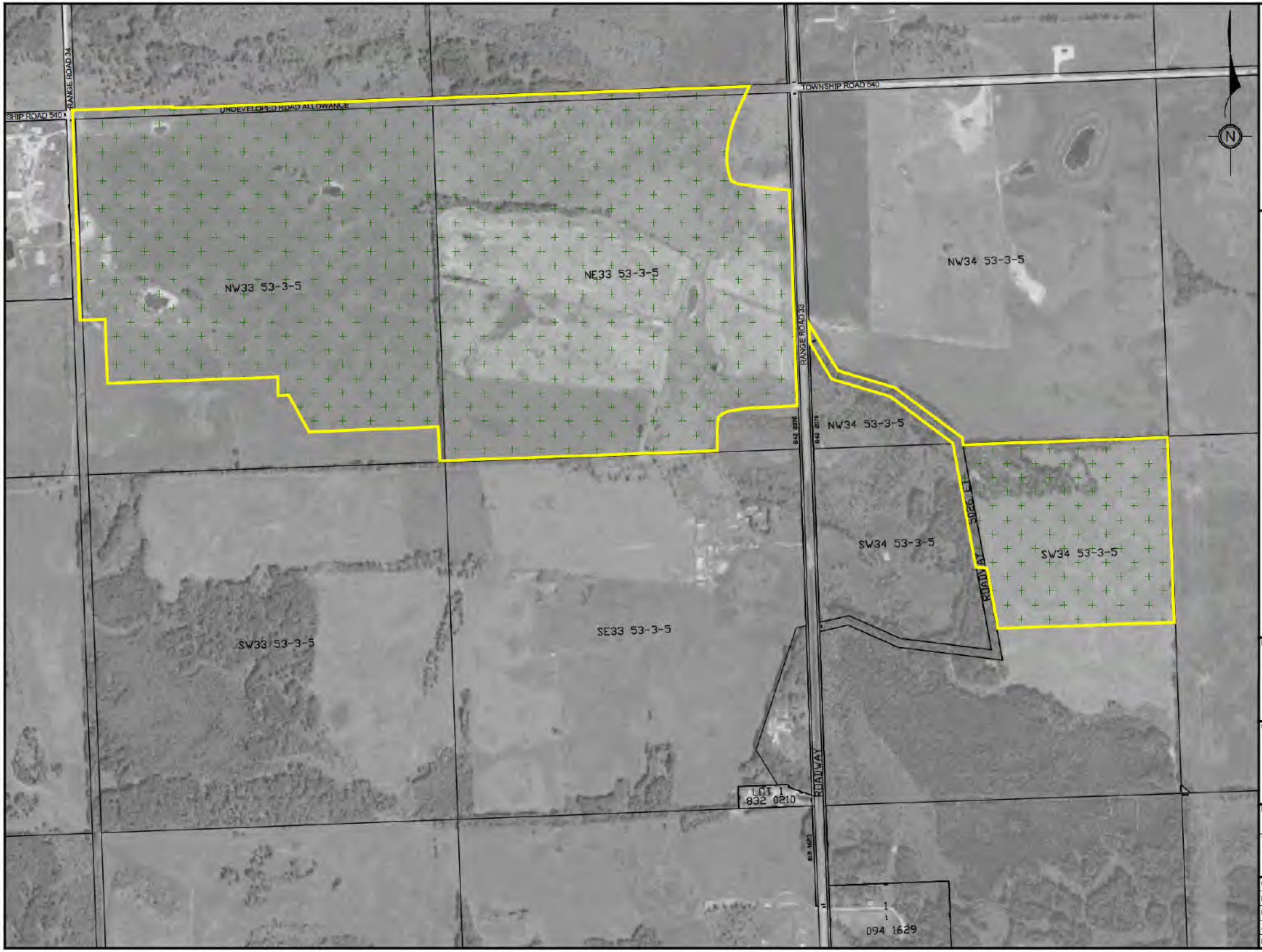
Total area (hectares / acres): 132.68 ha
Active area (hectares / acres): 0 ha
Undisturbed area (hectares / acres): 132.68 ha
Certified area (hectares / acres): 0 ha

Scale drawing of pit attached: Yes
Date pit size measured: (2022 Date of Air Photo) 1531486 Alberta Ltd. confirmed that the site was not entered.
Date drawing made: September 4, 2025

Signature and title of person submitting form: _____ This information redacted as per Protection of Privacy Act

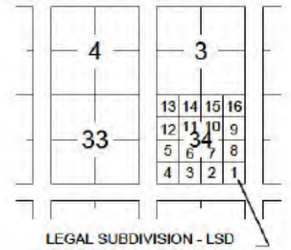
Dana Dunabr, BIT

Aspen Land Group Inc.



LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- PROPERTY LINES
- PIT BOUNDARY (132.68 ha)
- UNDISTURBED AREA (132.68 ha)

Prepared By

Aspen LAND GROUP

Client

1531486 ALBERTA LTD.

Project

ALBERTA BEACH PIT

Title

CURRENT CONDITIONS

Checked By: L. FOY	Scale 1: 8000
Designed By: L. FOY	Drawing No. 1 - 1
Drawn By: T. FOY	
Air Photo: 2022	
DATE: SEPTEMBER 04, 2025	

Appendix D

Preliminary Development and Reclamation Plan (September 2011)
Prepared by RoJaS Management Ltd.

1531486 ALBERTA LTD.

ALBERTA BEACH GRAVEL PIT

DEVELOPMENT AND RECLAIMATION PLAN

FOR AGGREGATE EXTRACTION AND PROCESSING

NE & NW of section 33 and SW of section 34
Township 53, range 3 west of the 5th meridian

Prepared by : R. J. (Bob) Sanderson, P.Eng.
RoJaS Management Ltd.
September, 2011

The Operations

This property was tested by a series of 43 flight auger drill holes and a test pit to determine the quantity and quality of aggregate. The whole area is underlain by an aggregate deposit but in many locations the aggregate is covered with too much overburden to be economically extracted in the foreseeable future. To determine the areas on this property from which aggregate can economically be extracted, an overburden to aggregate ratio of 3:1 was used. That is any area with an overburden to aggregate ratio of greater than 3:1 was deemed uneconomical to extract and was not included in the mining plan. A summary of the drill hole information is attached.

The areas that will be mined contain an estimated 6.56 million tonne of aggregate products. This mining development is planned to primarily supply construction aggregates to a sister company, G & J Parking Lot Maintenance, an Edmonton based heavy construction company. The expected annual quantity removed from this property is 300,000 tonne. The life of this project is expected to be approximately 22 years.

The majority of the products will be produced by portable crushing and screening operations. Two crushing sites will be used; one on each of the NW and NE quarters of section 33. An estimated 25% of the products will be washed. A stationary wash plant operation will be set up on the NW quarter of section 33. The wash plant will recirculate the wash water and will use a series of settling ponds to remove the silt. Approximately 49.5 cubic meters of water per day will be used at the wash plant. We estimate approximately 10% of this will be lost to evaporation. Adsorption of water into the product will be minimal as the material comes from below water and the pores are already saturated. Water consumption is estimated to be 49.5 cubic meters per day or 1,980 cubic meters per year.

The crushing operation will use a conventional one stage crushing and screening process. A primary crusher is not expected to be required as the amount of boulders too large to be crushed by secondary crushing is expected to be very small. These boulders will be scalped off and sold as rock products. The crushing sites are situated well away from any residents. All the pit run aggregate will be extracted in a damp to wet condition and dust created by crushing will be minimal.

The crushing/screening operation will operate 12 hours per day from Monday to Friday. Approximately 2,880 tonne of product per day will be produced. The crushing/screening operation will occur for 5 months each year. Approximately 75,000 tonne per year of the crushed product will be hauled to the wash plant site and washed. The wash plant will operate for approximately 2 months per year.

A truck scale will be installed on the NE quarter of section 33 along the access road to Range Road 33. Adequate space for truck parking will be provided on site in order that trucks will not have to stop on municipal roads. Hauling of product will occur for 12 hours per day from Monday to Saturday. Hauling frequency will vary by season with the peak of approximately 67 loads per day leaving the pit expected in October of each year.

No hauling is expected in January or February. It is expected that an average of 37 loads per day will leave the pit daily for 10 months per year. The internal haul roads will be sprayed with water to control dust. The school bus schedule will be acquired and no trucks will leave the pit while school buses are on the road.

Range Road 33 will be upgraded to industrial haul road standards from the point of entry southward to the point where it was previously upgraded by another gravel producer in Parkland County, a distance of 3.1 kilometers.

Overburden removal will occur for approximately 1.3 months each year. The initial year when the pit is being developed earthworks will occur for approximately 4 months.

The manpower on site will peak at 16 persons if all operations coincide. An additional 13 truck drivers would haul from the site at peak times. This is equivalent to 12 full time jobs created. The royalty payment to Lac Ste Anne County would be $75,000 per year or $1.64 million over the life of the project. This royalty is over and above property taxes.

The domestic water supply will be hauled and stored on site. All sewage will be collected in holding tanks and hauled from site for disposal. All other wastes will be hauled from site for disposal. All petroleum products will be stored in CSA approved fuel vault containers. Spill containment products will be on site at all times and employees will be trained in their use.

The site will be fenced along all sides where public access is possible and gates will be installed and locked during non-operating times. Signs will be installed to conform to municipal and provincial requirements.

A continuous air quality monitoring station exists on the SE of 6-54-3-W5M and is operated by the West Central Airshed Society. Air quality background information is available and air quality changes due to this development will be monitored.

All the material in this deposit can be made into aggregate products. If more sand is produced than market demand will accommodate the surplus will be placed into the bottom of the excavations.

The total disturbed area of this development will be 137.6 hectares. The maximum disturbed area at any time will be 35.4 hectares including all berms, stockpiles, access roads, mining areas and processing areas. The maximum extraction area at any time will be 6 hectares.

Basic Mining Parameters

This mining and reclamation plan has been designed using basic parameters which comply with Lac Ste Anne County regulations, with Alberta Environment Code of Practice and with industry acknowledged best practices.

All excavated materials will be treated in six categories which are mineral topsoil, organic topsoil, subsoil, overburden, sand and gravel. Each type of excavated material will be handled separately. If stockpiled, the categories of material will be kept separate. All stockpiles with duration of more than one year will be vegetated by an appropriate grass mixture.

The aggregates will be mined in a succession of mining blocks. As much as possible the categories of excavated material will be directly placed in a previously mined block. As much as possible the materials excavated will be replaced near the same location they originated from. This procedure will minimize the disturbed area at any time.

The aggregate deposits on this property occur below water table. De-watering is necessary to extract the aggregates. For de-watering of the first mining block the water will be temporarily stored on surface in a water storage area. All subsequent mining blocks will be de-watered into an excavated mining block which has direct hydraulic connection to the aquifer. When the aggregate is extracted from the first mining block the temporarily stored water will be pumped into the empty mining block. The water from de-watering mining blocks 25 & 26 will also be temporarily stored on surface and then pumped into mining block 26 after the gravel has been extracted.

A reclaimed surface topography will be established for the entire mining area. Several areas on the property will not be mined and will be used for overburden, topsoil, and subsoil stockpiling. As successive mining blocks are excavated and reclaimed materials will be taken from or added to these stockpiles to maintain the final reclaimed topography. The various materials will be replaced in the same layers of material categories as they were excavated. The top of each material type will be scarified before the next material type is placed upon it.

The product will be hauled from the property on internal haul roads and will exit the development on the east side of the north east quarter of section of 33-53-3-W5 on to Range Road 33. The product will be hauled southward to Highway 16 and the majority will proceed eastward into the Edmonton area. Range Road 33 will be upgraded to industrial haul road standards through Lac Ste Anne County southward from the point of entry and through Parkland County to the point where it was previously upgraded by another gravel pit operator.

Berms will be constructed at the perimeter of the mining property to act as visual and sound barriers at all locations where the public could reasonably access the property.

The surface of the property is generally sloped toward the north with an elevation differential of only 7 meters across the property. The only clearly defined drainage channel on the property is a ditch which has been excavated across the NE of 33-53-3-W5.

Several wetlands have been identified on the property and care has been taken to minimize wetland disturbance. The wetland disturbance will be mostly on Class III wetlands.

Ground water movement is from south-east to north-west. The mining blocks will generally be staged from the north-west to the south-east to minimize the quantity of de-watering required.

A Ste. Anne Gas Co-op pipeline is located through the NE and NW of 33-53-3-W5. This pipeline will be relocated prior to any development.

The areas to be mined contain an estimated 6,559,650 tonne of aggregate products. The planned extraction and processing rate is 300,000 tonne per year. This project is expected to span approximately 23 years.

After reclamation two water bodies will remain. The water body on the NW of 33-53-3-W5M will have a full supply surface area of 0.88 hectares and will have a drainage area of 104.1 hectares. The water body on the SW of 34-53-3-W5M will have a full supply surface area of 0.4 hectares and will have a drainage area of 2.4 hectares.

The average depth of the total excavations on this development will be 19.8 meters.

Mining and Reclamation Sequence

Phase 1 Development

Block 1 in the north-west portion of the north-west of 33-53-3-W5 is approximately 4.0 ha. in surface area and is typified by test hole BH 08-1439 & BH 08-1440. The average material thickness and quantities are :

	Thickness (meters)	Quantity (cubic meters)
Topsoil	0.23	9,200
Sub-soil	0.55	22,000
Overburden	12.17	486,800
Coarse Gravel	4.85	194,000

The topsoil, sub-soil, and overburden will all have to be stockpiled as this mining block will act as the recharge area for de-watering from the subsequent mining blocks in the north-west and north-east quarters of section 33-53-3-W5. The area immediately to the

south of the mining block will be used as the crushing site for the aggregate from the mining block and will later be used as a washing plant site.

Mining block 2 immediately west of mining block 1 will be mined next. It is approximately 1.87 ha. in surface area and is typified by test holes BR 08–1439 & BR 08–1440. The average material thickness and quantities are:

	Thickness (meters)	Quantity (cubic meters)
Topsoil	0.47	8,790
Sub-soil	0.72	13,460
Overburden	11.76	219,910
Coarse gravel	4.85	90,695

There are two distinct types of topsoil present; mineral topsoil and organic topsoil. These types of topsoil will be stockpiled separately.

The areas and quantities of topsoil and subsoil that will have to be stockpiled are listed below.

Mineral topsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 1	40,000	9,200
Processing Site	60,000	13,200
Overburden Berm	16,420	2,960
Water Storage Dykes	8,500	2,980
Subsoil Stockpile	25,600	14,080
Haul Road	31,590	7,900
Mining Block 2	18,700	22,000
Area A	40,000	9,200
Area B	45,000	13,500
Mining Block 3	19,000	7,600
Mining Block 4	18,500	3,700
Total	323,310	106,320

Organic topsoil

Location	Area (square meters)	Quantity (cubic meters)
Overburden Berm	19,700	21,280
Water Storage Dykes	8,500	9,780
Total	28,200	31,060

Subsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 1	40,000	22,000
Processing Site	60,000	39,600
Overburden Berm	16,420	5,580
Water Storage Dykes	8,500	1,700
Haul Road	31,290	25,970
Mining Block 2	18,700	13,460
Mining Block 3	19,000	11,590
Area A	40,000	18,000
Area B	45,000	13,500
Total	278,910	151,400

The mineral topsoil will be stockpiled to the south of the processing site. This stockpile will be 5 meters in height with 3:1 side slopes. The area of the stockpile will be 1.90 hectares.

The organic topsoil will be stockpiled between the processing site and area A. It will be 5 meters in height with 2:1 side slopes. The area of the stockpile will be 0.38 hectares.

The subsoil will be stockpiled to the south of area B. It will be 5 meters in height with 2:1 side slopes. The area of the stockpile will be 2.56 hectares.

Step 1: The topsoil and subsoil will be removed from mining block 1, the processing site, the overburden berm, the water storage dykes and the haul road and stockpiled at the appropriate locations.

The overburden will be removed from mining block 1 and used to construct the water storage dykes, the overburden berm and the haul road. The remainder of overburden will be stockpiled at area A.

The water storage dykes will be 3.5 meters in height with a 4 meter wide top and 3:1 side slopes. This area will hold 150,000 cubic meters of water with a 0.8 meter freeboard. A 600mm CSP culvert will be installed as an emergency spillway to provide for an extraordinary precipitation event which may occur when the storage area is at full supply level.

The overburden berm will be 4 meters in height with a 4 meter wide top and 3:1 side slopes. The overburden berm is designed to be partially on top of the undeveloped road allowance along the north side of the property.

The haul road will be constructed without ditches. It will be 1 meter in height with 3:1 side slopes and have a 10 meter wide top. A 600mm CSP culvert will be installed to

accommodate any surface water drainage. The best clay from the overburden will be used to construct the Water Storage Dykes and Haul Road.

A drainage ditch will be constructed along the west and north outside of the overburden berm to drain surface water from the Hickie Property.

The pit run aggregate will be extracted from mining block 1 and processed at the processing site. Water from de-watering mining block 1 will be temporarily stored at the water storage area.

Step 2 : The topsoil and subsoil will be removed from mining block 2 and area B and stockpiled at the appropriate locations.

The overburden from mining block 2 will be excavated next. A clay dyke will be constructed along the west side of mining block 1 with a top width of 4 meters. The water from the water storage area will now be pumped into the empty mining block 1. The remaining overburden from Mining Block 2 will be stockpiled on Area B.

Ground water from de-watering of mining block 2 will be pumped into mining block 1 where it will re-enter the ground water.

This phase of development along with the stockpiling of topsoil and subsoil from mining block 3 and stockpiling of topsoil from mining block 4 will be the maximum disturbance of the project. The estimated cost of reclamation will reflect this situation.

Phase 2 Development

In Phase 2 the overburden from each successive mining block will be placed into the previously extracted mining block. Ground water from de-watering of each mining block will be pumped into the former mining block 1 which is now the ground water recharge area.

The topsoil and subsoil from mining block 3 will be excavated and stockpiled at the appropriate locations. The overburden will be placed directly in mining block 2.

After the gravel has been extracted from mining block 3, the stripping of mining block 4 will begin. The topsoil will once again be stockpiled in the appropriate area but the sub-soil will now be placed directly onto mining block 2.

All materials from excavation of the remaining mining blocks in phase 2 development will now be placed directly on previously filled in mining blocks.

Upon completion of mining block 6 operations will relocate to the NE quarter of 33-53-3-W5. This re-location is necessary to have the end pit water body remaining after reclamation located on the NW of 33-53-3-W5 as this land is owned by the developer rather than leased.

Overburden will be taken from the temporary water storage dykes and from area A to backfill mining block 6; subsoil and topsoil will be taken from the stockpiles to complete reclamation of mining blocks 2,3,4,5 & 6.

Phase 3 Development

Mining block 7 will be located in the south west portion of the NE quarter of 33-53-3-W5. It is typified by BH 07-1124. It will be 1.94 ha. in size and the average material thickness and quantities are as follows :

	Thickness (meters)	Quantity (cubic meters)
Topsoil	0.28	5,430
Subsoil	0.45	8,730
Overburden	11.27	218,640
Coarse Gravel	5.40	104,760

The areas and quantities of topsoil and subsoil that will have to be stockpiled are listed below.

Mineral topsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 7	19,400	5,430
Crushing Plant Site	40,000	9,600
Overburden Berm	28,190	11,280
Area C	36,900	12,550
Subsoil Stockpile	15,200	3,040
Mining Block 8	19,800	6,530
Total	159,490	48,430

Organic topsoil

Location	Thickness (meters)	Quantity (cubic meters)
Overburden Berm	35,230	35,930
Mining Block 9	18,700	16,640
Totals	53,930	52,570

Subsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 7	19,400	8,730
Crushing Plant Site	40,000	27,200
Overburden Berm	28,190	16,350
Area C	36,900	24,720
Mining Block 8	19,800	13,270
Totals	144,290	90,270

The mineral topsoil will be placed in a stockpile north of the haul road. This stockpile will be 5 meters high with 2:1 side slopes. It will cover 0.82 hectares.

The organic topsoil will be stockpiled to the east of the crushing plant site. The stockpile will be 5 meters in height with 2:1 side slopes and will cover 0.89 hectares.

The subsoil will be stockpiled south of the haul road. The stockpile will be 5 meters in height with 2:1 side slopes and will cover 1.52 hectares.

The overburden from mining block 7 will be used to complete the overburden berm along the north, east and south sides of the NE quarter of 33-53-3-W5. The berm will go around the wetland in the south east corner of the quarter section and around the wetland and the communication tower in the north east corner. The remaining overburden will be stockpiled at Area C.

A drainage ditch must be excavated from the existing dugout to the property line south of mining block 11. A 600mm CSP culvert will be placed under the perimeter berm to the ditch on Range Road 33. This will accommodate any surface drainage issues in the NE of 33-53-3-W5.

The gravel from this mining block and subsequent ones will be crushed at the crushing plant site. Aggregates designated for washing will be hauled to the wash plant site and processed.

The topsoil from mining blocks 8 & 9 will be stockpiled at the designated sites as will the sub-soil from mining block 8. After this all materials excavated from mining blocks 10 to 24 will be placed directly on previously excavated mining blocks. The final reclamation topography will have been determined and material will be added to or taken away from areas A, B & C to achieve this. As soon as each mining block has received topsoil it will be seeded to the desired crop or pasture.

All of the NE and NW of 33-53-3-W5 will now be reclaimed except for the crushing plant site, the haul road from Range Road 33 to the site and the sub-soil and topsoil berms kept for reclaimation of the crushing plant site. An end pit water body will be left

in the area of mining block 24. The overburden from the perimeter berms and the remaining overburden stockpiles will be used to fill in the ground water discharge area.

Phase 4 Development

The area in the SW of 34-53-3-W5 with gravel deemed economical to mine will be mined in two blocks; mining blocks 25 & 26. The gravel will be extracted from here and hauled to the NE of 33-53-3-W5 for processing. It will be processed into crushed and screened products, no washed products will be produced from here.

The gravel in mining block 26 is typified by BH08-1500. It is 3.0 hectares in size with overburden and pit run gravel as follows:

	Thickness (meters)	Quantity (cubic meters)
Topsoil	0.21	6,300
Sub-soil	0.55	16,500
Overburden	2.74	82,200
Fine Gravel	4.9	147,000
Coarse Gravel	0.9	27,000
Overburden	6.4	192,000
Sand	2.2	66,000
Coarse Gravel	1.5	45,000
Sand	1.5	45,000
Coarse Gravel	1.5	45,000

The gravel in mining block 26 is typified by BH08-1498. It is 2.9 hectares in size with overburden and pit run gravel as follows:

	Thickness (meters)	Quantity (cubic meters)
Topsoil	0.22	6,380
Sub-soil	0.53	15,370
Overburden	11.65	337,850
Sand	0.6	17,400
Coarse Gravel	0.6	17,400
Sand	2.1	60,900
Coarse gravel	4.3	124,700

All of the ground water from de-watering of the two mining blocks will have to be temporarily stored on surface. This quantity of water is estimated to be a maximum of 450,000 cubic meters. A storage area will be constructed on an area of 11.2 hectares. The dykes will be 4.8 meters in height have a 4 meter wide top and 3:1 side slopes. This will contain the maximum estimated quantity of water and have 0.8 meters of freeboard. A 600 mm diameter CSP culvert will be installed for an emergency spillway to provide for an extraordinary precipitation event.

A small berm of 2 meters in height will be constructed along the property lines in the north east half of the property. This berm will have a 4 meter wide top and 3:1 sideslopes.

The mineral topsoil, organic topsoil and subsoil from the following areas will have to be stockpiled.

Mineral topsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 25	30,000	6,300
Perimeter Berms	8,480	1,700
Water Storage Dykes	14,500	2,900
Overburden Stockpile	26,900	6,190
Sand Stockpile	18,700	3,180
Subsoil Stockpile	9,500	2,090
Total	108,080	22,360

Organic Topsoil

Location	Area (square meters)	Quantity (cubic meters)
Perimeter Berms	2,820	2,820
Water Storage Dykes	29,500	35,400
Total	32,320	38,220

Subsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 25	30,000	16,500
Perimeter Berms	8,480	4,490
Water Storage Dykes	14,500	10,150
Overburden Stockpile	26,900	14,800
Sand Stockpile	18,700	10,280
Total	98,580	56,220

The overburden will be removed from mining block 25 and used to construct the perimeter berms and the temporary water storage dyke. The remaining overburden will be stockpiled. The 111,000 cubic meters of sand will be excavated and stockpiled.

The organic overburden will be stockpiled in a berm to the south of the temporary water storage area. Care will be taken not to construct the water storage dykes on top of any organic topsoil to eliminate any leakage from the reservoir.

The 147,000 cubic meters of fine gravel and the 117,000 cubic meters of coarse gravel will be hauled to the processing area on the NE of 33-53-3-W5. An abandoned municipal

road allowance exists along the edge of the Franczak property in the NW of 34-53-3-W5. It will be upgraded and used as a haul road for the pit run.

Upon completion of the gravel extraction from mining block 25, the stockpiled sand will be placed at the bottom of the excavation. The topsoil and subsoil will be removed from mining block 26 and stockpiled in the appropriate locations. The overburden will be removed and placed on top of the sand in the excavated mining block 25. The sand from mining block 26 will be stockpiled at the appropriate location.

The 142,100 cubic meters of coarse gravel from mining block 27 will be hauled to the processing area on the NE of 33-53-3-W5.

The water from the temporary water storage area will be pumped back into mining block 26 and will be allowed to infiltrate back into the groundwater. The stockpiled sand will be placed at the bottom of the excavation and the stockpiled overburden placed on top of it.

The temporary water storage dykes, the perimeter berms and the haul road will be excavated and the material used to contour the mined area. The sub-soil and topsoil will be replaced and seeded.

The crushing plant site and washing plant site will now be reclaimed.

Reclamation Plan

Progressive reclamation will be a feature of this development plan. The overburden from the first two mining blocks will be used to construct berms and roads and the remainder will be stockpiled. Care will be taken to stockpile the mineral topsoil, organic topsoil, subsoil and other overburden separately. The overburden from the third mining block will be directly placed into the second mining block and all subsequent mining blocks will have the overburden directly placed into the previously mined block. The sub-soil from the fourth mining block will be placed on top of the replaced overburden in mining block 2. The topsoil from mining block 5 will be placed on top of the sub-soil on mining block 2. The following table shows the movement of the topsoil, sub-soil and overburden.

Mining Block	Top Soil	Sub Soil	Overburden
1	Stockpiled	Stockpiled	Stockpiled
2	Stockpiled	Stockpiled	Stockpiled
3	Stockpiled	Stockpiled	Mining Block 2
4	Stockpiled	Mining Block 2	Mining Block 3
5	Mining Block 2	Mining Block 3	Mining Block 4
6	Mining Block 3	Mining Block 4	Mining Block 5
7	Stockpiled	Stockpiled	Stockpiled
8	Stockpiled	Stockpiled	Mining Block 7

9	Stockpiled	Mining Block 7	Mining Block 8
10	Mining Block 7	Mining Block 8	Mining Block 9
11	Mining Block 8	Mining Block 9	Mining Block 10
12	Mining Block 9	Mining Block 10	Mining Block 11
13	Mining Block 10	Mining Block 11	Mining Block 12
14	Mining Block 11	Mining Block 12	Mining Block 13
15	Mining Block 12	Mining Block 13	Mining Block 14
16	Mining Block 13	Mining Block 14	Mining Block 15
17	Mining Block 14	Mining Block 15	Mining Block 16
18	Mining Block 15	Mining Block 16	Mining Block 17
19	Mining Block 16	Mining Block 17	Mining Block 18
20	Mining Block 17	Mining Block 18	Mining Block 19
21	Mining Block 18	Mining Block 19	Mining Block 20
22	Mining Block 19	Mining Block 20	Mining Block 21
23	Mining Block 20	Mining Block 21	Mining Block 22
24	Mining Block 21	Mining Block 22	Mining Block 23
25	Stockpiled	Stockpiled	Stockpiled
26	Stockpiled	Stockpiled	Mining Block 25

The two distinct types of overburden which have been stockpiled separately will be replaced separately at as near as possible to the same location it originated from.

When the gravel from mining block 6 has been extracted overburden from the temporary water storage area dykes and from the stockpile at area A will be used to backfill it. Sub-soil and topsoil will be taken from the stockpiles and used to reclaim it. Mining Blocks 2, 3, 4, 5 & 6 will all have been reclaimed at this time.

When the gravel from mining block 24 has been extracted an end pit water body will remain. At this time the wash plant will be removed and the site reclaimed. The water from the Ground Water Recharge Area will be pumped into the end pit water body and the overburden from the perimeter dikes and the remaining stockpiles will be used to reclaim this area.

All the north half of 33-53-3-W5 except the crushing plant site, the topsoil and subsoil berms and the road to the crushing plant site will have been reclaimed.

When the gravel from mining block 26 has been extracted an end pit water body will remain. The water from the Temporary Water Storage Area will be pumped into the water body and all berms and remaining stockpiles will be used for final contouring and reclamation.

In some areas on the NE of 33-53-3-W5 and the NW of 34-53-3-W5 the testing logs indicate a layer of sand on top of the gravel. This sand will be stockpiled and placed at the bottom of the excavation as a partial aquifer replacement. The pit run from this gravel deposit appears to contain approximately 70% sand and 30% stone. If a surplus of sand

occurs more than can be marketed, the surplus sand will be placed at the bottom of the excavations.

The final reclaimed topography of the site has been determined and the stockpiles of overburden will be utilized to maintain this topography during progressive reclamation. The property has CSI classification of Class 3, Subclasses H & T and Class 7, Subclasses W & V. Final reclamation will have maximum slopes of 10 : 1 except below water at the end pit water bodies.

Two end pit water bodies are included in the reclamation plan along with two other depressions which will be above groundwater level. The end pit water bodies will be landscaped in such a manner that there is a shallow portion suitable for vegetation growth and waterfowl use and a deeper portion through which water will infiltrate into the groundwater.

The areas of depression are expected to pond surface runoff for short periods of time in spring and after heavy precipitation events. The ponded water is expected to infiltrate down to ground water level and to evaporate and these areas are expected to remain dry for most of the year.

To counteract soil compaction caused by earthmoving equipment, the surface of the overburden and of the subsoil will be scarified before placing the next material. The topsoil surface will be cultivated and seeded as required for the next land use.
will be controlled by mowing and/or spraying.

The CLI soil capacity for agriculture of the pre-disturbed landscape is 60% 3HT and 40%

It is not anticipated that any portion of this pit will be inactive and un-reclaimed for any period of time. If this does occur all pit walls will be sloped to a minimum 3:1 and weeds 7W. The expected soil capacity of the reclaimed landscape will remain near the pre-disturbed.

Development and Reclamation Schedule

This schedule is based on a material processing rate of 300,000 tonne per year. Market conditions may cause deviations from this schedule.

Year 1 – Relocate Ste. Anne Gas Co-op pipeline

- Remove topsoil from mining blocks 1 & 2, berms, dikes, roads, process area and stockpile areas and stockpile.
- Remove subsoil from mining blocks 1 & 2, berms, dikes, roads, process area and stockpile areas and stockpile.
- Remove overburden from mining blocks 1 & 2 and construct roads, berms, dikes and stockpiles.

- Extract and process gravel from mining block 1

Year 2 -
- Extract and process gravel from mining block 2
- Remove topsoil from mining block 3 and stockpile.
- Remove subsoil from mining block 3 and stockpile
- Remove the overburden from mining block 3 and place in mining block 2.
- Extract and process gravel from mining block 3.
- Remove topsoil from mining block 4 and stockpile.
- Remove subsoil from mining block 4 and place on mining block 2.
- Remove overburden from mining block 4 and place in mining block 3

Year 3 -
- Extract and process gravel from mining block 4.
- Remove topsoil from mining block 5 and place on mining block 2.
- Remove subsoil from mining block 5 and place on mining block 3.
- Remove overburden from mining block 5 and place in mining block 4.
- Cultivate and seed mining block 2.

Year 4 -
- Extract and process gravel from mining block 5.
- Remove topsoil from mining block 6 and place on mining block 3.
- Remove subsoil from mining block 6 and place on mining block 4.
- Remove overburden from mining block 6 and place in mining block 5.
- Cultivate and seed mining block 3.
- Extract and process gravel from mining block 6.
- Remove topsoil from mining block 7, berms, process area and stockpile areas and stockpile.
- Remove subsoil from mining block 7, berms, process area, and stockpile area and stockpile.
- Remove overburden from mining block 7 and construct berms and stockpiles.

Year 5 –
- Remove overburden from stockpiles and place in mining block 6.
- Remove subsoil from stockpiles and place on mining blocks 5 & 6.
- Remove topsoil from stockpiles and place on mining blocks 4, 5 & 6.
- Cultivate and seed mining blocks 4, 5 & 6.
- Extract and process gravel from mining block 7.
- Remove topsoil from mining block 8 and stockpile.
- Remove subsoil from mining block 8 and stockpile.
- Remove overburden from mining block 8 and place in mining block 7.

Year 6 -
- Extract and process gravel from mining block 8.
- Remove topsoil from mining block 9 and stockpile.
- Remove subsoil from mining block 9 and place on mining block 7.
- Remove overburden from mining block 9 and place in mining block 8.

Year 7 -
- Extract and process gravel from mining block 9.
- Remove topsoil from mining block 10 and place on mining block 7.
- Remove subsoil from mining block 10 and place on mining block 8.

- Remove overburden from mining block 10 and place in mining block 9.
- Cultivate and seed mining block 7.

Year 8 - Extract and process gravel from mining block 10.
- Remove topsoil from mining block 11 and place on mining block 8.
- Remove subsoil from mining block 11 and place on mining block 9.
- Remove overburden from mining block 11 and place in mining block 10.
- Cultivate and seed mining block 8.
- Extract and process gravel from mining block 11.
- Remove topsoil from mining block 12 and place on mining block 9.
- Remove subsoil from mining block 12 and place on mining block 10.
- Remove overburden from mining block 12 and place in mining block 11.
- Cultivate and seed mining block 9.

Year 9 - Extract and process gravel from mining block 12.
- Remove topsoil from mining block 13 and place on mining block 10.
- Remove subsoil from mining block 13 and place on mining block 11.
- Remove overburden from mining block 13 and place in mining block 12.
- Cultivate and seed mining block10.

Year 10 - Extract and process gravel from mining block 13.
- Remove topsoil from mining block 14 and place on mining block 11.
- Remove subsoil from mining block 14 and place on mining block 12.
- Remove overburden from mining block 14 and place in mining block 13.
- Cultivate and seed mining block 11.

Year 11 - Extract and process gravel from mining block 14.
- Remove topsoil from mining block 15 and place on mining block 12.
- Remove subsoil from mining block 15 and place on mining block 13.
- Remove overburden from mining block 15 and place in mining block 14.
- Cultivate and seed mining block 12.

Year 12 - Extract and process gravel from mining block 15.
- Remove topsoil from mining block 16 and place on mining block 13.
- Remove subsoil from mining block 16 and place on mining block 14.
- Remove overburden from mining block 16 and place in mining block 15.
- Cultivate and seed mining block 13.
- Extract and process gravel from mining block 16.
- Remove topsoil from mining block 17 and place on mining block 14.
- Remove subsoil from mining block 17 and place on mining block 15.
- Remove overburden from mining block 17 and place in mining block 16.
- Cultivate and seed mining block 14.

Year 13 - Extract and process gravel from mining block 17.
- Remove topsoil from mining block 18 and place on mining block 15.
- Remove subsoil from mining block 18 and place on mining block 16.

- Remove overburden from mining block 18 and place in mining block 17.
- Cultivate and seed mining block 15.

Year 14 - Extract and process gravel from mining block 18.
- Remove topsoil from mining block 19 and place on mining block 16.
- Remove subsoil from mining block 19 and place on mining block 17.
- Remove overburden from mining block 19 and place in mining block 18.
- Cultivate and seed mining block 16.

Year 15 - Extract and process gravel from mining block 19.
- Remove topsoil from mining block 20 and place on mining block 17.
- Remove subsoil from mining block 20 and place on mining block 18.
- Remove overburden from mining block 20 and place in mining block 19.
- Cultivate and seed mining block 17.

Year 16 - Extract and process gravel from mining block 20.
- Remove topsoil from mining block 21 and place on mining block 18.
- Remove topsoil from mining block 21 and place on mining block 19.
- Remove overburden from mining block 21 and place on mining block 20.
- Cultivate and seed mining block 18.

Year 17 - Extract and process gravel from mining block 21.
- Remove topsoil from mining block 22 and place on mining block 19.
- Remove subsoil from mining block 22 and place on mining block 20.
- Remove overburden from mining block 22 and place in mining block 21.
- Cultivate and seed mining block 19.

Year 18 - Extract and process gravel from mining block 22.
- Remove topsoil from mining block 23 and place on mining block 20.
- Remove subsoil from mining block 23 and place on mining block 21.
- Remove overburden from mining block 23 and place in mining block 22.
- Cultivate and seed mining block 20.

Year 19 - Extract and process gravel from mining block 23.
- Remove topsoil from mining block 24 and place on mining block 21.
- Remove subsoil from mining block 24 and place on mining block 22.
- Remove overburden from mining block 24 and place in mining block 23.
- Cultivate and seed mining block 21.

Year 20 - Extract and process gravel from mining block 24.
- Remove overburden from berms, roads and stockpiles and place in ground water recharge area.
- Remove subsoil from stockpiles and place on berms, roads, stockpile areas, process area and ground water recharge area.
- Remove topsoil from stockpiles and place on berms, roads, stockpile areas, process area and ground water recharge area.

- Cultivate and seed all disturbed areas in NW 33-53-3-W5.
- Remove the topsoil from mining block 25 and stockpile.
- Remove the subsoil from mining block 25 and stockpile.
- Remove the overburden from mining block 25 and construct berms, dikes, roads, and stockpiles.

Year 21 - Extract and process the gravel from mining block 25.
- Remove topsoil from mining block 26 and stockpile.
- Remove subsoil from mining block 26 and stockpile.
- Remove the overburden from mining block 26 and place in mining block 25.

Year 22 - Extract and process the gravel from mining block 26.
- Remove overburden from berms, dikes, roads and stockpiles and place in mining block 26.
- Remove subsoil from stockpiles and place on mining blocks 25 & 26, berms, dikes, roads and stockpile areas.
- Remove topsoil from stockpiles and place on mining blocks 25 & 26, berms, dikes, roads, and stockpile areas,
- Cultivate and seed disturbed areas in SW 34-53-3-W5.

Year 23 – Remove subsoil from stockpiles and place on process area and roads.
- Remove topsoil from stockpiles and place on process area and roads.
- Cultivate and seed remaining disturbed areas in NE 33-53-3-W5.

TOWNSHIP ROAD 540

RANGE ROAD 34

DETAIL B

DRAINAGE DITCH

LIMIT OF EXTRACTION PHASE 1

N

HICKIE PROPERTY

LIMIT OF GRAVEL ECONOMICAL TO EXTRACT

BLK. 2

BLK. 1

WATER STORAGE AREA

600mm ϕ CSP EMERGENCY SPILLWAY

PIT BOUNDARY PHASE 1

OVERBURDEN BERM

PROCESSING SITE

ORGANIC TOPSOIL

AREA A

DETAIL A

NE 32-53-3-W5

NW 33-53-3-W5

HAUL ROAD

MINERAL TOPSOIL

AREA B

600mm

SUBSOIL

This information redacted as per Protection of Privacy Act (POPA)

WETLANDS

ROAD ALLOWANCE

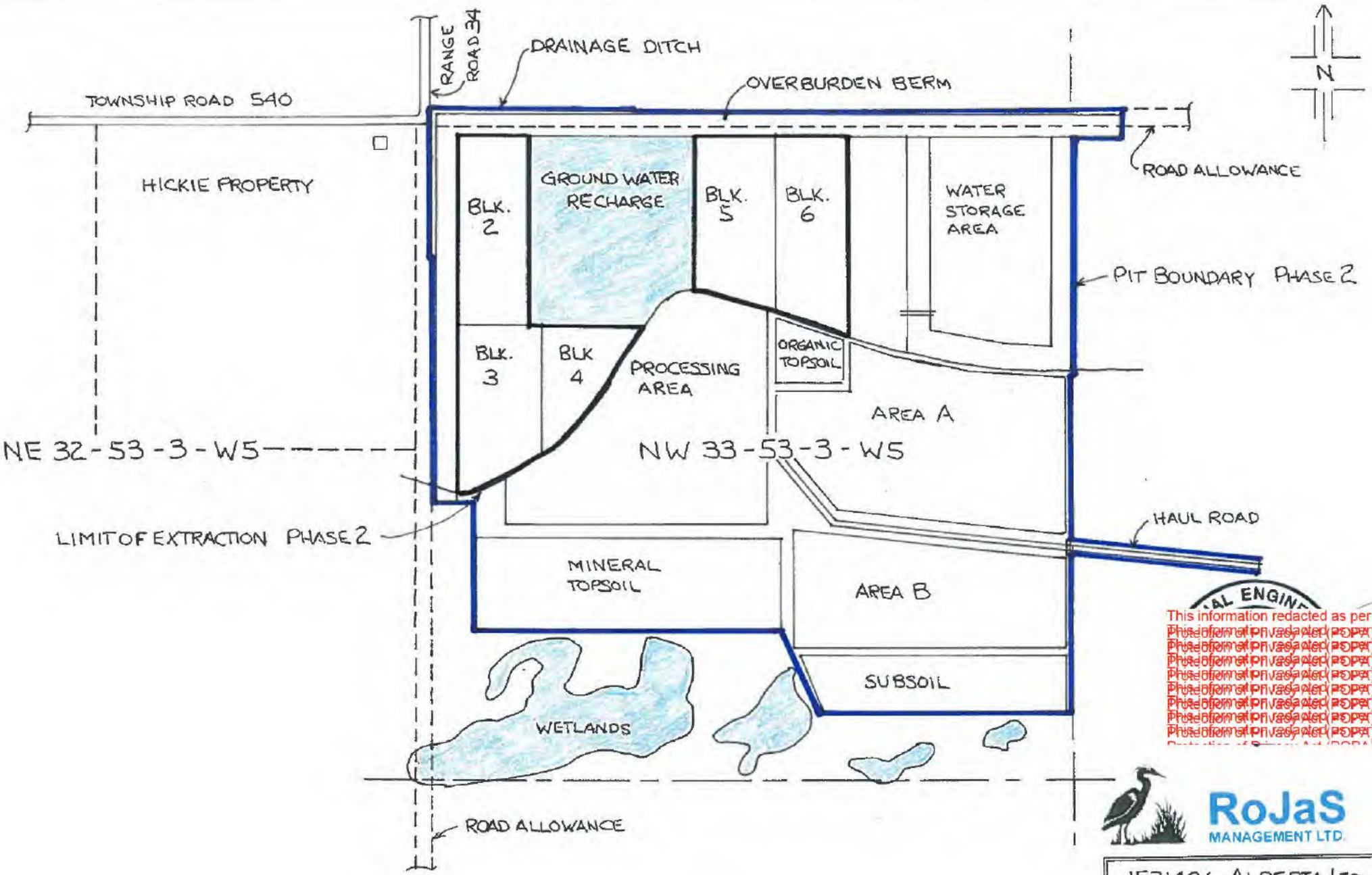
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

PLAN
PHASE 1 DEVELOPMENT

SCALE 1:5000

DRWG. 1 OF 18 REV. 2



This information redacted as per Protection of Privacy Act (POPA)

RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

PLAN
PHASE 2 DEVELOPMENT

SCALE 1:5000

DRWG. 2 OF 18 REV. 2

RANGE ROAD 34

DRAINAGE DITCH

LIMIT OF EXTRACTION PHASE 3

TOWNSHIP ROAD 540

COMMUNICATION TOWER

GROUND WATER RE-CHARGE AREA

BLK. 6

BLK. 24

BLK 22

BLK 23

BLK. 21

BLK. 20

BLK. 18

BLK. 19

BLK. 17

BLK. 16

BLK. 14

BLK. 15

BLK. 13

BLK. 12

BLK. 11

WETLAND

DRAINAGE DITCH

ORGANIC TOPSOIL

WASH PLANT SITE

AREA A

NW 33-53-3-W5

AREA C

MINERAL TOPSOIL

NE 33-53-3-W5

CRUSHING PLANT SITE

600 mm ϕ CSP CULVERT

DETAIL C

DUGOUT

ORGANIC TOPSOIL

MINERAL TOPSOIL

AREA B

SUBSOIL

TOPSOIL BERM

SUB-SOIL BERM

SCALE

RANGE ROAD 33

BLK. 7

BLK. 8

BLK. 9

BLK. 10

WETLAND

WETLAND

PIT BOUNDARY PHASE 3

OVERBURDEN BERM

FRANCZAK RESIDENCE

This information redacted as per Protection of Privacy Act (POPA)

RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

PLAN
PHASE 3 DEVELOPMENT

SCALE 1:5000

DRWG. 3 OF 18 REV. 3

SCALE

CRUSHING PLANT SITE

HAUL ROAD

OVERBURDEN BERMS

FRANCZAK RESIDENCE

FRANCZAK PROPERTY

BLK.26

TOP SOIL

SUBSOIL

BLK.25

LIMIT OF EXTRACTION PHASE 4

OVERBURDEN

SAND

600mm CSP EMERGENCY SPILLWAY

PIT BOUNDARY PHASE 4

RANGE ROAD 33

TEMPORARY WATER STORAGE

FEN

SW 34-53-3-W5

BOG

ORGANIC TOPSOIL

SWAMP

This information redacted as personal information is protected under the Protection of Privacy Act (POPA)

RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

PLAN
PHASE 4 DEVELOPMENT

SCALE 1:5000

DRWG. 4 OF 18 REV. 1

RANGE ROAD 34

772

B

773

774

A

775

NW 33-53-3-W5

776

777

778

779

780

WETLANDS

SURFACE WATER FLOW

C

D

FEN

NE 33-53-3-W5

TOWNSHIP ROAD 540

RANGE ROAD 33

WETLANDS

FRANCZAK RESIDENCE

This information
This information
redacted as per
Protection of Privacy
Act (POPA)

2011

RoJaS
MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

EXISTING
SURFACE TOPOGRAPHY

SCALE 1:5000

DRWG. 5 OF 18

RANGE ROAD 34

TOWNSHIP ROAD 540

RANGE ROAD 33

NW 33-53-3-W5

NE 33-53-3-W5

WETLANDS

WETLANDS

772 773 771 770 769 755 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 772 773 772 771 770 772 771 772 773 774 775 776 774 773

A A B B C C D D

SURFACE WATER FLOW

FRANCEAK RESIDENCE

This information redacted as per Protection of Privacy Act (POPA)

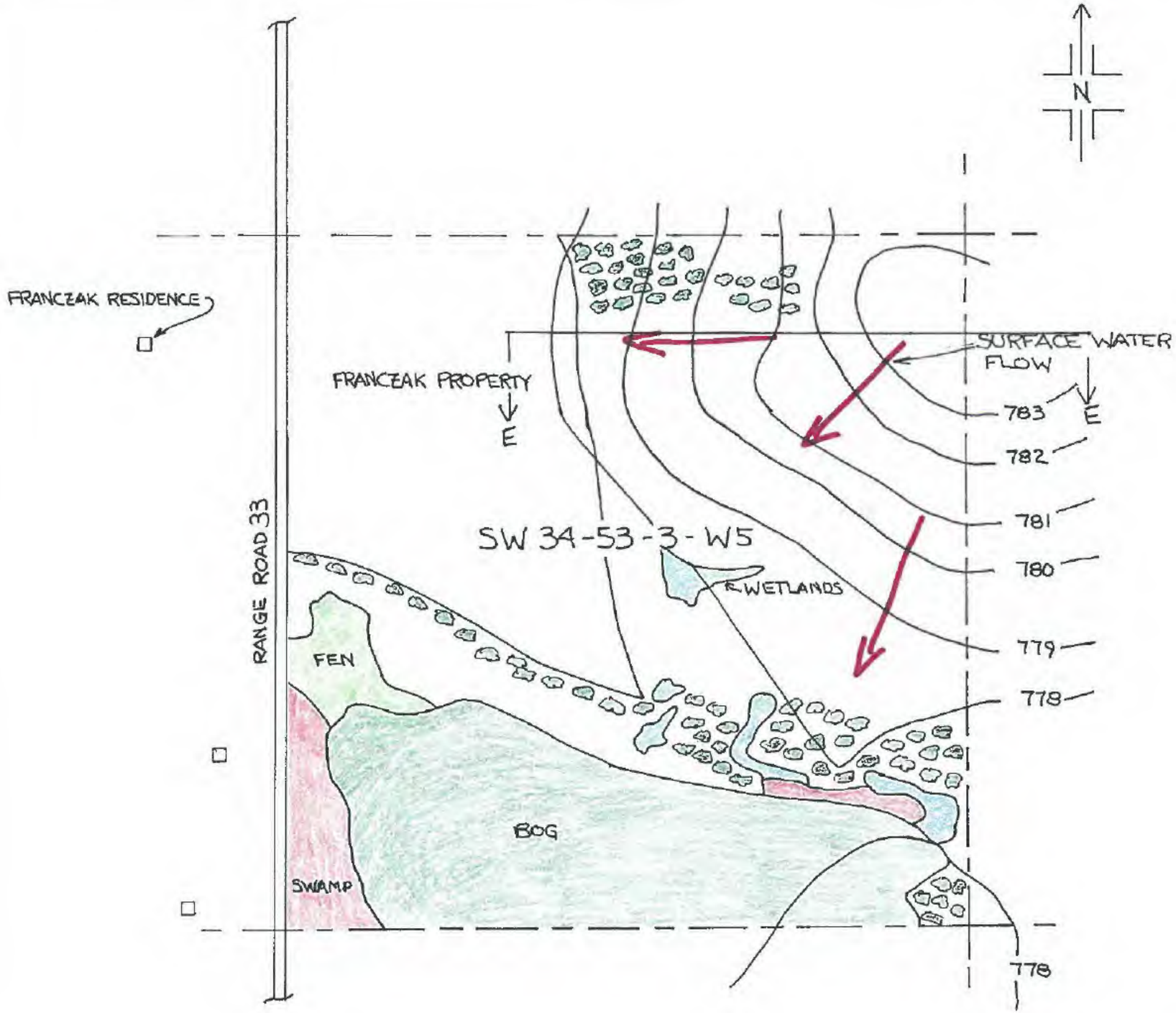
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

RECLAIMED
SURFACE TOPOGRAPHY

SCALE 1:5000

DRWG. 6 OF 18



SCALE 1:5000

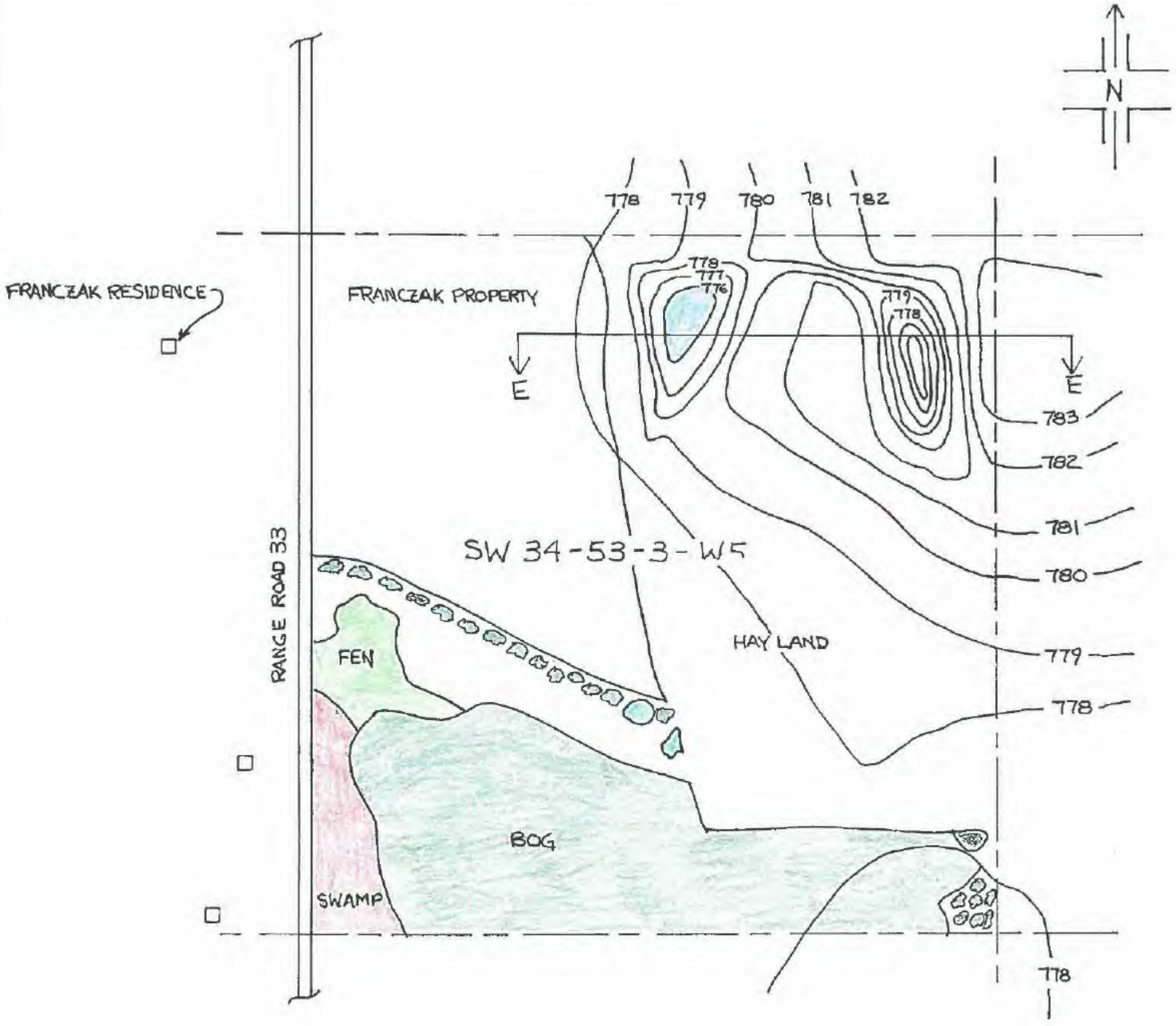
This information redacted as per Protection of Privacy Act

RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

EXISTING
SURFACE TOPOGRAPHY

DRWG. 7 OF 18



This information redacted as per Protection of Privacy Act (POPA)

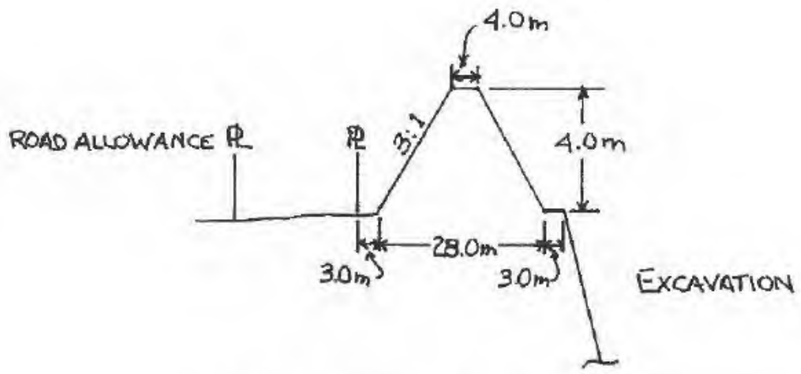
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD
ALBERTA BEACH GRAVEL PIT

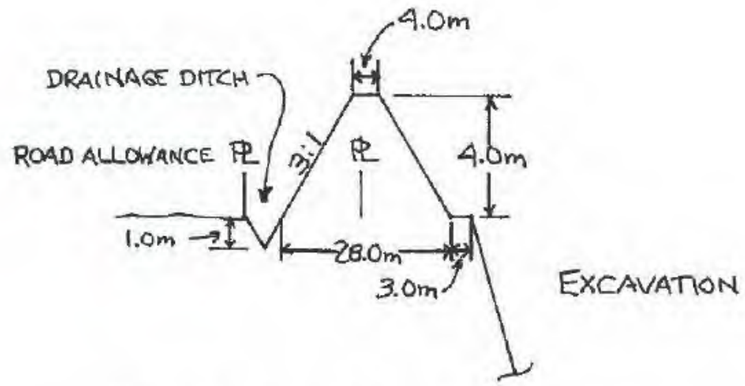
RECLAIMED
SURFACE TOPOGRAPHY

SCALE 1:5000

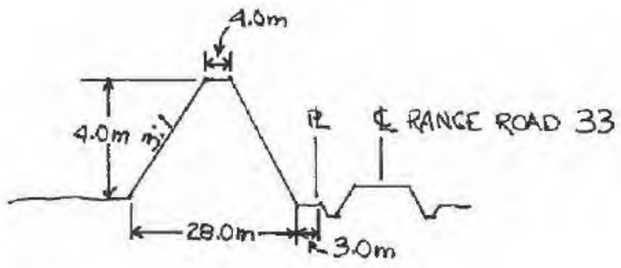
DRWG. 8 OF 18



CROSS SECTION DETAIL A



CROSS SECTION DETAIL B



CROSS SECTION DETAIL C

This information redacted as per Protection of Privacy Act (POPA)

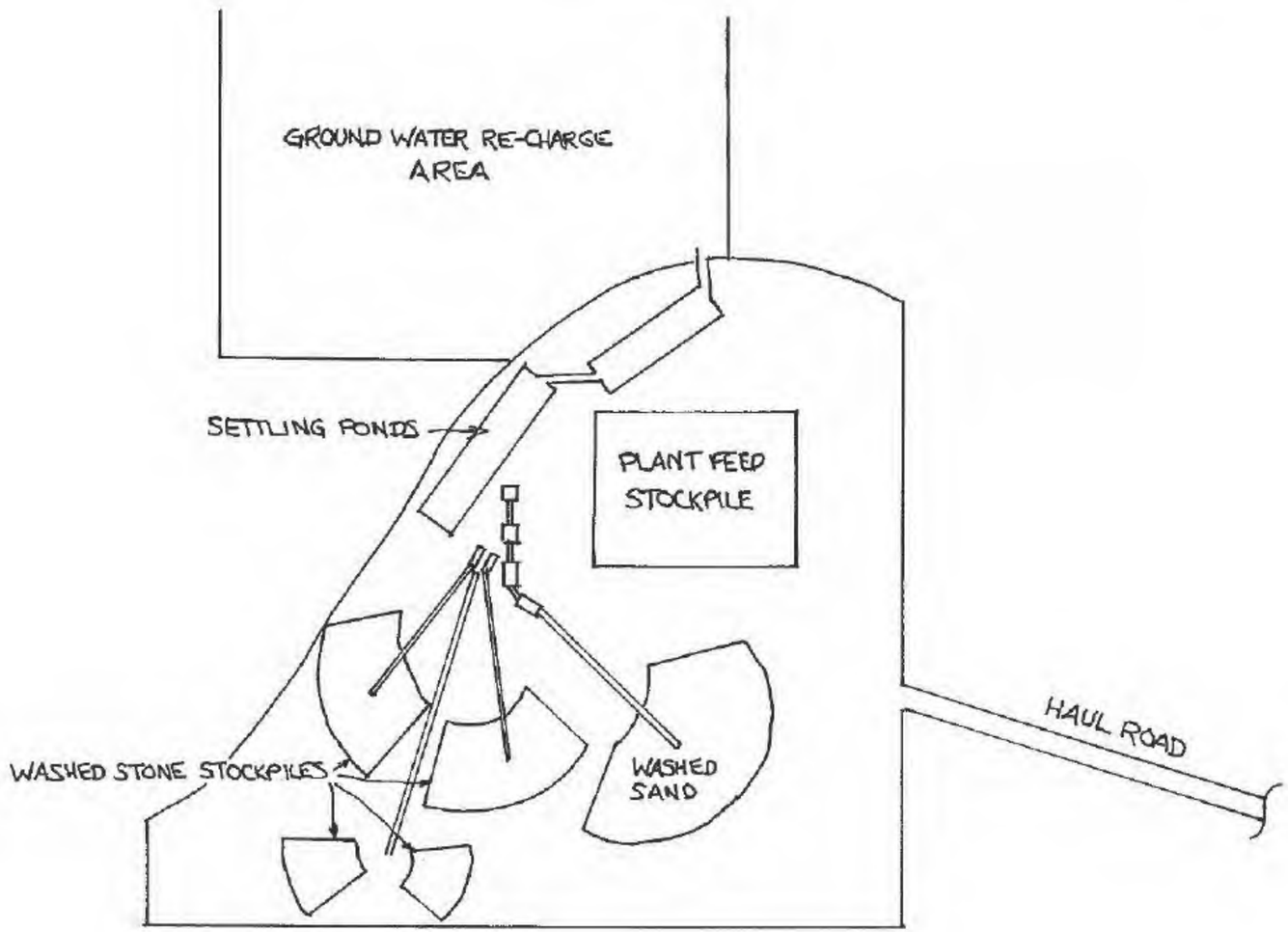
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

BERMS AND SETBACK DETAILS

SCALE HORIZ. 1:1000
VERT. 1:200

DRWG. 9 OF 18



This information redacted as per Protection of Privacy Act (POPA)

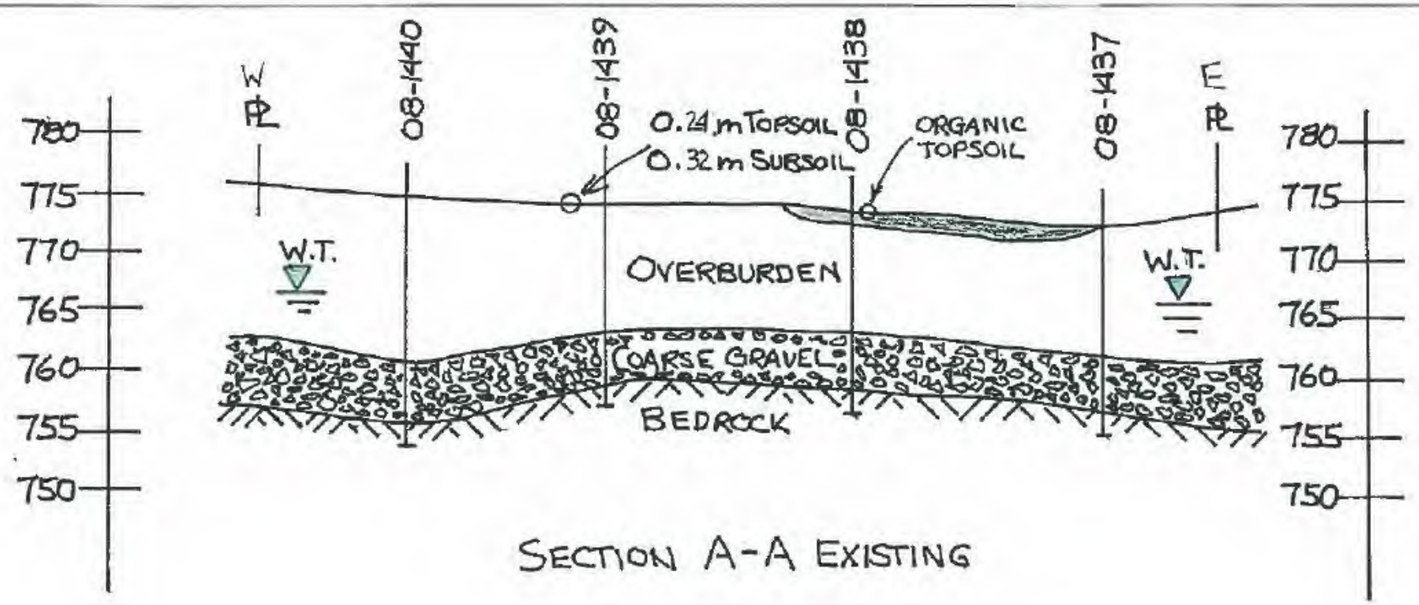
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

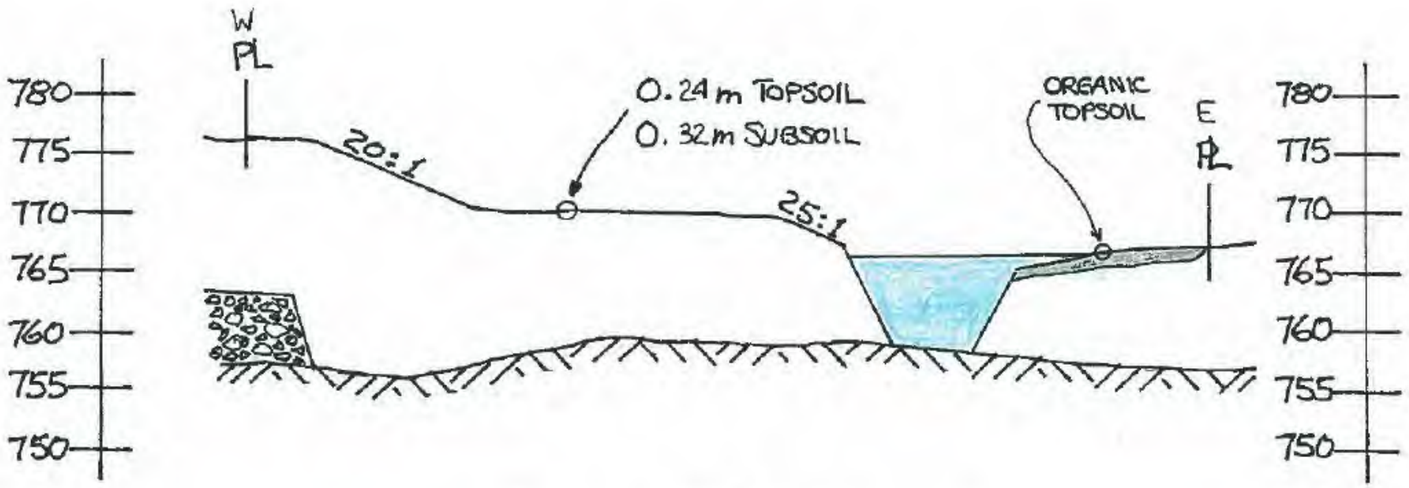
WASH PLANT SITE DETAILS

SCALE 1:2500

DRWG. 10 OF 18



SECTION A-A EXISTING



SECTION A-A RECLAIMED

This information redacted as per Protection of Privacy Act (POPA)

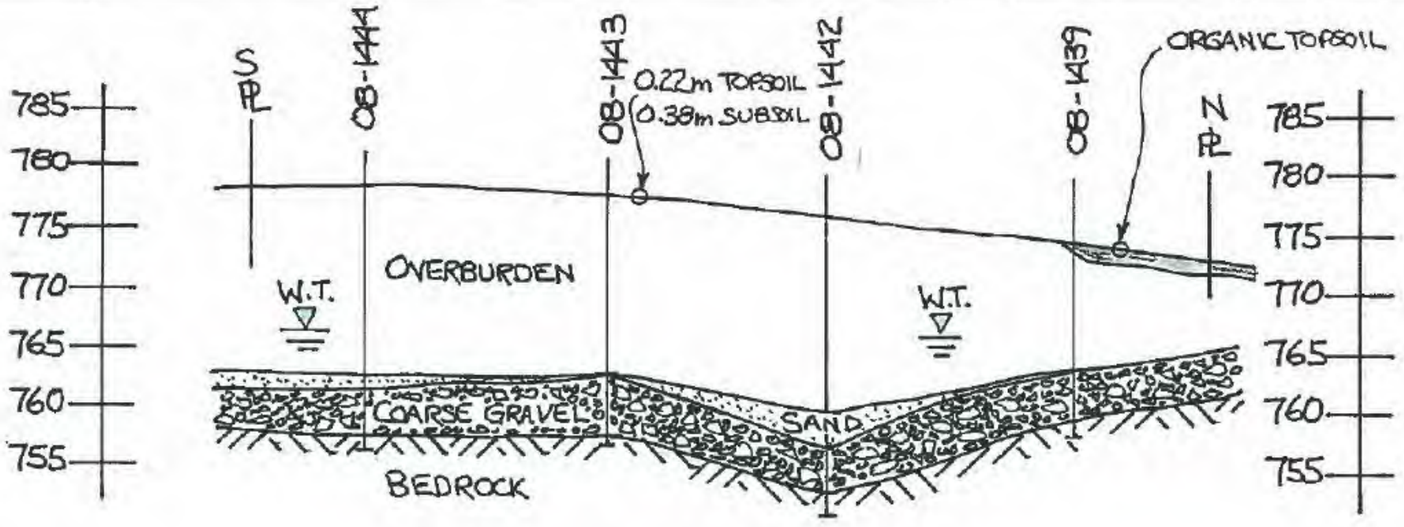
RoJaS MANAGEMENT LTD

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

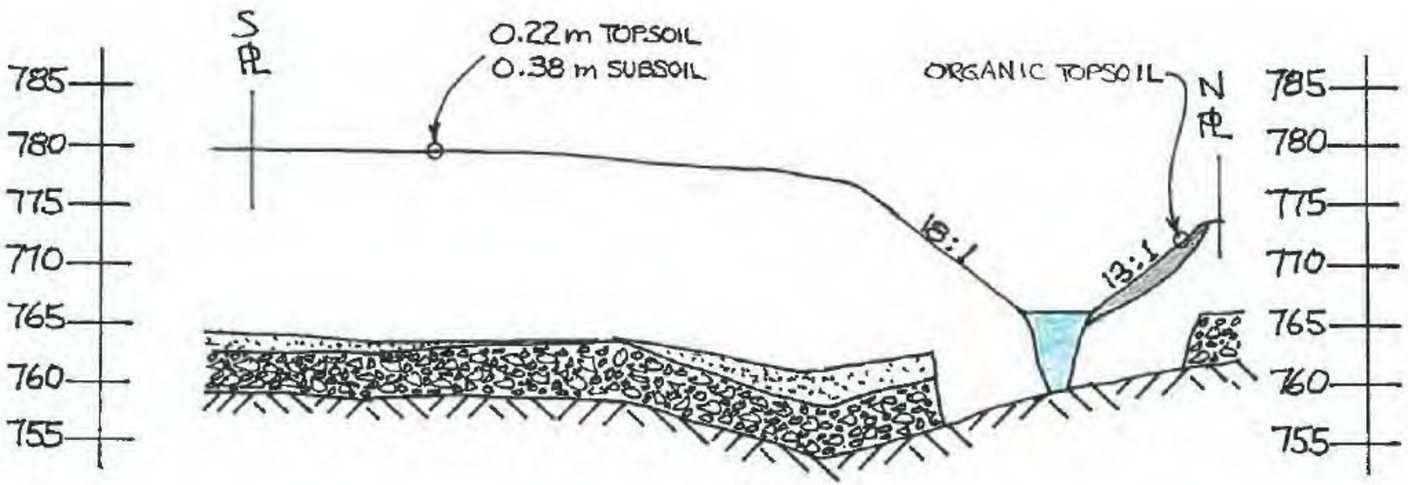
NW 33-53-3-W5
CROSS SECTIONS

SCALE HORIZ. 1:5000
VERT. 1:500

DRWG. 11 OF 18 REV.1



SECTION B-B EXISTING



SECTION B-B RECLAIMED

This information redacted as per Protection of Privacy Act (POPA)

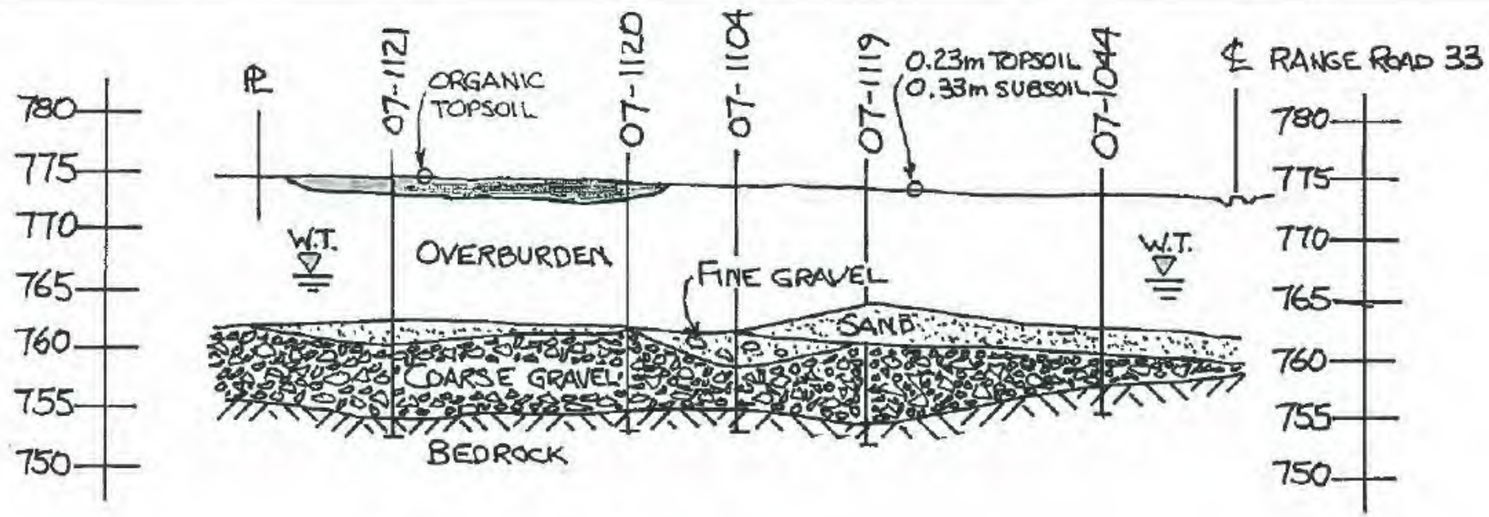
RoJaS MANAGEMENT LTD

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

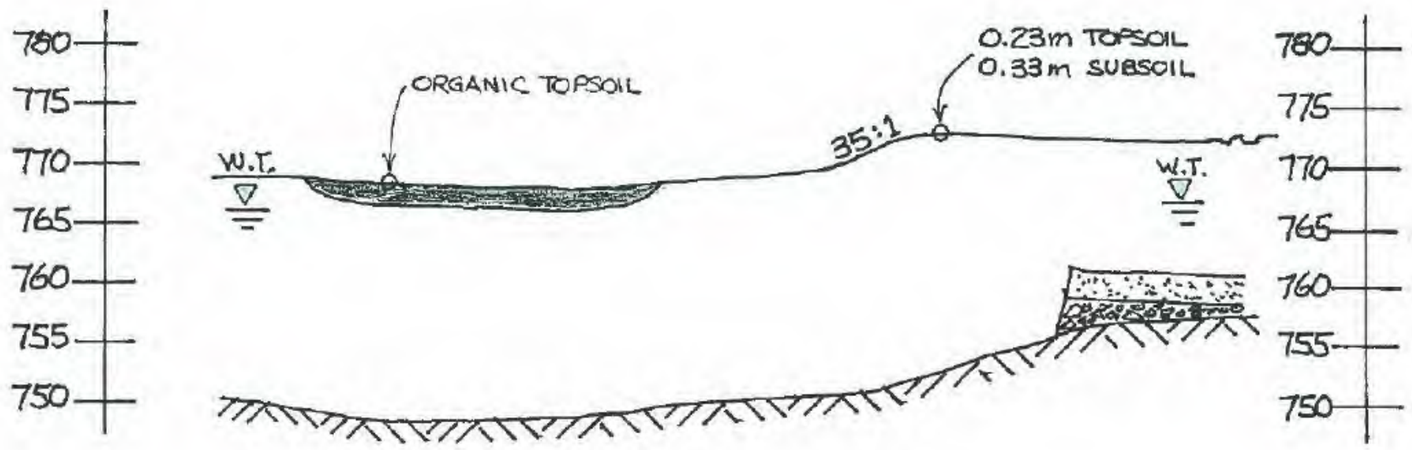
NW 33-53-3-W5
CROSS SECTIONS

SCALE HORIZ. 1:5000
VERT. 1:500

DRWG. 12 OF 18 REV.1



SECTION C-C EXISTING



SECTION C-C RECLAIMED

SCALE HORIZ. 1:5000
VERT. 1:500

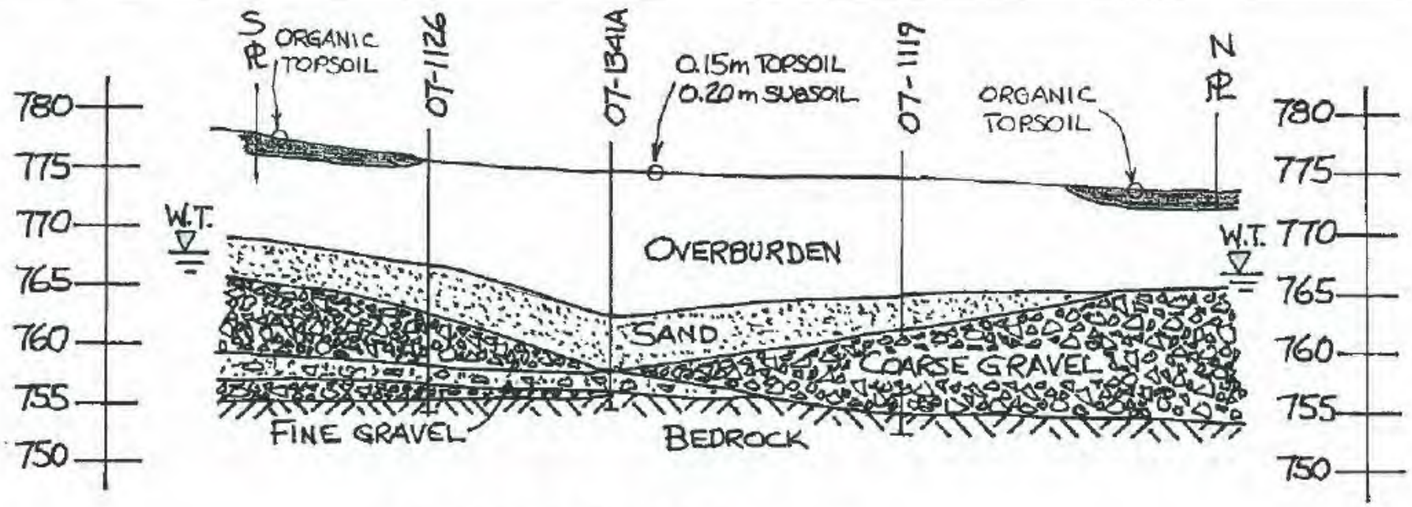
This information redacted as per Protection of Privacy Act (POPA)

RoJaS MANAGEMENT LTD

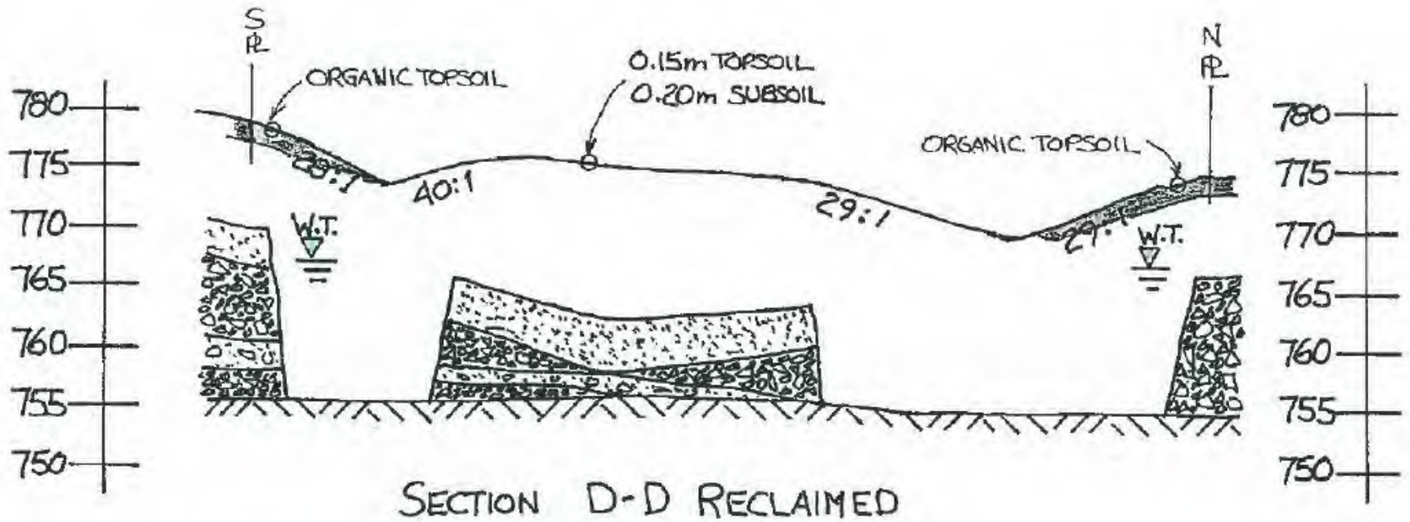
1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

NE 33-53-3-W5
CROSS SECTIONS

DRWG. 13 OF 18 REV. 1



SECTION D-D EXISTING



SECTION D-D RECLAIMED

This information redacted as per Protection of Privacy Act (POPA)

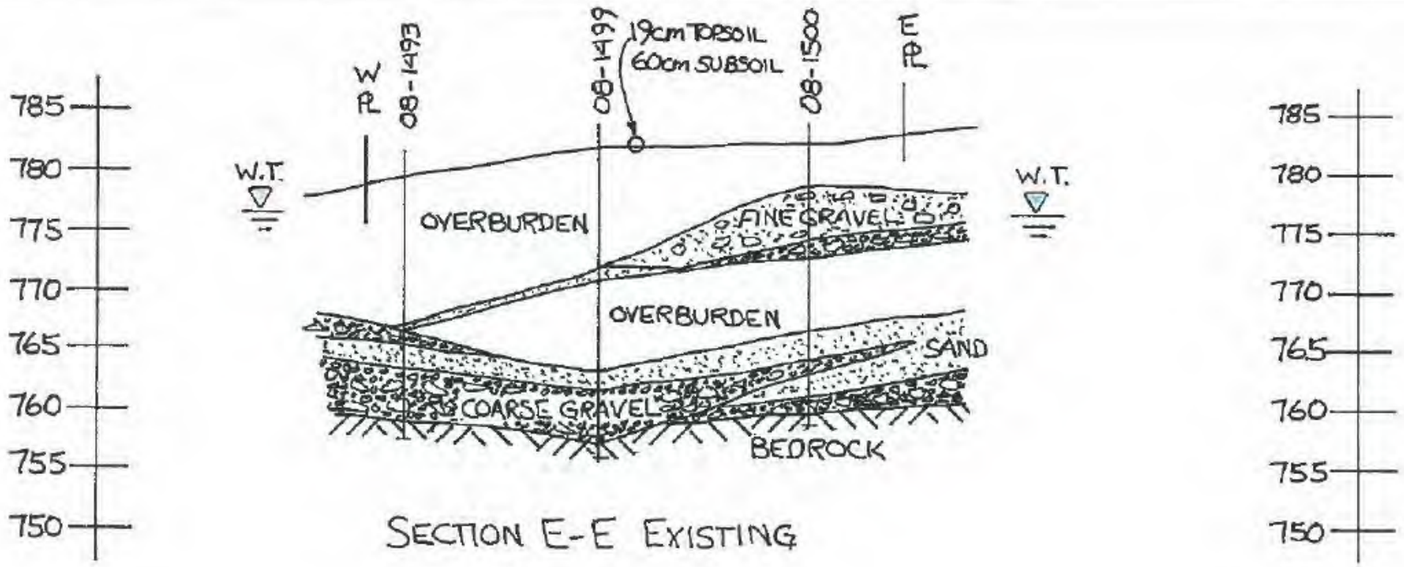
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

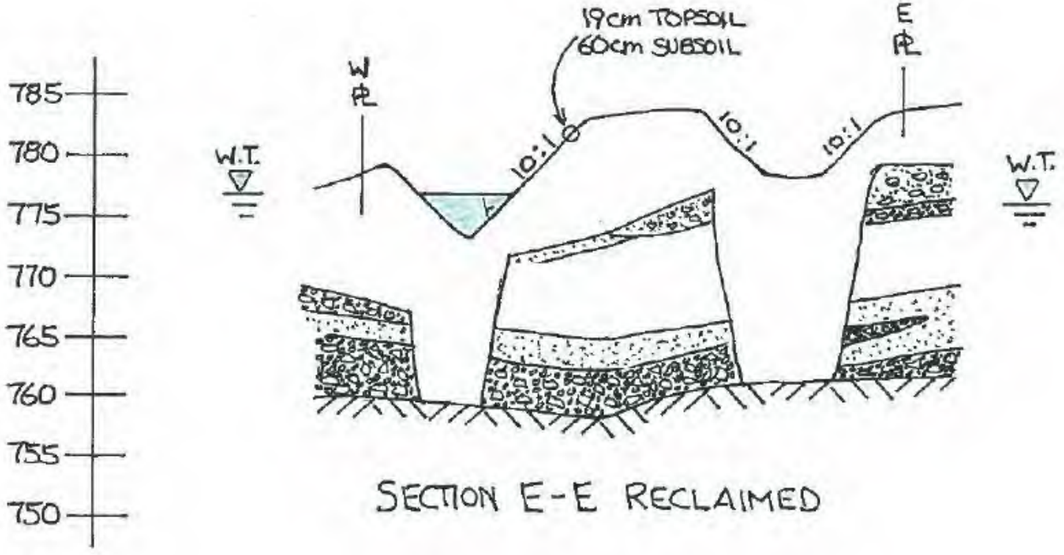
NE 33-53-3-W5
CROSS SECTIONS

SCALE HORIZ. 1:5000
VERT. 1:500

DRWG. 14 OF 18 REV. 1



SECTION E-E EXISTING



SECTION E-E RECLAIMED

This information redacted as per Protection of Privacy Act (POPA)

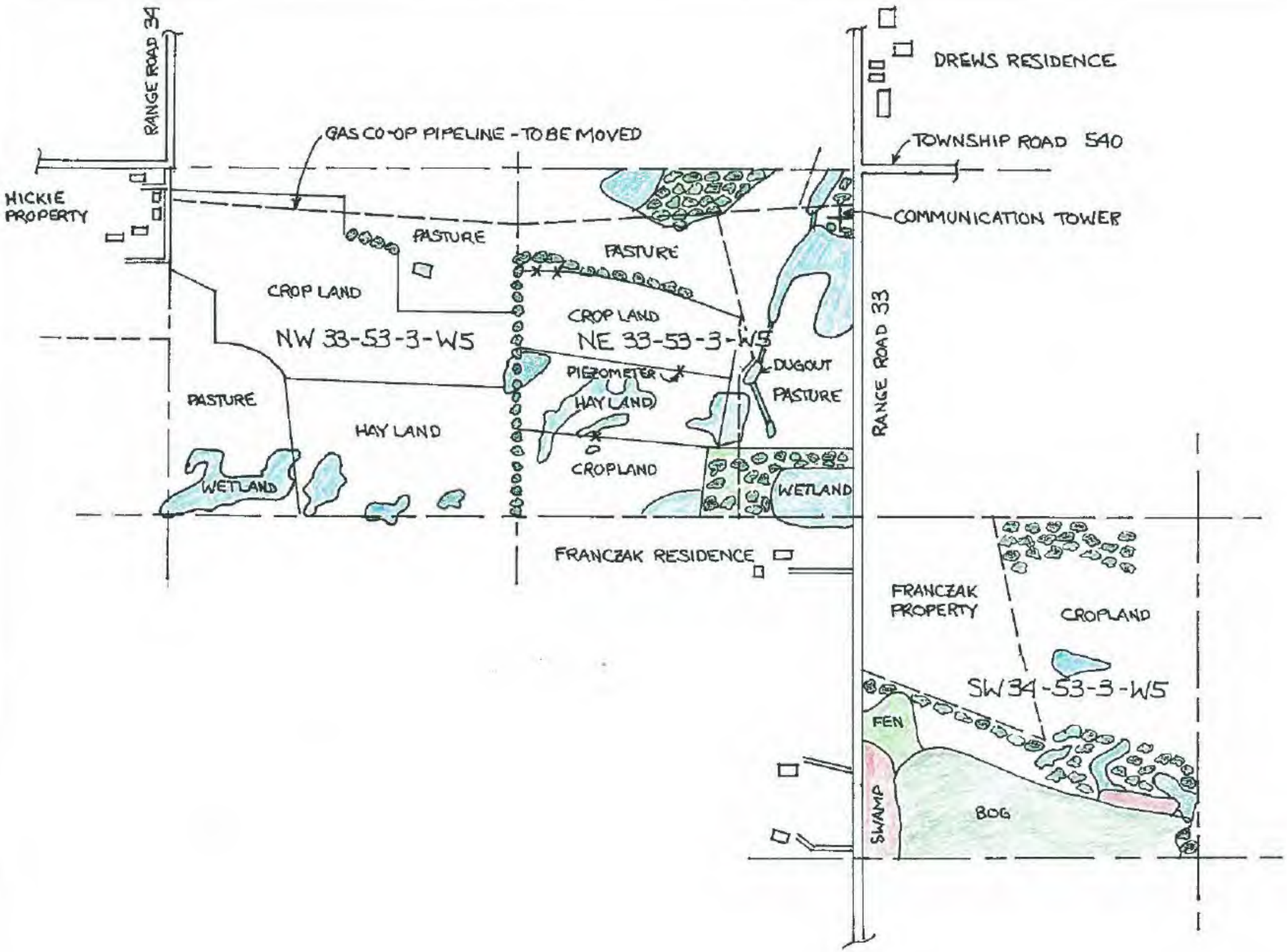
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

SW 34-53-3-W5
CROSS SECTIONS

SCALE HORIZ. 1:5000
VERT. 1:500

DRWG. 15 OF 18



This information redacted as per Protection of Privacy Act (POPA)

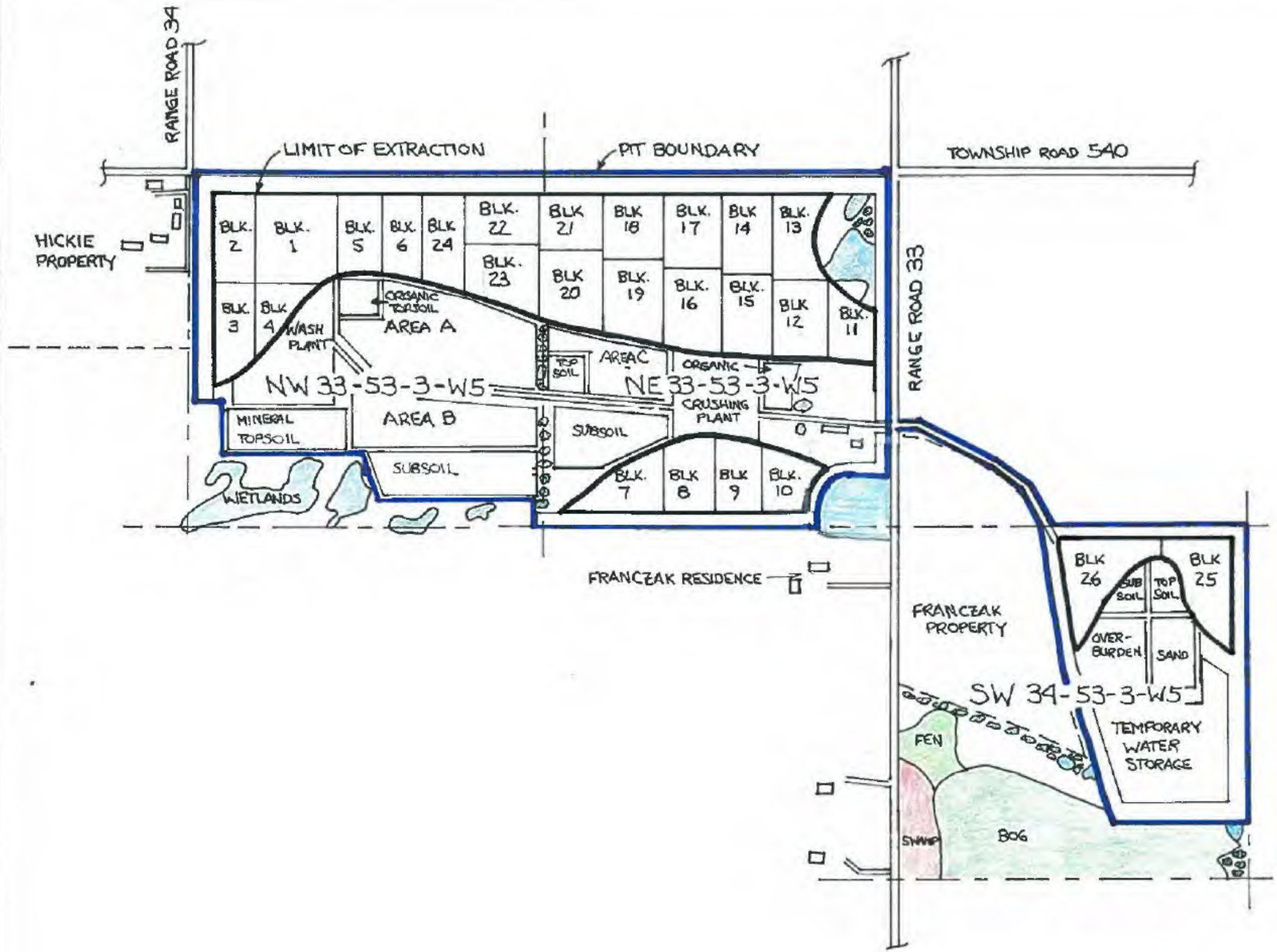
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

EXISTING PLAN

SCALE 1: 10,000

DRWG. 16 OF 18



SCALE 1:10,000

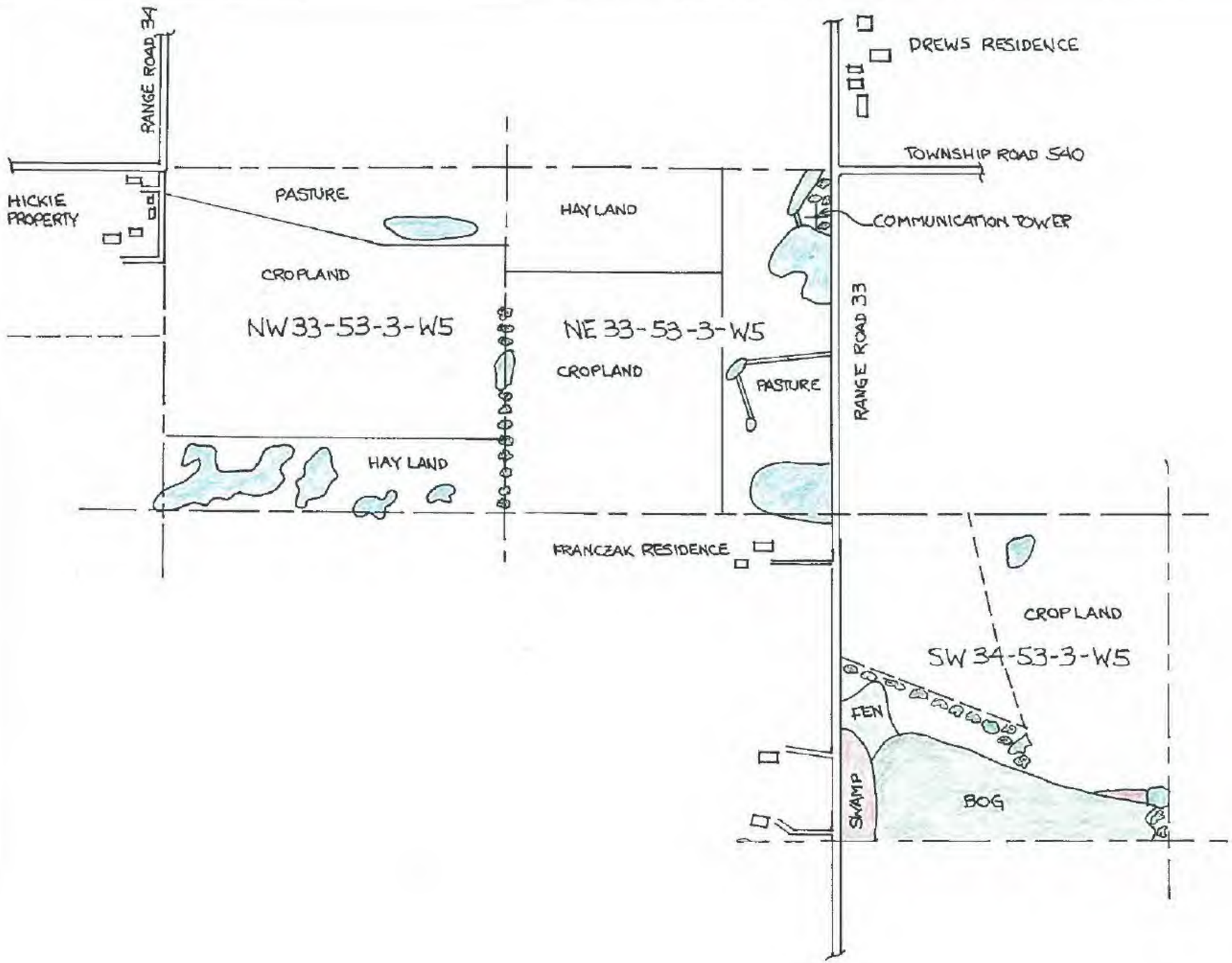
This information redacted as per Protection of Privacy Act (POPA)

RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

OVERALL DEVELOPMENT PLAN

DRWG. 17 OF 18 REV. 1



This information redacted as per Protection of Privacy Act (POPA)

RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

RECLAIMED PLAN

SCALE 1:10,000

DRWG. 18 OF 18

Appendix E

Groundwater Review (December 2012) & Addendum to 2012 Groundwater Review (September 2025) Prepared by Hydrogeological Consultants Ltd.

Groundwater Review

Lac Ste. Anne Area

Parts of Sections 28 and 32 to 34, Tp 053, R 03, W5M

Prepared for
1531486 Alberta Ltd.

Prepared by
hydrogeological consultants ltd. **(HCL)**
1.800.661.7972

December 2012

HCL Project No.: 10-505.00

PERMIT TO PRACTICE
HYDROGEOLOGICAL CONSULTANTS LTD.
This information redacted as per Protection of Privacy Act (POPA)
Date This information January 7, 2013
PERMIT NUMBER P 385
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

© 2013 hydrogeological consultants ltd.

TABLE OF CONTENTS

Executive Summary i

1. Introduction 1
1.1. Purpose 1
1.2. Scope 2

2. Background 3
2.1. Physiography and Climate 3
2.2. General Hydrogeology 3
2.2.1. Geology 3
2.2.2. Groundwater Availability 3
2.2.3. Groundwater Query 4
2.3. Previous Work 5
2.4. Proposed Development Technique 6

3. Present Program 7
3.1. Maps and Aerial Photographs 7
3.2. Groundwater Database 7
3.3. Field Work 8
3.3.1. Field-Verified Water Well Survey 8
3.3.2. Drilling 8
3.3.3. Aquifer Tests and Groundwater Sampling 9
3.3.3.1. Residential Water Wells 10
3.4. Data Processing 11
3.4.1. Calculation of Drawdown 11
3.4.2. Calculation of Storativity 12
3.4.3. Calculation of Theoretical Long-Term Yield 12

4. Results 14
4.1. Groundwater Database 14
4.1.1. Regional Data 15
4.1.2. Local Data 16
4.2. Field-Verified Water Well Survey 19
4.3. Piezometers 20
4.3.1. Completion 20
4.3.2. Aquifer Testing 21
4.4. Groundwater Quality 22

5. Interpretation 25
5.1. Extent of Gravel Aquifer 25
5.2. Gravel Aquifer Parameters 26

5.2.1. Physical Properties 26
5.2.2. Chemical Properties 26
5.3. Groundwater Flow 27
5.4. Calculated Dewatering Volumes 27
5.5. Water Wells of Interest 29
5.6. Predicted Impact Resulting from Dewatering 30
5.6.1. Temporary Seasonal Impacts 30
5.6.2. Ongoing Annual Impacts 31
5.7. Predicted Post-Mining Impact 32

6. Conclusions 33

7. Recommendations 34

8. Bibliography 35

9. Supplementary Information 41
9.1. Glossary of Terms 41
9.2. Glossary of Commonly Used Abbreviations, Acronyms and Symbols 43

10. Conversions 44

Executive Summary

1531486 Alberta Ltd. intends to develop lands in Parkland and Lac Ste. Anne counties for gravel extraction. The proposed development comprises parts of five quarter sections approximately four kilometres south of Lac. Ste. Anne. The present review is to determine possible impacts to the local hydrogeological setting resulting from the proposed mining operation in Lac Ste. Anne County.

The proposed gravel mining operation will involve seasonal dewatering of pits and the groundwater removed will be used for gravel washing; excess groundwater will flow back into the gravel aquifer through recharge pit(s). Dewatering will require in the order of 60,000 to 150,000 cubic metres per year (m^3/year) of groundwater to be removed from the aquifer. This seasonal diversion may result in temporary drawdowns of approximately 50% of the available drawdowns in water wells situated within 200 metres of a pit being dewatered. As part of the activities, the expectation is that an average of approximately 2,000 m^3/year of the groundwater removed from the pit will be used for gravel processing, with the remainder of the groundwater returned to the aquifer via a recharge pit or pits. The net loss of 2,000 m^3/year of groundwater will not have an adverse effect on the aquifer or any nearby water wells.

If a recharge pit is not able to contain the volumes of groundwater being removed from extraction pits in the short-term, a contingency to divert excess groundwater into a surface drainage channel may be exercised.

At the site of the proposed development, the groundwater flow is from the southeast to the northwest. Once the sand and gravel aquifer is removed and replaced with less permeable material, groundwater flow through the area will be reduced, which may result in the mounding of groundwater upgradient from the mined area. However, mounding is not expected to cause any adverse effects outside the development area. If mounding were to become an issue, a groundwater bypass system may be necessary.

As part of the proposed development, a meaningful groundwater monitoring program is necessary to ensure that the impact of the groundwater diversions does not pose undo risk to the groundwater from local water wells or to the local hydrogeology. Also, there is a need to provide local water well users with an assurance that 1531486 Alberta Ltd. will accept responsibility for any negative impacts to their groundwater supplies as a result of their operations, should they occur.

Because the proposed development includes a gravel-washing operation, and because the required dewatering may temporarily adversely affect a household groundwater user, an approval under the *Water Act* may be required. This report would provide technical support for a groundwater approval application under the *Water Act*.

1. Introduction

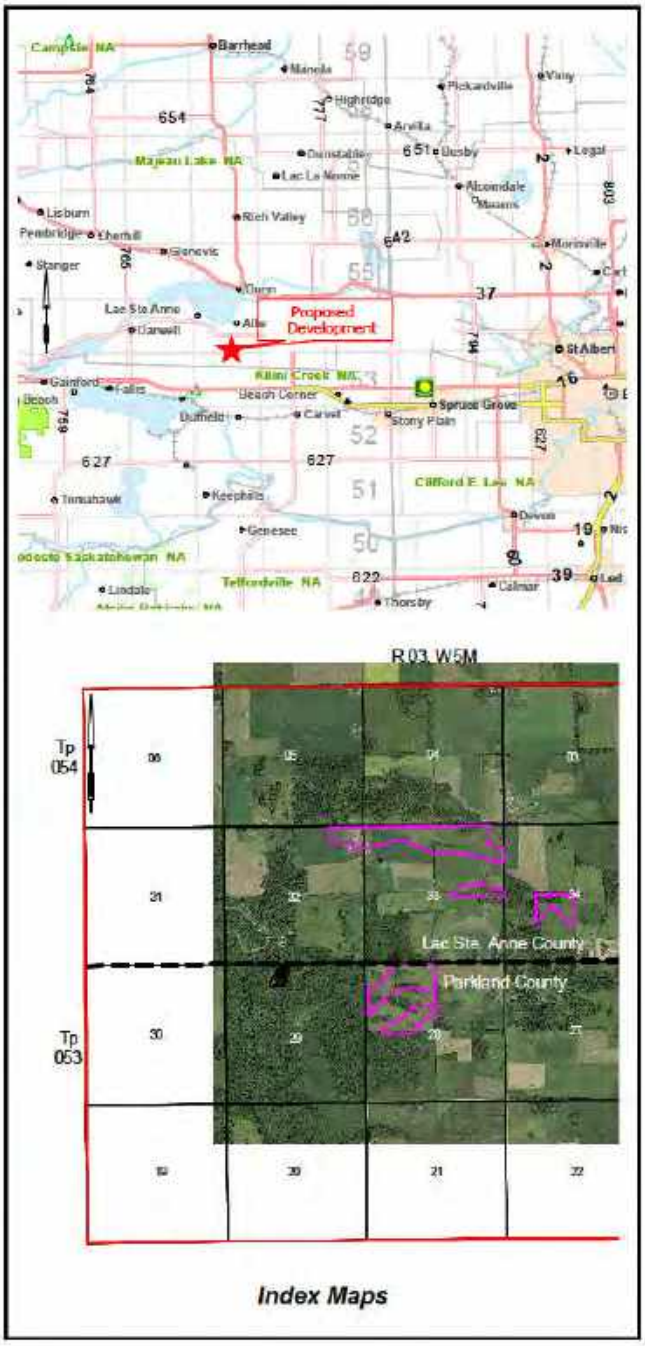
Numbered company 1531486 Alberta Ltd. has acquired lands in Parkland County and the County of Lac Ste. Anne for a proposed gravel mining and processing operation. The lands are parts of Sections 28, 32, 33 and 34, in Township 053, Range 03, west of the Fifth Meridian, as shown in the adjacent index maps. The present report has been completed in support of the proposed development in Lac Ste. Anne County.

The proposed gravel mining operation will involve pit-to-pit dewatering in order to extract gravel below the water table, which does not require an approval from Alberta Environment and Sustainable Resource Development (ESRD) unless there is a potential adverse impact to local groundwater users[1]. However, because some of the groundwater that is removed from the pits as part of the dewatering operation will be used for gravel washing, a licence under the Water Act may be required. Any excess groundwater will flow back into the gravel aquifer through recharge pit(s).

1.1. Purpose

As a result of the proposed mining operation, there will be changes to the local hydrogeological setting. 1531486 Alberta Ltd., through their mining consultant (RoJaS Management Ltd.), has retained the services of Hydrogeological Consultants Ltd. (HCL) to determine:

- The expected quantity of groundwater to be removed from mining pits.
- The most probable impacts the proposed gravel mining will have on the local hydrogeology.
- To specifically identify any local groundwater users who may be adversely affected by the proposed gravel extraction.



Index Maps

[1] Schedule 3 of the Water (Ministerial) Regulation (Province of Alberta, 1998) states that an adverse effect on a household groundwater user prevents the proposed dewatering program from being exempt from the requirement of an approval.

1.2. Scope

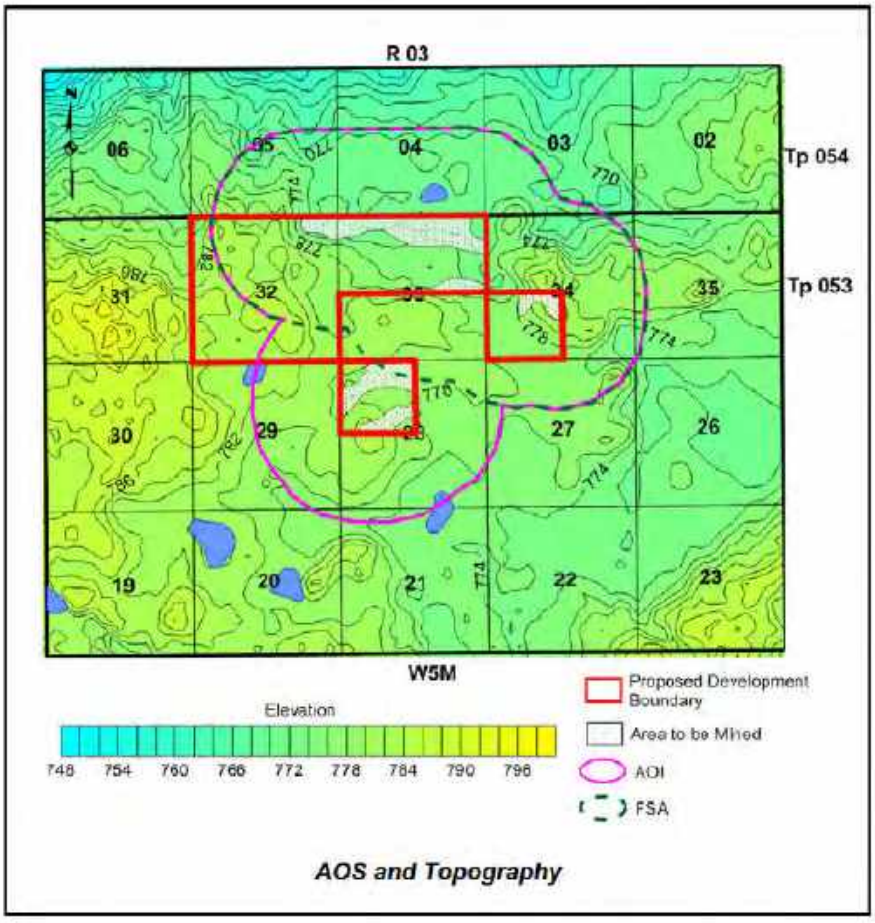
ESRD does not require a licence to be issued for a dewatering project associated with a gravel pit, when the groundwater is allowed to be re-introduced into the aquifer. ESRD has indicated that dewatering the pits must be "on-site", which means that groundwater re-introduced to the aquifer must be on the same quarter section or parcel of land or within a contiguous pit operation. However, gravel washing is a licensable use of groundwater, according to ESRD's Regulatory Assurance.

The present program includes the review of existing data and information gathered as part of the 2010 field program. The existing data include those that were available when data compilation was completed, in December 2010. The existing data were reviewed to determine hydrogeological data deficiencies and to set out a field program to collect additional data; HCL was responsible for retaining the services of third parties to complete the field program. The 2010 field program included:

- A field-verified water well survey.
- The drilling and completion of six shallow monitoring wells (piezometers).
- Analysis of groundwater samples collected from selected piezometers.
- Aquifer testing with selected piezometers.
- Baseline testing of selected residential water wells in the AOI; the baseline testing consisted of groundwater sampling for chemical analysis, and, where possible, short aquifer tests.

Collected data were entered into The Groundwater Centre (TGWC) database, which is an enhanced version of the ESRD water well database. The synthesis and analysis of the collected hydrogeological information are included in the present groundwater review.

The area of study (AOS) for the present program is the 20-section area shown in the adjacent map. The area of interest (AOI) is the area within 1,000 metres of the proposed mining areas, also shown in the adjacent map. Because this report has been prepared in support of an application to Lac Ste. Anne County, the field survey area (FSA) is the area within 1,000 metres of the proposed mining blocks in Sections 32, 33 and 34.



AOS and Topography

2. Background

2.1. Physiography and Climate

The AOS lies along the western edge of the interior plains. The ground surface at the location of the proposed development is generally flat-lying at an elevation of approximately 778 to 784 metres above mean sea level (AMSL), as shown in the map on the previous page. The AOS is underlain by varying thicknesses of till deposited by the Wisconsin ice sheet resulting in moderately developed hummocky topography (Shetsen, 1990).

The proposed development is approximately three kilometres north of the surface-water divide separating Lac Ste. Anne to the north and Wabamun Lake to the south (Ozoray, 1972).

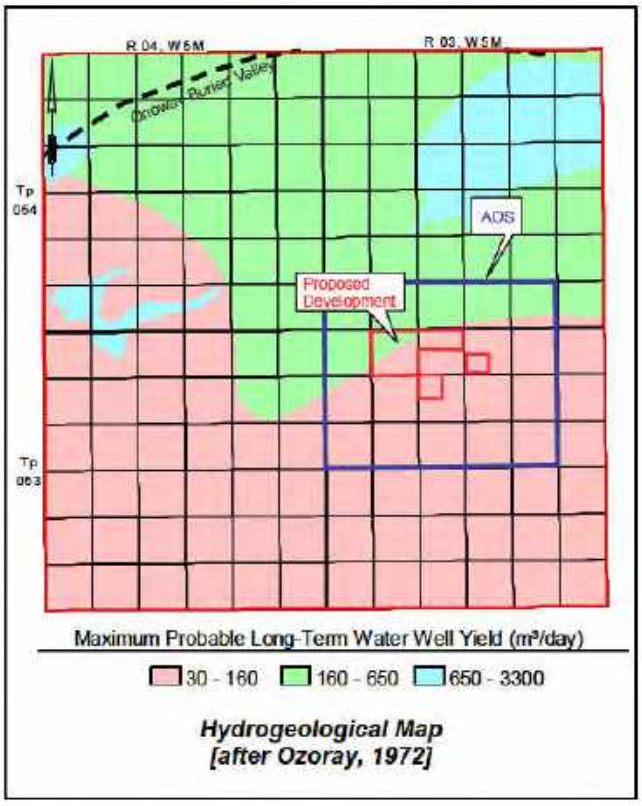
The AOS is in the "short, cool summer" Koppen zone, with mean temperatures of approximately minus 15 °C in January, and plus 15°C in July. The mean annual precipitation is approximately 530 millimetres (mm).

2.2. General Hydrogeology

2.2.1. Geology

Surficial deposits in the AOS are primarily composed of till, though pockets of sand or gravel deposits are known to be present. The thickest sequences of sand or gravel deposits are typically associated with the thalwegs of linear bedrock lows. One linear bedrock low identified as the Buried Beverly Valley has a southwest-northeast orientation and is located approximately 20 kilometres southeast of the proposed development (Carlson, 1971). A second linear bedrock low identified as the Onoway Buried Valley is located approximately ten kilometres north and northwest of the proposed development.

The upper bedrock in the AOS is the Upper Cretaceous Scollard Formation of the Edmonton Group, which consists mainly of non-marine sandstone, mudstone and coal units. The partially-eroded Scollard Formation is typically less than five metres thick in the area of proposed development, and overlies two minor units, the Battle Formation and the Whitemud Formation. The Kneehills Zone of the Battle Formation was used by Green (1982) as a marker bed for contouring the surface of the Edmonton Group. The mainly non-marine sandstones, mudstones and shales of the Horseshoe Canyon Formation underlie the Whitemud Formation in the AOS.



Hydrogeological Map [after Ozoray, 1972]

2.2.2. Groundwater Availability

Water wells completed in aquifers within the AOS are generally expected to yield in the order of 30 to 160 cubic metres per day (m³/day), except in the northern and northwestern parts of the AOS, where water well yields are expected to be in the range of 160 to 650 m³/day, as shown on the adjacent hydrogeological map (Ozoray, 1972). Aquifers that are used for water supplies in the

AOS are mainly in the upper bedrock. These aquifers are predominantly thin sandstone layers or layers of fractured shale.

Only a small number of water wells in the AOS are completed in aquifers in the surficial deposits and, because of the limited nature of the deposits, the yields of water wells completed in these aquifers are usually low. The exception is the sand or gravel aquifers associated with the thalwegs of linear bedrock lows such as the Buried Onoway Valley and the Buried Beverly Valley, which are outside the AOS.

Groundwaters from water wells completed in upper bedrock aquifers in the AOS tend to be bicarbonate-type waters, with calcium plus magnesium (Ca+Mg) being the dominant cations in recharge areas and in discharge areas of short, local flow systems, and sodium (Na) becoming dominant in discharge areas of longer flow systems. The concentration of total dissolved solids (TDS) from bedrock groundwaters in the AOS is generally between 600 and 1,200 milligrams per litre (mg/L).

2.2.3. Groundwater Query

A groundwater query (gwQuery) was developed by Mow-Tech Ltd. as part of the regional groundwater assessments completed for various counties in Alberta. The results of the groundwater query for NE 33-053-03 W5M provide a summary of expected local hydrogeology. The gwQuery results are based on more than 30 regional maps prepared by HCL, and are provided in the adjacent table. The gwQuery is based on regional data and, therefore, local conditions may vary. The Mow-Tech Ltd. gwQuery is available on the internet: http://www.gwquery.com.

Lac Ste. Anne County
NE 33-053-03 W5M
MOW-TECH LTD. gwQuery Results

General Results Depth(s)	Top metre	Yield* m³/day	NPWL metre	TDS mg/L	Sulfate mg/L	Chloride mg/L	Fluid Expected
gwQuery Determined Minimum	52	15[2]	16	893	188	3	--
gwQuery Determined Maximum	55	15[2]	16	893	188	3	--

Detailed Results Geologic Unit Encountered	Top metre	Yield* m³/day	NPWL metre	TDS mg/L	Sulfate mg/L	Chloride mg/L	Fluid Expected
Upper Surficial Deposits	--	--	--	689	60	36	--
Bedrock Surface	27						
Lower Scollard Formation	27	2[2]	11	1061	163	5	--
Upper Horseshoe Canyon Formation	29	15[2]	16	893	188	3	--
Middle Horseshoe Canyon Formation	123	9[2]	72	510	79	--	--
Lower Horseshoe Canyon Formation	187	--	69	765	149	86	--
Bearpaw Formation	344	24[3]	--	--	--	--	--
Oldman Formation	447	55[3]	--	--	--	--	Water

Parameter	metre
Base of Groundwater Protection (Depth)	401
Ground Elevation (AMSL)	774

Legend/Notes
'--' indicates information not available.
Base of Groundwater Protection (BGP: TDS > 4,000 mg/L).
* Yield based on the 'Fluid Encountered' being water.
[2] Results are based on a regional groundwater study by hydrogeological consultants ltd. (HCL)
[3] Results are based on a summary of Drill Stem Test (DST) results.

Contact at least three local licensed water well drillers to get estimates of drilling and water well completion costs in your area. Consult the 'Water Wells that Last for Generations' booklet for advice on hiring a water well driller, and for a check list of items that you and the driller should discuss and agree to before starting the work.

The information calculated with the MOW-TECH LTD. gwQuery is meant only as a guide. Actual drilling conditions may vary. MOW-TECH LTD. is not liable for drilling or groundwater problems as a result of using these data.

Mow-Tech Ltd. gwQuery Results

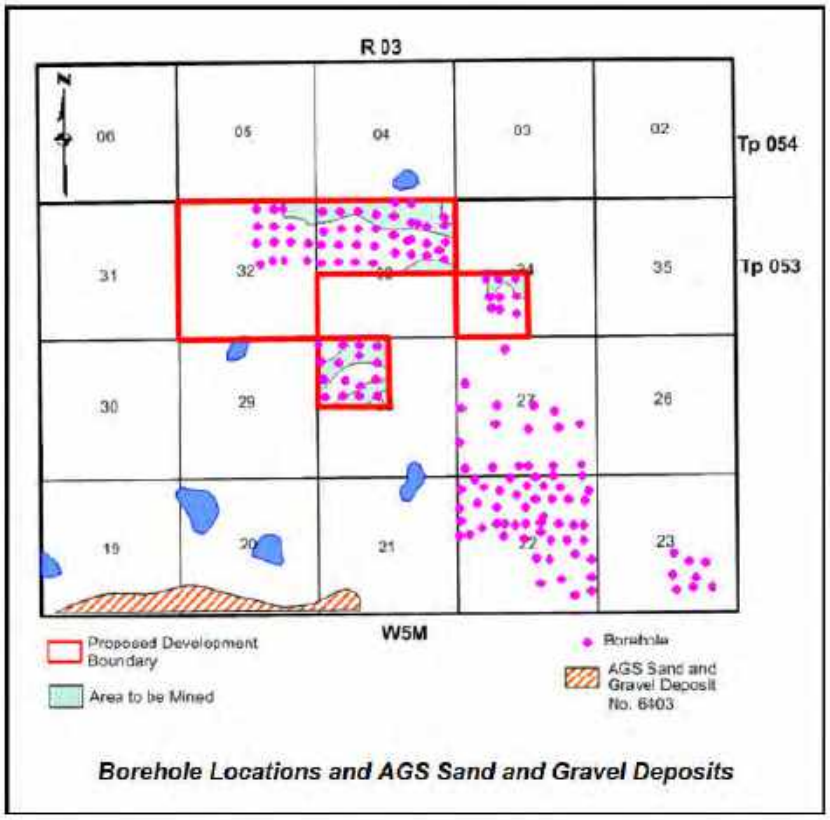
The adjacent table shows that there is an expected 27 metres of surficial deposits overlying bedrock at the NE 33 location; the uppermost bedrock unit is expected to be the Late Cretaceous Lower Scollard Formation of the Edmonton Group. The Lower Scollard Formation is of non-marine origin, and composed primarily of sandstone, siltstone and mudstone units, with occasional coal seams.

The gwQuery shows that the aquifers in the Lower Scollard Formation are expected to have long-term yields of approximately two m^3/day. Water wells completed in the underlying Upper Horseshoe Canyon Formation are expected to have long-term yields of approximately 15 m^3/day and contain groundwater with a TDS concentration of approximately 900 mg/L. Water wells completed in surficial deposits in the AOS are expected to have a TDS concentration of approximately 700 mg/L; there are insufficient data to make an estimate of long-term yield for a water well completed in the surficial deposits.

2.3. Previous Work

The Bibliography section of this report includes documents that relate to hydrogeology in the general area of the proposed development.

In 2007 and 2008, 73 boreholes were drilled for Reperio Resources Corp. under the direction of SNC Lavalin Environment in the proposed development area. The borehole information included spatial coordinates and lithologic descriptions. Information from the boreholes has been added to TGWC database.



Borehole Locations and AGS Sand and Gravel Deposits

The locations of the 73 boreholes drilled within the proposed development boundary are shown on the adjacent map. The map also shows the locations of 74 additional boreholes drilled in 1974, 1978 and 2002 as part of previous gravel exploration programs, in Sections 22, 23 and 27. The area in the north half of Section 22 is an active gravel extraction area. Some of the hydrogeological information determined by HCL regarding the gravel deposit being mined in the north half of Section 22 is as follows:

- The gravel thickness in the north half of Section 22 averages approximately 3.8 metres, and is typically deposited on top of the bedrock surface, at an elevation of approximately 760 to 770 metres AMSL.
- The sand and gravel aquifer has an effective transmissivity of approximately 73 metres squared per day (m^2/day) and a corresponding storativity of 0.005.
- The sand and gravel aquifer is saturated to partially saturated, with a water-level gradient to the east-southeast.
- Groundwater recharge in early spring is a significant contributor to the shallow groundwater supply.
- Dewatering and replacement of the gravel aquifer has so far not resulted in any adverse effect on area water levels or groundwater quality[2].

The map above also shows the location of a sand and gravel deposit, partially within the AOS, that is identified by the Alberta Geological Survey (AGS) as Deposit No. 6403.[3] AGS information for Deposit No. 6403 includes an area of 595 hectares (ha), a gravel volume of 4,774,000 m^3, a sand volume of 10,110,000 m^3, and a thickness of 5.0 metres. The deposit is described as a dirty, gravelly sand, with a gravel content representing 30% of the material, and a sand content representing 63%.

[2] HCL, June 2003; HCL, November 2008a; HCL, March 2012.
[3] The AGS deposits are based on work conducted by Edwards (1980a) and Edwards et al. (1985).

2.4. Proposed Development Technique

Preliminary design plans propose a 2.77-hectare recharge pond in the northeast corner of NW 33-053-03 W5M; a 3.5-metre-high berm around the recharge pond will be constructed with overburden material. During construction of the recharge pond, groundwater may be diverted to a dugout in NE 33-053-03 W5M, from which excess water may be diverted along a northeasterly-trending drainage ditch.

Gravel extraction is expected to begin in NW 33. At each extraction pit, pumps will be employed for dewatering as the gravel pit deepens. The groundwater from the gravel pits that is required for washing will be pumped to a holding pit near the wash plant. Any additional groundwater will be piped to the recharge pond and/or a previously-excavated pit.

The water that fills any previously-excavated pit or the recharge pond will recharge the shallow aquifer by infiltration through the pit floor and pit walls; there will be no net loss of groundwater other than through evaporation and adhesion to the aggregate as part of the gravel washing process.

Overburden will be removed and stockpiled, and subsequently used for reclamation. Volume deficiencies will occur near the end of the project, allowing for the development of end pit lakes.

3. Present Program

3.1. Maps and Aerial Photographs

The AOS is situated within the 83G 1:250,000 National Topographic Series (NTS) map sheet, with local detail available from the 1:50,000 83G/09 map sheet. Digital topographic control is from the 1:20,000 digital elevation model (DEM) prepared by the Spatial Data Warehouse (SDW).

Digital ortho-imagery has been obtained from Valtus Imagery Services (Valtus) for the present program. Otho-imagery is created for a digital image of an aerial photograph when displacements caused by the camera and the terrain have been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. The aerial photographs used in the creation of the ortho-images were collected in July of 2007. The ortho-imagery was provided by Valtus at a 1.0-metre resolution.

3.2. Groundwater Database

TGWC database includes 410 records for the AOS.[4] Of the 410 groundwater records, 213 are classified as water wells. Information relating to the records in the groundwater database has been used in the preparation of cross-sections, as the starting point for the water well survey, and to determine aquifer parameters.

Of the 410 records, 148 are abandoned boreholes drilled to investigate gravel deposits in the AOS; 73 of these 148 boreholes were drilled in 2007 and 2008 within Sections 28, 32, 33 and 34.

Type of Work	No. of Records
Water Well	213
Borehole - Abandoned	148
Piezometer	17
Reclaimed Water Well	9
Piezometer - Abandoned	6
Dugout	5
Structure Test Hole	5
Unknown	4
Coal Test Hole	3
Total:	***410***

Groundwater Records in AOS

[4] The table includes changes to the database made as part of the present program.

3.3. Field Work

3.3.1. Field-Verified Water Well Survey

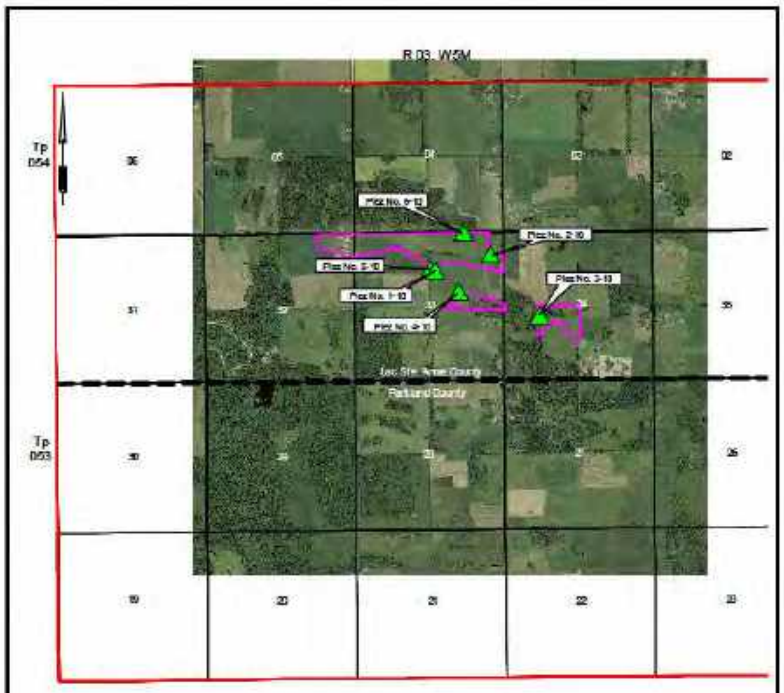
A field-verified water well survey was completed within the field survey area by HCL personnel between October 18 and November 3, 2010; two additional water wells were field-verified on October 6, 2011. All water well records available in the groundwater database for the field-survey area were used as a starting point for the water well survey. Coordinates for water wells located in the field were determined with a hand-held, consumer-grade global positioning system (GPS) receiver. When the owner allowed, water levels were measured in water wells. A visit was made to each residence in the AOI. If residents were not home, a letter was left explaining the purpose of the water well survey, and an opportunity was given to the residents to provide details from their water wells for the survey. A copy of the letter used for the survey is in Appendix A.

A map and tables of the results of the survey are included in Appendix D.

3.3.2. Drilling

The locations of the six piezometers that were completed as part of the present program are shown in the adjacent map. Criteria for site selection were based on:

- The presence and thickness of sand and gravel determined from borehole data.
- The proposed mining sequence, which begins in NE 33.
- Elevation of bedrock surface, mainly determined from borehole data.
- Site accessibility based on land use and landowner's consent.
- Location of underground utilities.



2010 Piezometer Locations

An additional borehole (GCID No. M40471.554033) was drilled to a depth of 22.9 metres below ground level (BGL) on October 19, 2010 but was not completed as a piezometer because of sloughing material.

Lakeland Drilling Ltd. (Lakeland) drilled and completed Piezometer (Pz) Nos. 1-10 to 5-10 between October 19 and 22, 2010; Summers Drilling Ltd. (Summers) drilled and completed Pz No. 6-10 on October 28, 2010. Drilling and completion was supervised by Mow-Tech Ltd. personnel. The piezometers were completed using 89-mm outside-diameter (OD) plastic (PVC) casing, and 0.51-mm (20-slot) screens. After completion, elevations of the ground surface and the water level reference points for the piezometers were surveyed by Altus Geomatics.

Details for the piezometers and the results of any tests associated with individual piezometers are included in the Results section of this report and in Appendix B.

3.3.3. Aquifer Tests and Groundwater Sampling

Short aquifer tests with individual piezometers were conducted with Pz Nos. 1-10, 3-10, 5-10 and 6-10. An extended aquifer test was conducted with Pz No. 1-10, which included the monitoring of each of the piezometer Nos. 2-10 through 6-10 as observation water wells.

The table below summarizes the aquifer tests conducted with the piezometers by Mow-Tech Ltd. as part of the present program. The tests were conducted using a submersible pump; water levels were measured with pressure transducers and data loggers; a turbine and flow analyzer connected to a data logger were used to measure groundwater production.

Piezometer No.	Aquifer Test	Date Test Started	Pumping Rate (lpm)	NPWL (m BTOC)	Pumping Interval (min)	Recovery Interval (min)	Observation Water Wells
1-10	I	2010-10-20	20.2	11.29	120	750	No
	II	2010-11-04	32.2	11.28	11,380	4,240	Yes
3-10	I	2010-11-15	15.5, 23.0 and 30.3	13.93	80	1,130	No
5-10	I	2010-11-03	20.9	11.47	120	120	No
6-10	I	2010-11-01	37.9	7.86	120	120	No

lpm - litres per minute
NPWL (m BTOC) - non-pumping water level in metres below top of casing

Aquifer Test Summary

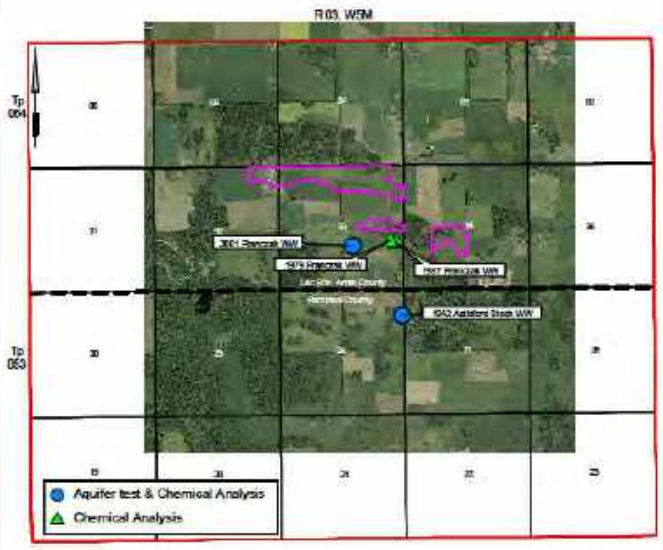
Groundwater samples were collected from Piezometer Nos. 1-10, 3-10, 5-10 and 6-10 during aquifer testing and submitted to Exova Canada Inc. (Exova) for analysis of dissolved metals and routine chemical parameters. The groundwater samples were collected by field staff wearing fresh nitrile gloves for each piezometer. Sample bottles were filled to capacity with little or no air space remaining. The bottle type and any associated preservatives were prescribed by the laboratory conducting the analyses (Exova). The collected groundwater samples were stored in a cooler with ice packs until arrival at the laboratory.

The results from short aquifer tests conducted without observation water wells are in Appendix B; the results from the extended aquifer test (AT II) with Pz No. 1-10 are in Appendix C.

3.3.3.1. *Residential Water Wells*

In order to obtain baseline information related to water well yield and groundwater quality, an aquifer testing and groundwater sampling program was initiated with selected residential domestic and stock water wells. Water wells were selected based on proximity to the proposed development, whether the water wells were completed in surficial deposits and the degree of concern expressed by the resident.

The 2010 baseline testing included the four water wells shown in the table below and on the adjacent map. Aquifer testing was conducted by Mar-Wayne Water Well Drilling Services Ltd.; groundwater sampling and supervision of aquifer testing was conducted by Mow-Tech Ltd. personnel.



Tested Residential Water Wells

Aquifer testing with the 1942 Astleford Stock WW consisted of 60 minutes of pumping at 16.6 litres per minute (lpm) followed by 60 minutes of recovery. Aquifer testing with the 2001 Franczak WW consisted of 64 minutes of pumping at 31.5 lpm, followed by 64 minutes of recovery.

Water Well Name	Water Well Owner	GCID	Legal Location (Tp 053, R 03, W5M)	Aquifer Test	Groundwater Sampling	Test Date
1942 Astleford Stock WW	George Astleford	M37713.708345	NE 28	Yes	Yes	2010-10-21
2001 Franczak WW	Dave Franczak	M39227.488655	SE 33	Yes	Yes	2010-10-21
1987 Franczak WW	Dave Franczak	M36056.964297	SE 33	No	Yes	2010-10-21
1979 Franczak WW	Dave Franczak	M36056.964300	SE 33	No	Yes	2010-10-21

During the site visit, coordinates of each water well were determined with a GPS receiver, the diameter and material of the casing was noted, the water well was photographed, and the casing stick-up was measured. The groundwater samples were collected after at least ten minutes of pumping by field staff wearing fresh nitrile gloves for each water well. Sample bottles were filled to capacity with little or no air space remaining. The bottle type and any associated preservatives were prescribed by the laboratory conducting the analyses (Exova). The collected groundwater samples were stored in a cooler with ice packs until arrival at the laboratory. Groundwater samples collected for analysis were analyzed by Exova for dissolved metals, total and fecal coliforms and routine chemical parameters.

The results of groundwater sampling and aquifer testing are included in Appendix B. The results of the aquifer testing and groundwater sampling were provided to each resident for that resident's water well.

3.4. Data Processing

The horizontal coordinates in this report are based on a 10-degree Transverse Mercator (10TM) projection, referenced to 115 degrees west longitude and using the NAD83 datum. Coordinates were determined for features identified in the field using a consumer-grade, hand-held GPS receiver.

Transmissivity values from the aquifer test data from pumped water wells and piezometers have been calculated using the following approximation of the Theis non-equilibrium equation:

$$T = \frac{2.3 \cdot Q}{4 \cdot \pi \cdot \Delta s}$$

Where:

T	= transmissivity in m²/day
Q	= discharge in m³/day
Δs	= metres of drawdown per log cycle

Transmissivity from specific capacity is calculated based on the following equation:

$$\frac{Q}{s} = \frac{4 \cdot \pi \cdot T}{2.3 \cdot \log_{10}\left(\frac{2.25 \cdot T \cdot t}{S \cdot r^2}\right)}$$

Where:

Q	= discharge in m³/day
s	= drawdown in metres
T	= transmissivity in m²/day
S	= storativity, assumed to be 0.0001
t	= time since discharge started in days
r	= effective radius of the water well in metres

3.4.1. Calculation of Drawdown

Drawdowns at various times and distances from the groundwater discharge point are calculated using the Theis non-equilibrium equation based on approximations of W(u):

$$s = \frac{Q \cdot W(u)}{4 \cdot \pi \cdot T}$$

Where:

s	= drawdown in metres
Q	= discharge in m³/day
W(u)	= well function for non-leaky artesian aquifers
T	= transmissivity in m²/day

And

$$u = \frac{r^2 \cdot S}{4 \cdot T \cdot t}$$

Where:

r	= effective radius of the water well in metres
S	= aquifer storativity, dimensionless
T	= transmissivity in m²/day
t	= time since discharge started in days

Approximations of W(u) for values of u greater than zero and less than one, the following approximation is used:

$W(u) = - \ln u + (-0.57721556) + (0.99999193)*u + (-0.24991055)*u^2 + (0.05519968)*u^3 + (-0.000976004)*u^4 + (0.00107857)*u^5$

Where:

ln	= natural logarithm

For values of $1 < u <$ infinity, the following approximation is used:

$$W(u) = \frac{1}{u \cdot e^u} \cdot \frac{0.250621 + 2.334733 \cdot u + u^2}{1.681534 + 3.330657 \cdot u + u^2}$$

Where:

e	= the base of the natural logarithm

When multiple groundwater discharge points are involved, the principle of superposition is used. The multiple discharge points can be at various locations or at one location.

3.4.2. Calculation of Storativity

The storage coefficient for a confined aquifer represents water derived relative to: (1) the expansion of water as the aquifer is depressurized and (2) compression of the aquifer. In a confined aquifer setting, the load on top of an aquifer is supported by the solid rock skeleton and the hydraulic pressure exerted by the groundwater. The value for storativity (S) is calculated using the following:

$$u = \frac{r^2 \cdot S}{4 \cdot T \cdot t}$$

Where:

u	= from non-leaky artesian equation
r	= effective radius of the water well in metres
T	= transmissivity in m²/day
t	= time since discharge started in days

3.4.3. Calculation of Theoretical Long-Term Yield

Theoretical long-term yield is calculated from the Modified Moell Method (Alberta Government, March 2011), using the following equation:

$$Q_{20} = \frac{0.7 \, Q \,) \quad H_a \,)}{S_{100\,min} + \left(S_{20\,yrs} - S_{100\,min} \right)_{theor}}$$

Where:

Q_{20} = sustainable yield for 20 years
Q = pumping rate during the aquifer tests
H_A = available drawdown
s_{100min} = measured drawdown after 100 minutes of pumping
$s_{100min\ Theor}$ = calculated theoretical drawdown after 100 minutes of pumping Q using effective transmissivity
$s_{20yrs\ Theor}$ = calculated theoretical drawdown after 20 years of pumping Q using effective transmissivity
0.7 = safety factor

When the aquifer is fully confined, the available drawdown (H_A) is the linear distance from the non-pumping water level to the top of the aquifer. When the aquifer is not fully confined, the available drawdown (H_A) is two-thirds of the linear distance from the non-pumping water level to the bottom of the aquifer.

All gridding uses the Kriging method with a linear variogram model as provided in Golden Software Surfer V9.

A two-dimensional mathematical model is used to calculate the water levels at various times and distances from a pumping water well. The model, developed by Mow-Tech Ltd., is called the *Infinite Artesian Aquifer Model* (IAAM). The model can be used to calculate water levels at specific locations in the aquifer taking into consideration the effects of boundary conditions, using image water wells, and interference from nearby pumping water wells. The calculations are based on an aquifer that is homogeneous and isotropic and behaves as one of infinite areal extent with no recharge.

4. Results

4.1. Groundwater Database

The groundwater database is updated as data become available. Therefore, information obtained for or generated during the present program is entered into the database; any discussion that uses the database will reflect the updated information.

The groundwater database for the AOS includes 410 records. Of the 410 records, 73 are the boreholes entered into the database as part of the present program, all of which included a determination of the top of bedrock, and 74 are boreholes entered into the database as part of previous gravel exploration programs in Sections 22, 23 and 27; of these 74 boreholes, 37 included a determination of the top of bedrock. An additional seven bedrock picks were determined from the borehole drilling information compiled as part of the present program and an additional 178 groundwater records in TGWC database included a determination of the top of bedrock.

In the AOS, there are 137 results for the chemical quality of water that include sufficient parameters for determination of the category of chemical quality.[5] Of these 137 analyses:

- Four are groundwater samples collected from the 1531486 Alberta Ltd. piezometers.
- Four are from the residential water wells tested as part of the present program.
- 58 are piezometers and one water test hole owned by a gravel operator in the north half of Section 22.
- Five are surface water samples associated with the gravel development in the north half of Section 22.
- The remaining 66 analyses are from other area water wells.

Chemical quality results are discussed in Section 4.4 of this report.

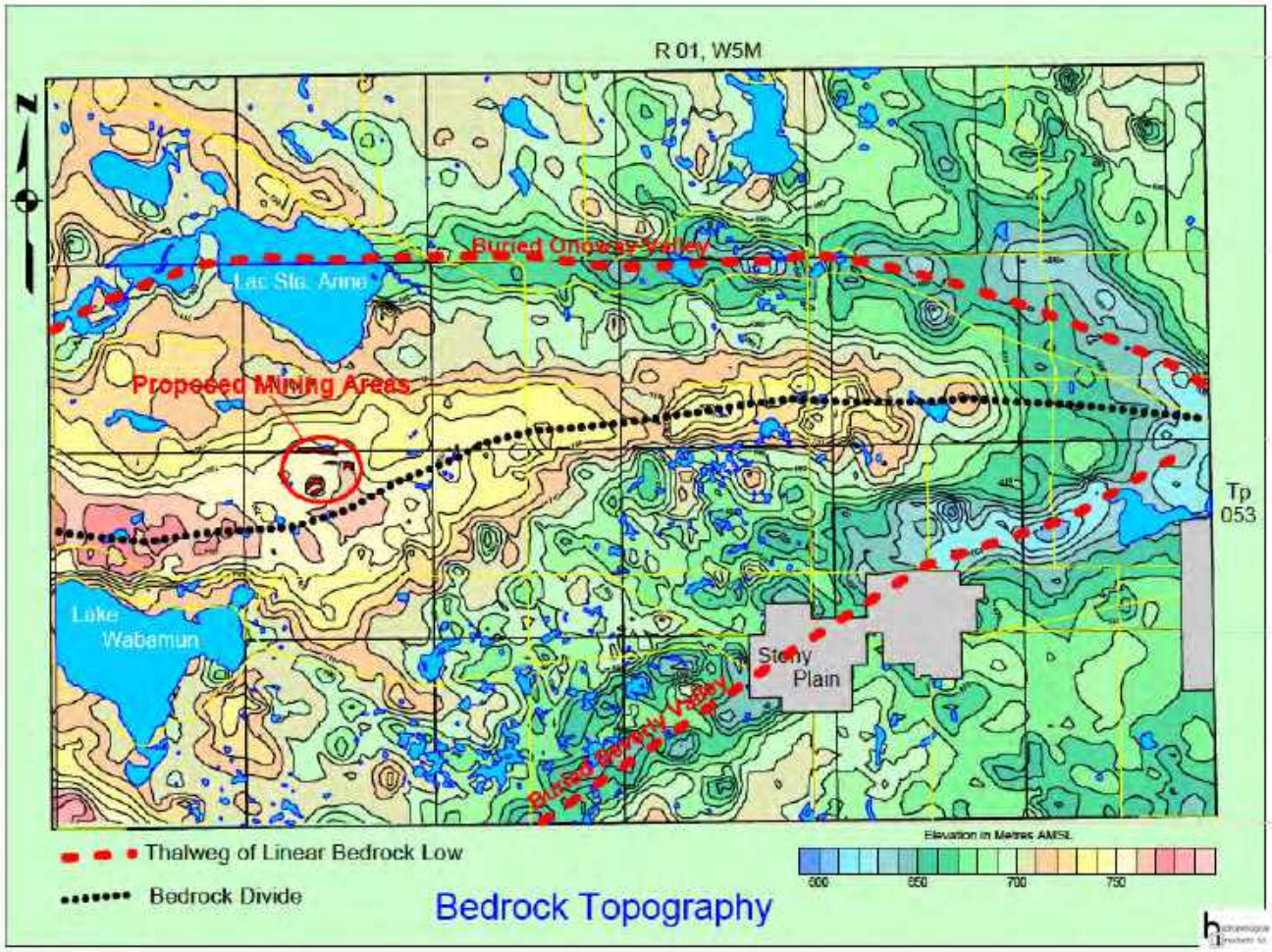
Gravel or sandy gravel was encountered in 64 of the 73 boreholes drilled in the proposed development area in 2007 and 2008, and in the seven boreholes drilled as part of the present program.[6] The borehole data were used to create the maps shown in Section 4.1.1.2 of this report.

Water-level elevations for the sand and gravel aquifer in the proposed development area are based on depth-to-water measurements recorded by digital water-level recorders on November 04, 2010 at 15:20 Hrs in the six surveyed piezometers completed as part of the present program.

[5] The parameters required are: sodium, potassium, calcium, bicarbonate, chloride and sulfate.
[6] The seven boreholes include the six completed piezometers, and one reclaimed borehole.

4.1.1. Regional Data

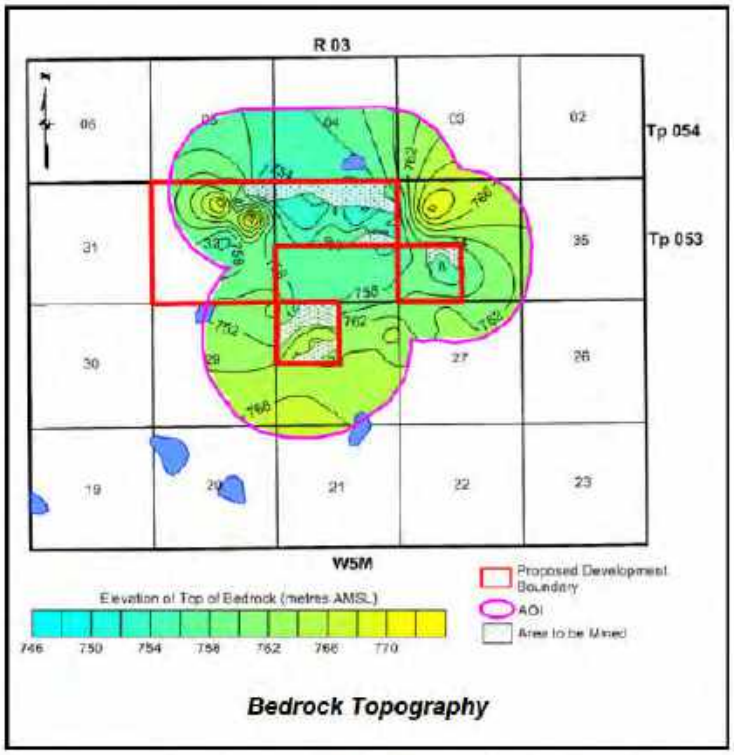
The regional groundwater assessments prepared by HCL for Parkland County (HCL, August 1998), Lac Ste. Anne County (HCL, July 1998) and Sturgeon County (HCL, September 2001) include bedrock topography maps. The bedrock topography maps show that there are two main linear bedrock lows in the general area of the proposed development. The thalweg of the Buried Onoway Valley linear bedrock low is approximately ten kilometres north of the proposed development; the second is the Buried Beverly Valley linear bedrock low is approximately 20 kilometres southeast of the proposed development. The proposed development is situated north of the crest of the northeasterly-trending linear bedrock divide, as shown on the bedrock topography map below. Because the map shows that the proposed mining area is north of the bedrock divide, shallow groundwater flow from the proposed mining area is expected to flow north, toward Lac Ste. Anne.



Bedrock Topography - Parts of Parkland, Lac Ste Anne and Sturgeon Counties

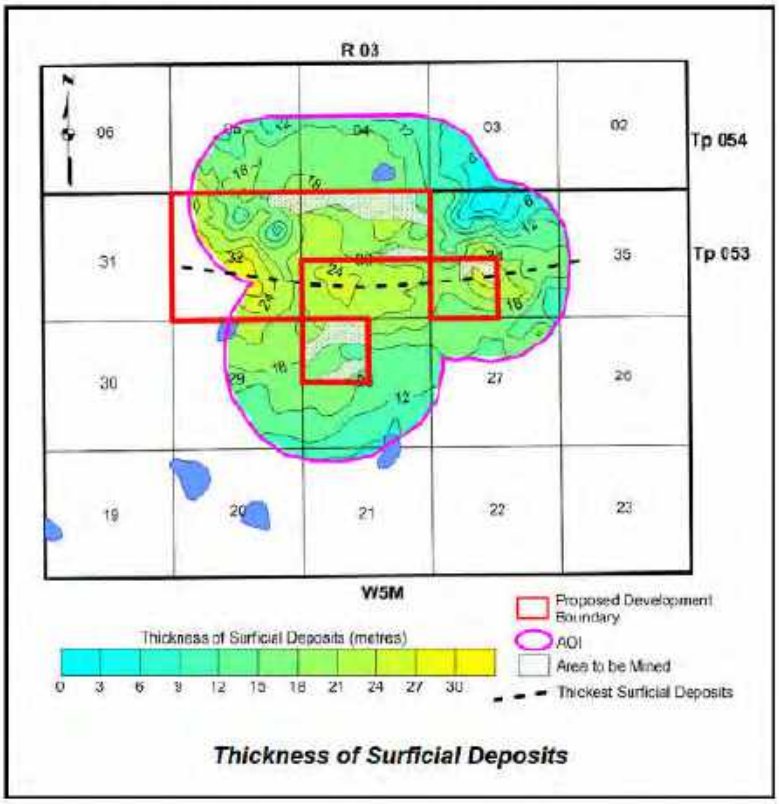
4.1.2. Local Data

One hundred twelve control points that included a determination of the top of bedrock were used to create a bedrock topography map for the AOI, as shown in the adjacent map.[7] The map shows that the top of bedrock in the north half of Section 33 is at an elevation of approximately 754 metres AMSL; in the SW 34, the top of bedrock is at an elevation of approximately 758 metres AMSL, and in NW 28, the top of bedrock is at an elevation of approximately 760 to 764 metres AMSL.



Bedrock Topography

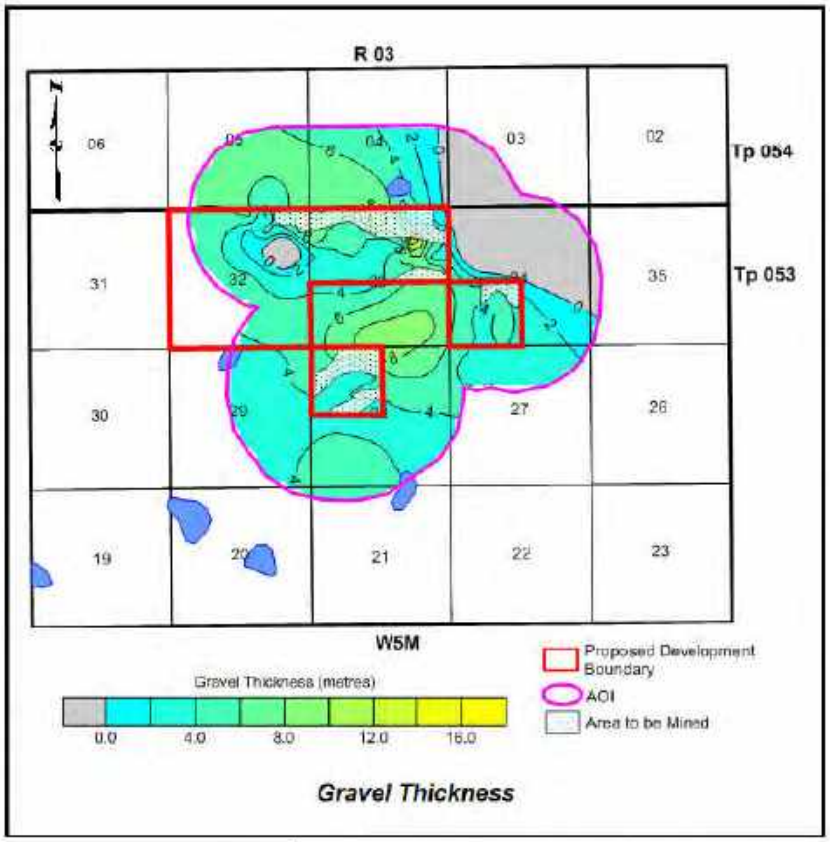
Sand and gravel deposits occur between the bedrock surface and the land surface. By subtracting the bedrock surface from the topographic surface, the thickness of the unconsolidated sediments overlying the bedrock surface can be determined. The map below shows that unconsolidated sediments in the AOI are generally in the order of 12 to 20 metres thick, and are thickest along an approximate west-east trend through the middle of the proposed development area, represented by the black dashed line. The depth to bedrock in this area can be more than 24 metres.



Thickness of Surficial Deposits

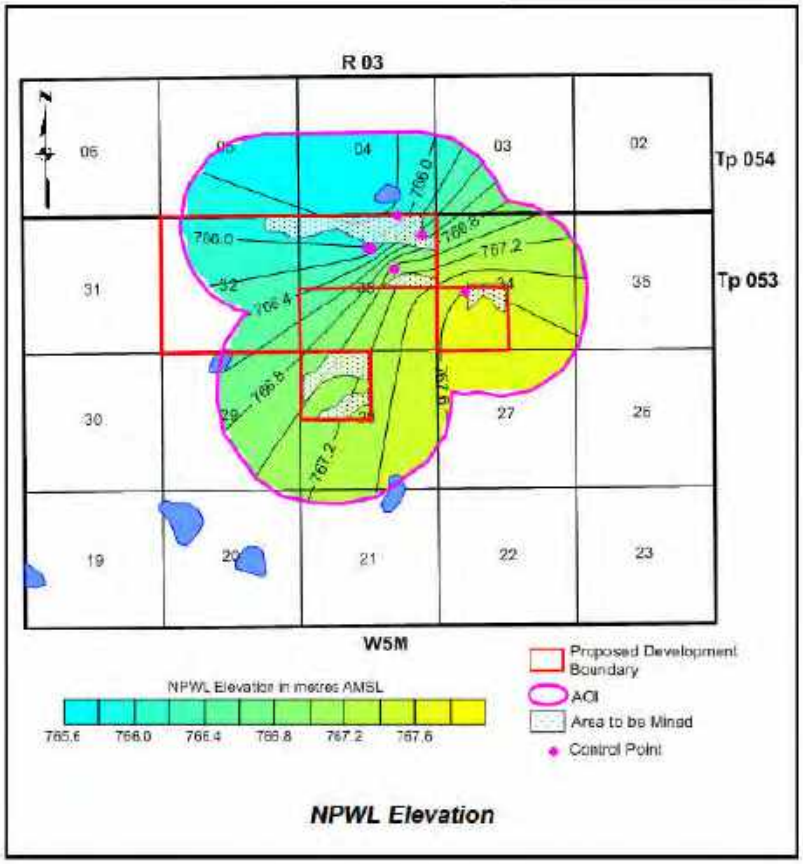
[7] Elevations of bedrock at the piezometer sites were based on surveyed ground level elevations; elevations at water well and borehole sites were based on the DEM.

The adjacent map shows the thickness of the gravel deposit in the AOI by subtracting the bedrock surface from the top of gravel surface. The map shows that the gravel thickness in the north half of Section 33 is expected to range from approximately two to eight metres, with the thinnest gravel occurring near the northeastern and northwestern extremities of the area to be mined. In the proposed mining area in SW 34, the gravel layer is expected to be two to four metres thick, and in NW 28, the gravel is expected to be approximately three to eight metres thick.



Gravel Thickness

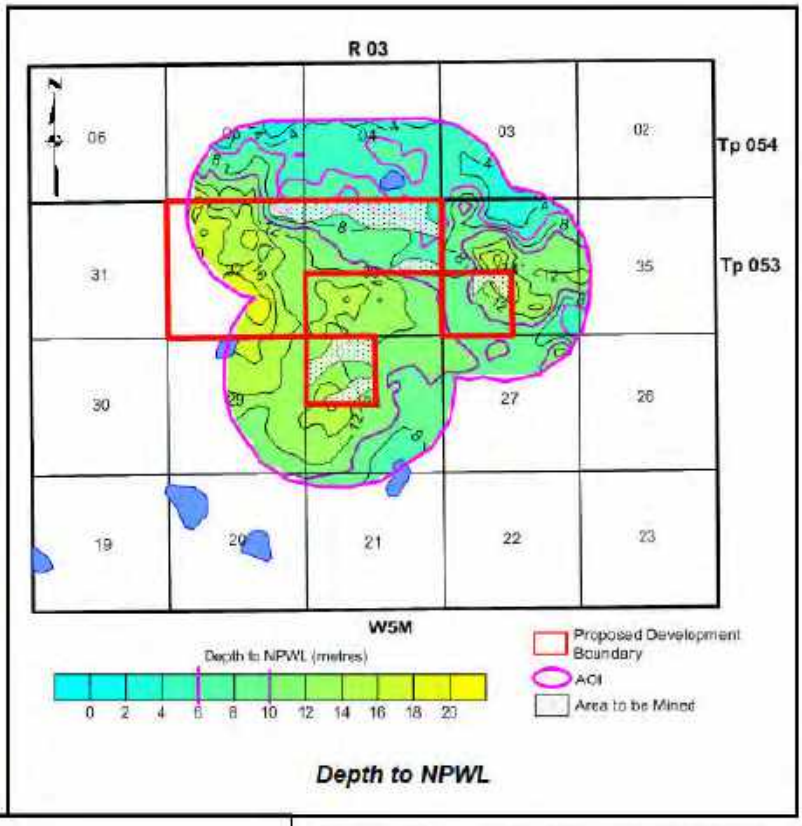
The map below shows the NPWL elevation based on measured NPWLs in the six piezometers that have been completed in the sand and gravel aquifer as part of the present program. The map shows that the NPWL surface in the AOI is generally at an elevation of 765.5 to 768 metres AMSL, and has a gradient to the northwest of approximately 0.0013 (which is 1.3 metres per kilometre).



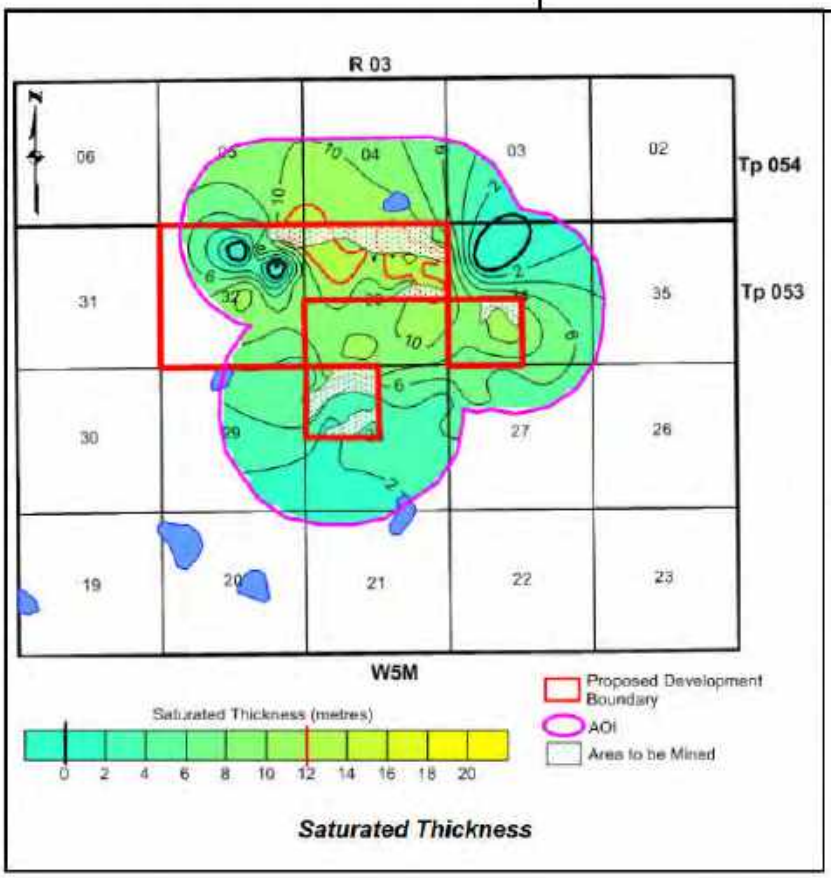
NPWL Elevation

The map to the right shows the depth to NPWL created by subtracting the NPWL surface from ground surface. The map shows that the depth to the NPWL is generally between six and 12 metres BGL. Depths to NPWL are lowest in the topographically lower areas in the north half of Section 33, where mining will begin.

The map below shows the saturated thickness of the surficial deposits, calculated by subtracting the bedrock surface from the NPWL surface. The map shows that the saturated thickness in the proposed mining area in Section 33 is generally in the order of 12 metres. In the proposed mining area of SW 34, the saturated thickness is approximately ten metres, and in the proposed mining area in NW 28 the saturated thickness is expected to be as low as two metres in the southern part of the area to be mined, and eight metres in the northern part of the area to be mined.



Depth to NPWL



Saturated Thickness

The areas within the three bold black contour lines are areas where the bedrock surface is expected to be at a higher elevation than the NPWL surface of the surficial deposits, based on reported lithology.

It is important to note that the two maps shown on this page are based on an extrapolated NPWL surface that has poor data control outside of NW 33 and SW 34.

4.2. Field-Verified Water Well Survey

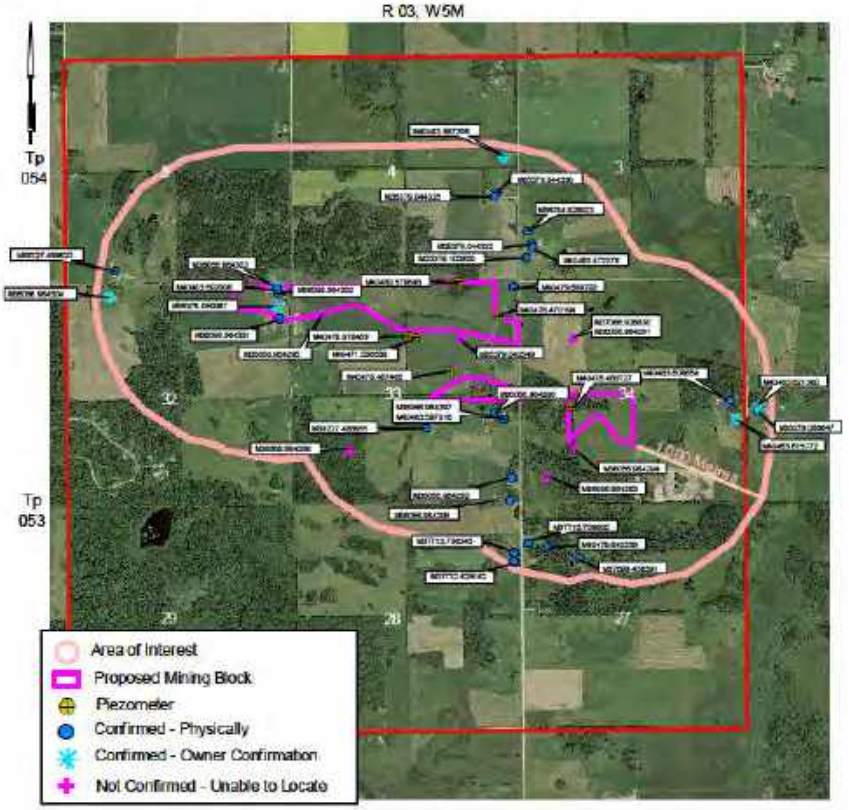
HCL personnel conducted a water well survey within the FSA between October 18 and November 3, 2010 and on October 6, 2011. The purpose of the field-verified water well survey was to locate as many of the water wells in the FSA as practical, and to update records accordingly. A field survey includes four field actions for identification of a feature:

1. Physically confirmed - this means the feature was observed, and horizontal coordinates were obtained after receiving authorization to do so by the owner/user.
2. The feature is confirmed by the owner/user, and horizontal coordinates were obtained based on information provided.
3. The feature could be expected based on information that is not provided by the owner/user.
4. No evidence of the feature could be observed in the field.

The adjacent map shows the spatial distribution of the 43 water wells within the FSA. Of these 43 water wells:

- Six are the piezometers completed as part of the present program (identified with ⊕ — Field Action 1).
- 24 water wells were physically confirmed in the field (identified with ● — Field Action 1).
- Six water wells were confirmed based on information provided by the owner (identified with ✱ — Field Action 2).
- Seven water wells were not located in the field and no evidence of the feature could be observed in the field (identified with ✚ — Field Action 4).

A larger version of the field survey map is in Appendix D. Water well details for the water wells within the FSA are also included in Appendix D.



Field-Verified Water Well Survey

4.3. Piezometers

4.3.1. Completion

Piezometer Nos. 1-10 to 5-10 were drilled and completed by Lakeland, and Pz No. 6-10 was drilled and completed by Summers; Mow-Tech Ltd. personnel supervised all drilling and completion. The boreholes were drilled deep enough to ensure bedrock was encountered and the piezometers have a completion interval that extends to the bottom of the sand and gravel deposit encountered at each site; no borehole has a depth of greater than 22.9 metres.

Pz No. 3-10

All six piezometers were completed using 89-mm OD PVC casing, and 0.51-mm (20-slot) screens. A locked, metal casing protector was installed at each site, and affixed with an identity label, as shown in the adjacent photograph. After completion, elevations of the ground surface and the water level reference points for the piezometers were surveyed by Altus Geomatics. A summary of some of the completion details is shown in the table below.

Pz No.	Legal Location (Tp 053, R 03, W5M)	Completion Interval (m BGL) Top	Completion Interval (m BGL) Bottom	Gravel Interval (m BGL) Top	Gravel Interval (m BGL) Bottom	Top of Bedrock (m BGL)	Casing Stick-up (m)	NPWL (m BTOC)*
1-10	15-33	17.4	20.4	17.4	20.4	20.4	0.7	11.25
2-10	16-33	12.8	15.9	12.8	15.8	15.8	0.6	7.38
3-10	05-34	15.2	21.3	18.0	21.3	21.3	0.7	13.90
4-10	10-33	15.9	17.1	14.0	17.1	17.1	0.6	11.51
5-10	15-33	15.9	19.2	15.8	19.2	19.2	0.6	11.46
6-10	15-33	11.9	18.0	12.8	18.0	18.0	0.7	7.76

* Measured on November 04, 2010

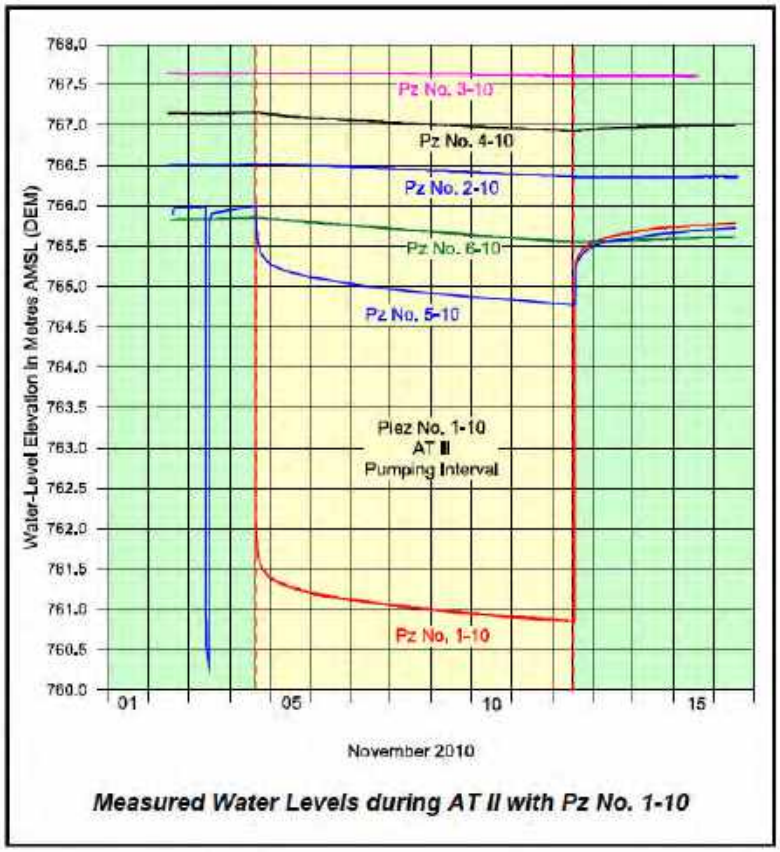
The table shows that the gravel unit directly overlies the bedrock surface at each site.

The detailed lithologic description for each site and the completion details for each piezometer are included in Appendix B.

4.3.2. Aquifer Testing

Short aquifer tests were conducted with Pz Nos. 1-10, 3-10, 5-10 and 6-10. Short aquifer tests were also conducted with the 1942 Astleford Stock WW, and the 2001 Franczak WW.

An extended aquifer test (AT II) was conducted with Pz No. 1-10 as the pumping piezometer; the other five piezometers were monitored as observation water wells during the extended aquifer test. The adjacent graph shows that drawdown was measured in each of the piezometers during AT II with Pz No. 1-10.



Measured Water Levels during AT II with Pz No. 1-10

Values of aquifer transmissivity were determined from the pumping and recovery data of each test using a modified Jacob Method of analysis. Values of effective transmissivity and storativity were determined from the observation water well data of AT II with Pz No. 1-10 by analyzing the drawdown data on a log-log plot with a Theis curve. Aquifer test graphs of the short aquifer tests are included in Appendix B. The results of the extended aquifer test are included in Appendix C.

Aquifer test results are summarized in the table below. The table shows that transmissivity values determined from the aquifer tests range from 5.8 to 109.0 metres squared per day (m²/day), and storativity values range from 0.00005 to 0.001.

Pz or Water Well	Aquifer Test	Date Started (2010)	Pumping Rate (lpm)	Pumping Interval (min)	Recovery Interval (min)	Specific Capacity at 10 minutes (lpm/m)	Transmissivity (m²/day)						Storativity		
							Pumping Water Well				Observation WW		Observation WW		
							Pumping Interval		Recovery Interval		Pumping Interval		Pumping Interval		
							Early	Late	Early	Late	Early	Late	Early	Late	Obs WW
Pz No. 1-10	I	Oct 20	20.2	120	750	7.8	17.1	17.1	17.1	17.1	-	-	-	-	-
	II	Nov 4	32.1	11,360	4,240	9.4	23.7	13.8	29.5	21.3	19.5	25.8	0.00056	0.00005	Pz No. 5-10
											88.5	22.3	0.0006	0.001	Pz No. 4-10
											109.0	13.7	0.0004	0.0004	Pz No. 6-10
											75.7	14.8	0.0009	0.0005	Pz No. 2-10
											-	39.3	-	0.00007	Pz No. 3-10
Pz No. 3-10	I	Nov 15	15.5 to 30.3	80	1,130	6.0	5.8 to 17.5		-	-	-	-	-	-	-
Pz No. 5-10	I	Nov 3	20.9	120	120	3.9		9.6		18.2	-	-	-	-	-
Pz No. 6-10	I	Nov 1	37.9	120	120	7.8	8.4	8.4	8.4	8.4	-	-	-	-	-
1942 Astelford Stock WW	II	Oct 21	16.6	60	60	18.2	-	-	-	30.0	-	-	-	-	-
2001 Franczak WW	I	Oct 18	32.5	16	5	14.8	-	-	-	16.8	-	-	-	-	-
	II	Oct 21	31.5	64	64	12.5	18.0	18.0	18.0	18.0					

Aquifer Test Results

4.4. Groundwater Quality

Groundwater samples from four of the piezometers completed as part of the present program, and from four residential water wells were collected and submitted to Exova for analysis. In the table below, selected parameters[8] are compared to the Guidelines for Canadian Drinking Water Quality – Summary Table (GCDWQ-ST)[9]. Parameters that exceeded the recommended GCDWQ-ST limits for potable water are in red text; the parameters that exceeded the maximum acceptable concentration (MAC) for health objectives rather than aesthetic objectives (AO) have a green background.[10] Copies of the complete chemical analyses are in Appendix B.

Comparison Between Recommended Limits For Concentrations of Chemical Constituents in Potable Water and in Groundwater Sampled as Part of the 2010 Investigation

Constituent	Pz No. 1-10 21 Oct 10 mg/L	Pz No. 3-10 15 Nov 10 mg/L	Pz No. 5-10 03 Nov 10 mg/L	Pz No. 6-10 01 Nov 10 mg/L	1979 Franczak WW 21 Oct 10 mg/L	1987 Franczak WW 21 Oct 10 mg/L	2001 Franczak WW 21 Oct 10 mg/L	1942 Astleford Stock WW 21 Oct 10 mg/L	GCDWQ-ST Recommended Concentration AO	GCDWQ-ST Recommended Concentration MAC
pH	7.96	7.66	7.5	7.76	7.92	7.91	8.04	7.9	6.5-8.5	—
Conductivity (µS/cm)	955	816	908	1140	907	912	1020	878	—	—
Total Dissolved Solids	584	488	558	747	550	562	645	524	500	—
Sodium	49.3	33.8	47.4	42	42.4	43.9	58.5	20.5	200	—
Potassium	3.7	5.3	3.9	5	3.7	3.9	3.7	3.1	—	—
Calcium	123	117	118	160	115	118	126	126	—	—
Magnesium	30.9	30.7	28.7	45	30.1	31	33.5	35.8	—	—
Total Hardness	446	399	413	583	430	434	461	482	—	—
Carbonate	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	—	—
Bicarbonate	613	580	597	690	596	590	650	643	—	—
Total Alkalinity	502	476	490	566	489	484	533	527	—	—
Sulfate	68.6	24	64.3	157	55.3	68.2	97.9	11	500	—
Hydroxide	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5		
Chloride	0.6	1.8	1.2	< 0.4	0.4	0.5	0.6	1.7	250	—
Fluoride	0.12	< 0.2	0.14	0.17	0.13	0.14	0.13	0.24	—	1.5
Iron	0.06	0.04	2.41	2.08	0.01	2.13	1.52	0.17	0.3	
Manganese	0.84	0.85	0.83	0.80	0.58	0.58	0.81	0.59	0.05	
Nitrate + Nitrite (as N)	< 0.01	< 0.07	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.08	—	10
Colour (colour units)	> 60	45	> 60	> 60	> 60	> 60	45	16	15	
Turbidity (NTU)	33.9	33.3	27.1	25.4	28.4	33	20.9	7.9	—	< 0.1
Ionic Balance (%)	98	94	93	93	98	97	94	99	—	—
Total Coliforms (CFU/100mL)					<1	<1	<1	<1		0
Fecal Coliforms (CFU/100mL)					<1	<1	<1	<1		0
Chromium	0.0017	0.0022	0.0028	0.0019	0.002	0.0017	0.0015	0.0017		0.05
Mercury			< 0.0001							0.001
Aluminum	< 0.002	< 0.004	< 0.002	< 0.002	< 0.002	0.003	< 0.002	< 0.002	0.1	
Antimony	< 0.0002	< 0.0004	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002		0.006
Arsenic	0.0059	0.003	0.0112	0.0162	0.003	0.0011	0.005	0.0006		0.01
Barium	0.083	0.11	0.08	0.043	0.07	0.068	0.059	0.299		1
Boron	0.172	0.14	0.164	0.216	0.147	0.159	0.153	0.084		5
Cadmium	< 0.00001	< 0.00002	0.00003	0.00002	< 0.00001	< 0.00001	< 0.00001	0.00006		0.005
Copper	< 0.001	< 0.002	0.004	0.001	< 0.001	0.004	< 0.001	0.004	1	
Lead	< 0.0001	< 0.0002	0.0003	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001		0.01
Selenium	< 0.0002	< 0.0004	< 0.0002	0.0005	< 0.0002	< 0.0002	< 0.0002	< 0.0002		0.01
Uranium	< 0.0005	< 0.001	< 0.0005	0.0022	0.0018	0.0007	0.0024	0.0039		0.02
Zinc	0.012	0.01	0.018	0.006	0.001	0.002	< 0.001	0.015	5	

Concentrations are in milligrams per litre unless otherwise stated; extractable results are in brackets
AO - Aesthetic Objective
MAC - Maximum Acceptable Concentration
GCDWQ-ST - Guidelines for Canadian Drinking Water Quality – Summary Table, Health Canada, 2012

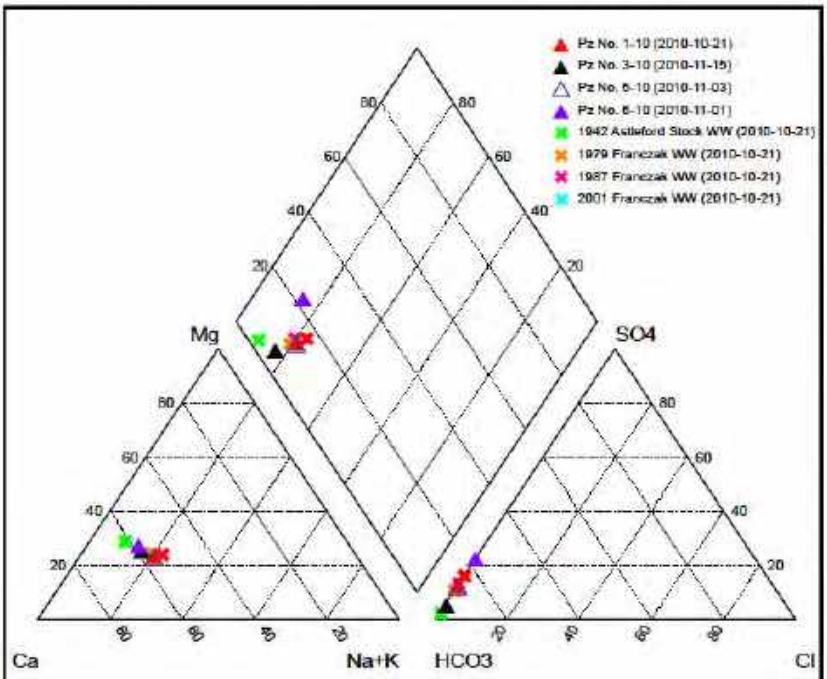
Groundwater Quality Results

[8] The parameters selected for the table include routine parameters, total and fecal coliforms and dissolved metals for which there is a guideline limit.
[9] Health Canada, 2012
[10] The MAC for turbidity refers to treated water.

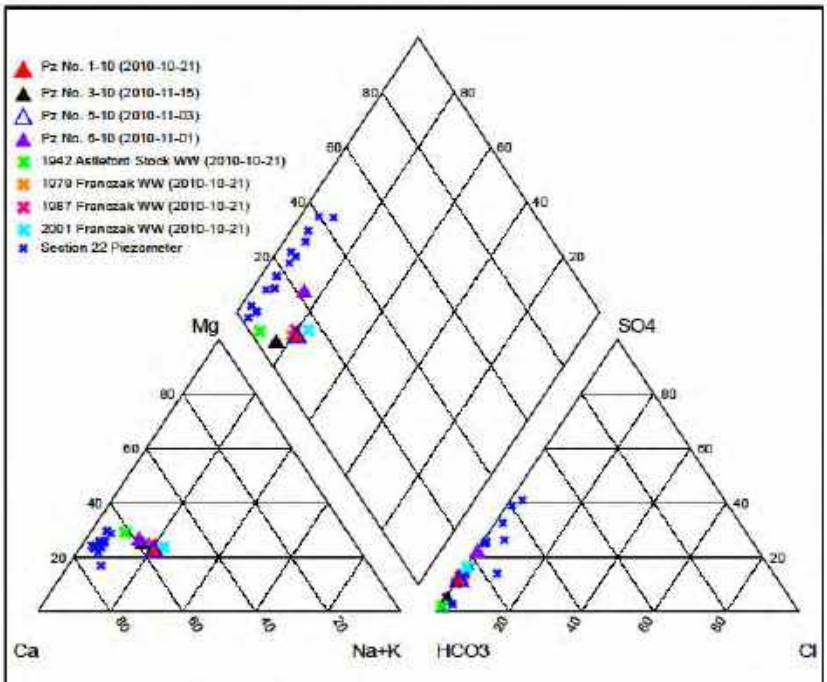
The only dissolved metal that exceeded the guidelines is arsenic from Pz Nos. 5-10 and 6-10. Arsenic is a naturally-occurring element in groundwater, typically derived from the weathering of rock or soil. In TGWC database for Alberta, there are 792 results that include an analysis for dissolved arsenic. Of these 792 results, 169 were below the laboratory's detection limit, 536 were below the 0.01 MAC, and 87 equalled or exceeded the MAC.

The results of a study of heavy metal concentrations associated with a gravel wash plant currently operated by Lafarge in the Onoway area showed that, after being in operation for over 40 years, gravel washing was not found to cause the concentration of heavy metals to increase in either sediment or water (Hemmera Envirochem Inc., February 2002).

A Piper tri-linear diagram of the routine chemical analyses conducted as part of the present program is shown in the adjacent figure. The diagram shows that the quality of the groundwaters from the four piezometers and four tested residential water wells is chemically similar, and classified as a calcium-bicarbonate-type water, which is typical of groundwater quality from aquifers in surficial deposits.



Piper Tri-Linear Diagram - Piezometers and Tested Residential WWs



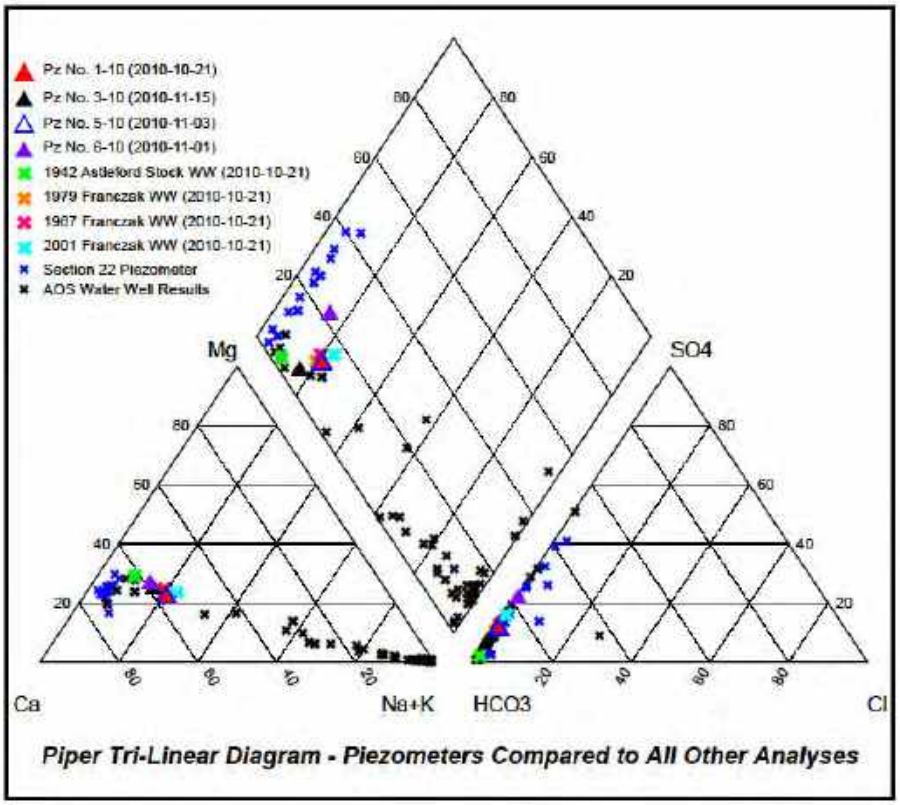
Piper Tri-Linear Diagram - Comparison to Section 22 Piezometers

The Piper diagram to the left compares the chemical quality of the groundwater samples collected as part of the present program to the groundwater samples collected from piezometers in Section 22.[11] The diagram shows that the groundwaters from the Section 22 piezometers have a range in chemical quality, from calcium-bicarbonate to calcium-sulfate-type waters.

[11] Because most of the Section 22 piezometers have been sampled multiple times, the diagram includes only the most recent sample from each site.

The Piper diagram to the right compares the chemical quality of the groundwater samples collected as part of the present program to the analyses of all other groundwater samples in the AOS for which there are sufficient parameters.[12] The diagram shows that the groundwater quality within the AOS ranges from calcium-bicarbonate-type waters, to calcium-sulfate-type waters, to sodium+potassium-bicarbonate-type waters.

Groundwater samples with a sodium+potassium-bicarbonate-type chemical quality are typical of groundwaters from bedrock aquifers.



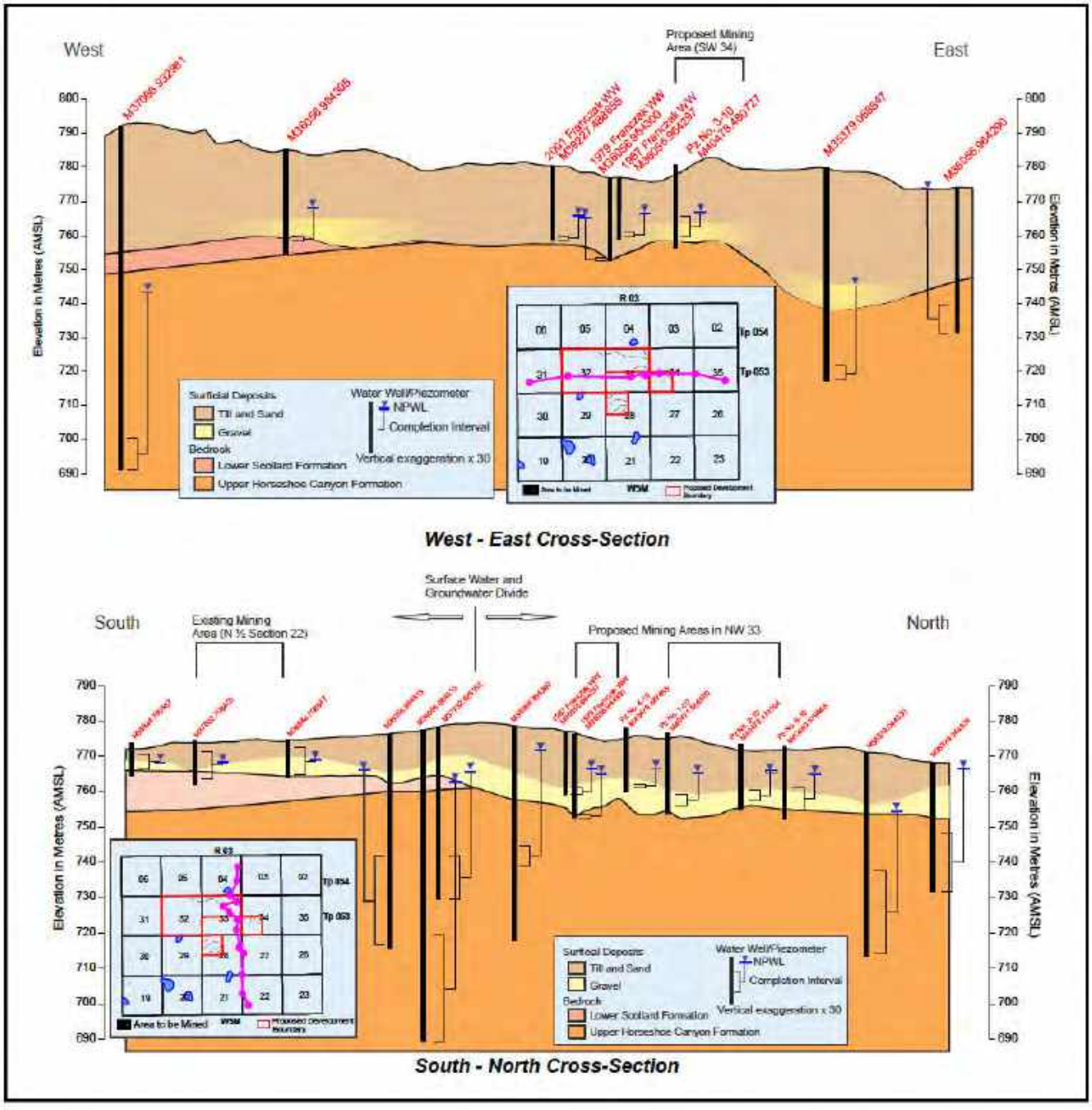
Piper Tri-Linear Diagram - Piezometers Compared to All Other Analyses

[12] The diagram includes only the most recent sample from each site.

5. Interpretation

5.1. Extent of Gravel Aquifer

The lithologic information from borehole drilling indicates that a sand and gravel aquifer underlies all of the proposed mining areas. The gravel thickness encountered in the 101 control points ranged from 0.7 to 18.9 metres, with an average of 4.4 metres; the gravel was identified mainly in the elevation interval between 750 and 770 metres AMSL.



West - East Cross-Section

South - North Cross-Section

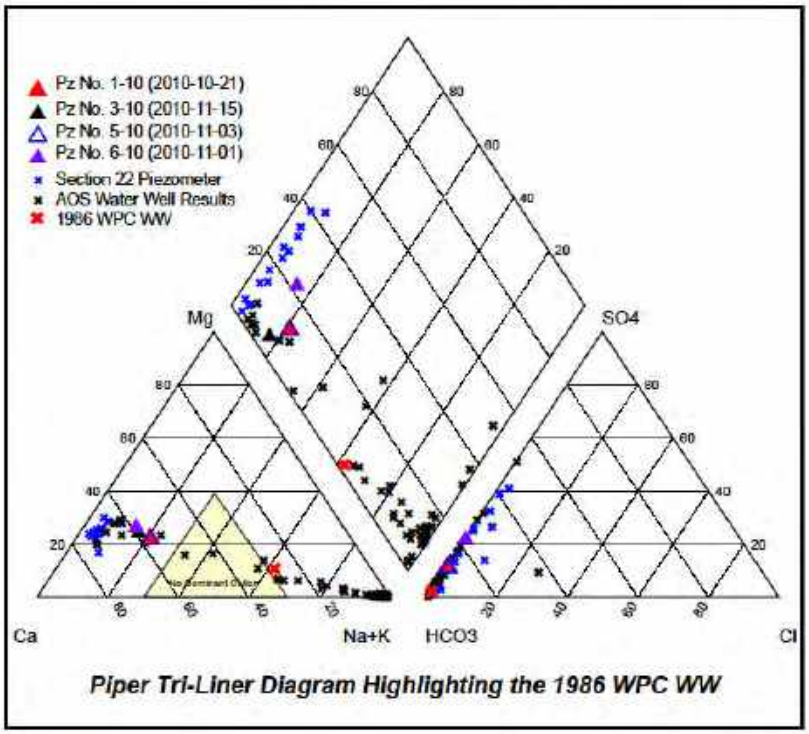
Two cross-sections have been prepared through part of the AOS and are shown on the previous page. Both cross-sections include piezometers completed as part of the present program, and nearby domestic or stock water wells. The three southernmost control points on the South – North cross-section are piezometers completed for the gravel extraction operation in the north half of Section 22. Significant information presented on the cross-sections includes:

- There is a topographic high shown on the South – North cross-section that is considered to represent the surface-water divide between Lac Ste. Anne to the north, and Lake Wabamun to the south.
- The gravel layer typically lies directly on the bedrock surface, although the gravel is not present everywhere in the AOS.
- Residential or stock water wells are typically completed in bedrock aquifers, although the three Franczak water wells are completed in surficial deposits that are at the same approximate elevation as the gravel to be mined.
- The NPWLs in the piezometers are above the top of the gravel, which indicates that the sand and gravel deposits and part of the overlying till layers are saturated.

5.2. Gravel Aquifer Parameters

5.2.1. Physical Properties

The summary table of aquifer test results in Section 4.3.2 shows effective transmissivities that range from approximately eight to 40 m²/day, and associated storativity values that range from 0.00005 to 0.001. The range in calculated aquifer parameters reflects the heterogeneity of the gravel aquifer. Based on a review of aquifer test results, groundwater calculations presented in the remainder of this report will be based on a range in effective transmissivity of 17 m²/day to 30 m²/day, with accompanying storativities of 0.00007 to 0.001. Since the proposed mining sequence is to begin extraction in NW 33, a saturated thickness of 12 metres will be considered for preliminary dewatering calculations. It should be noted that these aquifer parameters are based on data collected in the fall of 2010, and may not accurately reflect conditions throughout the year.



Piper Tri-Liner Diagram Highlighting the 1986 WPC WW

5.2.2. Chemical Properties

The Piper diagrams shown previously indicate that aquifers that are associated with calcium as the dominant groundwater cation may be hydraulically connected to the sand and gravel aquifer that is to be mined. Groundwaters with sodium+potassium as the dominant cation are expected to be derived from bedrock aquifers and would not be directly hydraulically connected to the sand and gravel that is to be mined. The adjacent Piper diagram highlights the 1986 Westland Park Water Well (WPC WW, shown as "x"), which is located in a part of the diagram very near to an

area that indicates no dominant cation. The drilling report for the 1986 WPC WW indicates a top of completion in a shale and coal aquifer, approximately 1.6 metres below the base of the surficial deposits. A hydraulic connection was shown to exist between the aquifer in which the 1986 WPC is completed and the sand and gravel aquifer during aquifer testing in 2003 (HCL, June 2003a). It was therefore inferred that the shale and coal aquifer in which the 1986 WPC WW is completed is a weathered bedrock aquifer, and the chemical quality of the groundwater from the water well indicates that the water well is obtaining a mix of groundwater from both the surficial deposits and the bedrock. Based on this information, diversion of groundwater from the sand and gravel aquifer could affect water wells that have a groundwater quality that has calcium as the dominant cation, or those in which the groundwater has no dominant cation.

5.3. Groundwater Flow

The groundwater flow through the sand and gravel aquifer that would be mined is calculated to be in the order of 66 to 117 m^3/day. This flow is based on the measured hydraulic gradient of 0.0013 metres per metre, an effective transmissivity ranging from 17 to 30 m^2/day and an estimated effective width of 3,000 metres. The flow would be through the aquifer from the southeast to the northwest. It should be noted that the calculated flow velocities do not take spring recharge events into account. Groundwater monitoring in the north half of Section 22 has shown that the volume of groundwater introduced into the aquifer as early spring recharge can be greater than the volume of groundwater removed for gravel processing (HCL, November 2008a).

5.4. Calculated Dewatering Volumes

As part of the mining operation, groundwater would have to be pumped out of extraction pits in order to extract the gravel, and a small part of this volume would be used for gravel washing.

The IAAM was used to calculate the water levels in the gravel aquifer at locations in and near a typical dewatering pit.

The table below shows the estimated groundwater diversions required to keep a typical extraction pit dewatered for an eight-month (240-day) extraction season. The calculations are based on:

- An effective transmissivity of 30 m^2/day and a corresponding storativity of 0.001.
- An effective transmissivity of 17 m^2/day and a corresponding storativity of 0.00007.
- A diversion site assumed to be in the centre of a two-hectare dewatering pit.
- Maintaining a drawdown of approximately 12 metres at the edges of the pit[13].
- No aquifer recharge.

Based on T = 30 m^2/day, S = 0.001			Based on T = 17 m^2/day, S = 0.00007		
Pumping Rate (m^3/day)	No. of Days	Total Diversion (m^3)	Pumping Rate (m^3/day)	No. of Days	Total Diversion (m^3)
800	21	16,800	330	21	6,930
740	9	6,660	315	9	2,835
690	20	13,800	298	10	2,980
655	20	13,100	282	10	2,820
626	20	12,520	274	20	5,480
601	30	18,030	266	20	5,320
580	30	17,400	258	60	15,480
560	90	50,400	250	90	22,500
	Total:	148,710		Total:	64,345

Estimated Annual Dewatering

[13] Based on a saturated thickness of approximately 12 metres in Section 33, as discussed in Section 4.1.2.

The table on the previous page shows that an expected dewatering rate could vary from approximately 60,000 to 150,000 m³ per season.[14] Variables associated with the above calculations could result in significant differences to the calculations; these variables include:

- Transmissivity and storativity near the location of the dewatering pit.
- Saturated thickness (the thickness varies by up to ten metres in the development area).
- Aquifer recharge (early spring groundwater levels may be significantly higher than those measured during the present program).
- Recirculation; depending on how close the infiltration pond is located to the dewatering site, a significant percentage of groundwater being pumped from a pit could be recirculated.

Since most of the variables mentioned above would result in more groundwater having to be pumped than what is calculated, operations should consider that at least 150,000 m³/year would have to be pumped in order to dewater a two-hectare extraction pit during an operating season.

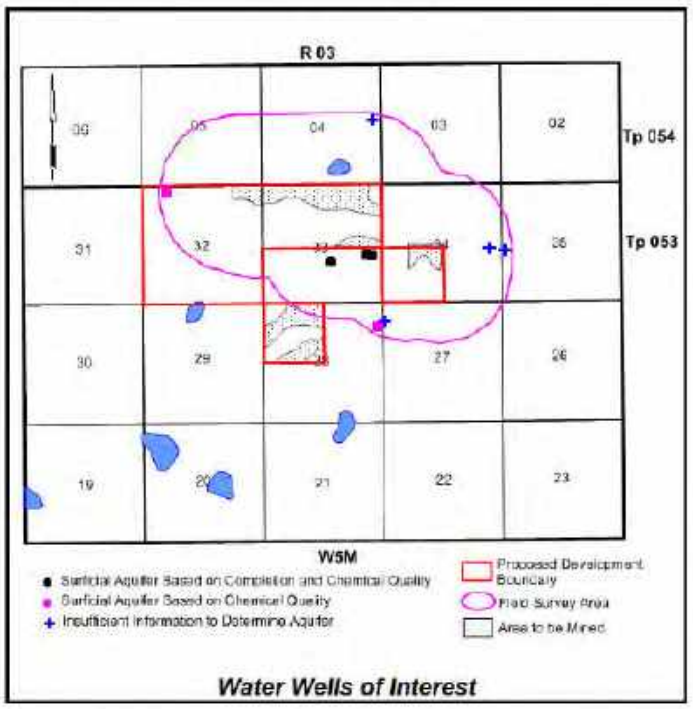
The proposed development plan is to pump the groundwater from an extraction pit to a holding pit from which the water is pumped to the wash plant(s). Any excess groundwater pumped from the gravel pits that is not used for gravel washing will be allowed to drain into the holding pit and a recharge pit. The water that fills the holding pit and recharge pit will recharge the shallow aquifer by infiltration through the pit floor and pit walls; there will be no net loss of groundwater other than through evaporation and adhesion to the aggregate. Preliminary development plans include a recharge pit in 14-33-053-03 W5M of 2.77 hectares. If required, groundwater removed during construction of the recharge pit will be diverted to a dugout, with a contingency that would allow temporary overflow from the dugout into a surface-drainage channel. Based on a depth to water of approximately eight metres as shown on page 18, the 2.77-hectare recharge pit would be able to accept an additional water supply of 221,600 m³, with the assumption that the additional water infiltrates back into the aquifer during the non-operating season. Based on this information, a 2.77-hectare recharge pit should be an adequate size to accept the calculated 60,000 to 150,000 m³/year of groundwater diverted from dewatering pits, even without the 3.5-metre-high berm around the recharge pit that is proposed as part of the development plan.

[14] The table shows a declining pumping rate over time, which is a result of the expanding water-level cone of depression as pumping continues.

5.5. Water Wells of Interest

There are 43 water well records within the FSA, including the six piezometers completed as part of the present program. Water wells that may be affected by dewatering or removal of the gravel aquifer would be those water wells that are completed in the same sand and gravel aquifer that is to be mined. Of the 37 water wells that exclude the six piezometers, six are no longer in use. Of the remaining 31 water wells:

- 21 have lithologic and completion information indicating a completion in a bedrock aquifer.
- Three have completion information and chemical-quality data indicating a completion in surficial deposits; these three water wells are the three Franczak water wells tested as part of the present program.
- One (GCID No. M36056.964296) has chemical-quality information indicating a completion in a bedrock aquifer.
- Two (including the 1942 Astleford Stock WW, which was tested as part of the present program) have chemical-quality data indicating a completion in the surficial deposits.
- Four have insufficient information to determine whether the water well is completed in the surficial deposits or a bedrock aquifer.



Water Wells of Interest

The adjacent map shows the locations of the nine in-use water wells in the FSA that are determined to be completed in an aquifer in the surficial deposits, or have insufficient information to determine the type of aquifer. The water wells with the symbol "●" are selected based on reported lithology and completion information. The water wells with the symbol "●" are selected based on reported chemical quality of groundwater[15], and the water wells with the symbol "+" have insufficient information to determine the type of aquifer. Some information related to the nine water wells is included in the table below:[16]

Water Wells of Interest

GCID	Water Well Name	Owner	Legal Location	Field Action*	Distance from Nearest Mining Area (m)**	Depth Drilled (m)	Well Status	Reported Use	Date Completed	Criteria
M36056.964300	1978 Franczak WW	Dave Franczak	SE 33	1	100	24.4	Producing	Stock	16-Nov-78	Lithology,
M36056.964267	1997 Franczak WW	Dave Franczak	SE 33	1	130	18.3	Producing	Domestic & Stock	08-Aug-97	Completion and
M36227.489855	2001 Franczak WW	Dave Franczak	SE 33	1	150	21.9	Producing	Stock	15-Jun-01	Chemical Quality
M27713.709346	1942 Astleford Stock WW	George Astleford	NE 29	1	900	18.6	Producing	Stock	1942	Chemical Quality
M36056.964304	Laniuk WW	Eugene Laniuk	NW 32	2	900	57.9	Producing	Domestic	1962	
M40463.609654	1975 Sonnenberg WW	Fritz & Eva Sonnenberg	SE 34	1	650	68.6	Producing	Domestic & Stock	1975	
M37713.708000	Astleford NW 27 Stock WW	George Astleford	NW 27	1	800	45.0	Producing	Stock	1955	Insufficient Information
M40463.621380	1972 Adams WW	Gordon Adams	SW 35	2	870	22.9	Producing	Domestic & Stock	1972	
M40463.587260	Sonnenberg WW	Art & Ben Sonnenberg	NE 04	2	900	54.9	Producing	Domestic	Unknown	

* 1 means physically located, 2 means location provided by owner
** the mining areas considered are those in Lac Ste. Anne County

All nine water wells shown on the map and table were located during the water well survey, based on a Field Action of 1 or 2. Of these nine water wells, the three Franczak water wells in SE 33 are closest to a proposed mining area.

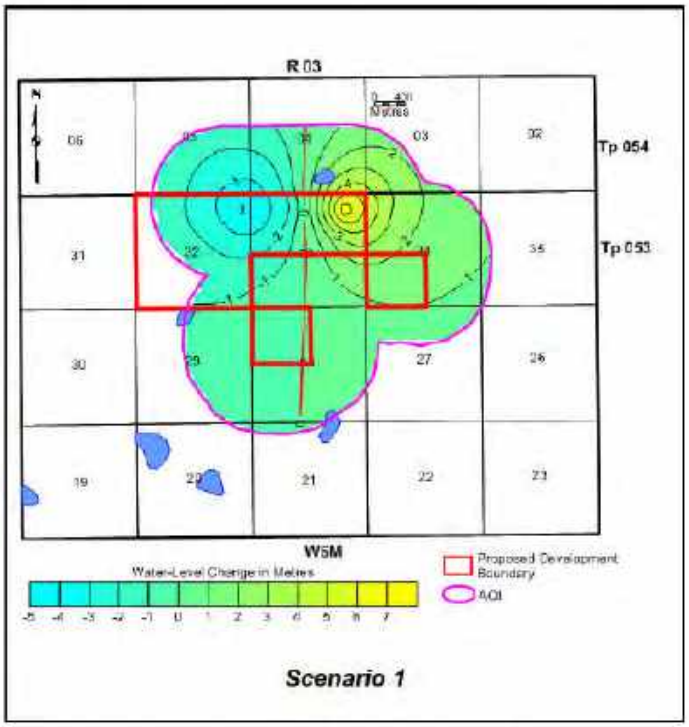
[15] The chemical analysis results for these three groundwater samples are included in the Piper diagram in Section 4.4.
[16] Additional information can be obtained from TGWC website at: http://www.tgwc.ca/

5.6. Predicted Impact Resulting from Dewatering

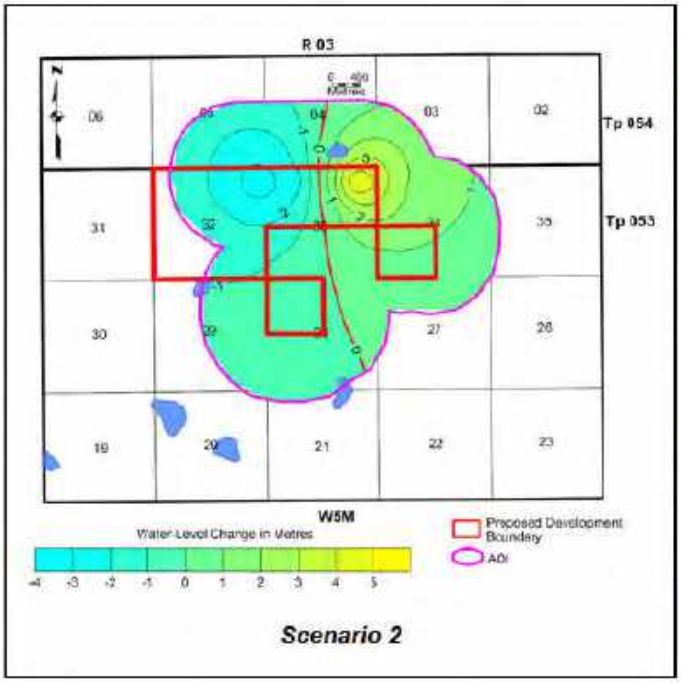
5.6.1. Temporary Seasonal Impacts

Dewatering and re-introduction of groundwater would result in a localized cone of depression around the dewatering site, and a localized mounding around the recharge site. The two maps on this page show the calculated water-level changes due to drawdown and mounding in the proposed development area based on two different scenarios:

- Scenario 1
  - Based on pumping 148,710 m³ during the dewatering season, as shown in the table in Section 5.4.
  - An effective transmissivity of 30 m²/day and a corresponding storativity of 0.001.
- Scenario 2
  - Based on pumping 64,345 m³ during the dewatering season, as shown in the table in Section 5.4.
  - An effective transmissivity of 17 m²/day and a corresponding storativity of 0.00007.



Scenario 1



Scenario 2

There is little difference between the two maps, because a gravel aquifer with high permeability would require a high pumping rate to dewater, while a gravel aquifer with a lower permeability would require a correspondingly lower dewatering rate.

Both maps show that there can be an expected temporary drawdown of approximately four metres at a distance of 200 metres from a dewatering pit, and approximately three metres of drawdown at a distance of 400 metres. The table on the previous page shows that the three Franczak water wells are within 200 metres of the nearest proposed mining area. The available drawdowns in the three Franczak water wells range from 7.9 to 12.7 metres, based on water levels measured in October 2010. A temporary drawdown of up to four metres in any of the Franczak water wells represents a maximum decline of over 50% of the available drawdown, which may represent an adverse effect. Schedule 3 of the Water (Ministerial) Regulation (Province of Alberta, 1998) states that an adverse effect on a household groundwater user prevents the proposed dewatering program from being exempt from the requirement of an approval.

5.6.2. Ongoing Annual Impacts

Pit-to-pit dewatering results in no net loss of groundwater except for the groundwater removed by adhesion and evaporation during the gravel washing process, which is anticipated to be 2,000 m³/year, an average of 5.5 m³/day.

The two graphs on this page show the calculated drawdowns as a function of distance from the location of net groundwater loss based on a net loss of groundwater of 2,000 m³/year for ten years; the adjacent graph uses an effective transmissivity of 17 m²/day and a corresponding storativity of 0.00007, and the graph below uses an effective transmissivity of 30 m²/day and a corresponding storativity of 0.001. The first graph shows that there would be a calculated drawdown of 0.3 metres in the gravel aquifer 100 metres from a dewatering pit after ten years, and the second graph shows that there would be a calculated drawdown of 0.14 metres at the same distance. The three Franczak water wells that were tested as part of the present program are located in SE 33, approximately 500 metres south of the mining area in the north half of NE 33, and approximately 100 metres south of the mining area in the south half of NE 33. The available drawdowns in the three Franczak water wells range from 7.9 to 12.7 metres, based on water levels measured in October 2010. A drawdown of up to 0.3 metres in any of the Franczak water wells represents a maximum decline of 4% of the available drawdown. The 2001 Franczak WW has the smallest available drawdown of 7.9 metres, based on an NPWL of 14.7 metres below top of casing (BTOC), a casing stick-up of 0.6 metres and a bottom of completion at 22.0 metres BGL. Aquifer Test II with the 2001 Franczak WW conducted on October 21, 2010 indicated an aquifer transmissivity of 18.0 m²/day; these data indicate a calculated long-term yield of 31 m³/day. A lowering of the NPWL by 0.3 metres would result in a reduction of the long-term water well yield from 31 to 30 m³/day. A reduction in long-term yield of this magnitude would not cause a water shortage for the water well owner and is not considered to represent an adverse effect. The calculated net loss is considered to be conservative, because aquifer recharge is not included in the calculation, and because gravel washing would cease after mining is completed.

Calculated Drawdown after Ten Years of Operation
T = 17 m²/day

Calculated Drawdown after Ten Years of Operation
T = 30 m²/day

5.7. Predicted Post-Mining Impact

At the present time, the groundwater flow is from the southeast to the northwest. The proposed gravel mining will remove the sand and gravel aquifer from the area that is mined. Once the sand and gravel aquifer is removed and replaced with a thinner, possibly less-permeable material, groundwater flow through the area will be reduced, which may result in the mounding of groundwater upgradient from the mined area. However, because the ground surface upgradient of the proposed mining areas is generally more than six metres higher in elevation than the NPWL, mounding is not expected to cause any adverse effects outside the development area.

The effective transmissivity of the sand and gravel aquifer is variable based on data collected from extended aquifer tests; calculations included in this report are based on a range from 17 to 30 m^2/day, resulting in a calculated flow through the sand and gravel aquifer of 66 to 117 m^3/day[17]; these calculations do not include the effects of spring recharge, which can be significant.

Once dewatering takes place, a more realistic determination of groundwater flow could be calculated. If the quantity of groundwater flowing through the gravel is very large and if the replacement material is too thin or has too low a permeability to transmit large quantities of groundwater, it may be necessary to design a more efficient groundwater bypass system to reduce mounding.

[17] Calculations include a gradient of 0.0013 and an effective width of 3,000 metres

6. Conclusions

The proposed gravel mining operation will involve pit-to-pit dewatering in order to extract gravel below the water table. ESRD has indicated that dewatering the pits must be "on-site", which means that groundwater re-introduced to the aquifer must be on the same quarter section or parcel of land or within a contiguous pit operation. Dewatering of the gravel from a typical pit for the proposed development to allow for the mining of the gravel will require in the order of 60,000 to 150,000 m³/year of groundwater to be removed from the aquifer, with most of the groundwater returned to the aquifer via recharge pit(s). This seasonal diversion may result in temporary drawdowns of approximately 50% of the available drawdowns in water wells situated within 200 metres of a pit being dewatered. ESRD does not require an approval to be issued for a dewatering project associated with a gravel pit, when the groundwater is allowed to be re-introduced into the aquifer, unless there is a potential adverse effect on a local groundwater user. Because there may be a temporary adverse effect on a household groundwater user when dewatering takes place in the south half of NE 33-053-03 W5M, the proposed development may require an approval under the *Water Act*.

Up to 2,000 m³/year of the groundwater that is pumped from a pit being dewatered will be used for gravel processing, with the remainder of the groundwater returned to the aquifer via recharge pit(s); this net loss of 2,000 m³/year of groundwater will not have an adverse effect on the aquifer or any nearby water wells outside the mining area. The calculated net loss is considered to be conservative, because aquifer recharge is not included in the calculation. Because gravel washing is a licensable use of groundwater, the proposed development may require a licence under the *Water Act*.

Calculations indicate a proposed 2.77-hectare recharge pit should be an adequate size to accept the calculated 60,000 to 150,000 m³/year of groundwater diverted from dewatering pits.

The proposed gravel mining will remove the sand and gravel aquifer from the area that is mined. At the present time, the groundwater flow is from the southeast to the northwest. Once the sand and gravel aquifer is removed and replaced with less-permeable material, groundwater flow through the area will be reduced, which may result in the mounding of groundwater upgradient from the mined area. However, because the ground surface upgradient of the proposed mining areas is generally more than six metres higher in elevation than the NPWL, mounding is not expected to cause any adverse effects outside the development area. Once dewatering takes place, a more realistic determination of groundwater flow could be calculated. If the quantity of groundwater flowing through the gravel is very large and if the replacement material is too thin or has too low a permeability to transmit large quantities of groundwater, it may be necessary to design a more efficient groundwater bypass system to reduce mounding.

7. Recommendations

Because the proposed development includes a gravel-washing operation, a licence under the *Water Act* may be required. Because the required dewatering may temporarily adversely affect a household groundwater user, an approval under the Water Act may be required. This report would provide technical support for an approval application and a groundwater licence application to ESRD under the *Water Act*.

Although the proposed mining activity is unlikely to have negative long-term impacts on the surrounding groundwater users, it is recommended that a meaningful groundwater monitoring program be established. The program should include:

- The measuring of water levels in at least four of the piezometers installed as part of the present program. Water levels should be recorded at least daily, to the nearest 0.01 metres.
- Measurement of daily groundwater diversions; the information should show the volumes of water pumped from specific sites, and the location(s) where the groundwater is discharged.
- The annual collection of groundwater samples from each of the six piezometers completed as part of the present program, and submission to an accredited laboratory for dissolved metals and routine chemical analyses.

Because the three Franczak water wells in SE 33-053-03 W5M are completed in the gravel aquifer and are within 200 metres of the proposed mining area in the south half of NE 33, it is recommended that at least daily water-level monitoring in at least one of the Franczak water wells commence prior to development in the south half of NE 33.

After one year of mining, the monitoring data should be analyzed; if there are significant discrepancies to the preliminary review, an updated hydrogeological analysis will be required.

Local groundwater users may be concerned that the operation may impact their groundwater supply. It is recommended that the operator(s) make a commitment to enact a procedure similar to the following:

- When any nearby water well user indicates to the operator(s) that they believe their water supply has been negatively impacted due to the gravel mining operation, the operator(s) will:
    - Provide a temporary alternate water supply within 24 hours, if the resident is without water.
    - Hire an outside consultant within 14 days to determine the cause of the problem.
    - Provide a permanent alternate water supply, if the problem is at least partially due to the operator's mining operation.

The types of action listed above could provide a comfort to local groundwater users.

Written By:

This information redacted as per Protection of Privacy Act (FOIP Act)

January 4, 2018

Jim Touw, P.Geol.
Senior Hydrogeologist

Assisted By:

This information redacted as per Protection of Privacy Act (FOIP Act)

Ben Gilham, C.E.T.
Hydrogeological Technologist

8. Bibliography

Akley Design. 1978. Johnson Park. Proposed Subdivision. SE 1/4 7-54-3 W5. County of Lac Ste. Anne. 07-054-03 W5. [L009542]

Alberta Geological Survey. 1999. Geology of Alberta - CD. [G 3501 C5 1999 A333-001] [L021341]

Alberta Government. March 2011. Guide to Groundwater Authorization. http://Alberta.ca

Bayda & Associates Surveys Ltd. 1978. Application to Subdivide Sec 1-54-3 W5. 01-054-03 W5. [L067131]

Borneuf, D. M. 1983. Springs of Alberta. [QE 186 P7 no. 82-03] [L016393]

Carlson, V. A. 1971. Bedrock Topography of the Wabamun Lake Map Area, Alberta, NTS 83G. Wabamun Lake Area. [AGS map 057] [L020396]

Domenico, P. A. 1963. Geology and Groundwater Hydrology of the Edmonton Formation in Central Alberta, Canada. [L021279]

Dupuy, G., G. Winner, and O. Tokarsky. Geoscience Consulting Ltd. August 1978. Water Table Tests, Percolation Tests, Groundwater Evaluation. SE 25-53-3 W5. 25-053-03 W5. [<hc fiche 1978.31>] [L082815]

Dupuy, G., G. Winner, and O. Tokarsky. Geoscience Consulting Ltd. November 1978. Water Table Tests, Percolation Tests, Groundwater Evaluation. NE 12-53-6 W5 (Seba Beach). 23-053-03 W5. [<hc fiche 1978.32>] [L063331]

Dupuy, G., G. Winner, and O. Tokarsky. Geoscience Consulting Ltd. March 1979. Water Table Tests, Grain Size Analyses, Groundwater Evaluation. NW 18-53-3 W5. 18-053-03 W5. [L097209]

Dupuy, G., G. Winner, and O. Tokarsky. Geoscience Consulting Ltd. December 1979. Water Table Tests, Percolation Tests, Groundwater Evaluation. NW 11-54-3 W5. 11-054-03 W5. [<hc fiche 1979.39>] [L058677]

Edwards, D., D. Scafe, R. Eccles, S. Miller, T. Berezniuk, and D. Boisvert. 1996. Mapping and Resource Exploration of the Tertiary and Preglacial Sand and Gravel Formations of Alberta. [QE 186 Op94-06-001] [L041538]

Edwards, W. A. D. 1980a. Sand and Gravel Resources of the Onoway Area, Alberta. [AGS Open File Report 1984-25] [L091356]

Edwards, W. A. D. 1980b. Aggregate Resources of the Onoway Map Area. NTS 83G/9. Alberta Research Council. Map A83G9. scale 1:50 000.

Edwards, W. A. D., R. B. Hudson, and D. W. Scafe.1985. Aggregate Resources of the Edmonton/Lloydminster Region. Alberta Research Council. Bulletin 47, 64 p.

EPEC Consulting Western Ltd. August 1976. Greentree Country-residential Tentative Subdivision and Outline Plan. 32-053-03 W5. [L084051]

Federal–Provincial–Territorial Committee on Drinking Water. May 2008. Guidelines for Canadian Drinking Water Quality Summary Table. Health Canada. http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/water-eau/sum_guide-res_recom/summary-sommaire-eng.pdf. [L057253]

Florkewich and Associates Ltd. January 1980. Application for Subdivision. NW 11-54-3 W5. County of Lac Ste. Anne No. 28. 11-054-03 W5. [L011468]

Geoscience Consulting Ltd. November 1974. Water Table Tests, Percolation Tests, Groundwater Evaluation and Pump Test. SE 22-53-3 W5. 22-053-03 W5. [<hc fiche 1974.28>] [L074142]

Geoscience Consulting Ltd. December 1974a. Water Table Tests, Percolation Tests, Groundwater Evaluation and Pump Test. NE 17-53-3 W5. 17-053-03 W5. [<hc fiche 1974.27>] [L036982]

Geoscience Consulting Ltd. December 1974b. Additional Water Table Information to SE 22-53-3 W5. 22-053-03 W5. [<hc fiche 1974.1>] [L032525]

Geoscience Consulting Ltd. 1975. Water Table Tests. N 1/2 21-53-3 W5. 21-053-03 W5. [<hc fiche 1975.35>] [L000191]

Geoscience Consulting Ltd. May 1975. Aquifer Test. NE 17-53-3 W5. 17-053-03 W5. [L073374]

Green, Robert. 1982. Geological Map of Alberta. [AGS map 27a] [L012286]

Groundwater Consultants Group. April 1978. Preliminary Groundwater Evaluation, Water Table Tests and Soil Analyses. SE 1/4 31-53-3 W5. 31-053-03 W5. [<hc fiche 1978.08>] [L025160]

Groundwater Consultants Group. March 1979. Pumping Test Analyses. SE¼ Sec 23 - Tp 53 - R3 - W5M. 23-53-3-W5M. [<hc fiche 1979.24>-001] [L099559]

Hall, P. L. Groundwater Consultants Group. August 1979. Pumping Test Analysis. SE 1/4 23-53-3 W5. 23-053-03 W5. [L029066]

Hamilton, W. H., W. Langenberg, M. C. Price, and D. K. Chao. 1998. Geological Map of Alberta (hardcopy). [AGS MAP 236] [L085735]

Health Canada. 2012. Guidelines for Canadian Drinking Water Quality – Summary Table. Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

Hemmera Envirochem Inc. February 2002. Metals Screening. Lafarge Onoway Operations. Onoway Alberta. File 322-553.01.

Hydrogeological Consultants Ltd. August 1997. Agriculture & Agri-Food Canada, PFRA. Regional Groundwater Assessment. Parkland. (unpublished contract report - August 1997) [83G .P375C6 1997/08] [97-202.00]

Hydrogeological Consultants Ltd. July 1998. Lac Ste. Anne County. Regional Groundwater Assessment - Final. Parts of the North Saskatchewan and Athabasca River Basins. Parts of Tp 053 to 059, R 01 to 09, W5M. [97-112]

Hydrogeological Consultants Ltd. August 1998. Parkland County. Regional Groundwater Assessment - Final. Part of the North Saskatchewan and Athabasca River Basins. Parts of Tp 050 to 054, R 25, W4M to R 08, W5M. (unpublished contract report - August 1998) [83G .P375C6 1998/08] [97-202.03]

Hydrogeological Consultants Ltd. January 1999a. Agriculture & Agri-Food Canada, PFRA. Water Sourcing Study - Proposal. Parts of the North Saskatchewan and Athabasca River Basins. Parts of Tp 050 to 054, R 25, W4M to R 08, W5M. (unpublished contract report - January 1999) [98-181]

Hydrogeological Consultants Ltd. January 1999b. Parkland County. Water Sourcing Study - Proposal. Parkland Area. Tp 050-054, R 25, W4M & R 08, W5M. (unpublished contract report - January 1999) [83G .P375C6 1999/01-001] [97-202.01]

Hydrogeological Consultants Ltd. January 1999c. Prairie Farm Rehabilitation Administration (P.F.R.A.). Water Sourcing Study: Parkland County - Proposal. Parkland County. Parts of Tp 050 to 054, R 25, W4M to R 08, W5M. (unpublished contract report - January 1999) [83G .P375C6 1999/01] [99-901.00]

Hydrogeological Consultants Ltd. September 2001. Sturgeon County. Regional Groundwater Assessment - Final. Sturgeon Area. Parts of Tp 053-058, R 20-28, W4M; Tp 054-057, R 01, W5M. — (unpublished contract report - Sep-2001.) [01-110.00] [83H .S78C6 2001/09]

Hydrogeological Consultants Ltd. June 2003a. BURNCO Rock Products Ltd. Burnco Aggregate De-Watering. Wabamun Area. 26-053-03 W5M. (unpublished contract report - June 2003) [83G09 .W33 2003/06-005] [02-252.00]

Hydrogeological Consultants Ltd. June 2003b. BURNCO Rock Products Ltd. Astleford Water Wells Testing. Wabamun Area. NW 27 and NE 28-053-03 W5M. (unpublished contract report - June 2003) [83G09 .W33 2003/06-002] [02-252.05]

Hydrogeological Consultants Ltd. June 2003c. BURNCO Rock Products Ltd. Selte/Thacik Water Well Testing. Wabamun Area. NW 22-053-03 W5M. (unpublished contract report - June 2003) [83G09 .W33 2003/06-010] [02-252.06]

Hydrogeological Consultants Ltd. June 2003d. BURNCO Rock Products Ltd. Westland Park Community Water Well Testing. Wabamun Area. SE 22-053-03 W5M. (unpublished contract report - June 2003) [83G09 .W33 2003/06-008] [02-252.07]

Hydrogeological Consultants Ltd. June 2003e. BURNCO Rock Products Ltd. Wiskow Water Well Testing. Wabamun Area. SE 22-053-03 W5M. (unpublished contract report - June 2003) [83G09 .W33 2003/06-001] [02-252.08]

Hydrogeological Consultants Ltd. June 2003f. BURNCO Rock Products Ltd. Kirkland Water Well Testing. Wabamun Area. SE 22-053-03 W5M. (unpublished contract report - June 2003) [83G09 .W33 2003/06-009] [02-252.09]

Hydrogeological Consultants Ltd. June 2003h. BURNCO Rock Products Ltd. Phillips Water Well Testing. Wabamun Area. SW 23-053-03 W5M. (unpublished contract report - June 2003) [83G09 .W33 2003/06-003] [02-252.10]

Hydrogeological Consultants Ltd. June 2003h. BURNCO Rock Products Ltd. Hughes Water Well Testing. Wabamun Area. SE 22-053-03 W5M. (unpublished contract report - June 2003) [83G09 .W33 2003/06] [02-252.11]

Hydrogeological Consultants Ltd. June 2003i. BURNCO Rock Products Ltd. Burnco - Heavy Metals in Sediment. Wabamun Area. NW 22-053-03 W5M. (unpublished contract report - June 2003) [83G09 .W33 2003/06-011] [03-170.00]

Hydrogeological Consultants Ltd. January 2006. ISL Engineering and Land Services Ltd. Groundwater Exploration and Development. Wabamun Area. 11-053-04 W5M. (unpublished contract report - January 2006) [83G10 .W33 2006/01] [05-947.00]

Hydrogeological Consultants Ltd. March 2006a. BURNCO Rock Products Ltd. Establishment of Groundwater Monitoring Program. Highway 16 North Project. Tp 053, R 03, W5M. (unpublished contract report - March 2006) [06-236]

Hydrogeological Consultants Ltd. March 2006b. BURNCO Rock Products Ltd. 2005 Annual Groundwater Monitoring Report. Wabamun Area. 22-53-03-W5M. (unpublished contract report - March 2006) [MR-201]

Hydrogeological Consultants Ltd. March 2006c. Robin Selte. Water Well Review. Wabamun Area. NW 22-053-03 W5M. (unpublished contract report - March 2006) [83G09 .W33 2006/03] [06-367.00]

Hydrogeological Consultants Ltd. May 2006. Infrastructure Systems Limited . Water Supply Well Classification. Village of Wabamun. Tp 053, R 04, W5M. (unpublished contract report - May 2006) [83G10 .W33 2006/05] [06-227.01]

Hydrogeological Consultants Ltd. December 2006. Village of Wabamun. Wabamun Area. Groundwater Supply Exploration, Development and Licensing. Tp 053, R 03-04, W5M. (unpublished contract report - December 2006) [83G09 ,W33 2006/12] [06-227.00]

Hydrogeological Consultants Ltd. March 2007. BURNCO Rock Products Ltd. 2006 Annual Groundwater Monitoring Report. Wabamun Area. 22-53-03-W5M. (unpublished contract report - March 2007) [83G09 .W33 2007/03] [MR-201.00]

Hydrogeological Consultants Ltd. November 2007. BURNCO Rock Products Ltd. 2007 Groundwater Assessment. Highway 16 North Gravel Operation. Tp 053, R 03, W5M. (unpublished contract report - November 2007) [08-314]

Hydrogeological Consultants Ltd. March 2008. BURNCO Rock Products Ltd. 2007 Annual Groundwater Monitoring Report. Wabamun Area. 22-53-03-W5M. (unpublished contract report - March 2008) [MR-201]

Hydrogeological Consultants Ltd. November 2008a. BURNCO Rock Products Ltd. Groundwater Approval. Wabamun Area. NW 22-053-03 W5M. (unpublished contract report - November 2008) [08-500]

Hydrogeological Consultants Ltd. November 2008b. BURNCO Rock Products Ltd. License a Groundwater Supply. Highway 16 North Project. NE 22-053-03 W5M. (unpublished contract report - November 2008) [08-695]

Hydrogeological Consultants Ltd. March 2009. BURNCO Rock Products Ltd. 2008 Annual Groundwater Monitoring Report. Wabamun Area. 22-53-03-W5M. (unpublished contract report - March 2009) [MR-201]

Hydrogeological Consultants Ltd. March 2010. BURNCO Rock Products Ltd. 2009 Annual Groundwater Monitoring Report. Wabamun Area. 22-053-03 W5M. (unpublished contract report - March 2010) [83G09 .W333 2010/03 Q609] [MR-201.09]

Hydrogeological Consultants Ltd. March 2012. 2011 Annual Groundwater Monitoring Report. Wabamun Area. Tp 053, R 03, W5M. (unpublished contract report prepared for BURNCO Rock Products Ltd - March 2012) [MR-201.11]

Jones, N. K. 1984. Aggregate Resources. Wabamun Lake 83G. [AGS map A83G] [L067063]

Kerr, H. A. and Groundwater Branch Staff. April 1978. Gunn-Lac St. Anne. Gunn Area. Tp 054-055, R 03-04, W5M. [83G09 .G86 1978/04] [L098646]

Land Ownership Map. 1994. 1:100000 Map: County of Lac Ste. Anne No. 28. Sangudo Area. Tp 053-059, R 1-9, W5M. [83G .S2636 1994 map] [L036956]

Land Ownership Map. 1996. 1:100000 Map: Parkland County. Parkland County Area. Tp 050-054, R 25, W4M to R 08, W5M. [83G .P375C6 1996 map] [L020971]

Mitchell, P., and E. E. Prepas. 1990. Atlas of Alberta Lakes. Alberta. [G 1166 C3 A84 1990] [L038770]

Ozoray, G. F. 1972. Hydrogeology of the Wabamun Lake Area, Alberta. Wabamun Lake Area. [QE 186 P7 no. 72-08-002] [L005070]

Pawlowicz, J. G., and M. M. Fenton. 1995. Bedrock Topography of Alberta. [AGS MAP 226] [L079262]

Province of Alberta. 1998. Water Act. Water (Ministerial) Regulation. Alberta Regulation 205/1998. With amendments up to and including Alberta Regulation 31/2012. Alberta Queen's Printer.

Puchala, Brian. April 2002. Aggregate Reserve Investigation. Parkland County. Parkland County Area. [83G .P375C6 2002/08] [L032940]

Rippon, R. E., and O. Tokarsky. Geoscience Consulting Ltd. November 1977. Water Table Tests, Percolation Tests, Groundwater Evaluation. SE 7-54-3 W5. 07-054-03 W5. [<hc fiche 1977.11.1>] [L055843]

Rippon, R. E., G. P. Lakeman, and O. Tokarsky. Geoscience Consulting Ltd. December 1977. Water Table Tests, Grain Size Analyses, Groundwater Evaluation. 1-54-3 W5. 01-054-03 W5. [<hc fiche 1977.1>] [L052962]

Shetsen, I. 1990. Quaternary Geology, Central Alberta. [AGS map 213] [L040295]

Shetsen, I. 2002. Quaternary Geology, Central Alberta. [AGS map 213 cd] [L062240]

SNC Lavalin Environment. 2007-2008. Borehole Logs provided by RoJaS Management Ltd.

Suvan, Fettig & Associates Ltd. February 1976. Geotechnical Data for Proposed Recreational Subdivision. Part of H.B.R. at Lac Ste. Anne, C of T. 165-174. Summer Village of Sunset Point. County of Lac Ste. Anne No. 28. 054-03 W5M. [L038049]

Tokarsky, O. 1976. Aquifer Test. SW 32-53-3W5. SW 32-53-3 W5. [<hc fiche 1976.25>-001] [L083778]

Tokarsky, O. Geoscience Consulting Ltd. March 1976a. Water Table Tests, Hydrometer Analysis, Groundwater Evaluation. W 1/2 19-53-3 W5. 19-053-03 W5. [L053498]

Tokarsky, O. Geoscience Consulting Ltd. March 1976b. Water Table Tests, Percolation Tests, Groundwater Evaluation. SW 23-53-3 W5. 23-053-03 W5. [L088437]

Tokarsky, O. Geoscience Consulting Ltd. April 1976. Water Table Tests, Hydrometer Analyses, Groundwater Evaluation. SW 32-53-3 W5. 32-053-03 W5. [<hc fiche 1976.87>] [L066694]

Tokarsky, O. Geoscience Consulting Ltd. June 1976. Aquifer Test. SW 23-53-3 W5. 23-053-03 W5. [<hc fiche 1976.27>] [L006841]

Tokarsky, O. Geoscience Consulting Ltd. June 1976. Water Table Tests, Percolation Tests, Groundwater Evaluation. NW 7-54-3 W5. 07-054-03 W5. [L003682]

Tokarsky, O. Geoscience Consulting Ltd. July 1976. Water Table Tests, Percolation Tests, Groundwater Evaluation. NE 35-61-6 W4. 19-053-03 W5. [<hc fiche 1976.12>] [L047323]

Tokarsky, O. Geoscience Consulting Ltd. November 1976. Aquifer Test. SW 32-53-3 W5. 32-053-03 W5. [<hc fiche 1976.24>] [L039454]

Tokarsky, O. Geoscience Consulting Ltd. March 1978. Aquifer Test. SE 7-54-3 W5. 07-054-03 W5. [L058539]

Tokarsky, O. Geoscience Consulting Ltd. May 1978. Aquifer Test. SE 1-54-3 W5. 01-054-03 W5. [L056680]

Tokarsky, O. Geoscience Consulting Ltd. June 1978. Aquifer Test. NE 1-54-3 W5. 01-054-03 W5. [L095934]

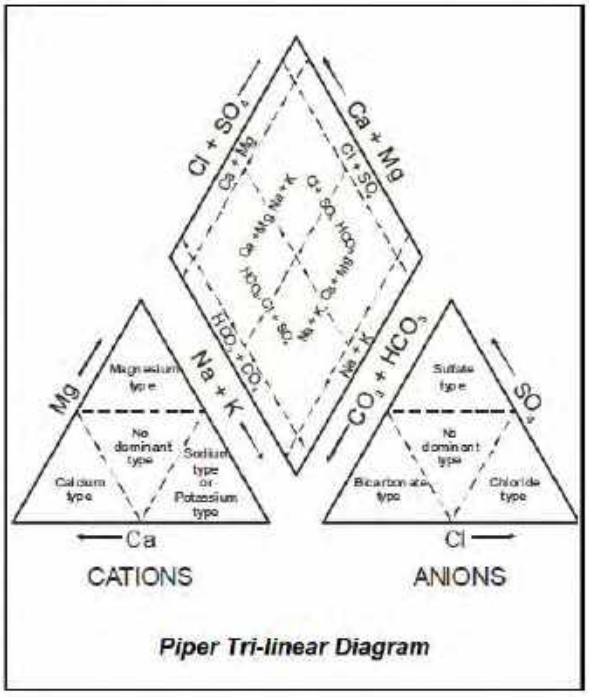
Tokarsky, O. Geoscience Consulting Ltd. July 1979. Aquifer Test. NW 18-53-3 W5. 18-053-03 W5. [L005275]

Znak, M. August 1974. Bergquist Well Relocation, Wabamun Area, SW 17-53-3 W5. 17-053-03 W5. [<hc fiche 1974.1>] [L077618]

9. Supplementary Information

9.1. Glossary of Terms

AO	aesthetic objective: Health Canada aesthetic quality guidelines address parameters that may affect consumer acceptance of drinking water, such as taste, odour and colour
aquifer	a formation, group of formations, or part of a formation that contains saturated permeable rocks capable of transmitting groundwater to water wells or springs in economical quantities
available drawdown	in a confined aquifer, the distance between the non-pumping water level and the top of the aquifer in an unconfined aquifer (water table aquifer), two thirds of the saturated thickness of the aquifer and water level within five metres of the top of the aquifer
MAC	maximum acceptable concentration: Health Canada determines that chemical substances may be present in drinking water supplies but these are generally only a concern if above guideline levels (MAC) and exposure occurs over an extended time
Piper tri-linear diagram	a method to show the composition of water based on major cation and anion composition. This diagram allows groupings or trends in the chemical quality data to be identified. Typically in Alberta, surface water and shallow groundwater are a Ca+Mg-HCO_3-type water, upper bedrock groundwaters are a Na+K-HCO_3-type water and deep groundwaters are a Na+K-Cl-type water. For a more detailed explanation, please refer to Freeze and Cherry, 1979
storativity (S)	the volume of water released from storage by a confined aquifer per unit surface area of aquifer per unit decline in hydraulic head (dimensionless)
surficial deposits	includes all sediments above the bedrock surface
till	a sediment deposited directly by a glacier that is unsorted and consisting of any grain size ranging from clay to boulders



Piper Tri-linear Diagram

transmissivity (T)	the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient; a measure of the ease with which groundwater can move through the aquifer apparent transmissivity: the value determined from a summary of aquifer test data, usually involving only two water-level readings effective transmissivity: the value determined from late pumping and/or late recovery water-level data from an aquifer test aquifer transmissivity: the value determined by multiplying the hydraulic conductivity of an aquifer by the thickness of the aquifer
yield	a regional analysis term referring to the rate at which a properly completed water well could be pumped, if fully penetrating the aquifer apparent yield: based mainly on apparent transmissivity long-term yield: based on effective transmissivity sustainable yield: based on aquifer parameters determined from long-term water-level and groundwater production monitoring

9.2. Glossary of Commonly Used Abbreviations, Acronyms and Symbols

AENV	Alberta Environment (formerly Alberta Environment, Alberta Environment and Water)
AMSL	above mean sea level
AOI	area of interest
AOS	area of study
BGL	below ground level
BTOC	below top of casing
DEM	digital elevation model
ESRD	Alberta Environment and Sustainable Resource Development (formerly Alberta Environment, Alberta Environment and Water)
GCDWQ-ST	Guidelines for Canadian Drinking Water Quality – Summary Table
km	kilometre
lpm/metre	litres per minute per metre
m	metres
mm	millimetres
m^2	metres squared
m^2/day	metres squared per day
m^3	cubic metres
m^3/day	cubic metres per day
mg/L	milligrams per litre
NPWL	non-pumping water level
TGWC	The Groundwater Centre www.tgwc.com
TDS	total dissolved solids
WSW	water source well *or* water supply well
WW	water well
VE	vertical exaggeration

10. Conversions

Multiply	by	To Obtain
Length/Area		
feet	0.304 785	metres
metres	3.281 000	feet
hectares	2.471 054	acres
centimetre	0.032 808	feet
centimetre	0.393 701	inches
acres	0.404 686	hectares
inches	25.400 000	millimetres
miles (statute)	1.609 344	kilometres
kilometres	0.621 370	miles (statute)
square feet (ft^2)	0.092 903	square metres (m^2)
square metres (m^2)	10.763 910	square feet (ft^2)
square metres (m^2)	0.000 001	square kilometres (km^2)
Concentration		
grains/gallon (UK)	14.270 050	parts per million (ppm)
parts per million (ppm)	0.998 859	milligrams per litre (mg/L)
milligrams per litre (mg/L)	1.001 142	parts per million (ppm)
Volume (capacity)		
acre feet	1233.481 838	cubic metres
cubic feet	0.028 317	cubic metres
cubic metres	35.314 667	cubic feet
cubic metres	219.969 248	imperial gallons (UK)
cubic metres	264.172 050	gallons (US liquid)
cubic metres	1000.000 000	litres
imperial gallons (UK)	0.004 546	cubic metres
imperial gallons (UK)	4.546 000	litres
Rate		
litres per minute	0.219 974	imperial gallons per minute (ipgm)
litres per minute	1.440 000	cubic metres/day (m^3/day)
imperial gallons per minute (igpm)	6.546 300	cubic metres/day (m^3/day)
cubic metres/day (m^3/day)	0.152 759	imperial gallons per minute (ipgm)
Pressure		
pound per square inch (psi)	6.894 757	kilopascal (kpa)
kilopascal (kpa)	0.145 038	pound per square inch (psi)
Miscellaneous		
Celsius	F° = 9/5 (C° + 32)	Fahrenheit
Fahrenheit	C° = (F°- 32) * 5/9	Celsius
degrees	0.017 453	radians

Appendix A – Administrative Details

TABLE OF CONTENTS

Field Survey Letter 2

Field Survey Letter

hydrogeological Consultants ltd.
investigations involving any aspect of **GROUNDWATER**
www.hcl.ca
17740 - 118 Avenue NW, Edmonton, AB T5S 2W3 Tel: 780.483.7240 Fax: 780.484.9413

Date Delivered

Our File No.: 10-505

To the Resident:

This visit is to gather background hydrogeological data relative to the proposed gravel pit application by 1531486 Alberta Ltd. The proposed gravel pit(s) will take up portions of the following Sections: NE 32, the North Half of 33, and SW 34, within Tp 053, R 03, W5M. I have included a preliminary map of the proposed mining areas. I visited your residence today to confirm some information about your water well(s) and, with your permission, to measure the depth to water in the water well(s), if physically possible. Unfortunately, no one was home.

I have information for a number of water wells in this ¼ section, which has not been assigned to any specific building location. A summary of the water well(s) for the ¼ section is attached, and perhaps one of these water well(s) is yours. If you wish to view details for the individual water well(s), the available data can be viewed at www.groundwatercentre.com by referring to the GCID number. If you wish to view details for the individual water well(s) and you do not have internet access, please contact me at the numbers below.

If you would like to have the data for your water well(s) verified, please call me toll-free at 1-800-661-6061 ext. 237, or on cell at 780.886.3423, and I will make arrangements to revisit you at a mutually acceptable time. I can also be reached via email at: ben@hcl.ca.

Thank you in advance for your time and assistance in the management of the groundwater resource in your area.

Yours truly,

Benjamin Gilham, C.E.T.
Hydrogeological Technologist
This information redacted as
Tel: 1-800-661-6061 ext. 237
Email: ben@hcl.ca

Please note: If you choose to have your water well verified, your name, in connection with your water well data, may be made publicly available. For further information, please request a copy of our Privacy Policy from our Privacy Officer, Lori Zastre, at 780.702.6243, or at lori@hcl.ca

Workspace\2010\10-505\1_Admin\Comp\Field Survey - Letter.doc

Appendix B – Water Well Details

TABLE OF CONTENTS

Piezometer No. 1-10 3
- Well Diagram 4
- Metric Drilling Report 5
- Chemical Analysis (Nov 21, 2010) 6
- Aquifer Test I 8

Piezometer No. 2-10 10
- Well Diagram 11
- Metric Drilling Report 12

Piezometer No. 3-10 13
- Well Diagram 14
- Metric Drilling Report 15
- Chemical Analysis (Nov 15, 2010) 16
- Aquifer Test I 18

Piezometer No. 4-10 20
- Well Diagram 21
- Metric Drilling Report 22

Piezometer No. 5-10 23
- Well Diagram 24
- Metric Drilling Report 25
- Chemical Analysis (Nov 03, 2010) 26
- Aquifer Test I 28

Piezometer No. 6-10 30
- Well Diagram 31
- Metric Drilling Report 32
- Chemical Analysis (Nov 01, 2010) 33
- Aquifer Test I 35

1942 Astleford Stock Water Well 37
- Well Diagram 38
- Metric Drilling Report 39
- Chemical Analysis (Oct 21, 2010) 40
- Aquifer Test II 42

2001 Franczak Water Well 44
- Well Diagram 45
- Metric Drilling Report 46
- Chemical Analysis (Oct 21, 2010) 47
- Aquifer Test I 49
- Aquifer Test II 51

1987 Franczak Water Well....53
Well Diagram....54
Metric Drilling Report....55
Chemical Analysis (Oct 21, 2010)....56
1979 Franczak Water Well....58
Well Diagram....59
Metric Drilling Report....60
Chemical Analysis (Oct 21, 2010)....61

Piezometer No. 1-10

(A1, Mike's 2-10)

15-33-053-03 W5M

(M40471.556580)

Well Spatial Location:

Easting: ***40,888***
Northing: ***5,939,571***
::*(spatial accuracy Surveyed (other) — 10TM NAD83)*

Ground Elevation AMSL (m): ***777***
::*(elevation accuracy Ground Survey)*

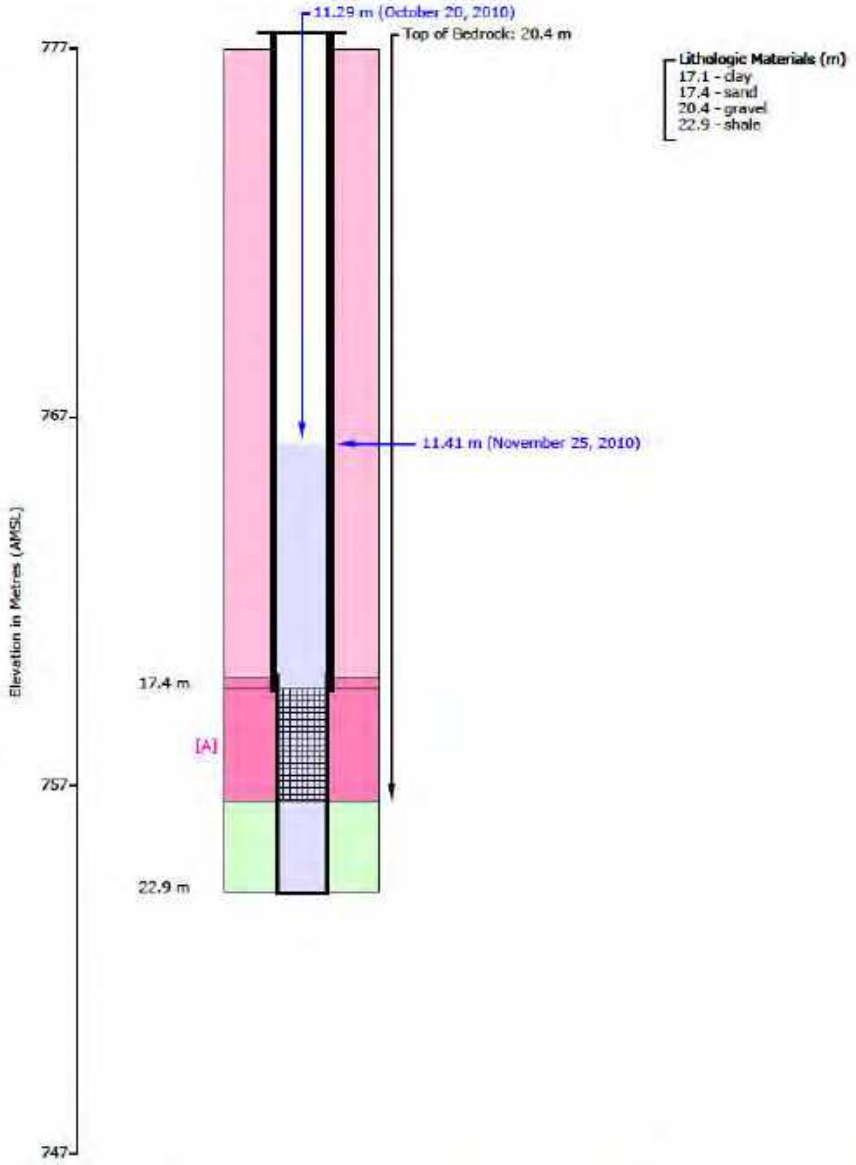
Date Completed: ***October 20, 2010***

Depth Drilled (m): ***22.9***

Completion Interval (m): ***17.4 — 20.4 ****
::*(* TGWC determined value)*

Most Recent Water Level (m): ***11.41 — November 25, 2010***
Earliest Water Level (m): ***11.29 — October 20, 2010***

Piezometer No. 1-10
Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained
Bedrock: Fine Grained; Coarse Grained
Other

Geologic Unit Legend (Top) - Regional Analysis

Geologic Unit Details not available for this location

Summary

TGWC ID: M40471.556580
Well Name: Piezometer No. 1-10
Legal Location: 15-33-053-03 W5M
Casing (OD): 88.9 mm; PVC (3.5")
Liner (OD): 77.9 mm; PVC (3.1")
Casing Stick-Up: 0.68 m (not drawn to scale)
Interval [A]: 17.4 to 20.4 m; Screened
Water Level (recent): 11.41 m on November 25, 2010 @ 11:00
Water Level (oldest): 11.29 m on October 20, 2010 @ 17:20
Top of Liner assumed to be 5% of 'non-cased' interval.

NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by hydrogeological consultants ltd. (HCL) (http://www.hcl.ca) on behalf of Lac Ste. Anne County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: December 02, 2010 11:42 --- http://www.tgwc.ca

Owner: *1531486 Alberta Ltd.*
11610 - 151 Street, Edmonton, AB T5M 4E9
Contractor: *Lakeland Drilling Ltd.*
Well Name: *Piezometer No. 1-10*

Field Survey: *October 20, 2010 - Confirmed - Physically*

METRIC REPORT

Easting (m):	408888 **	84/09
Northing (m):	5939572 **	
Elevation (m):	777 ***	

Google Earth

15-33-053-03 W5M

M40471.556580

190397-2

Work Type: *Piezometer*
Drilling Method: *Drilled*
Proposed Use: *Monitoring*
Completion Type: *Screen*
Date Started: *October 19, 2010*
Date Completed: *October 20, 2010*
Well Status: *Observation*
Feature Class: *Piezometer*

Elog Taken: *No*
Gamma Taken: *No*
Stick Up (m): *0.7*
Flowing: *No*

General Details

Depth Completed (m): *20.4*
Depth Drilled (m): *22.9*
Top of Bedrock (m): *20.4 **
Completion Interval (m): *17.4 — 20.4 **

Sand & Gravel Thickness (m): *3.4 (total) — 3.4 (below 15 m) **

Completion Details

Surface Casing: *PVC — 88.9 mm (O.D.) x 5.49 mm (thick) x 17.37 m (bottom)*

Screen Material: *PVC — 77.9 mm (I.D.)*

Pack: *[unknown]*

Intervals

Screen: 17.4 to 20.4 m - 20 slot

Bentonite: 0.0 to 16.8 m
Sand Pack: 16.8 to 21.3 m
Cuttings: 21.3 to 22.9 m

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (mte ipm)
759.5	17.1	Clay
759.2	17.4	Grey Sand
756.2	20.4	Gravel
753.7	22.9	Shale

General Comments / Observations

[Piezometer was developed for 30 minutes at a rate of 32 litres per minute on October 20, 2010. Piezometer surveyed (xy2) Nov 25, 2010 by Altus Geomatics.]

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: *October 21, 2010 (17.4 to 22.9 m)*
Analysis Details: *October 27, 2010 - Exova Canada Inc. (769933-3)*

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	955	Nitrate as N:	< 0.01	Colour (TCU):	> 60
TDS (Calculated):	584	Nitrite as N:	< 0.005	Turbidity (NTU):	33.9
Hardness (as CaCO3):	446	pH (pH Unit):	7.96	Fluoride:	0.12
T-Alkalinity (as CaCO3):	502	Ion Balance (%):	96	Carbonate:	< 6
P-Alkalinity (as CaCO3):	< 5	Total Coliforms**:		Bicarbonate:	613
Nitrate + Nitrite as N:	< 0.01	Fecal Coliforms**:		Hydroxide:	< 5
Total Suspended Solids:		Escherichia coli**:		Total Iron:	
Sulfate Reducing Bacteria*:				Total Mn:	
Iron Related Bacteria*:				Temperature (°C):	19.6

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	128	123	Mercury:		
Chloride:		0.6	Molybdenum:		0.001
Iron:	2.62	0.06	Magnesium:	30.7	30.9
Manganese:	0.868	0.836	Sodium:	51	49.3
Aluminum:		< 0.002	Potassium:	3.7	3.7
Arsenic:		0.0059	Vanadium:		0.0048
Barium:		0.083	Strontium:		0.684
Beryllium:		< 0.0001	Nickel:		0.0013
Cadmium:		< 0.00001	Zinc:		0.012
Chromium:		0.0017	Copper:		< 0.001
Cobalt:		0.0014	Lead:		< 0.0001
Sulfate:	68.6				

Extractable - unfiltered
Dissolved - filtered

(1 / 1)

Comments: *Sample collected by Mow-Tech Ltd.*

note: constituents have been compared to the maximum acceptable concentration,Health Canada, 2010. Guidelines for Canadian Drinking Water Quality – Summary Table. Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

Most Recent Water Level (m): *11.23 m — August 30, 2011*

Oil Present: *No*
Gas Present: *No*

Water Used For Drilling

Aquifer Tests

	Date & Time	Testing Method	Depth of Test Interval (metre)	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective
2	2010-11-04 15:40	Pump	17.37 to 20.42	11380.0	4240.0	32.1	11.28	5.19	22.90	34.4		14.9	26.6	17.6 RC
1	2010-10-20 17:20	Pump	17.40 to 22.90	120.0	730.0	20.2	11.29	2.91	—	30.1		13.0	17.1	17.1 RC

Alias IDs

* The Groundwater Centre (TGWC) calculated or determined value
** 84 - Surveyed (other) — 10TM NAD83
*** 89 - Ground Survey — (Ground, AMSL)

This report was generated on: November 07, 2012 — Data "AS IS"; no warranty either expressed or implied. [53.624744 -114.361518 (WGS 84)] INT

Piezometer No. 1-10
Chemical Analysis (Nov 21, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada
T: +1 (780) 438-5522
F: +1 (780) 438-5398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project:		Lot ID:	**769933**
Report To:	Hydrogeological Consultants	ID:	10-505	Control Number:	Z-065679
	17740 - 118 Avenue	Name:	Groundwater Review	Date Received:	Oct 22, 2010
	Edmonton, AB, Canada	Location:	Lac Ste. Anne Area	Date Reported:	Oct 27, 2010
	T5S 2W3	LSD:	Parts of Sections 28 and 32 to 34	Report Number:	1373210
Attn:	Tara Parker	P.O.:	14091		
Sampled By:	Hydrogeological Consultants Ltd.	Acct code:			
Company:					

Reference Number	769933-3
Sample Date	October 21, 2010
Sample Time	14:35
Sample Location	
Sample Description	M40471.556580 (WTH No. 2-10) / 6.1°C / 15-33-053-03
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Dissolved						
Silicon	Dissolved	mg/L	7.34	0.05		
Sulfur	Dissolved	mg/L	22.6	0.3		
Aluminum	Dissolved	mg/L	<0.002	0.002	0.1	Below OG
Antimony	Dissolved	mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Dissolved	mg/L	0.0059	0.0002	0.01	Below MAC
Barium	Dissolved	mg/L	0.083	0.001	1	Below MAC
Beryllium	Dissolved	mg/L	<0.0001	0.0001		
Bismuth	Dissolved	mg/L	<0.0005	0.0005		
Boron	Dissolved	mg/L	0.172	0.002	5	Below MAC
Cadmium	Dissolved	mg/L	<0.00001	0.00001	0.005	Below MAC
Chromium	Dissolved	mg/L	0.0017	0.0005	0.05	Below MAC
Cobalt	Dissolved	mg/L	0.0014	0.0001		
Copper	Dissolved	mg/L	<0.001	0.001	1	Below AO
Lead	Dissolved	mg/L	<0.0001	0.0001	0.01	Below MAC
Lithium	Dissolved	mg/L	0.033	0.001		
Molybdenum	Dissolved	mg/L	0.001	0.001		
Nickel	Dissolved	mg/L	0.0013	0.0005		
Selenium	Dissolved	mg/L	<0.0002	0.0002	0.01	Below MAC
Silver	Dissolved	mg/L	<0.00001	0.00001		
Strontium	Dissolved	mg/L	0.684	0.001		
Thallium	Dissolved	mg/L	<0.00005	0.00005		
Tin	Dissolved	mg/L	<0.001	0.001		
Titanium	Dissolved	mg/L	0.0019	0.0005		
Uranium	Dissolved	mg/L	<0.0005	0.0005	0.02	Below MAC
Vanadium	Dissolved	mg/L	0.0048	0.0001		
Zinc	Dissolved	mg/L	0.012	0.001	5	Below AO
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	>60	5	15	Above AO
Turbidity		NTU	33.9	0.1	0.1	Above OG
Routine Water						
pH			7.96		6.5 - 8.5	Within AO
Temperature of observed pH		°C	19.6			
Electrical Conductivity		µS/cm at 25 C	955	1		
Calcium	Dissolved	mg/L	123	0.2		
Calcium	Extractable	mg/L	128	0.2		

Terms and Conditions: www.exova.ca/terms&conditions

Piezometer No. 1-10
Chemical Analysis (Nov 21, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada
T: +1 (780) 438-5522
F: +1 (780) 438-0398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project ID:	10-505	Lot ID:	**769933**
Report To:	Hydrogeological Consultants	Name:	Groundwater Review	Control Number:	Z-065679
	17740 - 118 Avenue	Location:	Lac Ste. Anne Area	Date Received:	Oct 22, 2010
	Edmonton, AB, Canada	LSD:	Parts of Sections 28 and 32 to 34	Date Reported:	Oct 27, 2010
	T5S 2W3	P.O.:	14091	Report Number:	1373210
Attn:	Tara Parker				
Sampled By:	Hydrogeological Consultants Ltd.	Acct code:			
Company:					

Reference Number	769933-3
Sample Date	October 21, 2010
Sample Time	14:35
Sample Location	
Sample Description	M40471.556580 (WTH No. 2-10) / 6.1°C / 15-33-053-03
Sample Matrix	Water

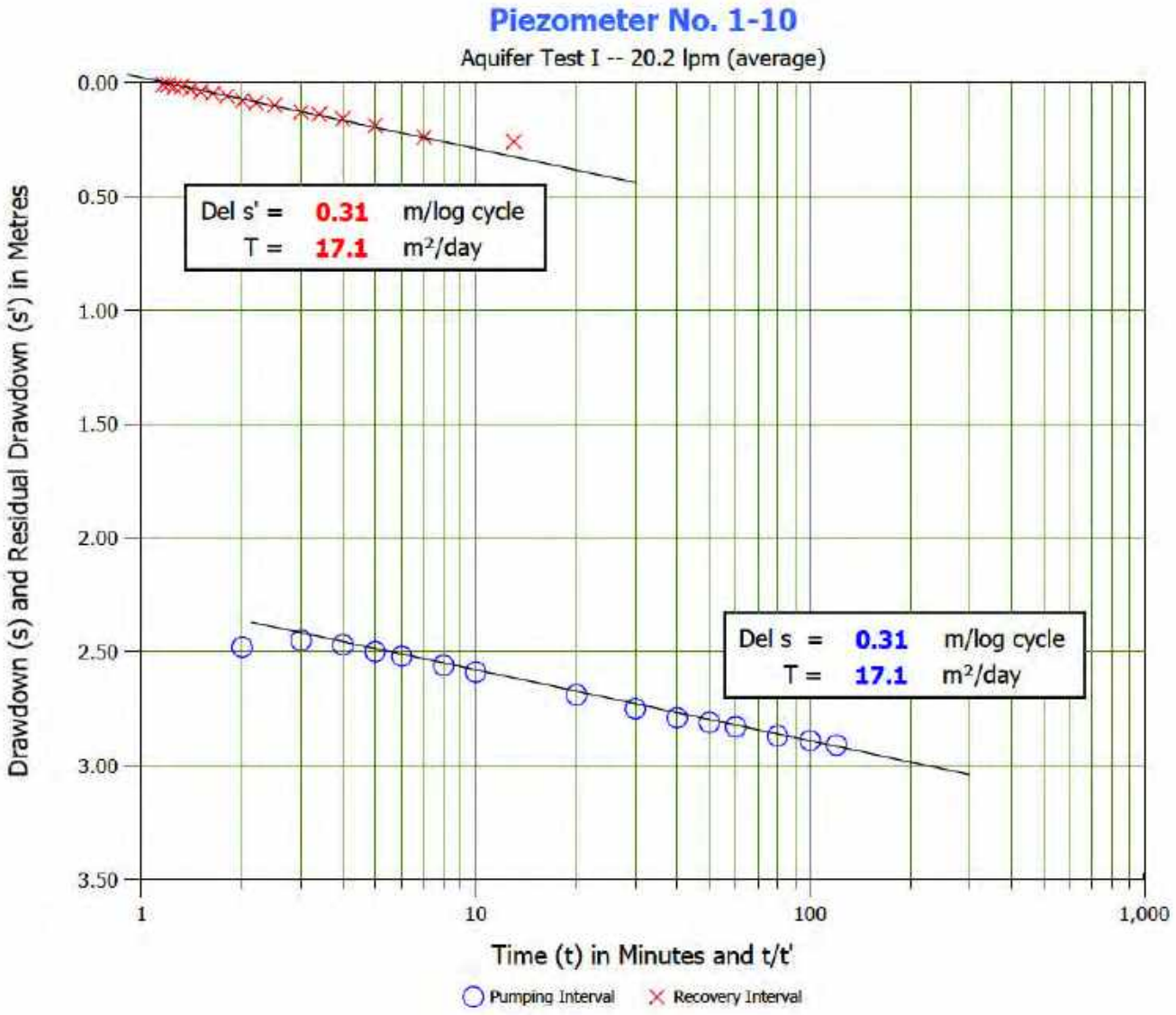
Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Magnesium	Dissolved	mg/L	30.9	0.2		
Magnesium	Extractable	mg/L	30.7	0.2		
Sodium	Dissolved	mg/L	49.3	0.4	200	Below AO
Sodium	Extractable	mg/L	51.0	0.4	200	Below AO
Potassium	Dissolved	mg/L	3.7	0.4		
Potassium	Extractable	mg/L	3.7	0.4		
Iron	Dissolved	mg/L	0.06	0.01	0.3	Below AO
Iron	Extractable	mg/L	2.62	0.01	0.3	Above AO
Manganese	Dissolved	mg/L	0.836	0.005	0.05	Above AO
Manganese	Extractable	mg/L	0.868	0.005	0.05	Above AO
Chloride	Dissolved	mg/L	0.6	0.4	250	Below AO
Fluoride		mg/L	0.12	0.05	1.5	Below MAC
Nitrate - N		mg/L	<0.01	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	<0.01	0.01	10	Below MAC
Sulfate (SO4)		mg/L	68.6	0.9	500	Below AO
Hydroxide		mg/L	<5	5		
Carbonate		mg/L	<6	6		
Bicarbonate		mg/L	613	5		
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	502	5		
Total Dissolved Solids		mg/L	584	1	500	Above AO
Hardness	as CaCO3	mg/L	446			
Ionic Balance		%	98			

This information redacted as per Protection of Privacy Act

Approved by:
Randy Neumann, BSc
General Manager

Terms and Conditions: www.exova.ca/terms&conditions

Piezometer No. 1-10
Aquifer Test I



Aquifer Test I

Piezometer No. 1-10

(formerly A1, Mike's 2-10)

15-33-053-03 W5M

Average Discharge (lpm):	**20.2**	Pre-Test Water Level - NPWL (m):	**11.29**
Date Test Started:	**October 20, 2010**	Depth to Pump Intake (m):	**N/A**
Time Test Started (hours):	**17:20**	Test Interval - Top (m):	**17.4**
Pumping Interval (minutes):	**120**	Test Interval - Bottom (m):	**22.9**
Recovery Interval (minutes):	**750**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*

Reference: M40471.556580 (AT 1)

** TGWC calculated or determined value.*

This report was generated on: December 02, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)	Discharge (Lpm)
2	2.48	20.3
3	2.45	20.3
4	2.47	20.3
5	2.50	20.3
6	2.52	20.3
8	2.56	20.3
10	2.59	20.3
20	2.69	20.3
30	2.75	20.2
40	2.79	20.2
50	2.81	20.2
60	2.83	20.2
80	2.87	20.2
100	2.89	20.2
120	2.91	20.2

Recovery Interval

Measurement Point: Top of Casing

Time (t') Since Pumping Stopped (minutes)	(t/t')	Residual Drawdown (s') (metre)
10	13.0	0.26
20	7.0	0.24
30	5.0	0.19
40	4.0	0.16
50	3.4	0.14
60	3.0	0.13
80	2.5	0.10
100	2.2	0.09
120	2.0	0.08
150	1.80	0.06
190	1.63	0.05
240	1.50	0.04
300	1.40	0.03
380	1.32	0.02
480	1.25	0.02
600	1.20	0.01
750	1.16	0.01

Test Comments:

Test conducted by Mow-Tech Ltd. Data-logger measurements.

Piezometer No. 2-10

(F3, Mike's 3-10)

16-33-053-03 W5M

(M40478.470194)

Well Spatial Location:

Easting: ***41,487***
Northing: ***5,939,737***
::(spatial accuracy Surveyed (other) — 10TM NAD83)

Ground Elevation AMSL (m): ***773***
::(elevation accuracy Ground Survey)

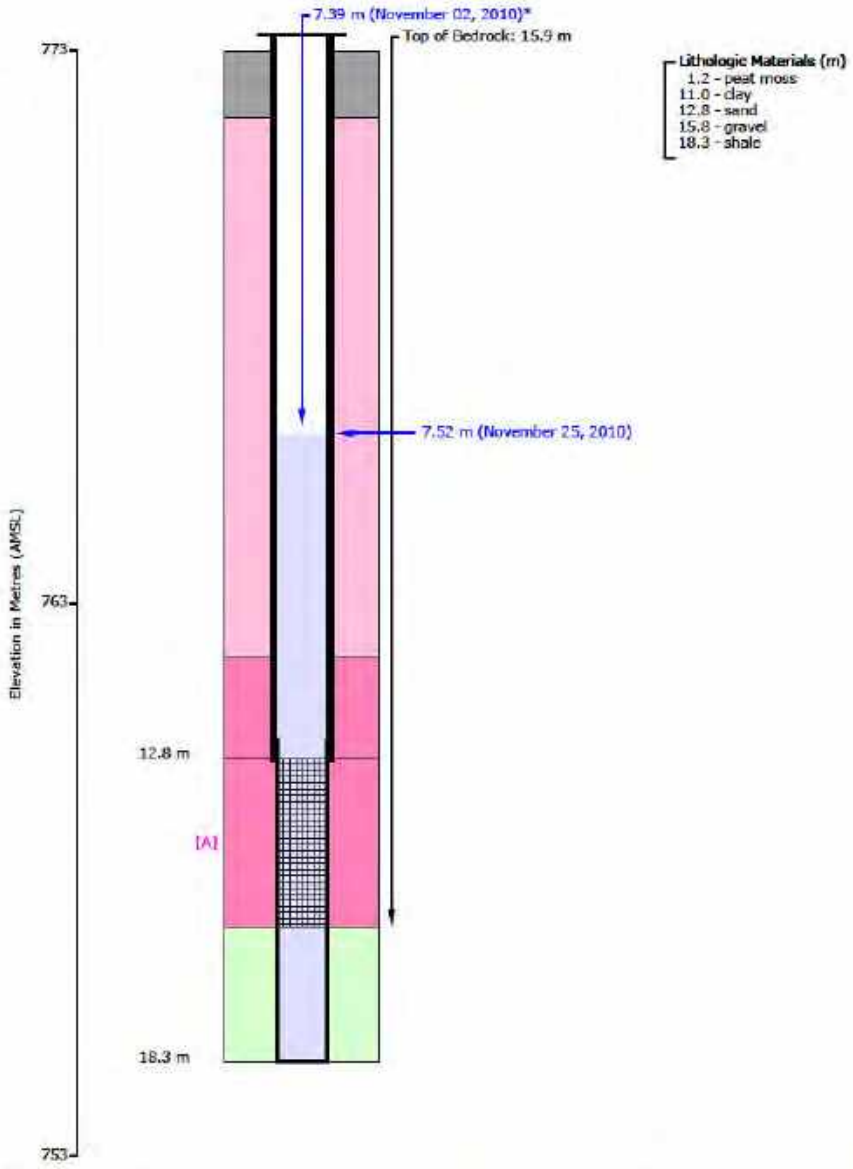
Date Completed: ***October 20, 2010***

Depth Drilled (m): ***18.3***

Completion Interval (m): ***12.8 — 15.9 ****
::(TGWC determined value)*

Most Recent Water Level (m): ***7.52 — November 25, 2010***
Earliest Water Level (m): ***7.39 — November 02, 2010***

Piezometer No. 2-10
Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained
Bedrock: Fine Grained; Coarse Grained
Other

Geologic Unit Legend (Top) - Regional Analysis

Geologic Unit Details not available for this location

Summary

TGWC ID: M40478.470194
Well Name: Piezometer No. 2-10
Legal Location: 16-33-053-03 W5M
Casing (OD): 88.9 mm; PVC (3.5")
Liner (OD): 77.9 mm; PVC (3.1")
Casing Stick-Up: 0.60 m (not drawn to scale)
Interval [A]: 12.8 to 15.9 m; Screened
Water Level (recent): 7.52 m on November 25, 2010 @ 11:15
*Water Level (oldest): 7.39 m on November 02, 2010 @ 12:10 - Reference Point: Top of Casing
Top of Liner assumed to be 5% of 'non-cased' interval.

** Water-Level Measurements are measured from reference point listed.*
NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by hydrogeological consultants ltd. (HCL) (http://www.hcl.ca) on behalf of Lac Ste. Anne County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: December 02, 2010 11:44 --- http://www.tgwc.ca

Owner: *1531486 Alberta Ltd.*
11610 - 151 Street, Edmonton, AB T5M 4E9
Contractor: *Lakeland Drilling Ltd.*
Well Name: *Piezometer No. 2-10*

Field Survey: *November 03, 2010 - Confirmed - Physically*

METRIC REPORT

Easting (m):	*41497* **	*84/89*
Northing (m):	*5939738* **	
Elevation (m):	*773* ***	

Google Earth

16-33-053-03 W5M

M40478.470194

Work Type: *Piezometer*
Drilling Method: *[unknown]*
Proposed Use: *Monitoring*
Completion Type: *Screen*

Date Started: *October 20, 2010*
Date Completed: *October 20, 2010*
Well Status: *Observation*

Elog Taken: *No*
Gamma Taken: *No*
Stick Up (m): *0.6*
Flowing: *No*

General Details

Depth Completed (m): *15.9*
Depth Drilled (m): *18.3*

Top of Bedrock (m): *15.8* *
Completion Interval (m): *12.8 — 15.9* *

Completion Details

Surface Casing: *PVC — 88.9 mm (O.D.) x 5.49 mm (thick) x 12.80 m (bottom)*

Screen Material: *PVC — 77.9 mm (I.D.)*

Intervals

Completion Interval: *Screen: 12.8 to 15.9 m - 20 slot*

Construction Interval: *Bentonite: 0.0 to 11.9 m*
Construction Interval: *Sand Pack: 11.9 to 15.9 m*
Construction Interval: *Cuttings: 15.9 to 18.3 m*

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (mte ipm)
772.1	1.2	Peat Moss
762.3	11.0	Clay
760.5	12.8	Grey Sand
757.5	15.8	Gravel
755.0	18.3	Shale

Chemistry Summary Details (mg/L, except as noted) (most recent first)

General Comments / Observations

[Piezometer developed for 45 minutes at 18 litres per minutes on October 20, 2010.
Piezometer surveyed (xyz) Nov 25, 2010 by Altus Geomatics.]

Most Recent Water Level (m): *7.52 m — November 25, 2010*

Oil Present: *No*
Gas Present: *No*

Water Used For Drilling

Aquifer Tests

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective	
— Used as Observation Water Well During Aquifer Test No. 2 with M40471.556500 —															R C

Alias IDs

** TGWC calculated or determined value*
*** 84 - Surveyed (other) — 10TM NAD83*
**** 89 - Ground Survey — [Ground, AMSL]*

This report was generated on: December 02, 2010 — Data "AS IS"; no warranty either expressed or implied. [53.62619 -114.37244 (WGS 84)], INT

Piezometer No. 3-10

(G1, Mike's 4-10)

05-34-053-03 W5M

(M40478.480727)

Well Spatial Location:

Easting: ***42,019***
Northing: ***5,939,052***
::(spatial accuracy Surveyed (other) — 10TM NAD83)

Ground Elevation AMSL (m): ***781***
::(elevation accuracy Ground Survey)

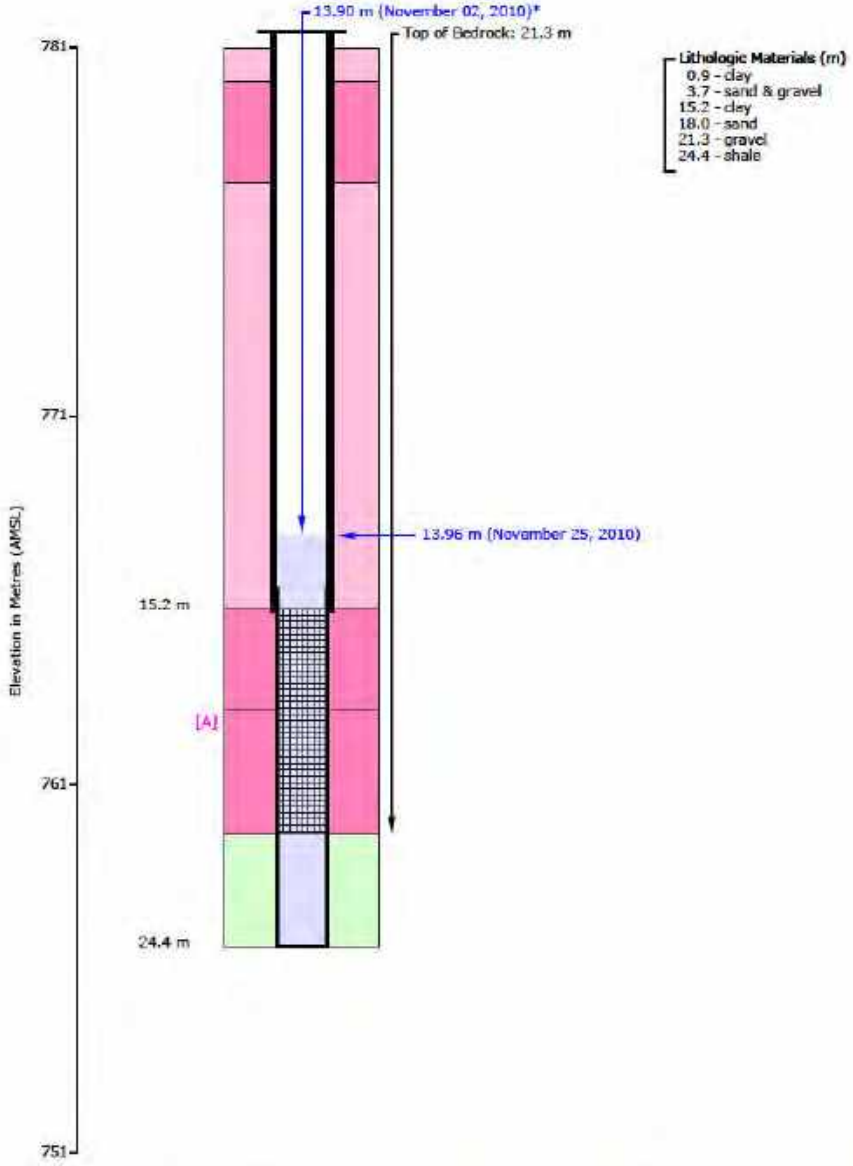
Date Completed: ***October 21, 2010***

Depth Drilled (m): ***24.4***

Completion Interval (m): ***15.2 — 21.3 ****
::(TGWC determined value)*

Most Recent Water Level (m): ***13.96 — November 25, 2010***
Earliest Water Level (m): ***13.90 — November 02, 2010***

Piezometer No. 3-10
Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained
Bedrock: Fine Grained; Coarse Grained
Other

Geologic Unit Legend (Top) - Regional Analysis

Geologic Unit Details not available for this location

Summary

TGWC ID: M40478.480727
Well Name: Piezometer No. 3-10
Legal Location: 05-34-053-03 W5M
Casing (OD): 88.9 mm; PVC (3.5")
Liner (OD): 77.9 mm; PVC (3.1")
Casing Stick-Up: 0.72 m (not drawn to scale)
Interval [A]: 15.2 to 21.3 m; Screened
Water Level (recent): 13.96 m on November 25, 2010 @ 11:23
*Water Level (oldest): 13.90 m on November 02, 2010 @ 11:10 - Reference Point: Top of Casing
Top of Liner assumed to be 5% of 'non-cased' interval.

** Water-Level Measurements are measured from reference point listed.*
NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by hydrogeological consultants ltd. (HCL) (http://www.hcl.ca) on behalf of Lac Ste. Anne County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: December 02, 2010 11:58 --- http://www.tgwc.ca

Owner: *1531486 Alberta Ltd.*
11610 - 151 Street, Edmonton, AB T5M 4E9
Contractor: *Lakeland Drilling Ltd.*
Well Name: *Piezometer No. 3-10*

Field Survey: *November 03, 2010 - Confirmed - Physically*

METRIC REPORT

Easting (m):	*42020* **	*84/89*
Northing (m):	*5939053* **	
Elevation (m):	*781* ***	

Google Earth

05-34-053-03 W5M

M40478.480727

190469-1

Work Type: *Piezometer*
Drilling Method: *Drilled*
Proposed Use: *Monitoring*
Completion Type: *Screen*

Date Started: *October 21, 2010*
Date Completed: *October 21, 2010*
Well Status: *Observation*

Elog Taken: *No*
Gamma Taken: *No*
Stick Up (m): *0.7*
Flowing: *No*

General Details

Depth Completed (m): *21.3*
Depth Drilled (m): *24.4*

Top of Bedrock (m): *21.3* *
Completion Interval (m): *15.2 — 21.3* *

Completion Details

Surface Casing: *PVC — 88.9 mm (O.D.) x 5.49 mm (thick) x 15.24 m (bottom)*

Screen Material: *PVC — 77.9 mm (I.D.)*

Intervals

Completion Interval: *Screen: 15.2 to 21.3 m - 20 slot*

Construction Interval: *Bentonite: 0.0 to 14.6 m*
Construction Interval: *Sand Pack: 14.6 to 21.3 m*
Construction Interval: *Cuttings: 21.3 to 24.4 m*

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (mte ipm)
779.9	0.9	Clay
777.2	3.7	Sand & Gravel
765.6	15.2	Clay
762.8	18.0	Sand
759.5	21.3	Gravel
756.4	24.4	Shale

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: *November 15, 2010 @ 15:00 (15.2 to 21.3 m)*
Analysis Details: *November 22, 2010 - Exova (774849-1)*

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	*816*	Nitrate as N:	*< 0.05*	Colour (TCU):	*45*
TDS (Calculated):	*488*	Nitrite as N:	*< 0.02*	Turbidity (NTU):	*33.3*
Hardness (as CaCO3):	*399*	pH (pH Unit):	*7.66*	Fluoride:	*< 0.2*
T-Alkalinity (as CaCO3):	*476*	Ion Balance (%):	*94*	Carbonate:	*< 6*
P-Alkalinity (as CaCO3):	*< 5*	Total Coliforms**:		Bicarbonate:	*580*
Nitrate + Nitrite as N:	*< 0.07*	Fecal Coliforms**:		Hydroxide:	*< 5*
Total Suspended Solids:	*58*	Escherichia coli**:		Total Iron:	
Sulfate Reducing Bacteria*:				Total Mn:	
Iron Related Bacteria*:				Temperature (°C):	*19.8*

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	*112*	*117*	Mercury:		
Chloride:		*1.8*	Molybdenum:		*< 0.002*
Iron:	*2.12*	*0.04*	Magnesium:	*29.0*	*30.7*
Manganese:	*0.793*	*0.046*	Sodium:	*30.9*	*33.8*
Aluminum:		*< 0.004*	Potassium:	*5.0*	*5.3*
Arsenic:		*0.0030*	Vanadium:		*0.0071*
Barium:		*0.11*	Strontium:		*0.624*
Beryllium:		*< 0.0002*	Nickel:		*0.0040*
Cadmium:		*< 0.00002*	Zinc:		*0.01*
Chromium:		*0.0022*	Copper:		*< 0.002*
Cobalt:		*0.0052*	Lead:		*< 0.0002*
Sulfate:		*24*			

Extractable - unfiltered
Dissolved - filtered

(1 / 1)

Comments: *Sample collected by Mow-Tech Ltd.*

note: constituents have been compared to the maximum acceptable concentration, as stated in the Summary of Guidelines for Canadian Drinking Water Quality (Federal–Provincial–Territorial Committee on Drinking Water, May 2008)

General Comments / Observations

[Piezometer was developed for 45 minutes at 13 litres per minute on October 21, 2010.
Piezometer surveyed (xyz) Nov 25, 2010 by Altus Geomatics.]

Most Recent Water Level (m): *13.96 m — November 25, 2010*

Oil Present: *No*
Gas Present: *No*

Water Used For Drilling

Aquifer Tests

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective	
1	*2010-11-15 14:00*	*Pump*	*80.0*	*1130.0*	*step test*	*13.93*	*6.39*	*20.32*	*23.80*	*3.1*		*6.3*			R C
		— Used as Observation Water Well During Aquifer Test No. 2 with M40471.336580 —													R C

Alias IDs

* *TGWC calculated or determined value*
** *84 - Surveyed (other) — 10TM NAD83*
*** *89 - Ground Survey — [Ground, AMSL]*

This report was generated on: December 02, 2010 — Data "AS IS"; no warranty either expressed or implied. [53.61999 -114.36447 (WGS 84)], INT

Piezometer No. 3-10
Chemical Analysis (Nov 15, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada
T: +1 (780) 438-5522
F: +1 (780) 438-5398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project:		Lot ID:	**774849**
Report To:	Hydrogeological Consultants	ID:	10-505	Control Number:	Z393460
	17740 - 118 Avenue	Name:	Groundwater Review	Date Received:	Nov 16, 2010
	Edmonton, AB, Canada	Location:	Lac Ste. Anne Area	Date Reported:	Nov 22, 2010
	T5S 2W3	LSD:	Parts of Sections 28 & 32 to 34	Report Number:	1388746
Attn:	Tara Parker	P.O.:	14206		
Sampled By:	Mow-Tech Ltd.	Acct code:			
Company:					

Reference Number	774849-1
Sample Date	November 15, 2010
Sample Time	NA
Sample Location	
Sample Description	05-34-053 / M40478.480727 (Piez No. 3-10 "G") / 8.9°C
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Dissolved						
Silicon	Dissolved	mg/L	7.83	0.05		
Sulfur	Dissolved	mg/L	8.5	0.3		
Aluminum	Dissolved	mg/L	<0.004	0.002	0.1	Below OG
Antimony	Dissolved	mg/L	<0.0004	0.0002	0.006	Below MAC
Arsenic	Dissolved	mg/L	0.0030	0.0002	0.01	Below MAC
Barium	Dissolved	mg/L	0.11	0.001	1	Below MAC
Beryllium	Dissolved	mg/L	<0.0002	0.0001		
Bismuth	Dissolved	mg/L	<0.001	0.0005		
Boron	Dissolved	mg/L	0.14	0.002	5	Below MAC
Cadmium	Dissolved	mg/L	<0.00002	0.00001	0.005	Below MAC
Chromium	Dissolved	mg/L	0.0022	0.0005	0.05	Below MAC
Cobalt	Dissolved	mg/L	0.0052	0.0001		
Copper	Dissolved	mg/L	<0.002	0.001	1	Below AO
Lead	Dissolved	mg/L	<0.0002	0.0001	0.01	Below MAC
Lithium	Dissolved	mg/L	0.052	0.001		
Molybdenum	Dissolved	mg/L	<0.002	0.001		
Nickel	Dissolved	mg/L	0.0040	0.0005		
Selenium	Dissolved	mg/L	<0.0004	0.0002	0.01	Below MAC
Silver	Dissolved	mg/L	0.00026	0.00001		
Strontium	Dissolved	mg/L	0.624	0.001		
Thallium	Dissolved	mg/L	<0.0001	0.00005		
Tin	Dissolved	mg/L	<0.002	0.001		
Titanium	Dissolved	mg/L	0.001	0.0005		
Uranium	Dissolved	mg/L	<0.001	0.0005	0.02	Below MAC
Vanadium	Dissolved	mg/L	0.0071	0.0001		
Zinc	Dissolved	mg/L	0.01	0.001	5	Below AO
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	45	5	15	Above AO
Turbidity		NTU	33.3	0.1	0.1	Above OG
Solids	Total Suspended	mg/L	58	1		
Routine Water						
pH			7.66		6.5 - 8.5	Within AO
Temperature of observed pH		°C	19.8			
Electrical Conductivity		µS/cm at 25 C	816	1		
Calcium	Dissolved	mg/L	117	0.2		

Terms and Conditions: www.exova.ca/terms&conditions

Piezometer No. 3-10
Chemical Analysis (Nov 15, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada
T: +1 (780) 438-5522
F: +1 (780) 438-0398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project ID:	10-505	Lot ID:	**774849**
Report To:	Hydrogeological Consultants	Name:	Groundwater Review	Control Number:	Z393460
	17740 - 118 Avenue	Location:	Lac Ste. Anne Area	Date Received:	Nov 16, 2010
	Edmonton, AB, Canada	LSD:	Parts of Sections 28 & 32 to 34	Date Reported:	Nov 22, 2010
	T5S 2W3	P.O.:	14206	Report Number:	1388746
Attn:	Tara Parker	Acct code:			
Sampled By:	Mow-Tech Ltd.				
Company:					

Reference Number	774849-1
Sample Date	November 15, 2010
Sample Time	NA
Sample Location	
Sample Description	05-34-053 / M40478.480727 (Piez No. 3-10 "G") / 8.9°C
Sample Matrix	Water

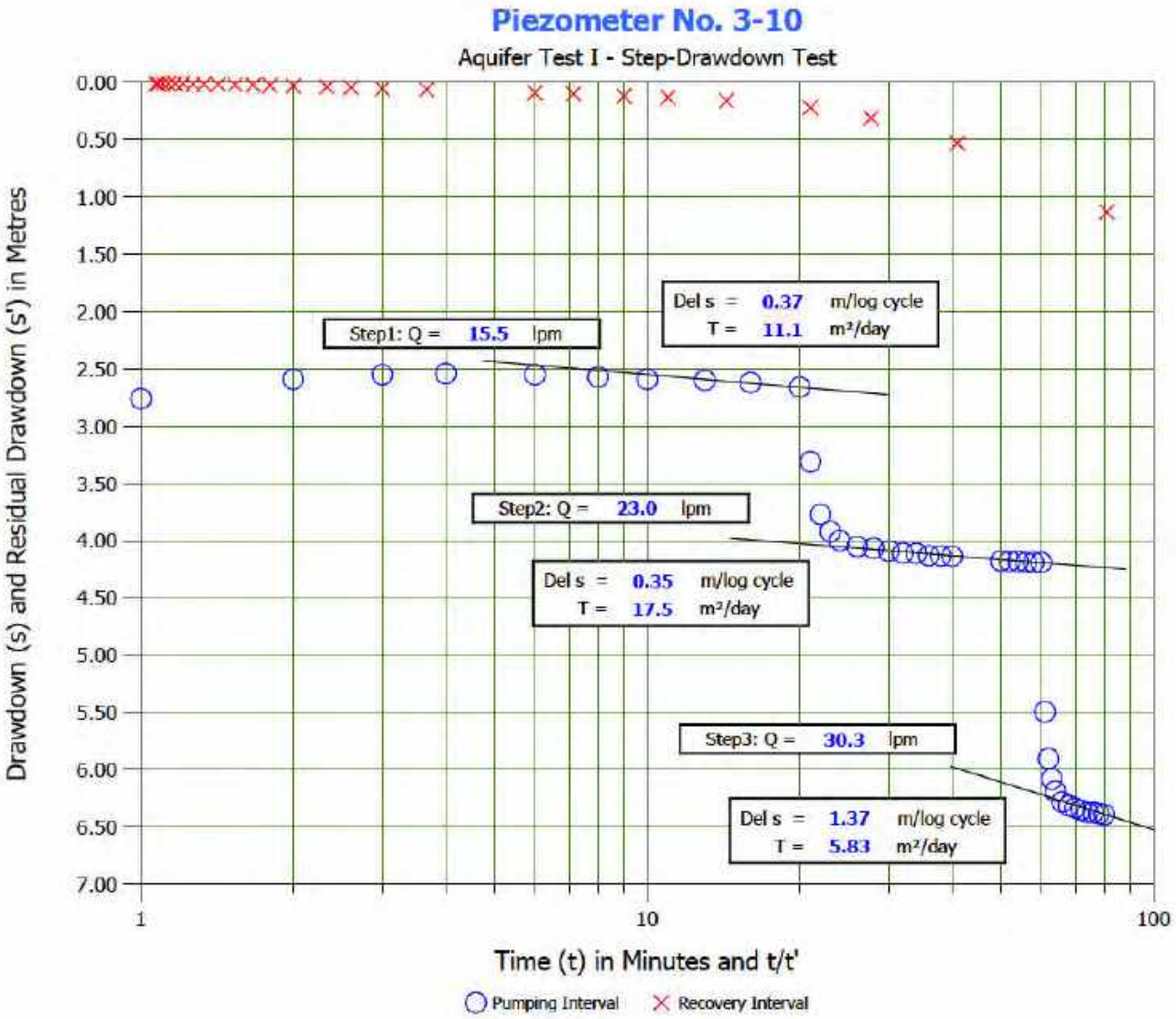
Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Calcium	Extractable	mg/L	112	0.2		
Magnesium	Dissolved	mg/L	30.7	0.2		
Magnesium	Extractable	mg/L	29.0	0.2		
Sodium	Dissolved	mg/L	33.8	0.4	200	Below AO
Sodium	Extractable	mg/L	30.9	0.4	200	Below AO
Potassium	Dissolved	mg/L	5.3	0.4		
Potassium	Extractable	mg/L	5.0	0.4		
Iron	Dissolved	mg/L	0.04	0.01	0.3	Below AO
Iron	Extractable	mg/L	2.12	0.01	0.3	Above AO
Manganese	Dissolved	mg/L	0.846	0.005	0.05	Above AO
Manganese	Extractable	mg/L	0.793	0.005	0.05	Above AO
Chloride	Dissolved	mg/L	1.8	0.4	250	Below AO
Fluoride		mg/L	<0.2	0.05	1.5	Below MAC
Nitrate - N		mg/L	<0.05	0.01	10	Below MAC
Nitrite - N		mg/L	<0.02	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	<0.07	0.01	10	Below MAC
Sulfate (SO4)		mg/L	24	0.9	500	Below AO
Hydroxide		mg/L	<5	5		
Carbonate		mg/L	<6	6		
Bicarbonate		mg/L	580	5		
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	476	5		
Total Dissolved Solids		mg/L	488	1	500	Below AO
Hardness	as CaCO3	mg/L	399			
Ionic Balance		%	94			

This information redacted as per protection of P t ti f

Approved by:
Randy Neumann, BSc
General Manager

Terms and Conditions: www.exova.ca/terms&conditions

Piezometer No. 3-10
Aquifer Test I - Step Drawdown Test



Aquifer Test I - Step-Drawdown Test

Piezometer No. 3-10

(formerly G1, Mike's 4-10)

05-34-053-03 W5M

Average Discharge (lpm):	**Variable**	Pre-Test Water Level - NPWL (m):	**13.93**
Date Test Started:	**November 15, 2010**	Depth to Pump Intake (m):	**23.8**
Time Test Started (hours):	**14:00**	Test Interval - Top (m):	**15.2**
Pumping Interval (minutes):	**80**	Test Interval - Bottom (m):	**21.3**
Recovery Interval (minutes):	**1,130**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*

Reference: M40478.480727 (AT 1)

** TGWC calculated or determined value.*

This report was generated on: December 02, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)	Discharge (Lpm)
1	2.76	15.5
2	2.59	15.5
3	2.55	15.5
4	2.54	15.5
6	2.55	15.5
8	2.57	15.5
10	2.59	15.5
13	2.60	15.5
16	2.62	15.5
20	2.66	15.5
21	3.31	23.0
22	3.77	23.0
23	3.92	23.0
24	4.00	23.0
26	4.05	23.0
28	4.06	23.0
30	4.09	23.0
32	4.11	23.0
34	4.11	23.0
36	4.13	23.0
38	4.13	23.0
40	4.13	23.0
50	4.18	23.0
52	4.18	23.0
54	4.18	23.0
56	4.19	23.0
58	4.19	23.0
60	4.19	23.0
61	5.49	31.0
62	5.50	31.0
63	6.08	30.5
64	6.19	30.4
66	6.28	30.4
68	6.31	30.3
70	6.33	30.3
72	6.35	30.3
74	6.37	30.3
76	6.37	30.3
78	6.38	30.3
80	6.39	30.3

Recovery Interval

Measurement Point: Top of Casing

Time (t') Since Pumping Stopped (minutes)	(t/t')	Residual Drawdown (s') (metre)
1	81	1.13
2	41	0.53
3	28	0.31
4	21	0.22
6	14.3	0.16
8	11.0	0.13
10	9.0	0.12
13	7.2	0.10
16	6.0	0.09
20	5.0	-0.13
30	3.7	0.06
40	3.0	0.05
50	2.6	0.05
60	2.3	0.04
80	2.0	0.03
100	1.80	0.03
120	1.67	0.02
150	1.53	0.02
190	1.42	0.02
240	1.33	0.02
300	1.27	0.01
380	1.21	0.01
480	1.17	0.01
600	1.13	0.01
760	1.11	0.01
960	1.08	0.01
1,130	1.07	0.01

Test Comments:

Test conducted by Mow-Tech Ltd. Data-logger measurements.

Piezometer No. 4-10

(D1, Mike's 5-10)

10-33-053-03 W5M

(M40478.487465)

Well Spatial Location:

Easting: ***41,144***
Northing: ***5,939,331***
::(spatial accuracy Surveyed (other) — 10TM NAD83)

Ground Elevation AMSL (m): ***778***
::(elevation accuracy Ground Survey)

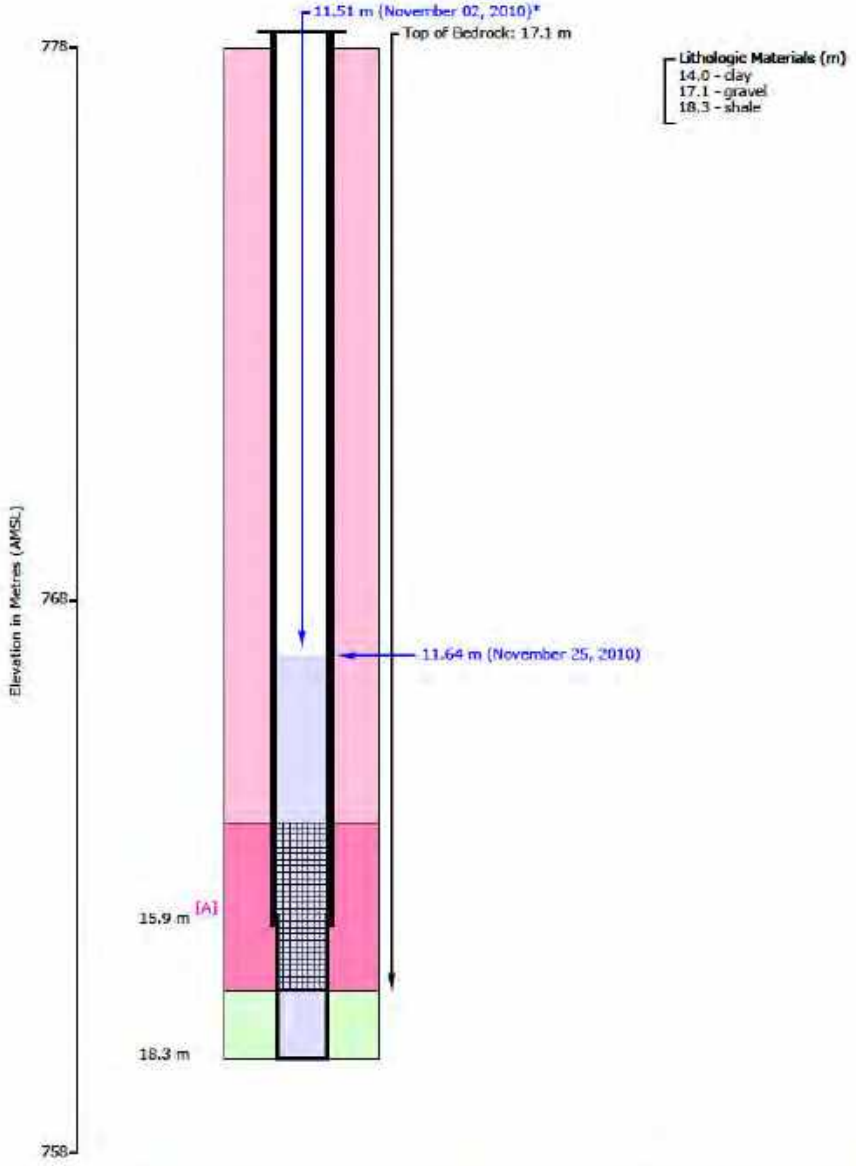
Date Completed: ***October 21, 2010***

Depth Drilled (m): ***18.3***

Completion Interval (m): ***15.9 — 17.1 ****
::(TGWC determined value)*

Most Recent Water Level (m): ***11.64 — November 25, 2010***
Earliest Water Level (m): ***11.51 — November 02, 2010***

Piezometer No. 4-10
Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained
Bedrock: Fine Grained; Coarse Grained
Other

Geologic Unit Legend (Top) - Regional Analysis

Geologic Unit Details not available for this location

Summary

TGWC ID: M40478.487465
Well Name: Piezometer No. 4-10
Legal Location: 10-33-053-03 W5M
Casing (OD): 88.9 mm; PVC (3.5")
Liner (OD): 77.9 mm; PVC (3.1")
Casing Stick-Up: 0.65 m (not drawn to scale)
Interval [A]: 14.0 to 17.1 m; Screened
Water Level (recent): 11.64 m on November 25, 2010 @ 10:30
*Water Level (oldest): 11.51 m on November 02, 2010 @ 11:40 - Reference Point: Top of Casing
Top of Liner assumed to be 5% of 'non-cased' interval.

** Water-Level Measurements are measured from reference point listed.*
NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by hydrogeological consultants ltd. (HCL) (http://www.hcl.ca) on behalf of Lac Ste. Anne County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: December 02, 2010 13:00 — http://www.tgwc.ca

Owner: *1531486 Alberta Ltd.*
11610 - 151 Street, Edmonton, AB T5M 4E9
Contractor: *Lakeland Drilling Ltd.*
Well Name: *Piezometer No. 4-10*

Field Survey: *November 03, 2010 - Confirmed - Physically*

METRIC REPORT

Easting (m):	*41144* **	*84/89*
Northing (m):	*5939332* **	
Elevation (m):	*778* ***	

Google Earth

10-33-053-03 W5M

M40478.487465

Work Type: *Piezometer*
Drilling Method: *Drilled*
Proposed Use: *Monitoring*
Completion Type: *Screen*

Date Started: *October 21, 2010*
Date Completed: *October 21, 2010*
Well Status: *Observation*

Elog Taken: *No*
Gamma Taken: *No*
Stick Up (m): *0.6*
Flowing: *No*

General Details

Depth Completed (m): *17.1*
Depth Drilled (m): *18.3*

Top of Bedrock (m): *17.1* *
Completion Interval (m): *15.9 — 17.1* *

Completion Details

Surface Casing: *PVC — 88.9 mm (O.D.) x 5.49 mm (thick) x 15.85 m (bottom)*

Screen Material: *PVC — 77.9 mm (I.D.)*

Intervals

Completion Interval: *Screen: 14.0 to 17.1 m - 20 slot*

Construction Interval: *Bentonite: 0.0 to 13.4 m*
Construction Interval: *Sand Pack: 13.4 to 18.3 m*

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (mte ipm)
764.0	*14.0*	*Clay*
761.0	*17.1*	*Gravel*
759.7	*18.3*	*Shale*

Chemistry Summary Details (mg/L, except as noted)

(most recent first)

General Comments / Observations

[Piezometer was developed for 50 minutes at eight litres per minute on October 21, 2010.
Piezometer surveyed (xyz) Nov 25, 2010 by Altus Geomatics.]

Most Recent Water Level (m): *11.64 m — November 25, 2010*

Oil Present: *No*
Gas Present: *No*

Water Used For Drilling

Aquifer Tests

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective	
— Used as Observation Water Well During Aquifer Test No. 2 with M40471 556500 —															R C

Alias IDs

** TGWC calculated or determined value*
*** 84 - Surveyed (other) — 10TM NAD83*
**** 89 - Ground Survey — [Ground, AMSL]*

This report was generated on: December 02, 2010 — Data "AS IS"; no warranty either expressed or implied. [53.62257 -114.37768 (WGS 84)], INT

Piezometer No. 5-10

(Mike's 6-10)

15-33-053-03 W5M

(M40478.679459)

Well Spatial Location:

Easting: ***40,840***
Northing: ***5,939,582***
::*(spatial accuracy Surveyed (other) — 10TM NAD83)*

Ground Elevation AMSL (m): ***777***
::*(elevation accuracy Ground Survey)*

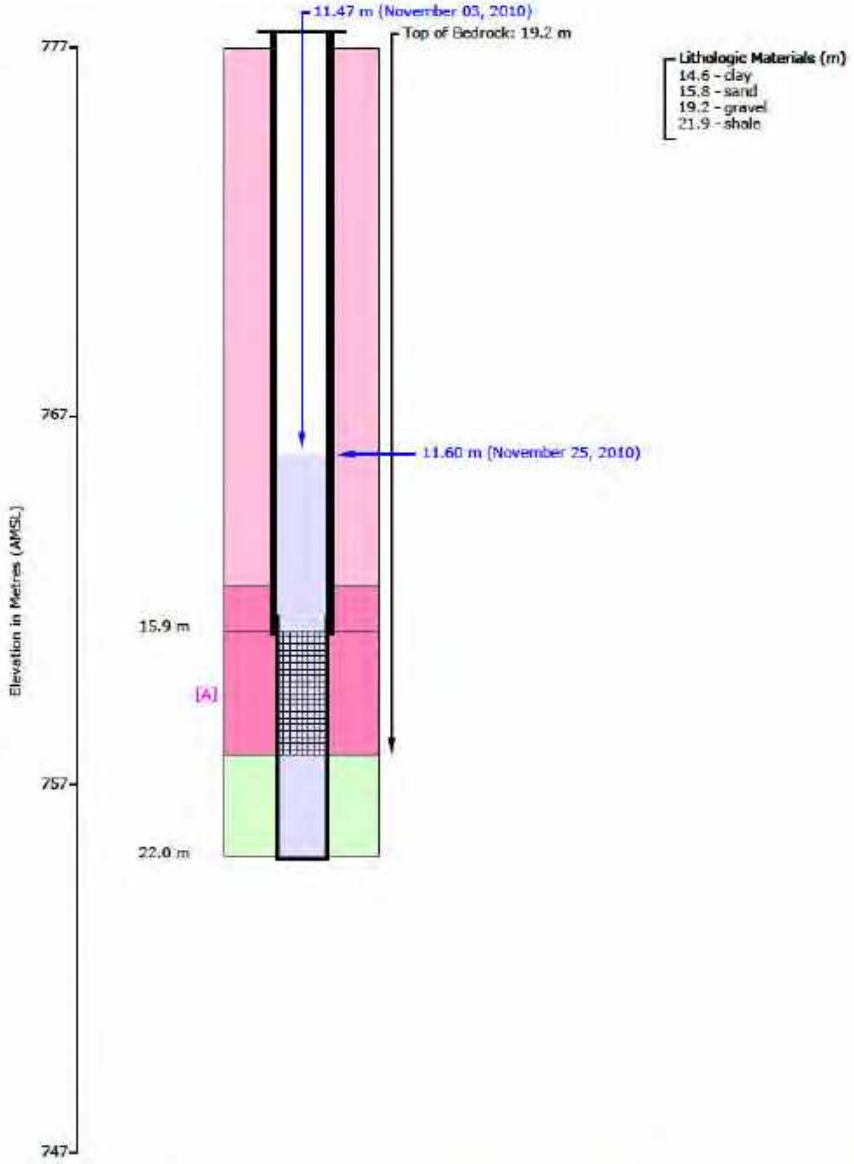
Date Completed: ***October 22, 2010***

Depth Drilled (m): ***21.9***

Completion Interval (m): ***15.9 — 19.2 ****
::*(* TGWC determined value)*

Most Recent Water Level (m): ***11.60 — November 25, 2010***
Earliest Water Level (m): ***11.47 — November 03, 2010***

Piezometer No. 5-10
Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained
Bedrock: Fine Grained; Coarse Grained
Other

Geologic Unit Legend (Top) - Regional Analysis

Geologic Unit Details not available for this location

Summary

TGWC ID: M40478.679459
Well Name: Piezometer No. 5-10
Legal Location: 15-33-053-03 W5M
Casing (OD): 88.9 mm; PVC (3.5")
Liner (OD): 77.9 mm; PVC (3.1")
Casing Stick-Up: 0.57 m (not drawn to scale)
Interval [A]: 15.9 to 19.2 m; Screened
Water Level (recent): 11.60 m on November 25, 2010 @ 10:50
Water Level (oldest): 11.47 m on November 03, 2010 @ 10:00
Top of Liner assumed to be 5% of 'non-cased' interval.

NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by hydrogeological consultants ltd. (HCL) (http://www.hcl.ca) on behalf of Lac Ste. Anne County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: December 02, 2010 15:07 --- http://www.tgwc.ca

Owner: *1531486 Alberta Ltd.*
11610 - 151 Street, Edmonton, AB T5M 4E9
Contractor: *Lehoiand Drilling Ltd.*
Well Name: *Piezometer No. 5-10*

Field Survey: *November 03, 2010 - Confirmed - Physically*

METRIC REPORT

Easting (m):	408840 **	84/89
Northing (m):	5939583 **	
Elevation (m):	777 ***	

Google Earth

15-33-053-03 W5M

M40478.679459

190445-1

Work Type: *Piezometer*
Drilling Method: *Drilled*
Proposed Use: *Monitoring*
Completion Type: *Screen*
Date Started: *October 22, 2010*
Date Completed: *October 22, 2010*
Well Status: *Observation*

Elog Taken: *No*
Gamma Taken: *No*
Stick Up (m): *0.6*
Flowing: *No*

General Details

Depth Completed (m): *19.2*
Depth Drilled (m): *21.9*
Top of Bedrock (m): *19.2 **
Completion Interval (m): *15.9 — 19.2 **

Completion Details

Surface Casing: *PVC — 88.9 mm (O.D.) x 5.49 mm (thick) x 15.85 m (bottom)*

Screen Material: *PVC — 77.9 mm (I.D.)*

Intervals

Completion Interval: *Screen: 15.9 to 19.2 m - 20 slot*

Construction Interval: *Bentonite: 0.0 to 15.2 m*
Construction Interval: *Sand Pack: 15.2 to 19.8 m*
Construction Interval: *Cuttings: 19.8 to 21.9 m*

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (mte ipm)
762.3	14.6	Clay
761.0	15.8	Sand
757.7	19.2	Gravel
754.9	21.9	Shale

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: *November 03, 2010 (15.9 to 19.2 m)*
Analysis Details: *November 09, 2010 - Exova (772761-1)*

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	908	Nitrate as N:	< 0.01	Colour (TCU):	> 60
TDS (Calculated):	558	Nitrite as N:	< 0.005	Turbidity (NTU):	27.1
Hardness (as CaCO3):	413	pH (pH Unit):	7.5	Fluoride:	0.14
T-Alkalinity (as CaCO3):	490	Ion Balance (%):	93	Carbonate:	< 6
P-Alkalinity (as CaCO3):	< 5	Total Coliforms**:		Bicarbonate:	597
Nitrate + Nitrite as N:	< 0.01	Fecal Coliforms**:		Hydroxide:	< 5
Total Suspended Solids:	24	Escherichia coli**:		Total Iron:	
Sulfate Reducing Bacteria*:				Total Mn:	
Iron Related Bacteria*:				Temperature (°C):	19.1

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:		118	Mercury:		< 0.0001
Chloride:		1.2	Molybdenum:		0.002
Iron:		2.41	Magnesium:		28.7
Manganese:		0.832	Sodium:		47.4
Aluminum:		< 0.002	Potassium:		3.9
Arsenic:		0.0112	Vanadium:		0.0069
Barium:		0.08	Strontium:		0.704
Beryllium:		< 0.0001	Nickel:		0.0031
Cadmium:		0.00003	Zinc:		0.018
Chromium:		0.0028	Copper:		0.004
Cobalt:		0.0022	Lead:		0.0003
Sulfate:		64.3			

Extractable - unfiltered
Dissolved - filtered

(1 / 1)

Comments: *Sample collected by Maxi-Tech Ltd.*

note: constituents have been compared to the maximum acceptable concentration, as stated in the Summary of Guidelines for Canadian Drinking Water Quality (Federal–Provincial–Territorial Committee on Drinking Water, May 2008)

General Comments / Observations

[Piezometer was developed for 15 minutes at 14 litres per minute on October 22, 2010.
Piezometer surveyed (xyz) Nov 25, 2010 by Altus Geomatics.]

Most Recent Water Level (m): *11.60 m — November 25, 2010*

Oil Present: *No*
Gas Present: *No*

Water Used For Drilling

Aquifer Tests

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective	
1	2010-11-03 10:00	Pump	120.0	120.0	20.9	11.47	5.75	17.22	21.30	10.8		6.5	13.9	13.9	R C
		— Used as Observation Water Well During Aquifer Test No. 2 with M40471.336580 —													R C

Alias IDs

* TGWC calculated or determined value
** 84 - Surveyed (other) — 10TM NAD83
*** 89 - Ground Survey — (Ground, AMSL)

This report was generated on: December 02, 2010 — Data "AS IS"; no warranty either expressed or implied. [53.62485 -114.38224 (WGS 84)], INT

Piezometer No. 5-10
Chemical Analysis (Nov 3, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 438-0398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project ID:	10-505	Lot ID:	**772761**
Report To:	Hydrogeological Consultants	Name:	Groundwater Review	Control Number:	Z-168794
	17740 - 118 Avenue	Location:	Lac Ste. Anne Area	Date Received:	Nov 4, 2010
	Edmonton, AB, Canada	LSD:	Parts Of Sections 28 And 32 To	Date Reported:	Nov 9, 2010
	T5S 2W3	P.O.:	14174	Report Number:	1381396
Attn:	Tara Parker	Acct code:			
Sampled By:					
Company:	Mow Tech Ltd.				

Reference Number	772761-1
Sample Date	November 03, 2010
Sample Time	11:30
Sample Location	
Sample Description	M40478.679459 (Piezometer No. 5-10) / 8.0°C
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Dissolved						
Silicon	Dissolved	mg/L	7.16	0.05		
Sulfur	Dissolved	mg/L	21.4	0.3		
Mercury	Dissolved	mg/L	<0.0001	0.0001		Below MAC
Aluminum	Dissolved	mg/L	<0.002	0.002	0.1	Below OG
Antimony	Dissolved	mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Dissolved	mg/L	0.0112	0.0002	0.01	Above MAC
Barium	Dissolved	mg/L	0.080	0.001	1	Below MAC
Beryllium	Dissolved	mg/L	<0.0001	0.0001		
Bismuth	Dissolved	mg/L	<0.0005	0.0005		
Boron	Dissolved	mg/L	0.164	0.002	5	Below MAC
Cadmium	Dissolved	mg/L	0.00003	0.00001	0.005	Below MAC
Chromium	Dissolved	mg/L	0.0028	0.0005	0.05	Below MAC
Cobalt	Dissolved	mg/L	0.0022	0.0001		
Copper	Dissolved	mg/L	0.004	0.001	1	Below AO
Lead	Dissolved	mg/L	0.0003	0.0001	0.01	Below MAC
Lithium	Dissolved	mg/L	0.030	0.001		
Molybdenum	Dissolved	mg/L	0.002	0.001		
Nickel	Dissolved	mg/L	0.0031	0.0005		
Selenium	Dissolved	mg/L	<0.0002	0.0002	0.01	Below MAC
Silver	Dissolved	mg/L	<0.00001	0.00001		
Strontium	Dissolved	mg/L	0.704	0.001		
Thallium	Dissolved	mg/L	<0.00005	0.00005		
Tin	Dissolved	mg/L	<0.001	0.001		
Titanium	Dissolved	mg/L	0.0015	0.0005		
Uranium	Dissolved	mg/L	<0.0005	0.0005	0.02	Below MAC
Vanadium	Dissolved	mg/L	0.0069	0.0001		
Zinc	Dissolved	mg/L	0.018	0.001	5	Below AO
Subsample	Field Filtered		Field Filtered			
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	>60	5	15	Above AO
Turbidity		NTU	27.1	0.1	0.1	Above OG
Solids	Total Suspended	mg/L	24	1		
Routine Water						
pH			7.50		6.5 - 8.5	Within AO
Temperature of observed pH		°C	19.1			

Terms and Conditions: www.exova.ca/terms&conditions

Piezometer No. 5-10
Chemical Analysis (Nov 3, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada
T: +1 (780) 438-5522
F: +1 (780) 438-0398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project ID:	10-505	Lot ID:	**772761**
Report To:	Hydrogeological Consultants	Name:	Groundwater Review	Control Number:	Z-168794
	17740 - 118 Avenue	Location:	Lac Ste. Anne Area	Date Received:	Nov 4, 2010
	Edmonton, AB, Canada	LSD:	Parts Of Sections 28 And 32 To	Date Reported:	Nov 9, 2010
	T5S 2W3	P.O.:	14174	Report Number:	1381396
Attn:	Tara Parker	Acct code:			
Sampled By:					
Company:	Mow Tech Ltd.				

Reference Number	772761-1
Sample Date	November 03, 2010
Sample Time	11:30
Sample Location	
Sample Description	M40478.679459 (Piezometer No. 5-10) / 8.0°C
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Electrical Conductivity		µS/cm at 25 C	908	1		
Calcium	Dissolved	mg/L	118	0.2		
Magnesium	Dissolved	mg/L	28.7	0.2		
Sodium	Dissolved	mg/L	47.4	0.4	200	Below AO
Potassium	Dissolved	mg/L	3.9	0.4		
Iron	Dissolved	mg/L	2.41	0.01	0.3	Above AO
Manganese	Dissolved	mg/L	0.832	0.005	0.05	Above AO
Chloride	Dissolved	mg/L	1.2	0.4	250	Below AO
Fluoride		mg/L	0.14	0.05	1.5	Below MAC
Nitrate - N		mg/L	<0.01	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	<0.01	0.01	10	Below MAC
Sulfate (SO4)	Dissolved	mg/L	64.3	0.9	500	Below AO
Hydroxide		mg/L	<5	5		
Carbonate		mg/L	<6	6		
Bicarbonate		mg/L	597	5		
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	490	5		
Total Dissolved Solids	Calculated	mg/L	558	1	500	Above AO
Hardness	Dissolved as CaCO3	mg/L	413			
Ionic Balance	Dissolved	%	93			

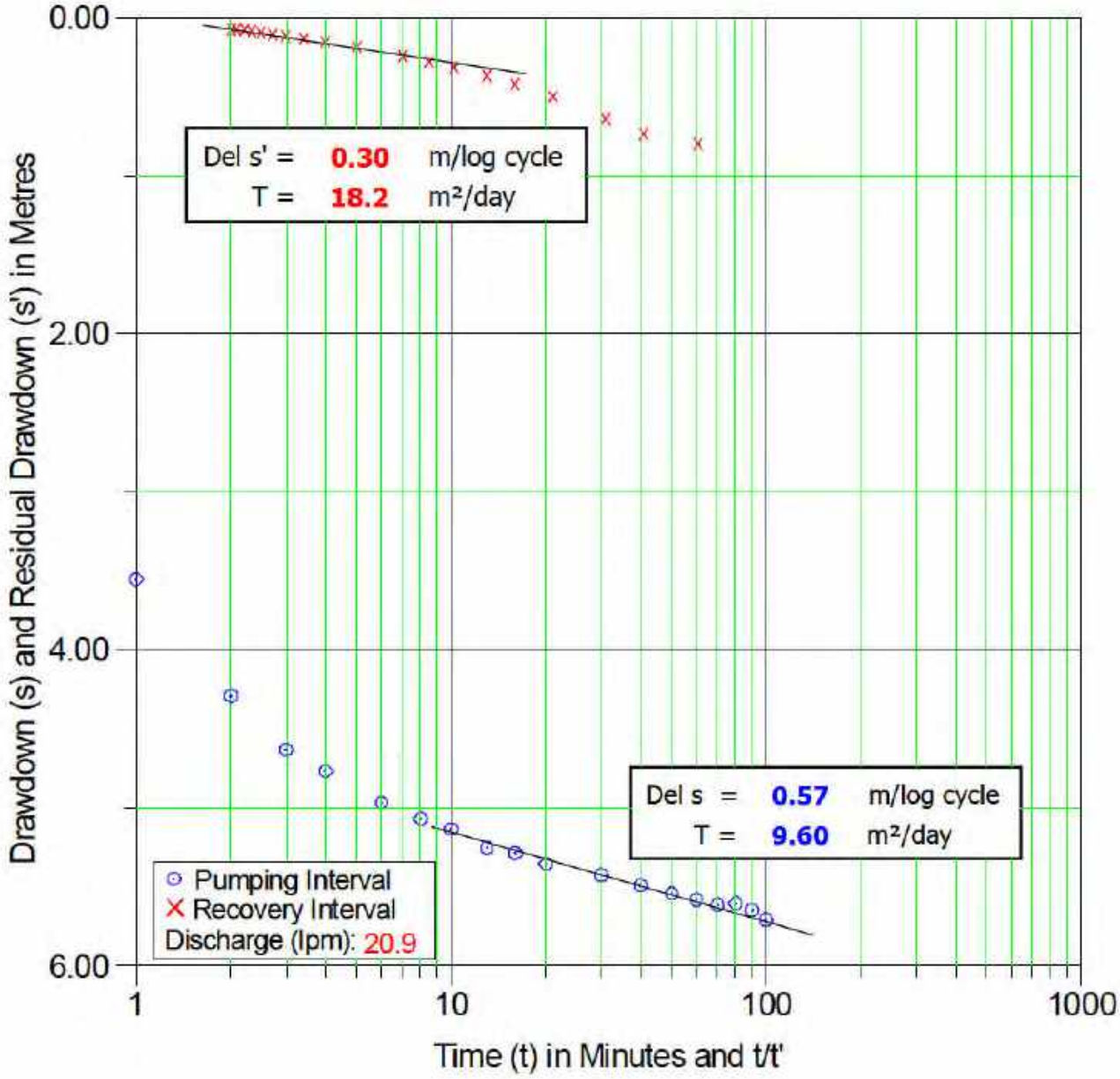
This information redacted as per Protection of Privacy Act (POPA)

Approved by:

Randy Neumann, BSc
General Manager

Terms and Conditions: www.exova.ca/terms&conditions

Piezometer No. 5-10
Aquifer Test I



Aquifer Test I

Piezometer No. 5-10

(formerly Mike's 6-10)

15-33-053-03 W5M

Average Discharge (lpm):	**20.9**	Pre-Test Water Level - NPWL (m):	**11.47**
Date Test Started:	**November 03, 2010**	Depth to Pump Intake (m):	**21.3**
Time Test Started (hours):	**10:00**	Test Interval - Top (m):	**15.9**
Pumping Interval (minutes):	**120**	Test Interval - Bottom (m):	**19.2**
Recovery Interval (minutes):	**120**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*

Reference: M40478.679459 (AT 1)

** TGWC calculated or determined value*

This report was generated on: December 02, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)	Discharge (Lpm)
1	3.55	20.1
2	4.29	20.1
3	4.63	20.1
4	4.77	20.1
6	4.97	20.1
8	5.07	20.1
10	5.13	20.1
13	5.25	20.1
16	5.29	20.1
20	5.35	21.0
30	5.42	21.0
40	5.49	21.0
50	5.54	20.9
60	5.58	21.0
80	5.60	21.0
100	5.71	20.9
120	5.75	21.0

Recovery Interval

Measurement Point: Top of Casing

Time (t') Since Pumping Stopped (minutes)	(t/t')	Residual Drawdown (s') (metre)
2	61	0.80
3	41	0.74
4	31	0.64
6	21	0.50
8	16.0	0.42
10	13.0	0.37
13	10.2	0.31
16	8.5	0.28
20	7.0	0.24
30	5.0	0.18
40	4.0	0.15
50	3.4	0.13
60	3.0	0.11
80	2.5	0.09
100	2.2	0.07
120	2.0	0.07

Test Comments:

Test conducted by Mow-Tech Ltd. CR-10 data-logger measurements. Flow rate was measured using a turbine flow meter.

Piezometer No. 6-10

(I1, Mike's 7-10)

15-33-053-03 W3M

(M40480.579648)

Well Spatial Location:

Easting: ***41,197***
Northing: ***5,939,975***
::(spatial accuracy Surveyed (other) — 10TM NAD83)

Ground Elevation AMSL (m): ***773***
::(elevation accuracy Ground Survey)

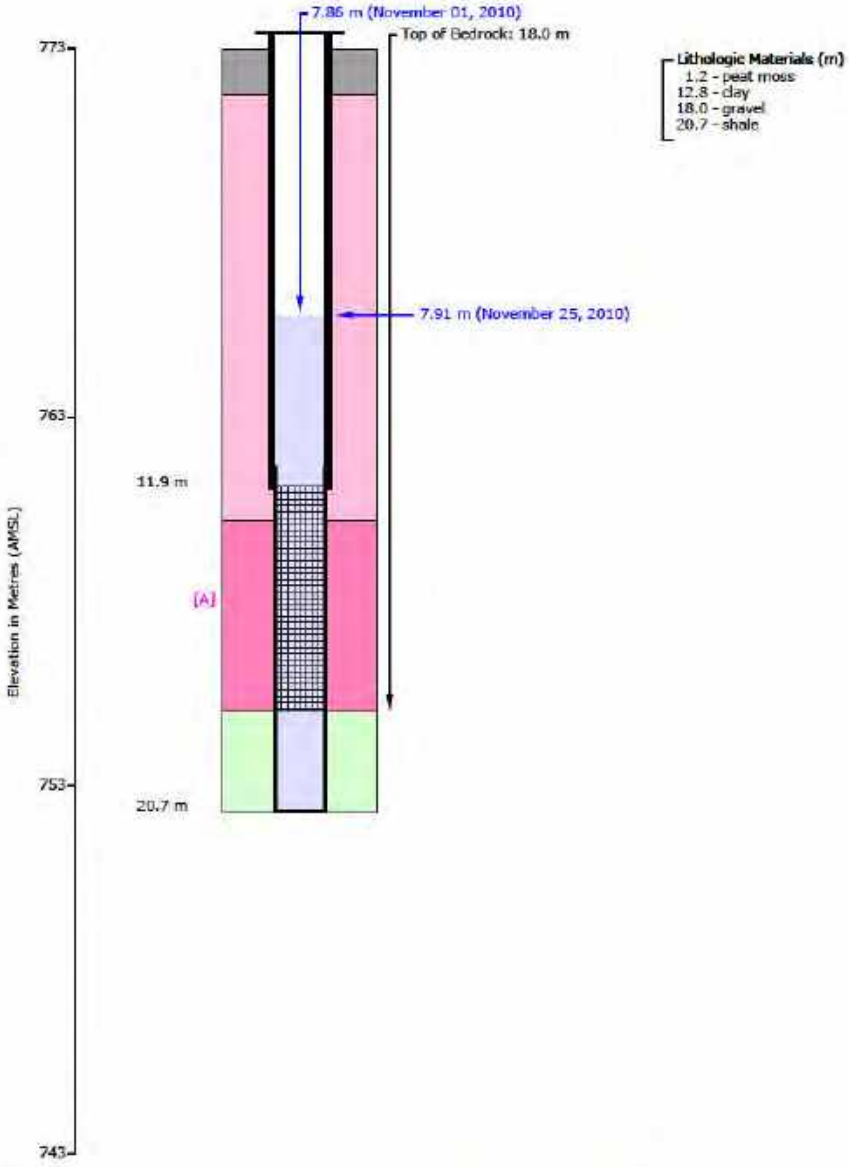
Date Completed: ***October 28, 2010***

Depth Drilled (m): ***20.7***

Completion Interval (m): ***11.9 — 18.0 ****
::(TGWC determined value)*

Most Recent Water Level (m): ***7.91 — November 25, 2010***
Earliest Water Level (m): ***7.86 — November 01, 2010***

Piezometer No. 6-10
Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained
Bedrock: Fine Grained; Coarse Grained
Other

Geologic Unit Legend (Top) - Regional Analysis

Geologic Unit Details not available for this location

Summary

TGWC ID: M40480.579648
Well Name: Piezometer No. 6-10
Legal Location: 15-33-053-03 W5M
Casing (OD): 88.9 mm; PVC (3.5")
Liner (OD): 77.9 mm; PVC (3.1")
Casing Stick-Up: 0.68 m (not drawn to scale)
Interval [A]: 11.9 to 18.0 m; Screened
Water Level (recent): 7.91 m on November 25, 2010 @ 10:14
Water Level (oldest): 7.86 m on November 01, 2010 @ 12:50
Top of Liner assumed to be 5% of 'non-cased' interval.

Drawn: December 02, 2010 15:20 --- http://www.tgwc.ca

Owner: *1531486 Alberta Ltd.*
11610 - 151 Street, Edmonton, AB T5M 4E9
Contractor: *Summers Drilling Ltd.*
Well Name: *Piezometer No. 6-10*

Field Survey: *November 01, 2010 - Confirmed - Physically*

METRIC REPORT

Easting (m):	*41197* **	*84/69*
Northing (m):	*5939975* **	
Elevation (m):	*773* ***	

15-33-053-03 W3M

M40480.579648

190413-1

Work Type: *Piezometer*
Drilling Method: *Drilled*
Proposed Use: *Observation*
Completion Type: *Screen*
Date Started: *October 28, 2010*
Date Completed: *October 29, 2010*
Well Status: *Observation*

Elog Taken: *No*
Gamma Taken: *No*
Stick Up (m): *0.7*
Flowing: *No*

General Details

Depth Completed (m): *18.0*
Depth Drilled (m): *20.7*
Top of Bedrock (m): *18.0* *
Completion Interval (m): *11.9 — 18.0* *

Completion Details

Surface Casing: *PVC — 88.9 mm (O.D.) x 5.49 mm (thick) x 11.89 m (bottom)*

Screen Material: *PVC — 77.9 mm (I.D.)*

Intervals

Completion Interval: *Screen: 11.9 to 18.0 m - 20 slot*

Construction Interval: *Bentonite: 0.0 to 6.1 m*
Construction Interval: *Sand Pack: 6.1 to 20.7 m*

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (mte ipm)
771.7	*1.2*	*Peat Moss*
760.1	*12.8*	*Clay*
754.9	*18.0*	*Gravel*
752.2	*20.7*	*Shale*

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: *November 01, 2010*
Analysis Details: *November 05, 2010 - Exova (772310-1)*

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	*1140*	Nitrate as N:	*< 0.01*	Colour (TCU):	*> 60*
TDS (Calculated):	*747*	Nitrite as N:	*< 0.005*	Turbidity (NTU):	*25.4*
Hardness (as CaCO3):	*583*	pH (pH Unit):	*7.76*	Fluoride:	*0.17*
T-Alkalinity (as CaCO3):	*566*	Ion Balance (%):	*93*	Carbonate:	*< 6*
P-Alkalinity (as CaCO3):	*< 5*	Total Coliforms**:		Bicarbonate:	*690*
Nitrate + Nitrite as N:	*< 0.01*	Fecal Coliforms**:		Hydroxide:	*< 5*
Total Suspended Solids:	*5*	Escherichia coli**:		Total Iron:	
Sulfate Reducing Bacteria*:				Total Mn:	
Iron Related Bacteria*:				Temperature (°C):	*20.7*

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	*161*	*160*	Mercury:		
Chloride:		*< 0.4*	Molybdenum:		*0.002*
Iron:	*6.77*	*2.08*	Magnesium:	*44.2*	*45*
Manganese:	*0.802*	*0.799*	Sodium:	*40.8*	*42*
Aluminum:		*< 0.002*	Potassium:	*4.8*	*5*
Arsenic:		*0.0162*	Vanadium:		*0.0064*
Barium:		*0.043*	Strontium:		*0.961*
Beryllium:		*< 0.0001*	Nickel:		*0.0088*
Cadmium:		*0.00002*	Zinc:		*0.006*
Chromium:		*0.0019*	Copper:		*0.001*
Cobalt:		*0.0016*	Lead:		*< 0.0001*
Sulfate:	*157*				

Extractable - unfiltered
Dissolved - filtered

(1 / 1)

Comments: *Sample collected by Mow-Tech Ltd.*

note: constituents have been compared to the maximum acceptable concentration, as stated in the Summary of Guidelines for Canadian Drinking Water Quality (Federal–Provincial–Territorial Committee on Drinking Water, May 2008)

General Comments / Observations

[Piezometer was developed for 25 minutes at 40 litres per minute on October 28, 2010.
Piezometer surveyed (xyz) Nov 25, 2010 by Altus Geomatics.]

Most Recent Water Level (m): *7.91 m — November 25, 2010*

Oil Present: *No*
Gas Present: *No*

Water Used For Drilling

Aquifer Tests

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective	
1	*2010-11-01 12:50*	*Pump*	*120.0*	*120.0*	*37.9*	*7.86*	*6.69*	*14.55*	*—*	*15.9*		*10.5*	*6.4*	*6.4*	R C
		— Used as Observation Water Well During Aquifer Test No. 2 with M40471.536580 —													R C

Alias IDs

* *TGWC calculated or determined value*
** *84 - Surveyed (other) — 10TM NAD83*
*** *69 - Ground Survey — (Ground, AMSL)*

This report was generated on: December 02, 2010 — Data "AS IS"; no warranty either expressed or implied. [53.40860 -111.56674 (WGS 84)], INT

Piezometer No. 6-10
Chemical Analysis (Nov 1, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada
T: +1 (780) 438-5522
F: +1 (780) 438-5398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project		Lot ID:	**772310**
Report To:	Hydrogeological Consultants	ID:	10-505	Control Number:	Z-328968
	17740 - 118 Avenue	Name:	Groundwater Review	Date Received:	Nov 2, 2010
	Edmonton, AB, Canada	Location:	Lac Ste. Anne Area	Date Reported:	Nov 8, 2010
	T5S 2W3	LSD:	Parts of Section 28 and 32 to 34	Report Number:	1380123
Attn:	Tara Parker	P.O.:	14170		
Sampled By:	Mow-Tech Ltd.	Acct code:			
Company:					

Reference Number	772310-1
Sample Date	November 01, 2010
Sample Time	14:30
Sample Location	
Sample Description	M40480.579648 (Piez No. 6-10 or WTH-I) / 8.8°C / 15-33-053-03 W3M
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Dissolved						
Silicon	Dissolved	mg/L	7.11	0.05		
Sulfur	Dissolved	mg/L	54.7	0.3		
Aluminum	Dissolved	mg/L	<0.002	0.002	0.1	Below OG
Antimony	Dissolved	mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Dissolved	mg/L	0.0162	0.0002	0.01	Above MAC
Barium	Dissolved	mg/L	0.043	0.001	1	Below MAC
Beryllium	Dissolved	mg/L	<0.0001	0.0001		
Bismuth	Dissolved	mg/L	0.0009	0.0005		
Boron	Dissolved	mg/L	0.216	0.002	5	Below MAC
Cadmium	Dissolved	mg/L	0.00002	0.00001	0.005	Below MAC
Chromium	Dissolved	mg/L	0.0019	0.0005	0.05	Below MAC
Cobalt	Dissolved	mg/L	0.0018	0.0001		
Copper	Dissolved	mg/L	0.001	0.001	1	Below AO
Lead	Dissolved	mg/L	<0.0001	0.0001	0.01	Below MAC
Lithium	Dissolved	mg/L	0.071	0.001		
Molybdenum	Dissolved	mg/L	0.002	0.001		
Nickel	Dissolved	mg/L	0.0088	0.0005		
Selenium	Dissolved	mg/L	0.0005	0.0002	0.01	Below MAC
Silver	Dissolved	mg/L	<0.00001	0.00001		
Strontium	Dissolved	mg/L	0.961	0.001		
Thallium	Dissolved	mg/L	<0.00005	0.00005		
Tin	Dissolved	mg/L	<0.001	0.001		
Titanium	Dissolved	mg/L	0.0034	0.0005		
Uranium	Dissolved	mg/L	0.0022	0.0005	0.02	Below MAC
Vanadium	Dissolved	mg/L	0.0064	0.0001		
Zinc	Dissolved	mg/L	0.006	0.001	5	Below AO
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	>60	5	15	Above AO
Turbidity		NTU	25.4	0.1	0.1	Above OG
Solids	Total Suspended	mg/L	5	1		
Routine Water						
pH			7.76		6.5 - 8.5	Within AO
Temperature of observed pH		°C	20.7			
Electrical Conductivity		µS/cm at 25 C	1140	1		
Calcium	Dissolved	mg/L	160	0.2		

Terms and Conditions: www.exova.ca/terms&conditions

Piezometer No. 6-10
Chemical Analysis (Nov 1, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 438-0398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project ID:	10-505	Lot ID:	**772310**
Report To:	Hydrogeological Consultants	Name:	Groundwater Review	Control Number:	Z-328968
	17740 - 118 Avenue	Location:	Lac Ste. Anne Area	Date Received:	Nov 2, 2010
	Edmonton, AB, Canada	LSD:	Parts of Section 28 and 32 to 34	Date Reported:	Nov 8, 2010
	T5S 2W3	P.O.:	14170	Report Number:	1380123
Attn:	Tara Parker	Acct code:			
Sampled By:	Mow-Tech Ltd.				
Company:					

Reference Number	772310-1
Sample Date	November 01, 2010
Sample Time	14:30
Sample Location	
Sample Description	M40480.579648 (Piez No. 6-10 or WTH-I) / 8.8°C / 15-33-053-03 W3M
Sample Matrix	Water

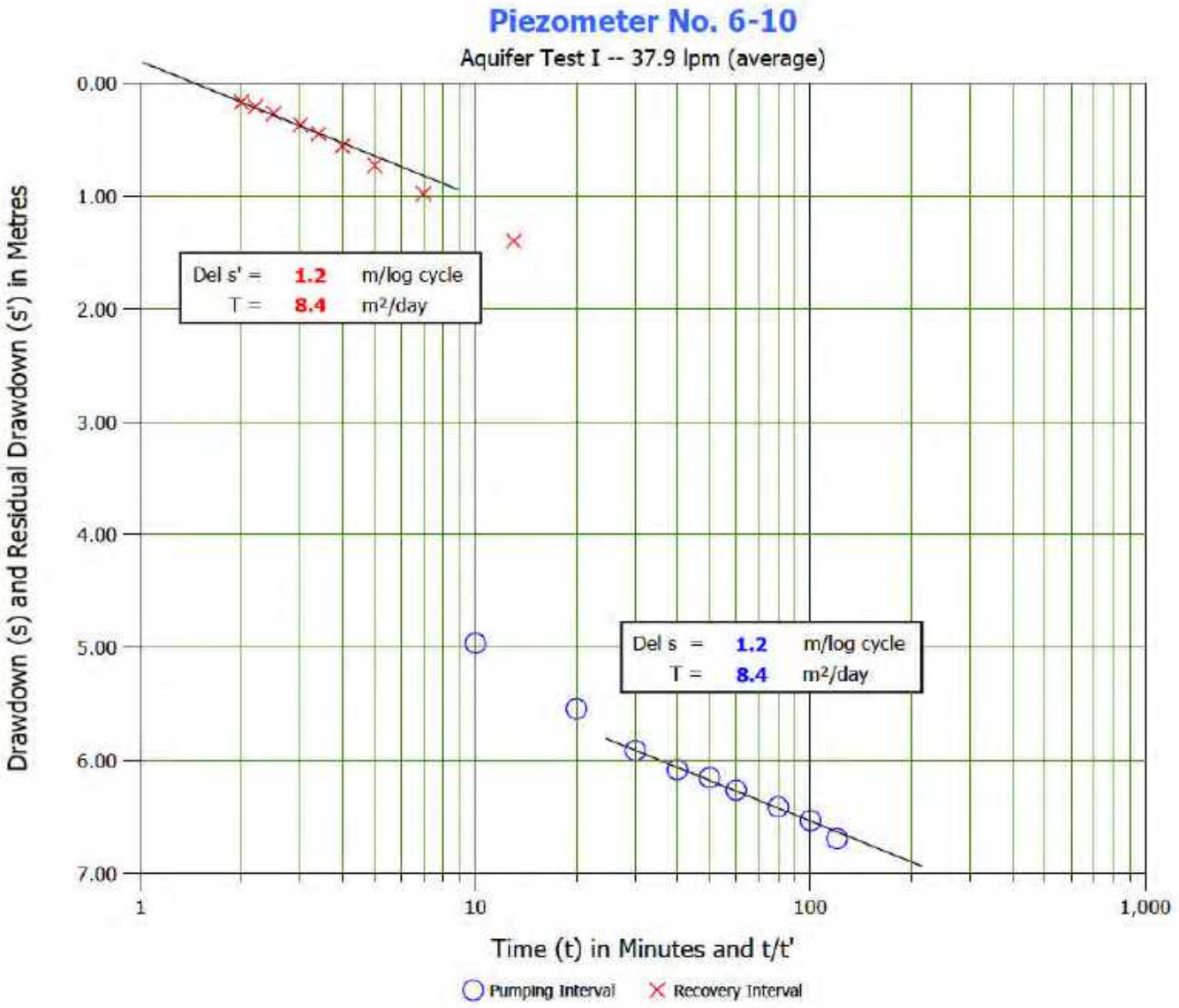
Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Calcium	Extractable	mg/L	161	0.2		
Magnesium	Dissolved	mg/L	45.0	0.2		
Magnesium	Extractable	mg/L	44.2	0.2		
Sodium	Dissolved	mg/L	42.0	0.4	200	Below AO
Sodium	Extractable	mg/L	40.8	0.4	200	Below AO
Potassium	Dissolved	mg/L	5.0	0.4		
Potassium	Extractable	mg/L	4.8	0.4		
Iron	Dissolved	mg/L	2.08	0.01	0.3	Above AO
Iron	Extractable	mg/L	6.77	0.01	0.3	Above AO
Manganese	Dissolved	mg/L	0.799	0.005	0.05	Above AO
Manganese	Extractable	mg/L	0.802	0.005	0.05	Above AO
Chloride	Dissolved	mg/L	<0.4	0.4	250	Below AO
Fluoride		mg/L	0.17	0.05	1.5	Below MAC
Nitrate - N		mg/L	<0.01	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	<0.01	0.01	10	Below MAC
Sulfate (SO4)		mg/L	157	0.9	500	Below AO
Hydroxide		mg/L	<5	5		
Carbonate		mg/L	<6	6		
Bicarbonate		mg/L	690	5		
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	566	5		
Total Dissolved Solids		mg/L	747	1	500	Above AO
Hardness	as CaCO3	mg/L	583			
Ionic Balance		%	93			

This information redacted as per Protection of Privacy

Approved by:
Randy Neumann, BSc
General Manager

Terms and Conditions: www.exova.ca/terms&conditions

Piezometer No. 6-10
Aquifer Test I



Aquifer Test I

Piezometer No. 6-10

(formerly I1, Mike's 7-10)

15-33-053-03 W3M

Average Discharge (lpm):	**37.9**	Pre-Test Water Level - NPWL (m):	**7.86**
Date Test Started:	**November 01, 2010**	Depth to Pump Intake (m):	**N/A**
Time Test Started (hours):	**12:50**	Test Interval - Top (m):	**11.9**
Pumping Interval (minutes):	**120**	Test Interval - Bottom (m):	**18.0**
Recovery Interval (minutes):	**120**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*

Reference: M40480.579648 (AT 1)

** TGWC calculated or determined value.*

This report was generated on: December 02, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)	Discharge (Lpm)
10	4.96	38.5
20	5.54	36.4
30	5.91	38.1
40	6.08	38.3
50	6.15	38.1
60	6.26	37.8
80	6.41	38.0
100	6.53	37.9
120	6.69	37.9

Recovery Interval

Measurement Point: Top of Casing

Time (t') Since Pumping Stopped (minutes)	(t/t')	Residual Drawdown (s') (metre)
10	13.0	1.40
20	7.0	0.98
30	5.0	0.73
40	4.0	0.56
50	3.4	0.45
60	3.0	0.37
80	2.5	0.27
100	2.2	0.21
120	2.0	0.17

Test Comments:

Aquifer test conducted by Mow-Tech Ltd. Data logger measurements.

1942 Astleford Stock Water Well

NE 28-053-03 W5M
(M37713.708345)

Well Spatial Location:

Easting: ***41,601***
Northing: ***5,938,032***
::(spatial accuracy MT GPS — 10TM NAD83)

Ground Elevation AMSL (m): ***779***
::(elevation accuracy MT DEM)

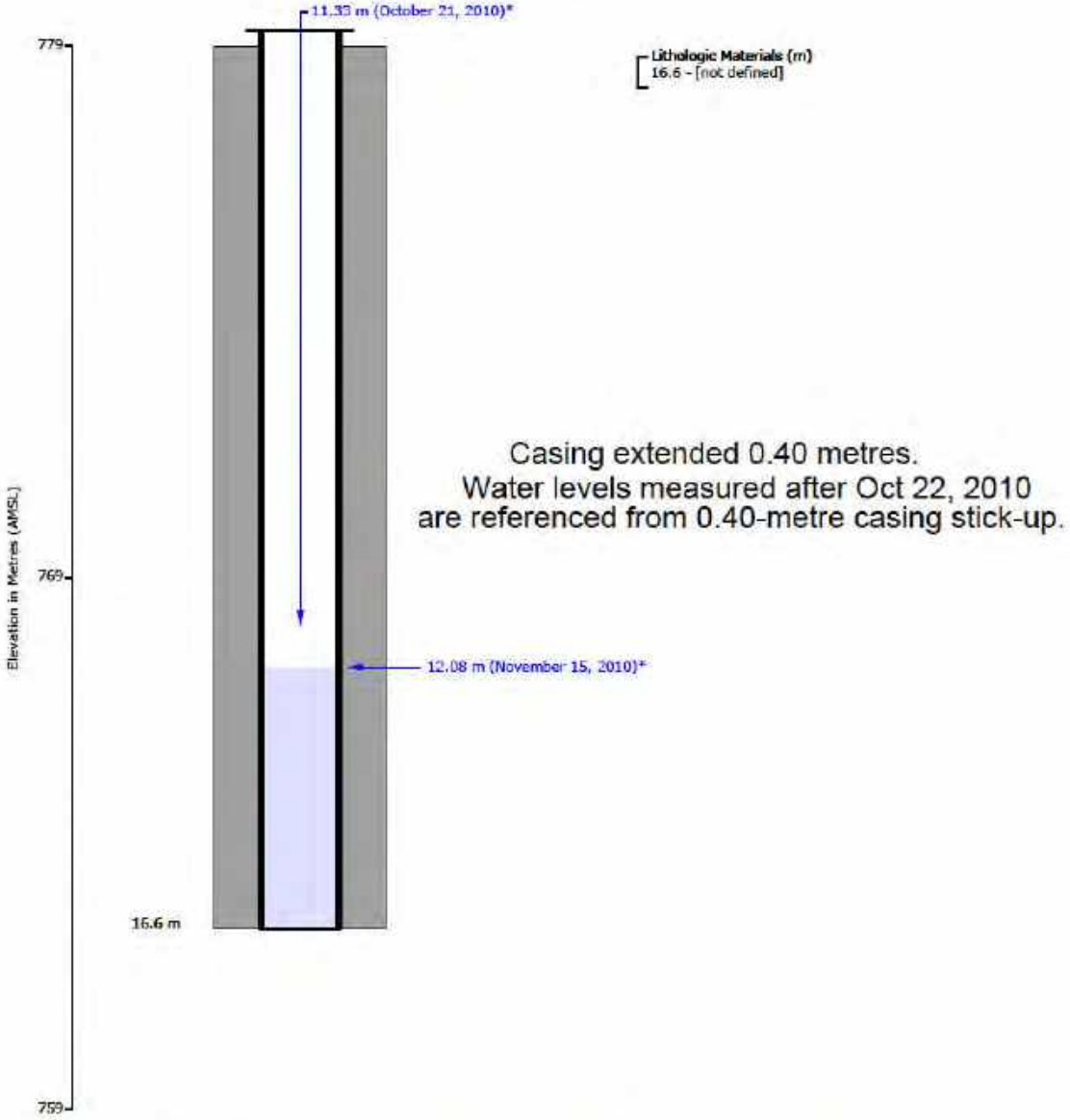
Date Completed: ***January 01, 1942***

Depth Drilled (m): ***16.6***

Completion Interval (m): ***Not Available***

Most Recent Water Level (m): ***12.08 — November 15, 2010***
Earliest Water Level (m): ***11.33 — October 21, 2010***

1942 Astleford Stock Water Well
Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained
Bedrock: Fine Grained; Coarse Grained
Other

Geologic Unit Legend (Top) - Regional Analysis

Geologic Unit Details not available for this location

Summary

TGWC ID: M37713.708345
Well Name: 1942 Astleford Stock Water Well
Legal Location: NE 28-053-03 W5M
Casing (OD): 127.0 mm; Steel (5.0")
Casing Stick-Up: 0.40 m (not drawn to scale)
*Water Level (recent): 12.08 m on November 15, 2010 @ 11:13 - Reference Point: Top of Casing
*Water Level (oldest): 11.33 m on October 21, 2010 @ 10:00 - Reference Point: Top of Casing

** Water-Level Measurements are measured from reference point listed.*
NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by hydrogeological consultants ltd. (HCL) (http://www.hcl.ca) on behalf of Parkland County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: December 02, 2010 15:29 --- http://www.tgwc.ca

Owner: *Astleford, George*
RR 2, Duffield, AB T0E 0N0
Contractor: *[unknown contractor]*
Well Name: *1942 Astleford Stock Water Well*

Field Survey: *March 14, 2003 - Confirmed - Physically*

METRIC REPORT

Easting (m): *41601.23* ** *75/60*
Northing (m): *5938032.51* **
Elevation (m): *779* ***
Google Earth

NE 28-053-03 W5M

M37713.708345

190398-2

Work Type: *Well Inventory*
Drilling Method: *Cable Tool*
Proposed Use: *Stock*
Completion Type: *Casing*
Date Started: *January 01, 1942*
Date Completed: *January 01, 1942*
Well Status: *Producing*
Feature Class: *Water Well*

Elog Taken: *No*
Gamma Taken: *No*
Stick Up (m): *0.4*
Flowing: *No*

General Details

Depth Drilled (m): *18.6*
Completion Aquifer: *Surficial **

Completion Details

Surface Casing: *Steel — 127.0 mm (O.D.) x 16.58 m (bottom)*

Pack: *[unknown]*

Intervals

Lithology Details

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: *October 21, 2010*
Analysis Details: *October 27, 2010 - Exova Canada Inc. (769933-4)*

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	878	Nitrate as N:	0.08	Colour (TCU):	16
TDS (Calculated):	524	Nitrite as N:	< 0.005	Turbidity (NTU):	7.9
Hardness (as CaCO3):	482	pH (pH Unit):	7.9	Fluoride:	0.24
T-Alkalinity (as CaCO3):	527	Ion Balance (%):	99	Carbonate:	< 6
P-Alkalinity (as CaCO3):	< 5	Total Coliforms**:	< 1	Bicarbonate:	643
Nitrate + Nitrite as N:	0.08	Fecal Coliforms**:	< 1	Hydroxide:	< 5
Total Suspended Solids:		Escherichia coli**:		Total Iron:	
Sulfate Reducing Bacteria*:				Total Mn:	
Iron Related Bacteria**:				Temperature (°C):	19.5

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	133	126	Mercury:		
Chloride:		1.7	Molybdenum:		< 0.001
Iron:	0.17		Magnesium:	36.4	35.8
Manganese:	0.623	0.589	Sodium:	21.6	20.5
Aluminum:		< 0.002	Potassium:	3.2	3.1
Arsenic:		0.0006	Vanadium:		0.0053
Barium:		0.299	Strontium:		0.518
Beryllium:		< 0.0001	Nickel:		0.0035
Cadmium:		0.00006	Zinc:		0.015
Chromium:		0.0017	Copper:		0.004
Cobalt:		0.001	Lead:		< 0.0001
Sulfate:	11				

Extractable - unfiltered
Dissolved - filtered

(1 / 2)

*MPN/mL
**CFU/mL

Comments: *Sample collected by Mow-Tech Ltd.*

note: constituents have been compared to the maximum acceptable concentration,Health Canada, 2010. Guidelines for Canadian Drinking Water Quality – Summary Table. Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

General Comments / Observations

[Water well is located in livestock area 50 metres northwest of house. Total depth of water well measured October 21, 2010 by Hydrogeological Consultants Ltd. (HCL).]
[Submersible pump installed in October 2010, casing extended 0.40 metres.]

Most Recent Water Level (m): *11.87 m — August 24, 2012*

Oil Present: *No*
Gas Present: *No*

Water Used For Drilling

Aquifer Tests

	Date & Time	Testing Method	Depth of Test Interval (metre)	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective	
2	2010-10-21 12:30	Pump	[unknown]	60.0	60.0	16.6	11.39	0.93	—			32.3	30.0	30.0	R C
1	2003-04-07 14:25	Pump	[unknown]	120.0		8.1	—	—	—						R

Alias IDs

* The Groundwater Centre (TGWC) calculated or determined value
** 75 - MT GPS — 10TM NAD83
*** 80 - MT DEM — [Ground, AMSL]

This report was generated on: November 07, 2012 — Data "AS IS"; no warranty either expressed or implied. [53.610847 -114.370941 (WGS 84)] INT

1942 Astleford Stock Water Well
Chemical Analysis (Oct 21, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada
T: +1 (780) 438-5522
F: +1 (780) 438-5398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project:		Lot ID:	**769933**
Report To:	Hydrogeological Consultants	ID:	10-505	Control Number:	Z-065679
	17740 - 118 Avenue	Name:	Groundwater Review	Date Received:	Oct 22, 2010
	Edmonton, AB, Canada	Location:	Lac Ste. Anne Area	Date Reported:	Oct 27, 2010
	T5S 2W3	LSD:	Parts of Sections 28 and 32 to 34	Report Number:	1373211
Attn:	Tara Parker	P.O.:	14091		
Sampled By:	Hydrogeological Consultants Ltd.	Acct code:			
Company:					

Reference Number	769933-4
Sample Date	October 21, 2010
Sample Time	13:30
Sample Location	
Sample Description	M37713.708345 (1942 Astleford Stock Water Well) / 6.1°C / NE 28-053-03
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Dissolved						
Silicon	Dissolved	mg/L	7.57	0.05		
Sulfur	Dissolved	mg/L	3.6	0.3		
Aluminum	Dissolved	mg/L	<0.002	0.002	0.1	Below OG
Antimony	Dissolved	mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Dissolved	mg/L	0.0006	0.0002	0.01	Below MAC
Barium	Dissolved	mg/L	0.299	0.001	1	Below MAC
Beryllium	Dissolved	mg/L	<0.0001	0.0001		
Bismuth	Dissolved	mg/L	<0.0005	0.0005		
Boron	Dissolved	mg/L	0.084	0.002	5	Below MAC
Cadmium	Dissolved	mg/L	0.00006	0.00001	0.005	Below MAC
Chromium	Dissolved	mg/L	0.0017	0.0005	0.05	Below MAC
Cobalt	Dissolved	mg/L	0.0010	0.0001		
Copper	Dissolved	mg/L	0.004	0.001	1	Below AO
Lead	Dissolved	mg/L	<0.0001	0.0001	0.01	Below MAC
Lithium	Dissolved	mg/L	0.046	0.001		
Molybdenum	Dissolved	mg/L	<0.001	0.001		
Nickel	Dissolved	mg/L	0.0035	0.0005		
Selenium	Dissolved	mg/L	<0.0002	0.0002	0.01	Below MAC
Silver	Dissolved	mg/L	<0.00001	0.00001		
Strontium	Dissolved	mg/L	0.518	0.001		
Thallium	Dissolved	mg/L	<0.00005	0.00005		
Tin	Dissolved	mg/L	<0.001	0.001		
Titanium	Dissolved	mg/L	<0.0005	0.0005		
Uranium	Dissolved	mg/L	0.0039	0.0005	0.02	Below MAC
Vanadium	Dissolved	mg/L	0.0053	0.0001		
Zinc	Dissolved	mg/L	0.015	0.001	5	Below AO
Microbiological Analysis						
Total Coliforms	Membrane Filtration	CFU/100 mL	<1	1	0	Below MAC
Fecal Coliforms	Membrane Filtration	CFU/100 mL	<1	1		
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	16	5	15	Above AO
Turbidity		NTU	7.9	0.1	0.1	Above OG
Routine Water						
pH			7.90		6.5 - 8.5	Within AO
Temperature of observed pH		°C	19.5			

Terms and Conditions: www.exova.ca/terms&conditions

1942 Astleford Stock Water Well
Chemical Analysis (Oct 21, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 438-0398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project ID:	10-505	Lot ID:	769933
Report To:	Hydrogeological Consultants	Name:	Groundwater Review	Control Number:	Z-065679
	17740 - 118 Avenue	Location:	Lac Ste. Anne Area	Date Received:	Oct 22, 2010
	Edmonton, AB, Canada	LSD:	Parts of Sections 28 and 32 to 34	Date Reported:	Oct 27, 2010
	T5S 2W3	P.O.:	14091	Report Number:	1373211
Attn:	Tara Parker				
Sampled By:	Hydrogeological Consultants Ltd.	Acct code:			
Company:					

Reference Number	769933-4
Sample Date	October 21, 2010
Sample Time	13:30
Sample Location	
Sample Description	M37713.708345 (1942 Astleford Stock Water Well) / 6.1°C / NE 28-053-03
Sample Matrix	Water

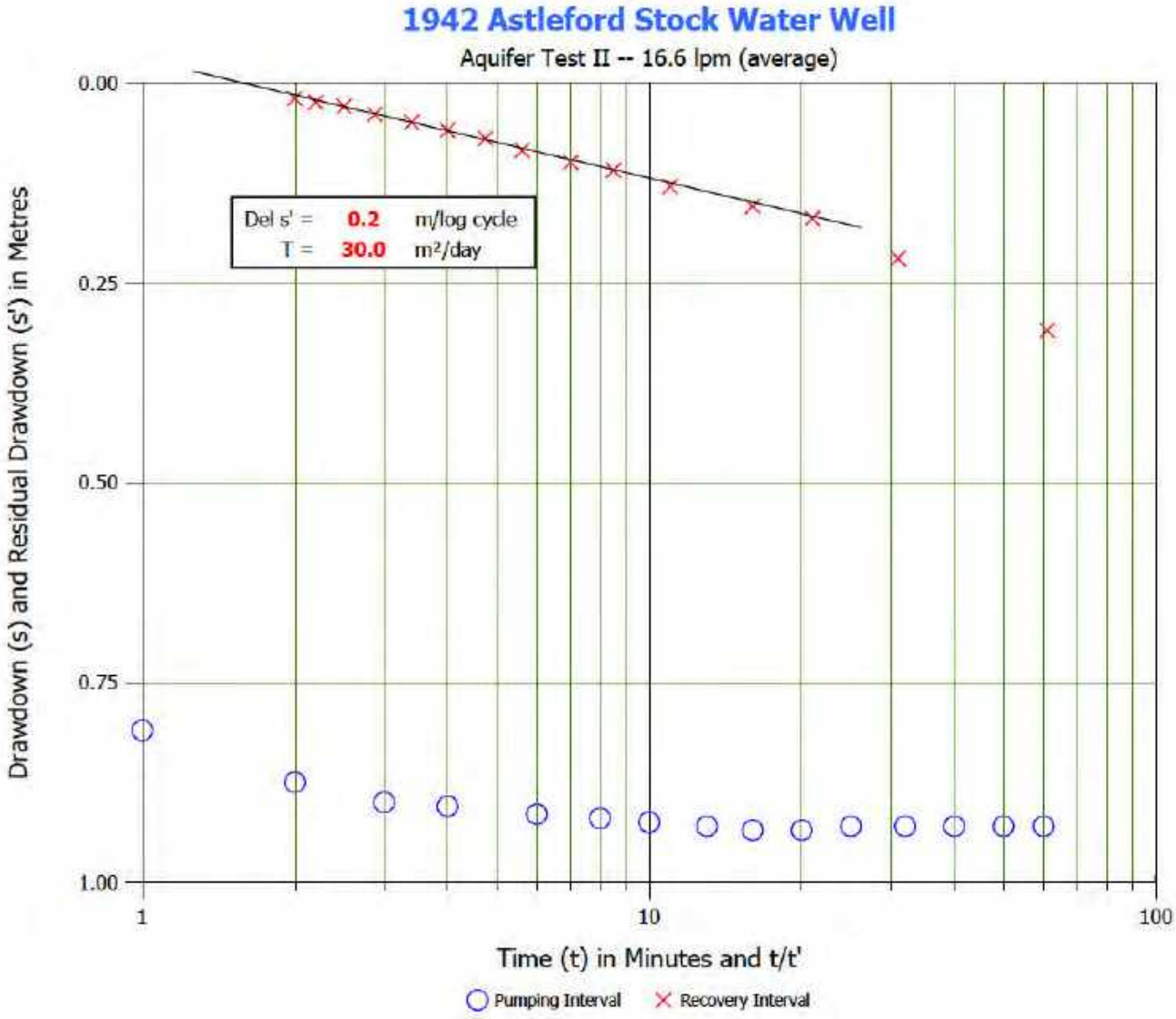
Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Electrical Conductivity		µS/cm at 25 C	878	1		
Calcium	Dissolved	mg/L	126	0.2		
Calcium	Extractable	mg/L	133	0.2		
Magnesium	Dissolved	mg/L	35.8	0.2		
Magnesium	Extractable	mg/L	36.4	0.2		
Sodium	Dissolved	mg/L	20.5	0.4	200	Below AO
Sodium	Extractable	mg/L	21.6	0.4	200	Below AO
Potassium	Dissolved	mg/L	3.1	0.4		
Potassium	Extractable	mg/L	3.2	0.4		
Iron	Dissolved	mg/L	<0.01	0.01	0.3	Below AO
Iron	Extractable	mg/L	0.17	0.01	0.3	Below AO
Manganese	Dissolved	mg/L	0.588	0.005	0.05	Above AO
Manganese	Extractable	mg/L	0.623	0.005	0.05	Above AO
Chloride	Dissolved	mg/L	1.7	0.4	250	Below AO
Fluoride		mg/L	0.24	0.05	1.5	Below MAC
Nitrate - N		mg/L	0.08	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	0.08	0.01	10	Below MAC
Sulfate (SO4)		mg/L	11	0.9	500	Below AO
Hydroxide		mg/L	<5	5		
Carbonate		mg/L	<6	6		
Bicarbonate		mg/L	643	5		
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	527	5		
Total Dissolved Solids		mg/L	524	1	500	Above AO
Hardness	as CaCO3	mg/L	482			
Ionic Balance		%	99			

This information redacted as per Protection of Privacy

Approved by:
Randy Neumann, BSc
General Manager

Terms and Conditions: www.exova.ca/terms&conditions

1942 Astleford Stock Water Well
Aquifer Test II



Aquifer Test II

1942 Astleford Stock Water Well

NE 28-053-03 W5M

Average Discharge (lpm):	**16.6**	Pre-Test Water Level - NPWL (m):	**11.39**
Date Test Started:	**October 21, 2010**	Depth to Pump Intake (m):	**N/A**
Time Test Started (hours):	**12:30**	Test Interval - Top (m):	**N/A**
Pumping Interval (minutes):	**60**	Test Interval - Bottom (m):	**N/A**
Recovery Interval (minutes):	**60**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*

Reference: M37713.708345 (AT 2)

** TGWC calculated or determined value*

This report was generated on: December 02, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)	Discharge (Lpm)
1	0.81	16.9
2	0.88	16.9
3	0.90	16.9
4	0.91	16.9
6	0.92	16.9
8	0.92	16.9
10	0.93	16.9
13	0.93	16.9
16	0.94	16.9
20	0.94	16.9
25	0.93	16.9
32	0.93	16.9
40	0.93	16.2
50	0.93	16.2
60	0.93	16.2

Recovery Interval

Measurement Point: Top of Casing

Time (t') Since Pumping Stopped (minutes)	(t/t')	Residual Drawdown (s') (metre)
1	61	0.31
2	31	0.22
3	21	0.17
4	16.0	0.16
6	11.0	0.13
8	8.5	0.11
10	7.0	0.10
13	5.6	0.09
16	4.8	0.07
20	4.0	0.06
25	3.4	0.05
32	2.9	0.04
40	2.5	0.03
50	2.2	0.03
60	2.0	0.02

Test Comments:

Test conducted by Mar-Wayne Water Well Drilling Ltd. 3" rental pump installed for aquifer test. Pump was powered using gen-set. Pumped water through 5.5 US gpm dole valve. Water pumped very dirty at the start, but cleared up after 10 minutes of pumping.

2001 Franczak Water Well

SE 33-053-03 W5M
(M39227.488655)

Well Spatial Location:

Easting: ***40,962***
Northing: ***5,938,926***
::(spatial accuracy MT GPS — 10TM NAD83)

Ground Elevation AMSL (m): ***780***
::(elevation accuracy MT DEM)

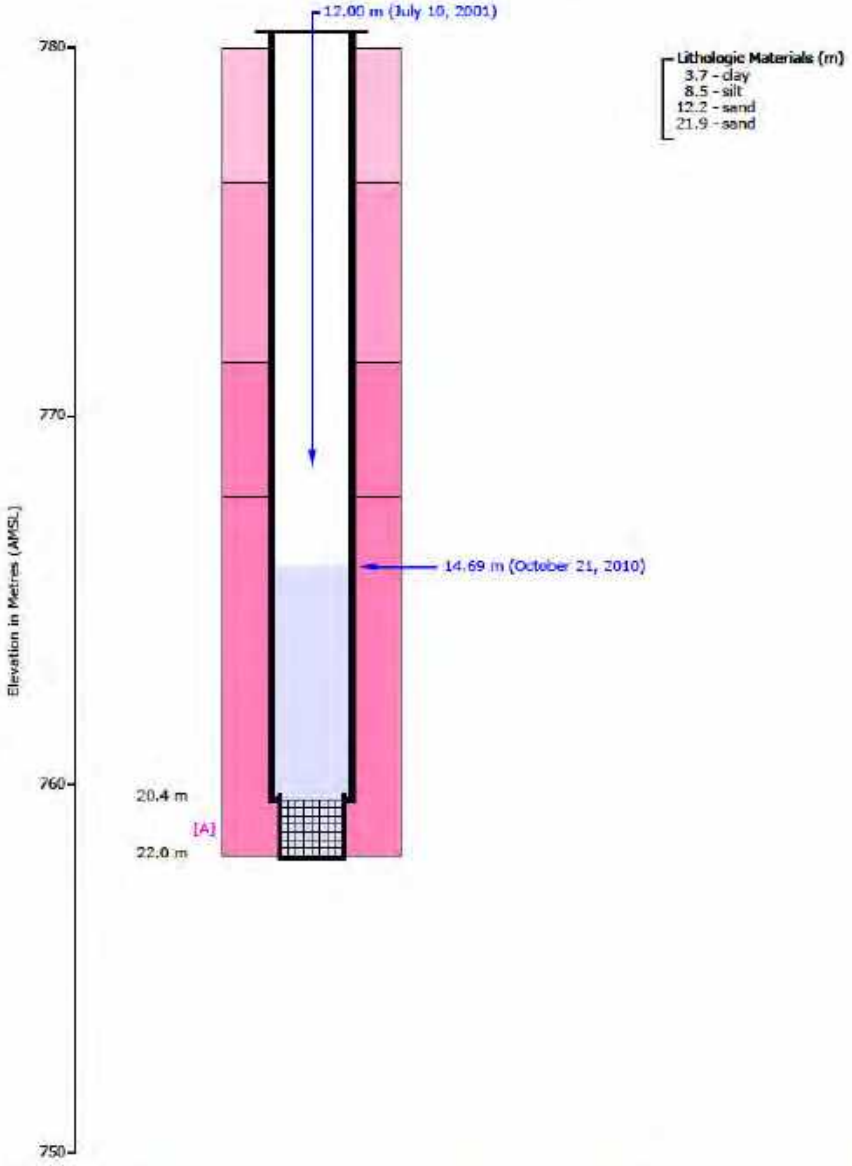
Date Completed: ***June 15, 2001***

Depth Drilled (m): ***21.9***

Completion Interval (m): ***20.4 — 21.9 ****
::(TGWC determined value)*

Most Recent Water Level (m): ***14.69 — October 21, 2010***
Earliest Water Level (m): ***12.00 — July 10, 2001***

2001 Franczak Water Well
Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained
Bedrock: Fine Grained; Coarse Grained
Other

Geologic Unit Legend (Top) - Regional Analysis

Geologic Unit Details not available for this location

Summary

TGWC ID: M39227.488655
Well Name: 2001 Franczak Water Well
Legal Location: SE 33-053-03 W5M
Casing (OD): 127.0 mm; Pletic (5.0")
Liner (OD): 101.6 mm; Stainless Steel (4.0")
Casing Stick-Up: 0.60 m (not drawn to scale)
Interval [A]: 20.4 to 21.9 m; Screened
Water Level (recent): 14.69 m on October 21, 2010 @ 15:13
Water Level (oldest): 12.00 m on July 10, 2001 @ 11:00
Top of Liner assumed to be 5% of 'non-cased' interval.

NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by hydrogeological consultants ltd. (HCL) (http://www.hcl.ca) on behalf of Lac Ste. Anne County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: December 02, 2010 15:45 --- http://www.tgwc.ca

Owner: *Franczak, Dave*
Site 105, Comp 3, RR 1, Alberta Beach, AB T0E 0A1
Contractor: *Summers Drilling Ltd.*
Well Name: *2001 Franczak Water Well*

Field Survey: *July 10, 2001 - Confirmed - Physically*

METRIC REPORT

Easting (m):	*40962.00* **	*75/60*
Northing (m):	*5938926.68* **	
Elevation (m):	*780* ***	

Google Earth

SE 33-053-03 W5M

M39227.488655

190388-3

Work Type: *New Well*
Drilling Method: *Rotary*
Proposed Use: *Stock*
Completion Type: *Screen*
Date Started: *June 15, 2001*
Date Completed: *June 15, 2001*
Well Status: *Producing*
Feature Class: *Water Well*

Elog Taken: *No*
Gamma Taken: *No*
Stick Up (m): *0.6*
Flowing: *No*

Water Required (L/day): *1818.4*

General Details

Depth Completed (m): *21.9*
Depth Drilled (m): *21.9*
Completion Aquifer: *Surficial **
Sand & Gravel Thickness (m): *12.8 (total) — 6.3 (below 15 m) **
Top of Bedrock: *Surficial Water Well **
Completion Interval (m): *20.4 — 21.9 **

Completion Details

Surface Casing: *Plastic — 127.0 mm (O.D.) x 20.42 m (bottom)*

Screen Material: *Stainless Steel — 101.6 mm (I.D.) (Attached To Casing)*
Fittings: *Top: Coupler — Bottom: Plug*
Pack: *Artificial (Coarse Sand) - 2000 Pounds*

Intervals

Screen: 20.4 to 21.9 m - 10 Slot

Bentonite Chips/Tablets: 0.0 to 15.2 m

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (mte ipm)
776.8	3.7	Clay
771.9	8.5	Silt
768.2	12.2	Sand
758.5	21.9	Coarse Grained Sand

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: *October 21, 2010*
Analysis Details: *October 27, 2010 - Exova Canada Inc. (769933-5)*

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	*1020*	Nitrate as N:	*< 0.01*	Colour (TCU):	*45*
TDS (Calculated):	*645*	Nitrite as N:	*< 0.005*	Turbidity (NTU):	*20.9*
Hardness (as CaCO3):	*461*	pH (pH Unit):	*8.04*	Fluoride:	*0.13*
T-Alkalinity (as CaCO3):	*533*	Ion Balance (%):	*94*	Carbonate:	*< 6*
P-Alkalinity (as CaCO3):	*< 5*	Total Coliforms**:	*< 1*	Bicarbonate:	*650*
Nitrate + Nitrite as N:	*< 0.01*	Fecal Coliforms**:	*< 1*	Hydroxide:	*< 5*
Total Suspended Solids:		Escherichia coli**:		Total Iron:	
Sulfate Reducing Bacteria*:				Total Mn:	
Iron Related Bacteria**:				Temperature (°C):	*19.4*

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	*130*	*126*	Mercury:		
Chloride:		*0.6*	Molybdenum:		*0.001*
Iron:	*1.52*		Magnesium:	*33.4*	*33.5*
Manganese:	*0.843*	*0.81*	Sodium:	*60.2*	*58.5*
Aluminum:		*< 0.002*	Potassium:	*3.8*	*3.7*
Arsenic:		*0.005*	Vanadium:		*0.0045*
Barium:		*0.059*	Strontium:		*0.689*
Beryllium:		*< 0.0001*	Nickel:		*0.0013*
Cadmium:		*< 0.00001*	Zinc:		*< 0.001*
Chromium:		*0.0015*	Copper:		*< 0.001*
Cobalt:		*0.0011*	Lead:		*< 0.0001*
Sulfate:	*97.9*				

Extractable - unfiltered
Dissolved - filtered

(1 / 1)

*MPN/mL
**CFU/mL

Comments: *Sample collected by Mow-Tech Ltd.*

note: constituents have been compared to the maximum acceptable concentration,Health Canada, 2010. Guidelines for Canadian Drinking Water Quality – Summary Table. Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

General Comments / Observations

Original owner: Franczak, Steve. Pack Grain size - Coarse Sand. [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located in shed in pasture. Submersible pump is powered by gen-set.] [53512 RR 33]

Most Recent Water Level (m): *14.92 m — June 23, 2011*

Borehole Details
200.0 mm

Oil Present: *No*
Gas Present: *No*

Water Used For Drilling

Aquifer Tests

	Date & Time	Testing Method	Depth of Test Interval (metre)	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective	
3	*2010-10-21 15:13*	*Pump*	*20.40 to 21.90*	*64.0*	*64.0*	*31.5*	*14.69*	*2.95*	*—*	*40.6*		*19.8*	*18.0*	*18.0*	*R C*
2	*2010-10-18 11:40*	*Pump*	*20.40 to 21.90*	*16.0*	*5.0*	*32.5*	*14.97*	*2.46*	*—*	*43.9*		*21.3*	*16.8*	*16.8*	*R C*
1	*2001-07-10 11:00*	*Pump*	*[unknown]*	*120.0*	*16.0*	*40.9*	*12.00*	*5.42*	*19.81*	*43.2*		*13.5*			*R C*

Alias IDs

ESRD - GIC (WELLID): *11046152; 1715127*
ESRD - GIC (WellReportID): *11046154*

** The Groundwater Centre (TGWC) calculated or determined value.*
*** 75 - MT GPS — 10TM NAD83*
**** 60 - MT DEM — [Ground, AMSL]*

This report was generated on: November 07, 2012 — Data "AS IS"; no warranty either expressed or implied. [53.624700 -114.376000 (WGS 84)] INT

2001 Franczak Water Well
Chemical Analysis (Oct 21, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada
T: +1 (780) 438-5522
F: +1 (780) 438-5398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project:		Lot ID:	**769933**
Report To:	Hydrogeological Consultants	ID:	10-505	Control Number:	Z-065679
	17740 - 118 Avenue	Name:	Groundwater Review	Date Received:	Oct 22, 2010
	Edmonton, AB, Canada	Location:	Lac Ste. Anne Area	Date Reported:	Oct 27, 2010
	T5S 2W3	LSD:	Parts of Sections 28 and 32 to 34	Report Number:	1373212
Attn:	Tara Parker	P.O.:	14091		
Sampled By:	Hydrogeological Consultants Ltd.	Acct code:			
Company:					

Reference Number	769933-5
Sample Date	October 21, 2010
Sample Time	16:13
Sample Location	
Sample Description	M39227.488655 (2001Franczak Water Well) / 6.1°C / SE 33-053-03
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Dissolved						
Silicon	Dissolved	mg/L	6.87	0.05		
Sulfur	Dissolved	mg/L	32.0	0.3		
Aluminum	Dissolved	mg/L	<0.002	0.002	0.1	Below OG
Antimony	Dissolved	mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Dissolved	mg/L	0.0050	0.0002	0.01	Below MAC
Barium	Dissolved	mg/L	0.059	0.001	1	Below MAC
Beryllium	Dissolved	mg/L	<0.0001	0.0001		
Bismuth	Dissolved	mg/L	<0.0005	0.0005		
Boron	Dissolved	mg/L	0.153	0.002	5	Below MAC
Cadmium	Dissolved	mg/L	<0.00001	0.00001	0.005	Below MAC
Chromium	Dissolved	mg/L	0.0015	0.0005	0.05	Below MAC
Cobalt	Dissolved	mg/L	0.0011	0.0001		
Copper	Dissolved	mg/L	<0.001	0.001	1	Below AO
Lead	Dissolved	mg/L	<0.0001	0.0001	0.01	Below MAC
Lithium	Dissolved	mg/L	0.039	0.001		
Molybdenum	Dissolved	mg/L	0.001	0.001		
Nickel	Dissolved	mg/L	0.0013	0.0005		
Selenium	Dissolved	mg/L	<0.0002	0.0002	0.01	Below MAC
Silver	Dissolved	mg/L	<0.00001	0.00001		
Strontium	Dissolved	mg/L	0.689	0.001		
Thallium	Dissolved	mg/L	<0.00005	0.00005		
Tin	Dissolved	mg/L	<0.001	0.001		
Titanium	Dissolved	mg/L	0.0026	0.0005		
Uranium	Dissolved	mg/L	0.0024	0.0005	0.02	Below MAC
Vanadium	Dissolved	mg/L	0.0045	0.0001		
Zinc	Dissolved	mg/L	<0.001	0.001	5	Below AO
Microbiological Analysis						
Total Coliforms	Membrane Filtration	CFU/100 mL	<1	1	0	Below MAC
Fecal Coliforms	Membrane Filtration	CFU/100 mL	<1	1		
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	45	5	15	Above AO
Turbidity		NTU	20.9	0.1	0.1	Above OG
Routine Water						
pH			8.04		6.5 - 8.5	Within AO
Temperature of observed pH		°C	19.4			

Terms and Conditions: www.exova.ca/terms&conditions

2001 Franczak Water Well
Chemical Analysis (Oct 21, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada
T: +1 (780) 438-5522
F: +1 (780) 438-0398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project ID:	10-505	Lot ID:	**769933**
Report To:	Hydrogeological Consultants	Name:	Groundwater Review	Control Number:	Z-065679
	17740 - 118 Avenue	Location:	Lac Ste. Anne Area	Date Received:	Oct 22, 2010
	Edmonton, AB, Canada	LSD:	Parts of Sections 28 and 32 to 34	Date Reported:	Oct 27, 2010
	T5S 2W3	P.O.:	14091	Report Number:	1373212
Attn:	Tara Parker				
Sampled By:	Hydrogeological Consultants Ltd.	Acct code:			
Company:					

Reference Number	769933-5
Sample Date	October 21, 2010
Sample Time	16:13
Sample Location	
Sample Description	M39227.488655 (2001Franczak Water Well) / 6.1°C / SE 33-053-03
Sample Matrix	Water

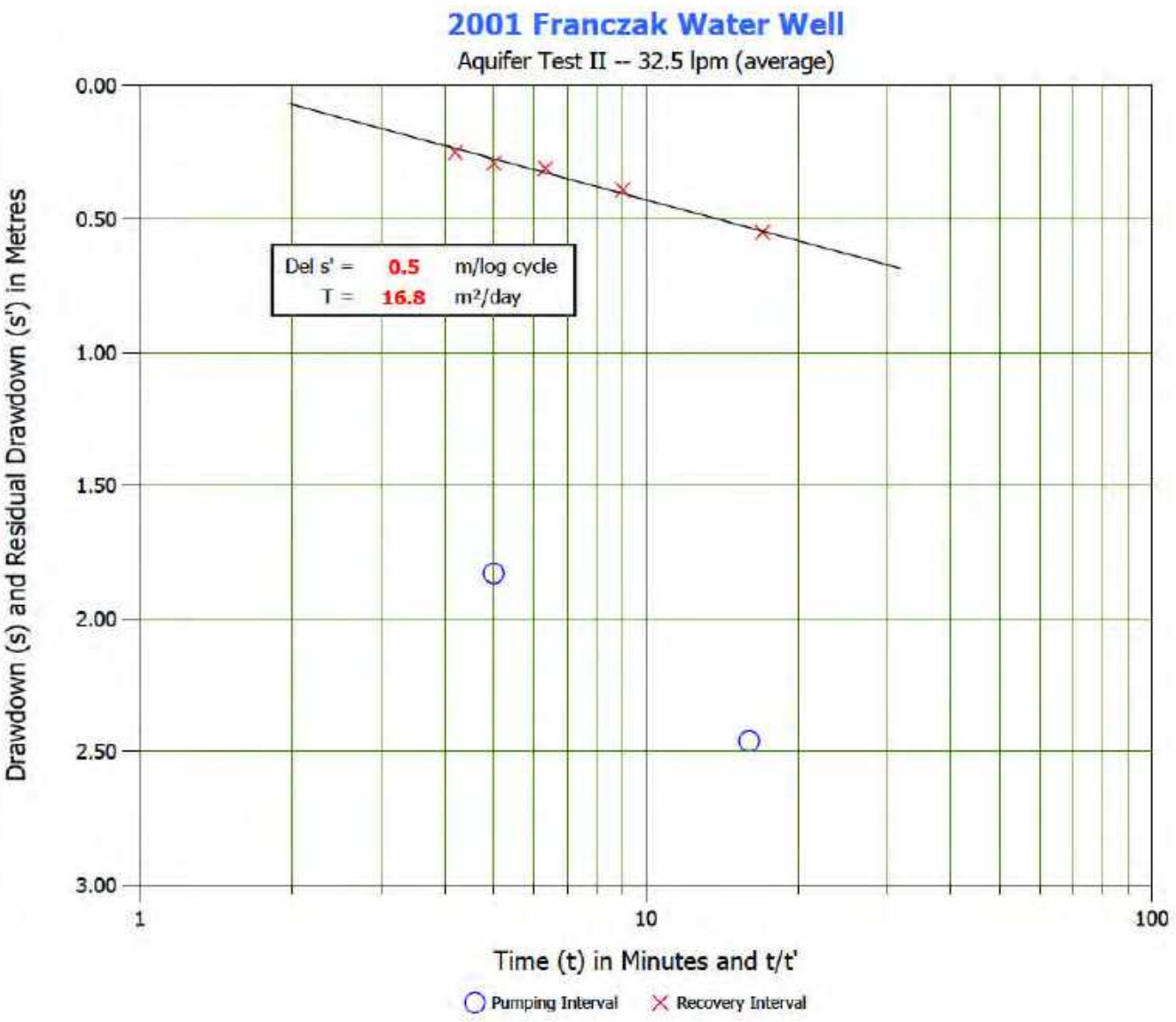
Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Electrical Conductivity		µS/cm at 25 C	1020	1		
Calcium	Dissolved	mg/L	126	0.2		
Calcium	Extractable	mg/L	130	0.2		
Magnesium	Dissolved	mg/L	33.5	0.2		
Magnesium	Extractable	mg/L	33.4	0.2		
Sodium	Dissolved	mg/L	58.5	0.4	200	Below AO
Sodium	Extractable	mg/L	60.2	0.4	200	Below AO
Potassium	Dissolved	mg/L	3.7	0.4		
Potassium	Extractable	mg/L	3.8	0.4		
Iron	Dissolved	mg/L	<0.01	0.01	0.3	Below AO
Iron	Extractable	mg/L	1.52	0.01	0.3	Above AO
Manganese	Dissolved	mg/L	0.810	0.005	0.05	Above AO
Manganese	Extractable	mg/L	0.843	0.005	0.05	Above AO
Chloride	Dissolved	mg/L	0.6	0.4	250	Below AO
Fluoride		mg/L	0.13	0.05	1.5	Below MAC
Nitrate - N		mg/L	<0.01	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	<0.01	0.01	10	Below MAC
Sulfate (SO4)		mg/L	97.9	0.9	500	Below AO
Hydroxide		mg/L	<5	5		
Carbonate		mg/L	<6	6		
Bicarbonate		mg/L	650	5		
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	533	5		
Total Dissolved Solids		mg/L	645	1	500	Above AO
Hardness	as CaCO3	mg/L	461			
Ionic Balance		%	94			

This information redacted as per

Approved by: Randy Neumann, BSc
General Manager

Terms and Conditions: www.exova.ca/terms&conditions

2001 Franczak Water Well
Aquifer Test II



Aquifer Test II

2001 Franczak Water Well

SE 33-053-03 W5M

Average Discharge (lpm):	**32.5**	Pre-Test Water Level - NPWL (m):	**14.97**
Date Test Started:	**October 18, 2010**	Depth to Pump Intake (m):	**N/A**
Time Test Started (hours):	**11:40**	Test Interval - Top (m):	**20.4**
Pumping Interval (minutes):	**16**	Test Interval - Bottom (m):	**21.9**
Recovery Interval (minutes):	**5**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*

Reference: M39227.488655 (AT 2)

** TGWC calculated or determined value*

This report was generated on: December 02, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)	Discharge (Lpm)
5	1.83	32.5
16	2.46	32.5

Recovery Interval

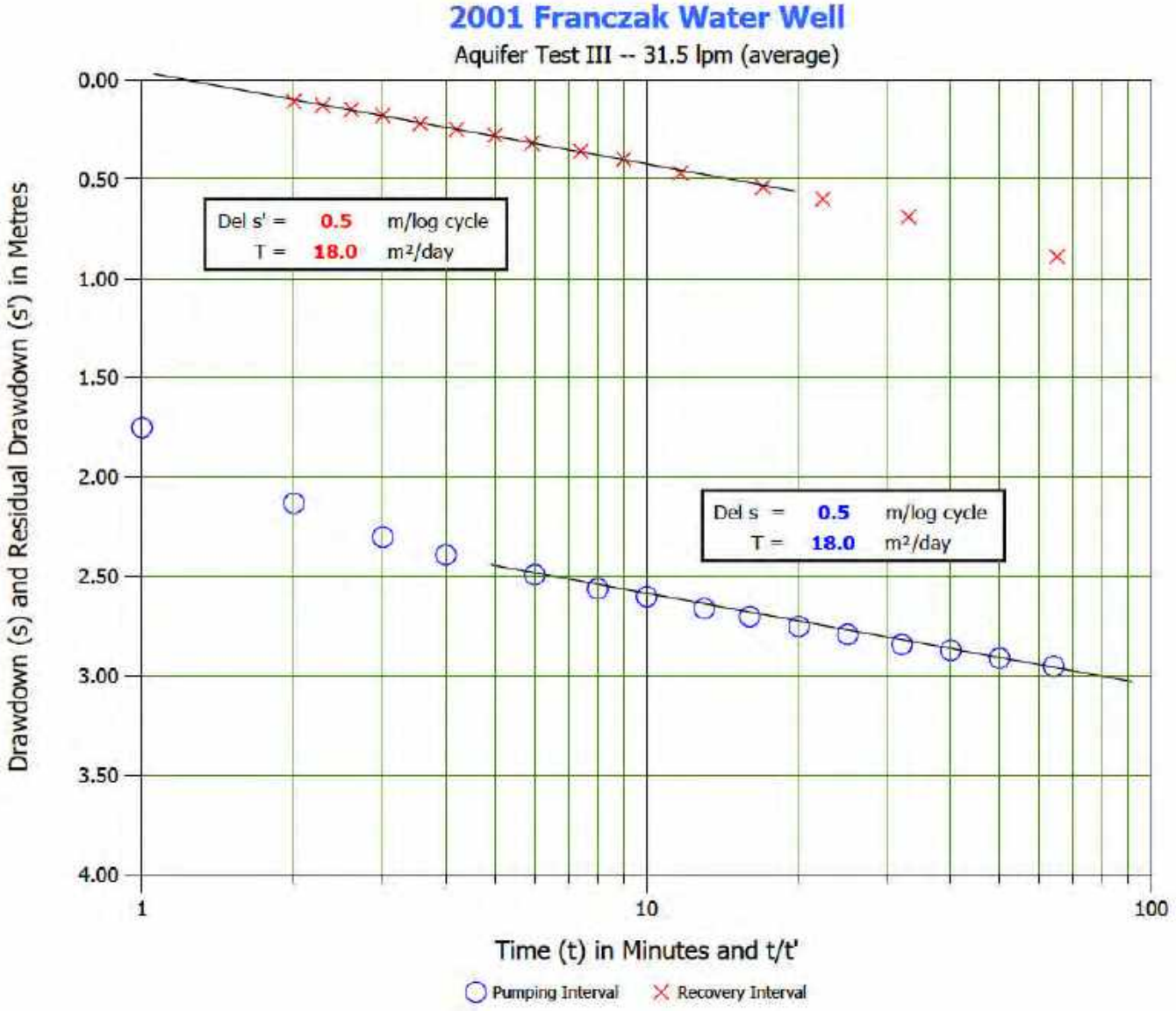
Measurement Point: Top of Casing

Time (t') Since Pumping Stopped (minutes)	(t/t')	Residual Drawdown (s') (metre)
1	17.0	0.55
2	9.0	0.39
3	6.3	0.31
4	5.0	0.29
5	4.2	0.25

Test Comments:

Test conducted by Hydrogeological Consultants Ltd.

2001 Franczak Water Well
Aquifer Test III



Aquifer Test III

2001 Franczak Water Well

SE 33-053-03 W5M

Average Discharge (lpm):	**31.6**	Pre-Test Water Level - NPWL (m):	**14.69**
Date Test Started:	**October 21, 2010**	Depth to Pump Intake (m):	**N/A**
Time Test Started (hours):	**15:13**	Test Interval - Top (m):	**20.4**
Pumping Interval (minutes):	**64**	Test Interval - Bottom (m):	**21.9**
Recovery Interval (minutes):	**64**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*

Reference: M39227.488655 (AT 3)

** **TGWC** calculated or determined value*

This report was generated on: December 02, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)	Discharge (Lpm)
1	1.75	32.4
2	2.13	32.4
3	2.30	32.4
4	2.39	32.4
6	2.49	32.4
8	2.56	32.4
10	2.60	32.4
13	2.66	32.4
16	2.70	32.4
20	2.75	32.4
25	2.79	32.4
32	2.84	32.4
40	2.87	32.4
50	2.91	30.0
64	2.95	30.0

Recovery Interval

Measurement Point: Top of Casing

Time (t') Since Pumping Stopped (minutes)	(t/t')	Residual Drawdown (s') (metre)
1	65	0.89
2	33	0.69
3	22	0.60
4	17.0	0.54
6	11.7	0.47
8	9.0	0.40
10	7.4	0.36
13	5.9	0.32
16	5.0	0.28
20	4.2	0.25
25	3.6	0.22
32	3.0	0.18
40	2.6	0.15
50	2.3	0.13
64	2.0	0.11

Test Comments:

Test conducted by Mar-Wayne Water Well Drilling Services Ltd.

1987 Franczak Water Well

SE 33-053-03 W5M
(M36056.964297)

Well Spatial Location:

Easting: ***41,528***
Northing: ***5,938,999***
::(spatial accuracy MT GPS — 10TM NAD83)

Ground Elevation AMSL (m): ***777***
::(elevation accuracy MT DEM)

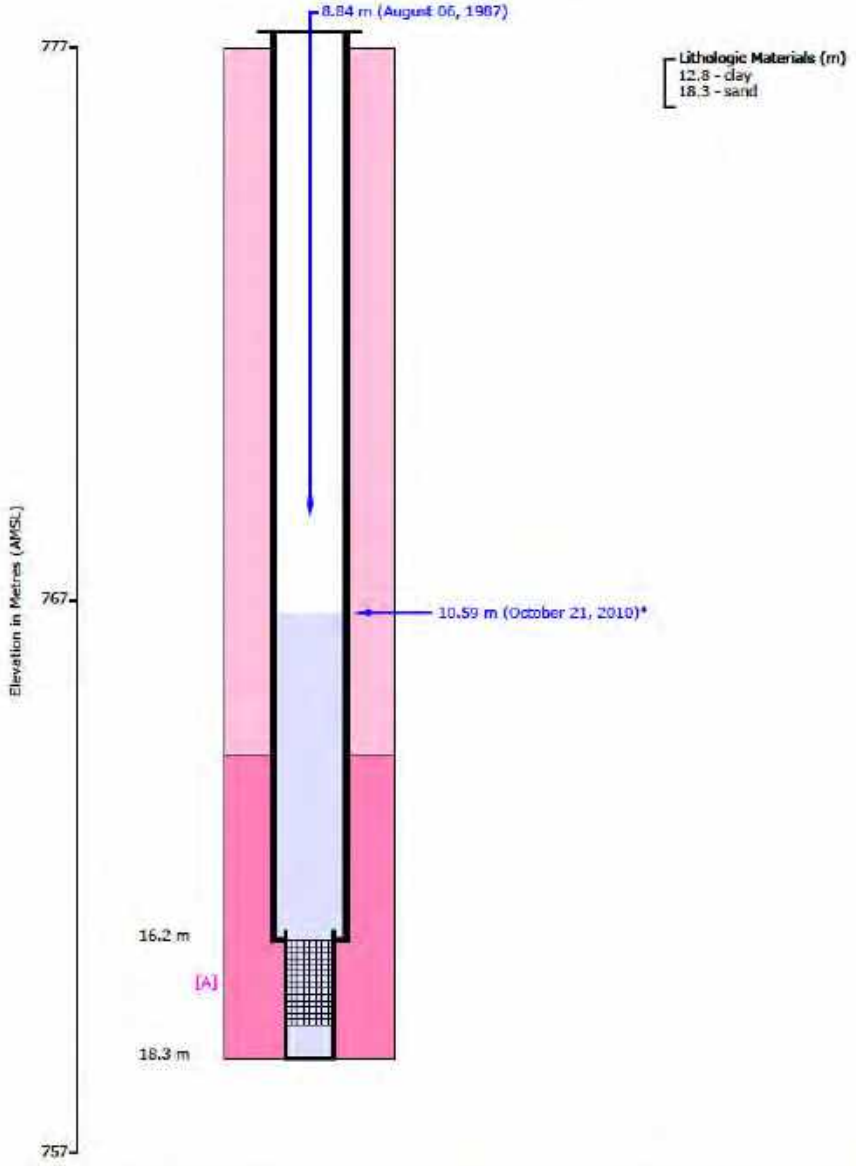
Date Completed: ***August 06, 1987***

Depth Drilled (m): ***18.3***

Completion Interval (m): ***16.2 — 17.7 ****
::(TGWC determined value)*

Most Recent Water Level (m): ***10.59 — October 21, 2010***
Earliest Water Level (m): ***8.84 — August 06, 1987***

1987 Franczak Water Well
Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained
Bedrock: Fine Grained; Coarse Grained
Other

Geologic Unit Legend (Top) - Regional Analysis

Geologic Unit Details not available for this location

Summary

TGWC ID: M36056.964297
Well Name: 1987 Franczak Water Well
Legal Location: SE 33-053-03 W5M
Casing (OD): 114.3 mm; Pletic (4.5")
Liner (OD): 76.2 mm; Stainless Steel (3.0")
Casing Stick-Up: 0.36 m (not drawn to scale)
Interval [A]: 16.2 to 17.7 m; Screened
*Water Level (recent): 10.59 m on October 21, 2010 @ 16:47 - Reference Point: Top of Casing
Water Level (oldest): 8.84 m on August 06, 1987 @ 11:00
Top of Liner assumed to be 5% of 'non-cased' interval.

** Water-Level Measurements are measured from reference point listed.*
NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by hydrogeological consultants ltd. (HCL) (http://www.hcl.ca) on behalf of Lac Ste. Anne County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: December 02, 2010 15:49 — http://www.tgwc.ca

Owner: *Franczsk, Dave*
Site 105, Comp 3, RR 1, Alberta Beach, AB T0E 0A1
Contractor: *Grove Drilling Enterprises (1980) Ltd.*
Well Name: *1987 Franczak Water Well*

Field Survey: *October 18, 2010 - Confirmed - Physically*

METRIC REPORT

Easting (m): *415218.60* ** 75/60
Northing (m): *5938999.82* **
Elevation (m): *777* ***
Google Earth

SE 33-053-03 W5M
M36056.964297
190395-1

Work Type: *New Well*
Drilling Method: *Rotary*
Proposed Use: *Domestic & Stock*
Completion Type: *Screen*
Date Started: *August 06, 1987*
Date Completed: *August 05, 1987*
Well Status: *Producing*

Elog Taken: *No*
Gamma Taken: *No*
Stick Up (m): *0.4*
Flowing: *No*

General Details

Depth Completed (m): *17.7*
Depth Drilled (m): *18.3*
Completion Aquifer: *Lower Surficial **
Sand & Gravel Thickness (m): *5.5 (total) — 3.3 (below 15 m) **
Top of Bedrock: *Surficial Water Well **
Completion Interval (m): *16.2 — 17.7 **

Completion Details

Surface Casing: *Plstic — 114.3 mm (O.D.) x 16.15 m (bottom)*
Screen Material: *Stainless Steel — 76.2 mm (I.D.)*
Fittings: *Top: Coupler — Bottom: Plug*
Pack: *Jet Sand - 0.25 Yards*

Intervals

Completion Interval: *Screen: 16.2 to 17.7 m - 10 Slot*

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (mte ipm)
764.3	12.8	Clay
758.8	18.3	Sand

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: *October 21, 2010*
Analysis Details: *October 27, 2010 - Exova (769933-1)*

Constituent	Result	Constituent	Result	Constituent	Result
Conductivity (µS/cm):	912	Nitrate as N:	< 0.01	Colour (TCU):	> 60
TDS (Calculated):	562	Nitrite as N:	< 0.005	Turbidity (NTU):	33
Hardness (as CaCO3):	434	pH (pH Unit):	7.91	Fluoride:	0.14
T-Alkalinity (as CaCO3):	484	Ion Balance (%):	97	Carbonate:	< 6
P-Alkalinity (as CaCO3):	< 5	Total Coliforms**:	< 1	Bicarbonate:	590
Nitrate + Nitrite as N:	< 0.01	Fecal Coliforms**:	< 1	Hydroxide:	< 5
Total Suspended Solids:		Escherichia coli**:		Total Iron:	
Sulfate Reducing Bacteria*:				Total Mn:	
Iron Related Bacteria**:				Temperature (°C):	19.3

Constituent	Extractable	Dissolved	Constituent	Extractable	Dissolved
Calcium:	123	118	Mercury:		
Chloride:		0.5	Molybdenum:		< 0.001
Iron:	2.13		Magnesium:	30.9	31
Manganese:	0.605	0.577	Sodium:	45.6	43.9
Aluminum:		0.003	Potassium:	4	3.9
Arsenic:		0.0011	Vanadium:		0.0047
Barium:		0.068	Strontium:		0.631
Beryllium:		< 0.0001	Nickel:		0.0006
Cadmium:		< 0.00001	Zinc:		0.002
Chromium:		0.0017	Copper:		0.004
Cobalt:		0.0002	Lead:		< 0.0001
Sulfate:	60.2				

Extractable - unfiltered
Dissolved - filtered
(1 / 1)
*MPN/mL
**CFU/mL

Comments: *Sample collected by Mow-Tech Ltd.*

note: constituents have been compared to the maximum acceptable concentration, as stated in the Summary of Guidelines for Canadian Drinking Water Quality (Federal–Provincial–Territorial Committee on Drinking Water, May 2008)

General Comments / Observations

[53512 RR 33, Original owner: Steve Franczak.] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located 25 metres southwest of house. Water well is primary house water well but can be used for stock purposes if needed.]

Most Recent Water Level (m): *10.59 m — October 21, 2010*

Oil Present: *No*
Gas Present: *No*

Water Used For Drilling

Aquifer Tests

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective	
1	1987-08-06 11:00	Bailer & Air			31.8	8.84	6.70	15.54	15.54	23.2		8.4			R

Alias IDs

AENV - GIC (WIN-WEB): *0470217*
AENV - GIC (WELLID): *470217*

* TGWC calculated or determined value.
** 75 - MT GPS — 10TM NAD83
*** 80 - MT DEM — (Ground, AMSL)

This report was generated on: December 02, 2010 — Data "AS IS"; no warranty either expressed or implied. [53.61754 -114.37839 (WGS 84)], INT

1987 Franczak Water Well
Chemical Analysis (Oct 21, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada
T: +1 (780) 438-5522
F: +1 (780) 438-5398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project:		Lot ID:	**769933**
Report To:	Hydrogeological Consultants	ID:	10-505	Control Number:	Z-065679
	17740 - 118 Avenue	Name:	Groundwater Review	Date Received:	Oct 22, 2010
	Edmonton, AB, Canada	Location:	Lac Ste. Anne Area	Date Reported:	Oct 27, 2010
	T5S 2W3	LSD:	Parts of Sections 28 and 32 to 34	Report Number:	1373195
Attn:	Tara Parker	P.O.:	14091		
Sampled By:	Hydrogeological Consultants Ltd.	Acct code:			
Company:					

Reference Number	769933-1
Sample Date	October 21, 2010
Sample Time	17:00
Sample Location	
Sample Description	M36056.964297 (1987 Franczak Water Well) / 6.1°C / SE 33-053-03
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Dissolved						
Silicon	Dissolved	mg/L	6.91	0.05		
Sulfur	Dissolved	mg/L	21.2	0.3		
Aluminum	Dissolved	mg/L	0.003	0.002	0.1	Below OG
Antimony	Dissolved	mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Dissolved	mg/L	0.0011	0.0002	0.01	Below MAC
Barium	Dissolved	mg/L	0.068	0.001	1	Below MAC
Beryllium	Dissolved	mg/L	<0.0001	0.0001		
Bismuth	Dissolved	mg/L	<0.0005	0.0005		
Boron	Dissolved	mg/L	0.159	0.002	5	Below MAC
Cadmium	Dissolved	mg/L	<0.00001	0.00001	0.005	Below MAC
Chromium	Dissolved	mg/L	0.0017	0.0005	0.05	Below MAC
Cobalt	Dissolved	mg/L	0.0002	0.0001		
Copper	Dissolved	mg/L	0.004	0.001	1	Below AO
Lead	Dissolved	mg/L	<0.0001	0.0001	0.01	Below MAC
Lithium	Dissolved	mg/L	0.049	0.001		
Molybdenum	Dissolved	mg/L	<0.001	0.001		
Nickel	Dissolved	mg/L	0.0006	0.0005		
Selenium	Dissolved	mg/L	<0.0002	0.0002	0.01	Below MAC
Silver	Dissolved	mg/L	<0.00001	0.00001		
Strontium	Dissolved	mg/L	0.631	0.001		
Thallium	Dissolved	mg/L	<0.00005	0.00005		
Tin	Dissolved	mg/L	<0.001	0.001		
Titanium	Dissolved	mg/L	0.0019	0.0005		
Uranium	Dissolved	mg/L	0.0007	0.0005	0.02	Below MAC
Vanadium	Dissolved	mg/L	0.0047	0.0001		
Zinc	Dissolved	mg/L	0.002	0.001	5	Below AO
Microbiological Analysis						
Total Coliforms	Membrane Filtration	CFU/100 mL	<1	1	0	Below MAC
Fecal Coliforms	Membrane Filtration	CFU/100 mL	<1	1		
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	>60	5	15	Above AO
Turbidity		NTU	33.0	0.1	0.1	Above OG
Routine Water						
pH			7.91		6.5 - 8.5	Within AO
Temperature of observed pH		°C	19.3			

Terms and Conditions: www.exova.ca/terms&conditions

1987 Franczak Water Well
Chemical Analysis (Oct 21, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 438-0398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project ID:	10-505	Lot ID:	769933
Report To:	Hydrogeological Consultants	Name:	Groundwater Review	Control Number:	Z-065679
	17740 - 118 Avenue	Location:	Lac Ste. Anne Area	Date Received:	Oct 22, 2010
	Edmonton, AB, Canada	LSD:	Parts of Sections 28 and 32 to 34	Date Reported:	Oct 27, 2010
	T5S 2W3	P.O.:	14091	Report Number:	1373195
Attn:	Tara Parker				
Sampled By:	Hydrogeological Consultants Ltd.	Acct code:			
Company:					

Reference Number	769933-1
Sample Date	October 21, 2010
Sample Time	17:00
Sample Location	
Sample Description	M36056.964297 (1987 Franczak Water Well) / 6.1°C / SE 33-053-03
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Electrical Conductivity		µS/cm at 25 C	912	1		
Calcium	Dissolved	mg/L	118	0.2		
Calcium	Extractable	mg/L	123	0.2		
Magnesium	Dissolved	mg/L	31.0	0.2		
Magnesium	Extractable	mg/L	30.9	0.2		
Sodium	Dissolved	mg/L	43.9	0.4	200	Below AO
Sodium	Extractable	mg/L	45.6	0.4	200	Below AO
Potassium	Dissolved	mg/L	3.9	0.4		
Potassium	Extractable	mg/L	4.0	0.4		
Iron	Dissolved	mg/L	<0.01	0.01	0.3	Below AO
Iron	Extractable	mg/L	2.13	0.01	0.3	Above AO
Manganese	Dissolved	mg/L	0.577	0.005	0.05	Above AO
Manganese	Extractable	mg/L	0.605	0.005	0.05	Above AO
Chloride	Dissolved	mg/L	0.5	0.4	250	Below AO
Fluoride		mg/L	0.14	0.05	1.5	Below MAC
Nitrate - N		mg/L	<0.01	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	<0.01	0.01	10	Below MAC
Sulfate (SO4)		mg/L	68.2	0.9	500	Below AO
Hydroxide		mg/L	<5	5		
Carbonate		mg/L	<6	6		
Bicarbonate		mg/L	590	5		
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	484	5		
Total Dissolved Solids		mg/L	562	1	500	Above AO
Hardness	as CaCO3	mg/L	434			
Ionic Balance		%	97			

This information redacted as per Protection of Privacy Act

Approved by:

Randy Neumann, BSc
General Manager

Terms and Conditions: www.exova.ca/terms&conditions

1979 Franczak Water Well

SE 33-053-03 W5M
(M36056.964300)

Well Spatial Location:

Easting: ***41,455***
Northing: ***5,939,026***
::(spatial accuracy MT GPS — 10TM NAD83)

Ground Elevation AMSL (m): ***777***
::(elevation accuracy MT DEM)

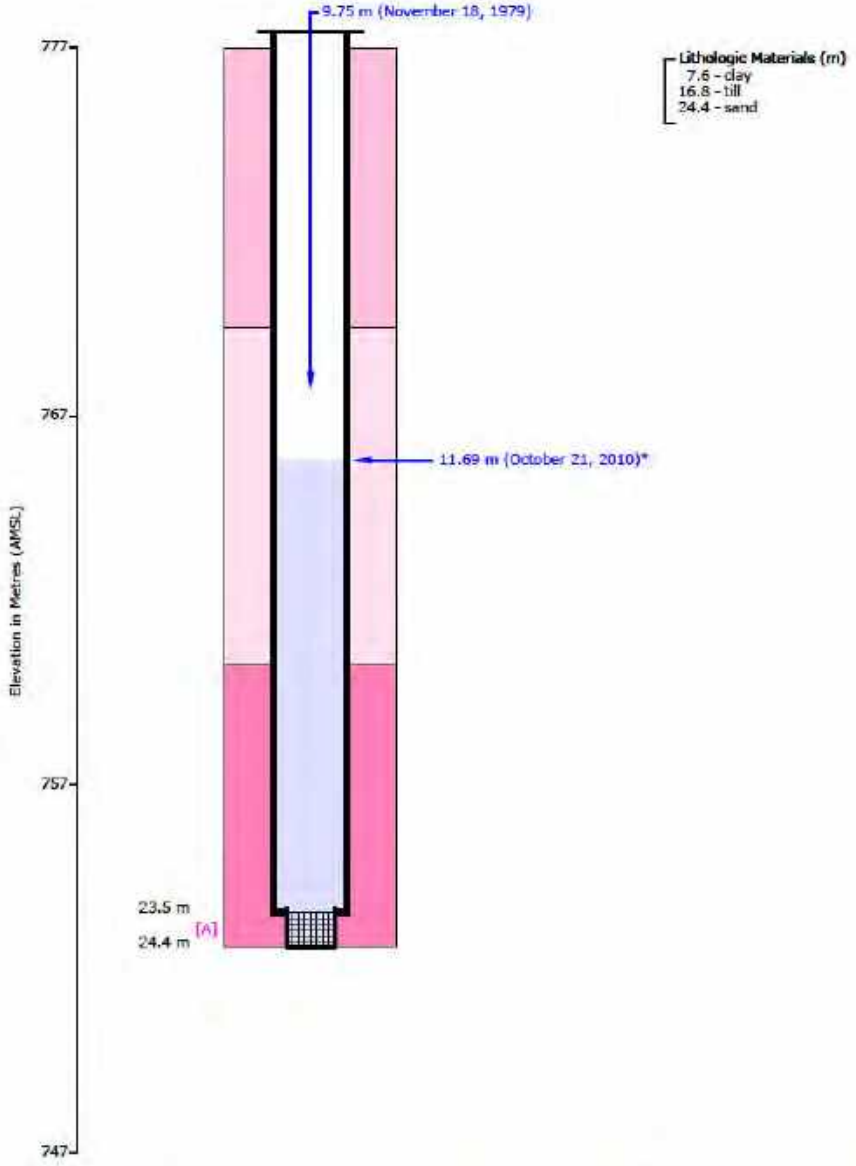
Date Completed: ***November 18, 1979***

Depth Drilled (m): ***24.4***

Completion Interval (m): ***23.5 — 24.4 ****
::(TGWC determined value)*

Most Recent Water Level (m): ***11.69 — October 21, 2010***
Earliest Water Level (m): ***9.75 — November 18, 1979***

1979 Franczak Water Well
Well Diagram



Lithology Legend

Surficial: Unsorted; Fine Grained; Coarse Grained
Bedrock: Fine Grained; Coarse Grained
Other

Geologic Unit Legend (Top) - Regional Analysis

Geologic Unit Details not available for this location

Summary

TGWC ID: M36056.964300
Well Name: 1979 Franczak Water Well
Legal Location: SE 33-053-03 W5M
Casing (OD): 115.8 mm; Steel (4.6")
Liner (OD): 76.2 mm; Stainless Steel (3.0")
Casing Stick-Up: 0.50 m (not drawn to scale)
Interval [A]: 23.5 to 24.4 m; Screened
*Water Level (recent): 11.69 m on October 21, 2010 @ 16:30 - Reference Point: Top of Casing
Water Level (oldest): 9.75 m on November 18, 1979 @ 11:00
Top of Liner assumed to be 5% of 'non-cased' interval.

** Water-Level Measurements are measured from reference point listed.*
NOTE: Geologic Unit is a guide based on a regional groundwater assessment completed by hydrogeological consultants ltd. (HCL) (http://www.hcl.ca) on behalf of Lac Ste. Anne County in conjunction with Prairie Farm Rehabilitation Administration (P.F.R.A.).
Drawn: December 02, 2010 15:52 — http://www.tgwc.ca

Owner: *Franczsk, Dave*
Site 105, Comp 3, RR 1, Alberta Beach, AB T0E 0A1
Contractor: *Caribou Drilling Ltd.*
Well Name: *1979 Franczsk Water Well*

Field Survey: *October 18, 2010 - Confirmed - Physically*

METRIC REPORT

Easting (m):	*41455.85* **	*75/60*
Northing (m):	*5939026.63* **	
Elevation (m):	*777* ***	

Google Earth

SE 33-053-03 W5M

M36056.964300

190396-1

Work Type: *New Well*
Drilling Method: *Rotary*
Proposed Use: *Stock*
Completion Type: *Screen*

Date Started: *November 15, 1979*
Date Completed: *November 18, 1979*
Well Status: *Producing*

Elog Taken: *No*
Gamma Taken: *No*
Stick Up (m): *0.5*
Flowing: *No*

General Details

Depth Completed (m): *24.4*
Depth Drilled (m): *24.4*
Completion Aquifer: *Lower Surficial **
Sand & Gravel Thickness (m): *7.6 (total) — 7.6 (below 15 m) **

Top of Bedrock: *Surficial Water Well **
Completion Interval (m): *23.5 — 24.4 **

Completion Details

Surface Casing: *Steel — 115.8 mm (O.D.) x 3.96 mm (thick) x 23.47 m (bottom)*

Screen Material: *Stainless Steel — 76.2 mm (I.D.)*
Fittings: *Top: Packer — Bottom: Washdown*

Intervals

Completion Interval: *Screen: 23.5 to 24.4 m - 15 Slot*

Lithology Details

Elevation (AMSL)	Depth (BGL)	Lithology Descriptions (mte ipm)
769.2	*7.6*	*Brown Clay*
760.0	*16.8*	*Grey Till*
752.4	*24.4*	*Sand*

Chemistry Summary Details (mg/L, except as noted) (most recent first)

Sampling Details: *October 21, 2010*
Analysis Details: *October 27, 2010 - Exova (769933-2)*

Constituent	Result
Conductivity (µS/cm):	*907*
TDS (Calculated):	*550*
Hardness (as CaCO3):	*430*
T-Alkalinity (as CaCO3):	*489*
P-Alkalinity (as CaCO3):	*< 5*
Nitrate + Nitrite as N:	*< 0.01*
Total Suspended Solids:	
Sulfate Reducing Bacteria*:	
Iron Related Bacteria**:	

Constituent	Result
Nitrate as N:	*< 0.01*
Nitrite as N:	*< 0.005*
pH (pH Unit):	*7.92*
Ion Balance (%):	*98*
Total Coliforms**:	*< 1*
Fecal Coliforms**:	*< 1*
Escherichia coli**:	

Constituent	Result
Colour (TCU):	*> 60*
Turbidity (NTU):	*28.4*
Fluoride:	*0.13*
Carbonate:	*< 6*
Bicarbonate:	*596*
Hydroxide:	*< 5*
Total Iron:	
Total Mn:	
Temperature (°C):	*19.6*

Constituent	Extractable	Dissolved
Calcium:	*122*	*115*
Chloride:		*0.4*
Iron:	*2.28*	*0.01*
Manganese:	*0.62*	*0.577*
Aluminum:		*< 0.002*
Arsenic:		*0.003*
Barium:		*0.07*
Beryllium:		*< 0.0001*
Cadmium:		*< 0.00001*
Chromium:		*0.002*
Cobalt:		*0.0002*
Sulfate:	*55.3*	

Constituent	Extractable	Dissolved
Mercury:		
Molybdenum:		*< 0.001*
Magnesium:	*30.8*	*30.1*
Sodium:	*45.3*	*42.4*
Potassium:	*3.9*	*3.7*
Vanadium:		*0.0053*
Strontium:		*0.644*
Nickel:		*< 0.0005*
Zinc:		*0.001*
Copper:		*< 0.001*
Lead:		*< 0.0001*

Extractable - unfiltered
Dissolved - filtered

(1 / 1)

*MPN/mL
**CFU/mL

Comments: *Sample collected by Mow-Tech Ltd.*

note: constituents have been compared to the maximum acceptable concentration, as stated in the Summary of Guidelines for Canadian Drinking Water Quality (Federal–Provincial–Territorial Committee on Drinking Water, May 2008)

General Comments / Observations

[53512 RR 33, original owner: Steve Franczak]. [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located in shed in livestock area 100 metres west of house.]

Most Recent Water Level (m): *11.69 m — October 21, 2010*

Oil Present: *No*
Gas Present: *No*

Water Used For Drilling

Aquifer Tests

No.	Date	Testing Method	Duration (minutes) Pumping	Duration (minutes) Recovery	Avg. Rate (lpm)	NPWL (metre)	Drawdown (metre)	Level-End (metre)	Pump (metre)	Q20 (m³/day)* Apparent	Q20 (m³/day)* Effective	Transmissivity (m²/day)* Apparent	Transmissivity (m²/day)* Aquifer	Transmissivity (m²/day)* Effective	
1	*1979-11-18 11:00*	*Air*			*27.3*	*9.75*	—	—	—						R

Alias IDs

AENV - GIC (WIN-WEB): *0470214*
AENV - GIC (WELLID): *470214*

** TGWC calculated or determined value.*
*** 75 - MT GPS — 10TM NAD83*
**** 60 - MT DEM — (Ground, AMSL)*

This report was generated on: December 02, 2010 — Data "AS IS"; no warranty either expressed or implied. [53.61754 -114.37839 (WGS 84)], INT

1979 Franczak Water Well
Chemical Analysis (Oct 21, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada
T: +1 (780) 438-5522
F: +1 (780) 438-5398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project:		Lot ID:	**769933**
Report To:	Hydrogeological Consultants	ID:	10-505	Control Number:	Z-065679
	17740 - 118 Avenue	Name:	Groundwater Review	Date Received:	Oct 22, 2010
	Edmonton, AB, Canada	Location:	Lac Ste. Anne Area	Date Reported:	Oct 27, 2010
	T5S 2W3	LSD:	Parts of Sections 28 and 32 to 34	Report Number:	1373209
Attn:	Tara Parker	P.O.:	14091		
Sampled By:	Hydrogeological Consultants Ltd.	Acct code:			
Company:					

Reference Number	769933-2
Sample Date	October 21, 2010
Sample Time	16:40
Sample Location	
Sample Description	M36056.964300 (1979 Franczak Stock Water Well) / 6.1°C / SE 33-053-03
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Dissolved						
Silicon	Dissolved	mg/L	6.86	0.05		
Sulfur	Dissolved	mg/L	17.7	0.3		
Aluminum	Dissolved	mg/L	<0.002	0.002	0.1	Below OG
Antimony	Dissolved	mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Dissolved	mg/L	0.0030	0.0002	0.01	Below MAC
Barium	Dissolved	mg/L	0.070	0.001	1	Below MAC
Beryllium	Dissolved	mg/L	<0.0001	0.0001		
Bismuth	Dissolved	mg/L	<0.0005	0.0005		
Boron	Dissolved	mg/L	0.147	0.002	5	Below MAC
Cadmium	Dissolved	mg/L	<0.00001	0.00001	0.005	Below MAC
Chromium	Dissolved	mg/L	0.0020	0.0005	0.05	Below MAC
Cobalt	Dissolved	mg/L	0.0002	0.0001		
Copper	Dissolved	mg/L	<0.001	0.001	1	Below AO
Lead	Dissolved	mg/L	<0.0001	0.0001	0.01	Below MAC
Lithium	Dissolved	mg/L	0.052	0.001		
Molybdenum	Dissolved	mg/L	<0.001	0.001		
Nickel	Dissolved	mg/L	<0.0005	0.0005		
Selenium	Dissolved	mg/L	<0.0002	0.0002	0.01	Below MAC
Silver	Dissolved	mg/L	<0.00001	0.00001		
Strontium	Dissolved	mg/L	0.644	0.001		
Thallium	Dissolved	mg/L	<0.00005	0.00005		
Tin	Dissolved	mg/L	<0.001	0.001		
Titanium	Dissolved	mg/L	0.0015	0.0005		
Uranium	Dissolved	mg/L	0.0018	0.0005	0.02	Below MAC
Vanadium	Dissolved	mg/L	0.0053	0.0001		
Zinc	Dissolved	mg/L	0.001	0.001	5	Below AO
Microbiological Analysis						
Total Coliforms	Membrane Filtration	CFU/100 mL	<1	1	0	Below MAC
Fecal Coliforms	Membrane Filtration	CFU/100 mL	<1	1		
Physical and Aggregate Properties						
Colour	Apparent, Potable	Colour units	>60	5	15	Above AO
Turbidity		NTU	28.4	0.1	0.1	Above OG
Routine Water						
pH			7.92		6.5 - 8.5	Within AO
Temperature of observed pH		°C	19.6			

Terms and Conditions: www.exova.ca/terms&conditions

1979 Franczak Water Well
Chemical Analysis (Oct 21, 2010)

Exova
7217 Roper Road NW
Edmonton, Alberta
T6B 3J4, Canada

T: +1 (780) 438-5522
F: +1 (780) 438-0398
E: Edmonton@exova.com
W: www.exova.com

Exova

Analytical Report

Bill To:	Hydrogeological Consultants	Project ID:	10-505	Lot ID:	769933
Report To:	Hydrogeological Consultants	Name:	Groundwater Review	Control Number:	Z-065679
	17740 - 118 Avenue	Location:	Lac Ste. Anne Area	Date Received:	Oct 22, 2010
	Edmonton, AB, Canada	LSD:	Parts of Sections 28 and 32 to 34	Date Reported:	Oct 27, 2010
	T5S 2W3	P.O.:	14091	Report Number:	1373209
Attn:	Tara Parker				
Sampled By:	Hydrogeological Consultants Ltd.	Acct code:			
Company:					

Reference Number	769933-2
Sample Date	October 21, 2010
Sample Time	16:40
Sample Location	
Sample Description	M36056.964300 (1979 Franczak Stock Water Well) / 6.1°C / SE 33-053-03
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Electrical Conductivity		µS/cm at 25 C	907	1		
Calcium	Dissolved	mg/L	115	0.2		
Calcium	Extractable	mg/L	122	0.2		
Magnesium	Dissolved	mg/L	30.1	0.2		
Magnesium	Extractable	mg/L	30.8	0.2		
Sodium	Dissolved	mg/L	42.4	0.4	200	Below AO
Sodium	Extractable	mg/L	45.3	0.4	200	Below AO
Potassium	Dissolved	mg/L	3.7	0.4		
Potassium	Extractable	mg/L	3.9	0.4		
Iron	Dissolved	mg/L	0.01	0.01	0.3	Below AO
Iron	Extractable	mg/L	2.28	0.01	0.3	Above AO
Manganese	Dissolved	mg/L	0.577	0.005	0.05	Above AO
Manganese	Extractable	mg/L	0.620	0.005	0.05	Above AO
Chloride	Dissolved	mg/L	0.4	0.4	250	Below AO
Fluoride		mg/L	0.13	0.05	1.5	Below MAC
Nitrate - N		mg/L	<0.01	0.01	10	Below MAC
Nitrite - N		mg/L	<0.005	0.005	1	Below MAC
Nitrate and Nitrite - N		mg/L	<0.01	0.01	10	Below MAC
Sulfate (SO4)		mg/L	55.3	0.9	500	Below AO
Hydroxide		mg/L	<5	5		
Carbonate		mg/L	<6	6		
Bicarbonate		mg/L	596	5		
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	489	5		
Total Dissolved Solids		mg/L	550	1	500	Above AO
Hardness	as CaCO3	mg/L	430			
Ionic Balance		%	98			

This information redacted as per Protection of Privacy

Approved by:
Randy Neumann, BSc
General Manager

Terms and Conditions: www.exova.ca/terms&conditions

Appendix C – Extended Aquifer Test Details

TABLE OF CONTENTS

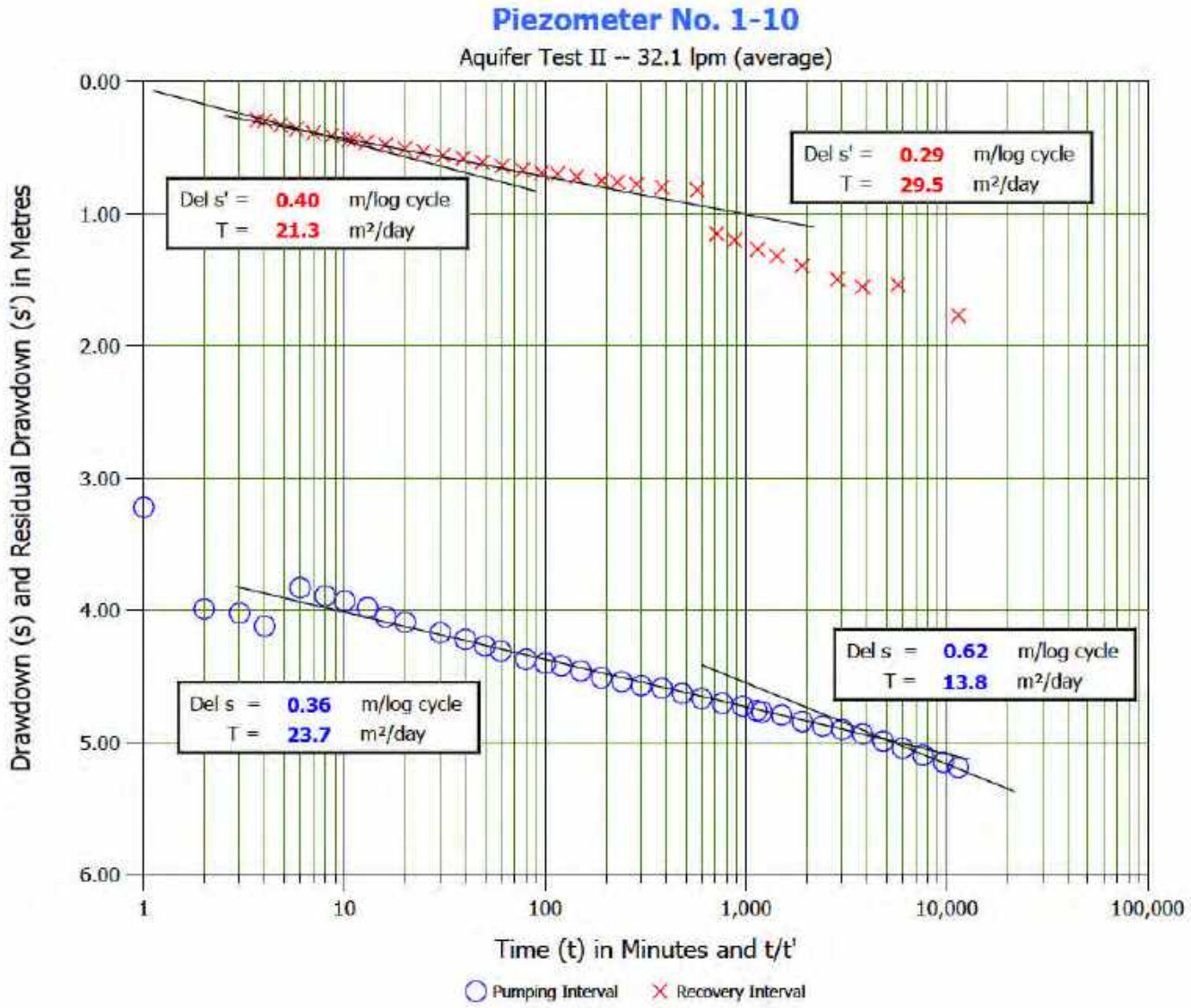
Aquifer Test II with Piez No. 1-10 2
Pumped Water Well (Piezometer No. 1-10) 3
Pumping Rate during Aquifer Test II 4
Piez No. 5-10 Used as Observation WW during Aquifer Test II with Piez No. 1-10 5
Piez No. 4-10 Used as Observation WW during Aquifer Test II with Piez No. 1-10 6
Piez No. 6-10 Used as Observation WW during Aquifer Test II with Piez No. 1-10 7
Piez No. 2-10 Used as Observation WW during Aquifer Test II with Piez No. 1-10 8
Piez No. 3-10 Used as Observation WW during Aquifer Test II with Piez No. 1-10 9
Aquifer Test II Data 10

Aquifer Test II with Piez No. 1-10

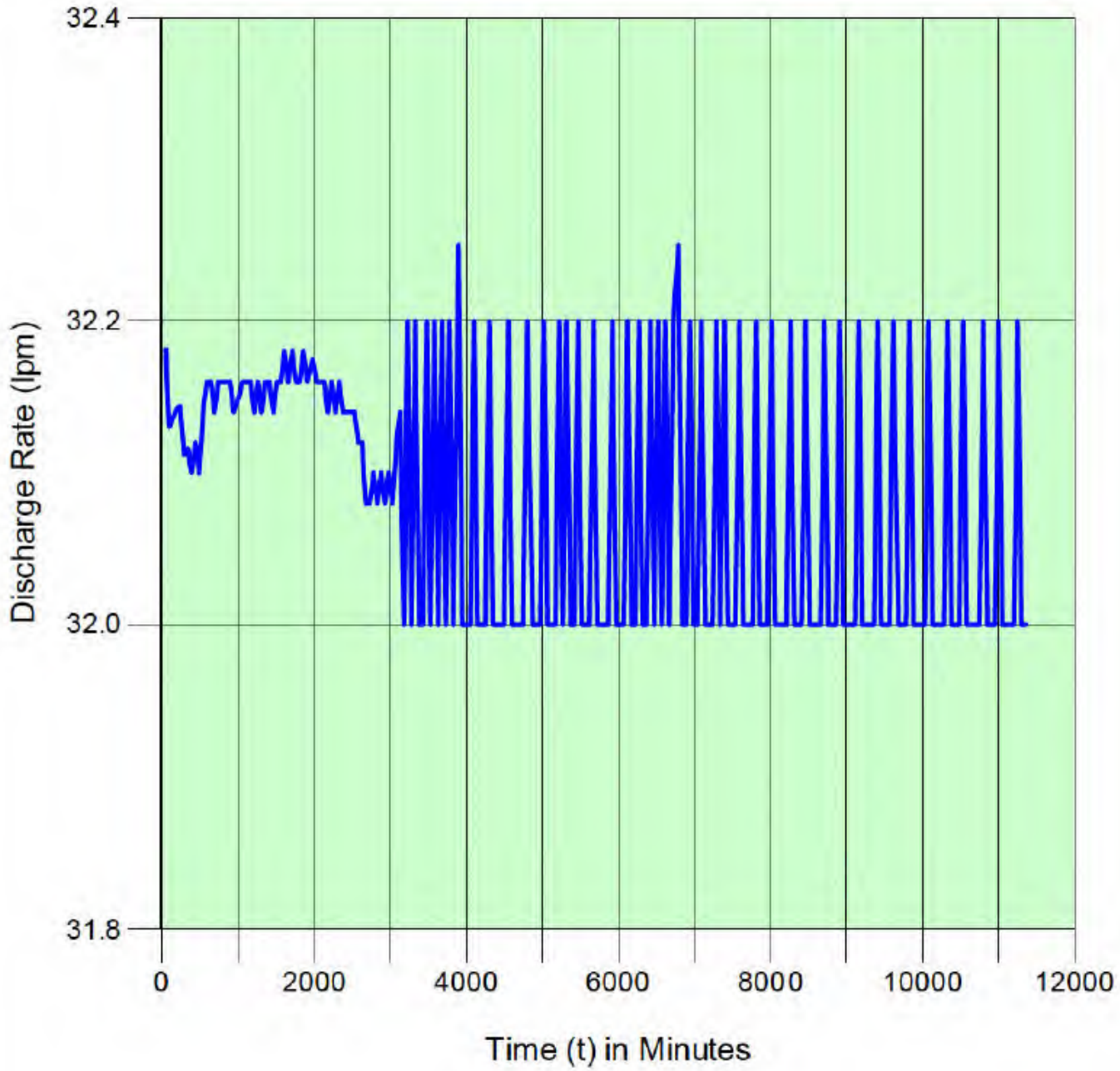
Test Started: November 04, 2010 @ 15:40 Hrs
Discharge (lpm): 32.1

	NPWL (m BTOC)	Distance from Pumped Water Well (m)
Pumped Water Well:		
Piezometer No. 1-10	11.28	
Observation Water Wells:		
Piezometer No. 5-10	11.46	49
Piezometer No. 4-10	11.51	351
Piezometer No. 6-10	7.76	508
Piezometer No. 2-10	7.38	621
Piezometer No. 3-10	13.90	1245

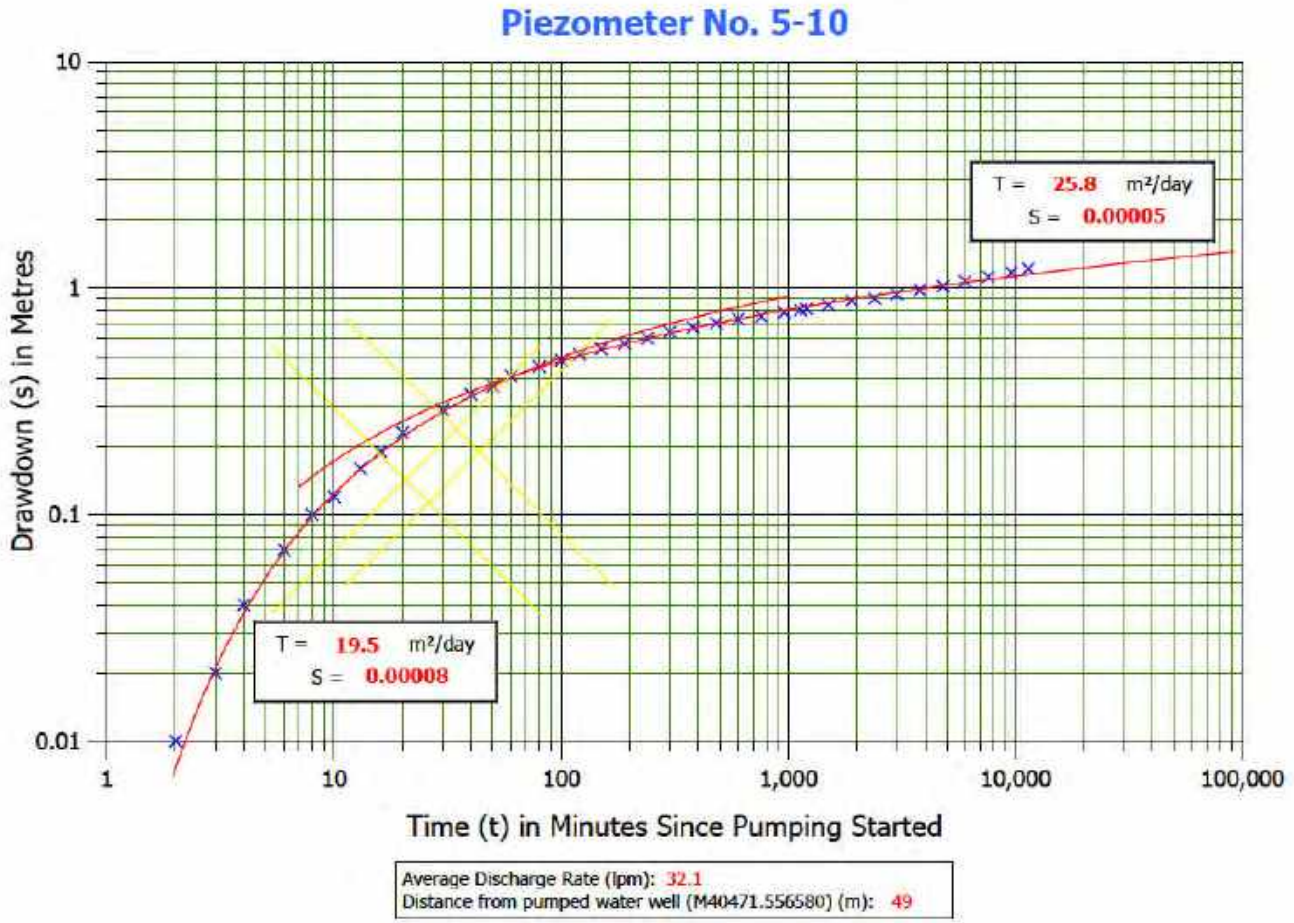
Aquifer Test II
Pumped Water Well (Piezometer No. 1-10)



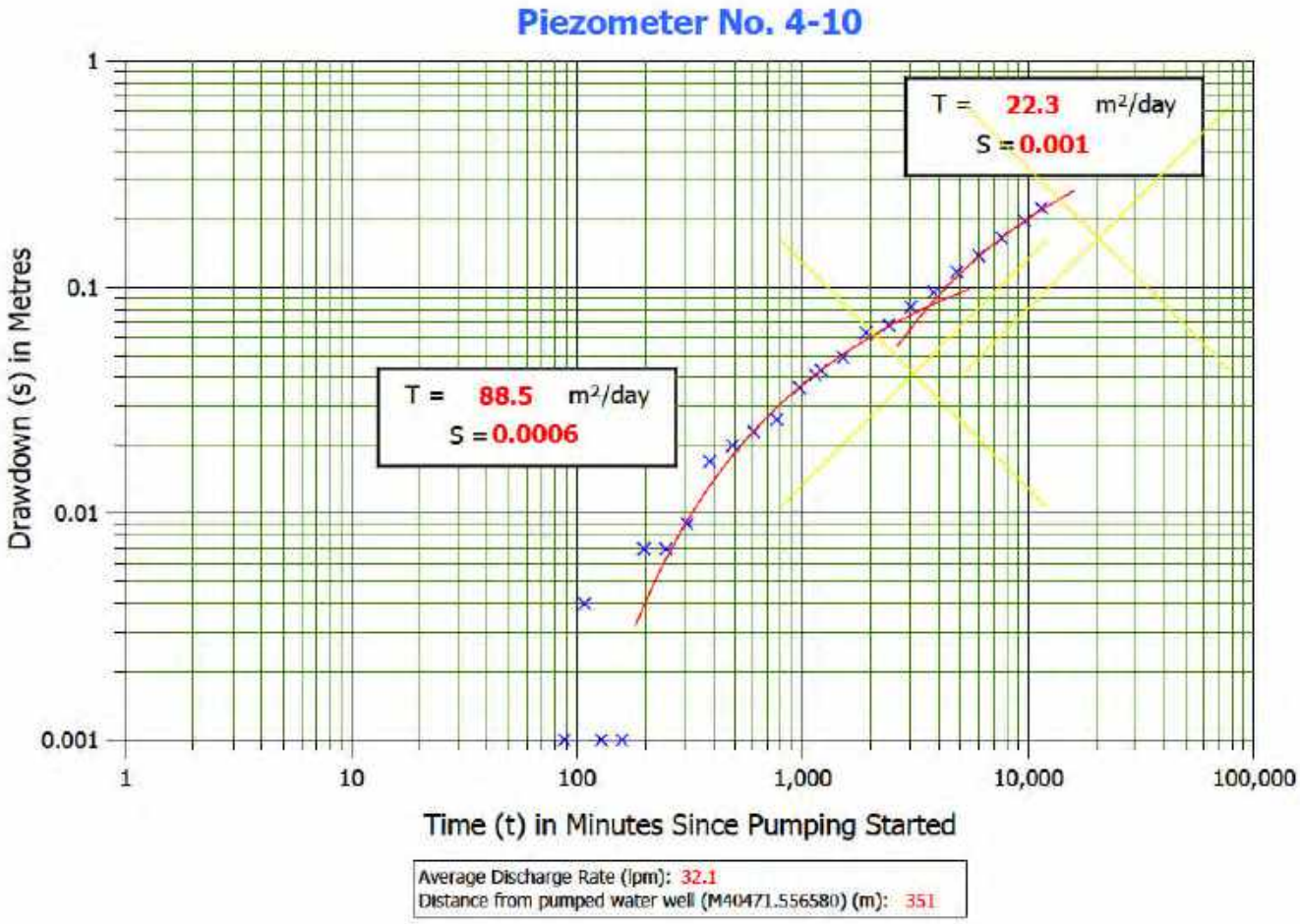
Pumping Rate during Aquifer Test II



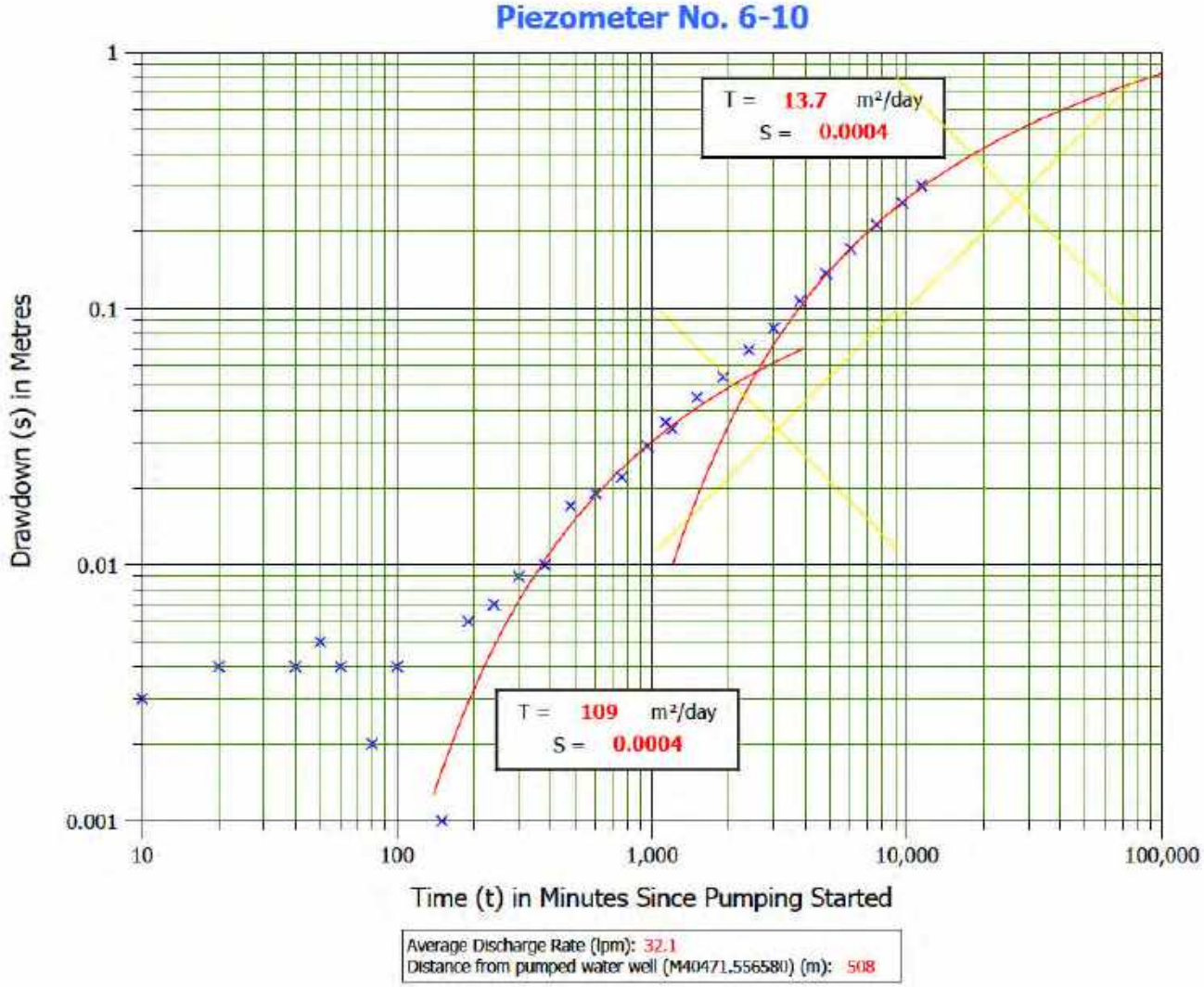
Piezometer No. 5-10
Used as Observation WW during Aquifer Test II with Piez No. 1-10



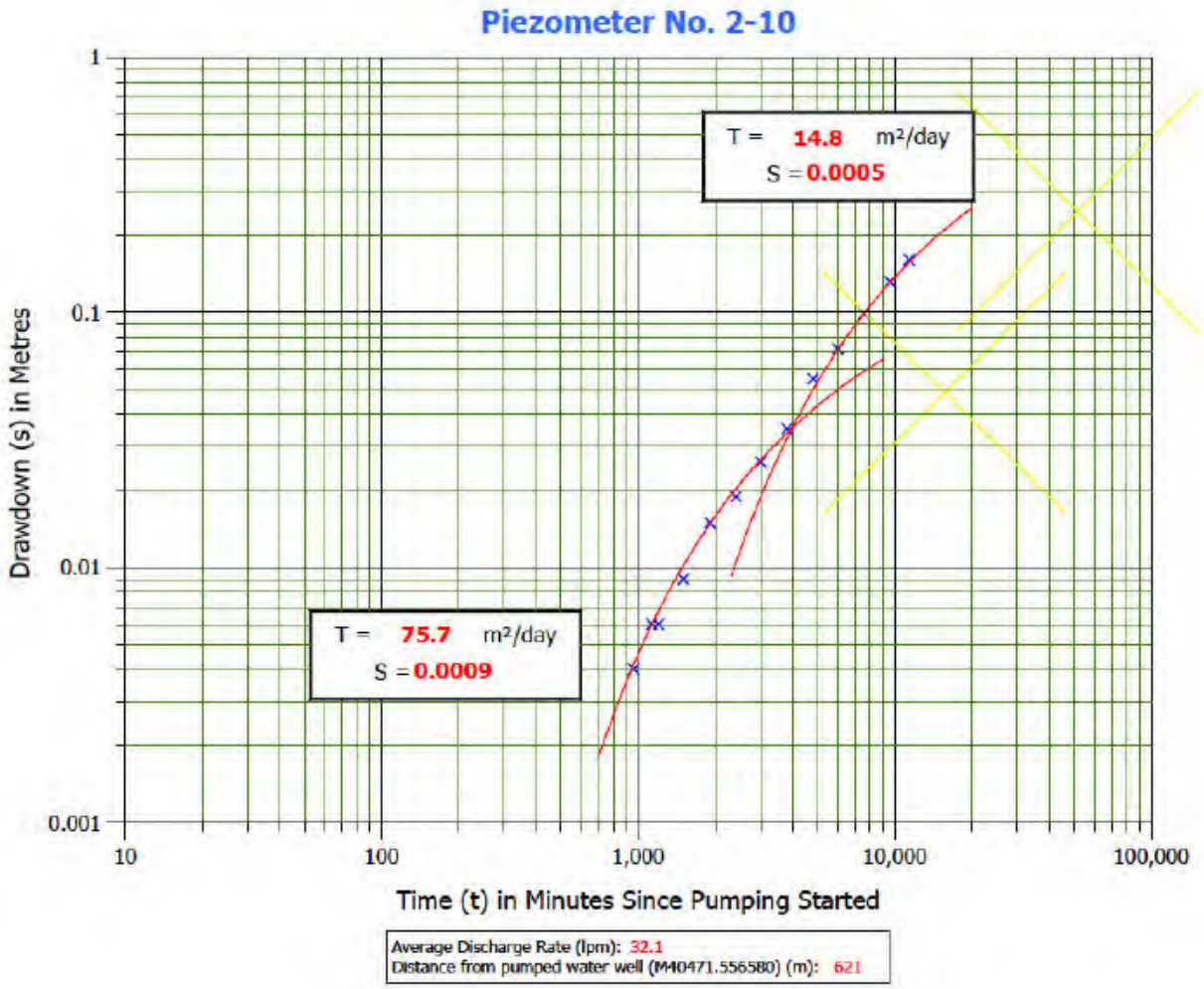
Piezometer No. 4-10
Used as Observation WW during Aquifer Test II with Piez No. 1-10



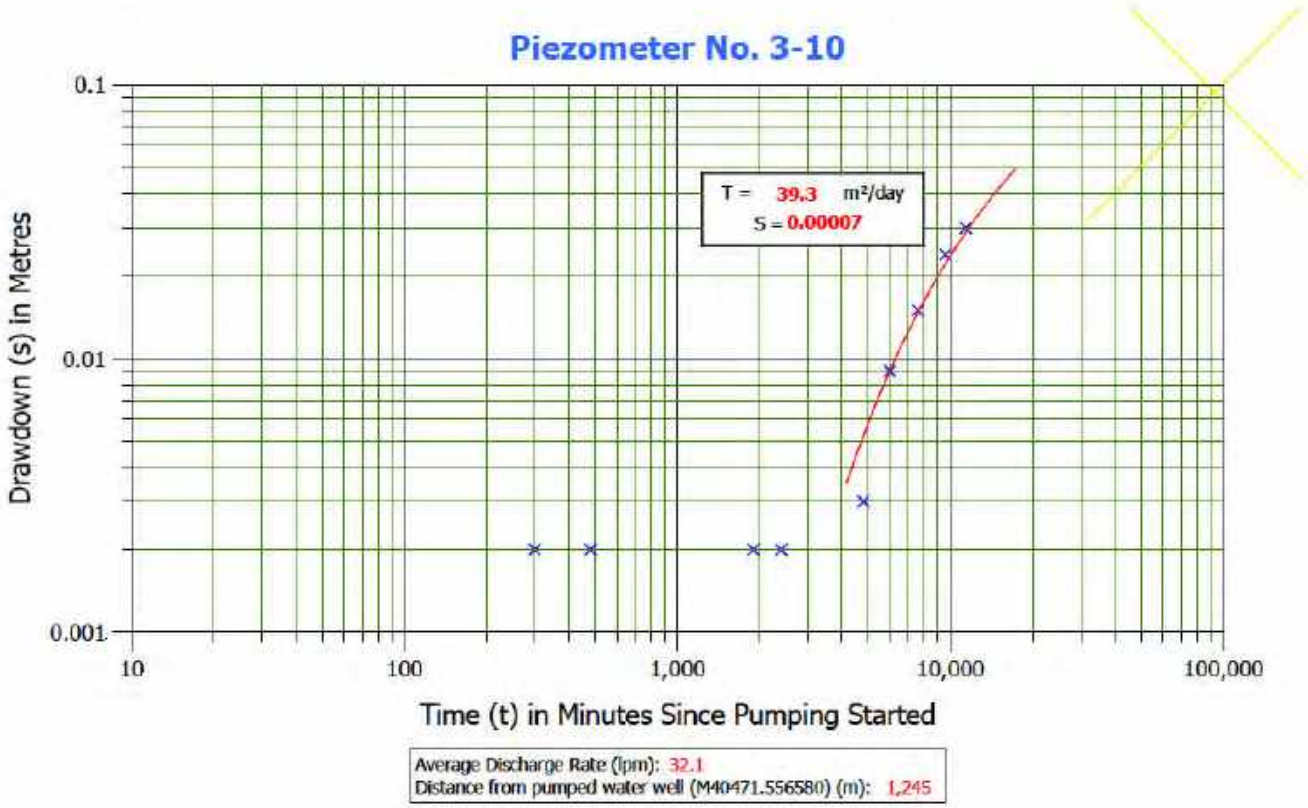
Piezometer No. 6-10
Used as Observation WW during Aquifer Test II with Piez No. 1-10



Piezometer No. 2-10
Used as Observation WW during Aquifer Test II with Piez No. 1-10



Piezometer No. 3-10
Used as Observation WW during Aquifer Test II with Piez No. 1-10



Aquifer Test II Data

Pumped Water Well:

Piezometer No. 1-10

Observation Water Well(s):

Piezometer No. 5-10
Piezometer No. 4-10
Piezometer No. 6-10
Piezometer No. 2-10
Piezometer No. 3-10

Aquifer Test II

Piezometer No. 1-10

(formerly A1, Mike's 2-10)

15-33-053-03 W5M

Average Discharge (lpm):	**32.1**	Pre-Test Water Level - NPWL (m):	**11.28**
Date Test Started:	**November 04, 2010**	Depth to Pump Intake (m):	**22.9**
Time Test Started (hours):	**15:40**	Test Interval - Top (m):	**17.4**
Pumping Interval (minutes):	**11,380**	Test Interval - Bottom (m):	**20.4**
Recovery Interval (minutes):	**4,240**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*

Reference: M40471.556580 (AT 2)

** TGWC calculated or determined value*

This report was generated on: December 03, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)	Discharge (Lpm)
1	3.22	40.0
2	3.99	40.0
3	4.02	40.0
4	4.12	40.0
6	3.83	32.4
8	3.89	32.5
10	3.93	32.4
13	3.98	32.4
16	4.05	32.4
20	4.09	32.3
30	4.17	32.3
40	4.22	32.2
50	4.27	32.2
60	4.31	32.1
80	4.37	32.2
100	4.40	32.1
120	4.42	32.1
150	4.46	32.1
190	4.51	32.2
240	4.54	32.1
300	4.57	32.1
380	4.59	32.1
480	4.63	32.1
600	4.67	32.2
760	4.70	32.1
960	4.73	32.1
1,130	4.76	32.1
1,200	4.77	32.2
1,500	4.79	32.1
1,900	4.84	32.2
2,400	4.88	32.1
3,000	4.90	32.1
3,800	4.94	33.0
4,800	4.99	32.0
6,000	5.04	32.0
7,600	5.10	32.0
9,600	5.15	32.0
11,380	5.19	32.0

Recovery Interval

Measurement Point: Top of Casing

Time (t') Since Pumping Stopped (minutes)	(t/t')	Residual Drawdown (s') (metre)
1	11381	1.77
2	5691	1.54
3	3794	1.55
4	2846	1.49
6	1898	1.39
8	1424	1.32
10	1139	1.27
13	876	1.20
16	712	1.15
20	570	0.82
30	380	0.80
40	286	0.78
50	229	0.76
60	191	0.75
80	143	0.72
100	115	0.70
120	96	0.69
150	77	0.67
190	61	0.64
240	48	0.61
300	39	0.58
380	31	0.56
480	25	0.53
600	20	0.51
760	16.0	0.48
960	12.9	0.46
1,130	11.1	0.44
1,200	10.5	0.44
1,500	8.6	0.41
1,900	7.0	0.39
2,400	5.7	0.36
3,000	4.8	0.33
3,800	4.0	0.30
4,240	3.7	0.29

Test Comments:

Test conducted by Mow-Tech Ltd. Data-logger measurements. Water pumped to dugout located approx. 600 metres east of Piez No. 1-10.

Piezometer No. 5-10

Used as Observation Water Well During
Aquifer Test II with Piezometer No. 1-10

15-33-053-03 W5M

Pumped Well: Average Discharge (lpm):	**32.1**	Pre-Test Water Level - NPWL (m):	**11.46**
Pumped Well: Date Test Started:	**November 04, 2010**	Distance From Pumped Well (m):	**49**
Pumped Well: Time Test Started (hours):	**15:40**	Test Interval - Top (m):	**15.9**
Pumped Well: Pumping Interval (minutes):	**11,380**	Test Interval - Bottom (m):	**19.2**
Pumped Well: Recovery Interval (minutes):	**4,240**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*

Obs: M40478.679459, 1.1 — Pumped: M40471.556580, 2

** TGWC calculated or determined value*

This report was generated on: December 03, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)
1	0.00
2	0.01
3	0.02
4	0.04
6	0.07
8	0.10
10	0.12
13	0.16
16	0.19
20	0.23
30	0.29
40	0.34
50	0.37
60	0.41
80	0.45
100	0.48
120	0.51
150	0.54
190	0.57
240	0.60
300	0.64
380	0.67
480	0.70
600	0.73
760	0.75
960	0.78
1,130	0.80
1,200	0.81
1,500	0.84
1,900	0.88
2,400	0.90
3,000	0.94
3,800	0.98
4,800	1.02
6,000	1.07
7,600	1.12
9,600	1.17
11,380	1.22

Test Comments:

Test conducted by Mow-Tech Ltd. Data-logger measurements.

Piezometer No. 4-10

Used as Observation Water Well During
Aquifer Test II with Piezometer No. 1-10

10-33-053-03 W5M

Pumped Well: Average Discharge (lpm):	**32.1**	Pre-Test Water Level - NPWL (m):	**11.51**
Pumped Well: Date Test Started:	**November 04, 2010**	Distance From Pumped Well (m):	**351**
Pumped Well: Time Test Started (hours):	**15:40**	Test Interval - Top (m):	**14.0**
Pumped Well: Pumping Interval (minutes):	**11,380**	Test Interval - Bottom (m):	**17.1**
Pumped Well: Recovery Interval (minutes):	**4,240**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*
Obs: M40478.487465, 1.1 — Pumped: M40471.556580, 2
** TGWC calculated or determined value*

This report was generated on: December 03, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)
8	0.00
18	0.00
28	0.00
38	0.00
48	0.00
58	0.00
68	0.00
88	0.00
108	0.00
128	0.00
158	0.00
198	0.01
248	0.01
308	0.01
388	0.02
488	0.02
608	0.02
768	0.03
968	0.04
1,138	0.04
1,208	0.04
1,508	0.05
1,908	0.06
2,408	0.07
3,008	0.08
3,808	0.10
4,808	0.12
6,008	0.14
7,608	0.17
9,608	0.20
11,378	0.22

Test Comments:

Test conducted by Mow-Tech Ltd. Data-logger measurements.

Piezometer No. 6-10

Used as Observation Water Well During
Aquifer Test II with Piezometer No. 1-10

15-33-053-03 W3M

Pumped Well: Average Discharge (lpm):	**32.1**	Pre-Test Water Level - NPWL (m):	**7.76**
Pumped Well: Date Test Started:	**November 04, 2010**	Distance From Pumped Well (m):	**508**
Pumped Well: Time Test Started (hours):	**15:40**	Test Interval - Top (m):	**11.9**
Pumped Well: Pumping Interval (minutes):	**11,380**	Test Interval - Bottom (m):	**18.0**
Pumped Well: Recovery Interval (minutes):	**4,240**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*
Obs: M40480.579648; 1.1 — Pumped: M40471.556580; 2
** TGWC calculated or determined value*

This report was generated on: December 03, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)
10	0.00
20	0.00
30	0.00
40	0.00
50	0.01
60	0.00
80	0.00
100	0.00
120	0.00
150	0.00
190	0.01
240	0.01
300	0.01
380	0.01
480	0.02
600	0.02
760	0.02
960	0.03
1,130	0.04
1,200	0.03
1,500	0.05
1,900	0.05
2,400	0.07
3,000	0.08
3,800	0.11
4,800	0.14
6,000	0.17
7,600	0.21
9,600	0.26
11,380	0.30

Test Comments:

Test conducted by Mow-Tech Ltd. Data-logger measurements.

Piezometer No. 2-10

Used as Observation Water Well During
Aquifer Test II with Piezometer No. 1-10

16-33-053-03 W5M

Pumped Well: Average Discharge (lpm):	**32.1**	Pre-Test Water Level - NPWL (m):	**7.38**
Pumped Well: Date Test Started:	**November 04, 2010**	Distance From Pumped Well (m):	**621**
Pumped Well: Time Test Started (hours):	**15:40**	Test Interval - Top (m):	**12.8**
Pumped Well: Pumping Interval (minutes):	**11,380**	Test Interval - Bottom (m):	**15.9**
Pumped Well: Recovery Interval (minutes):	**4,240**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*
Obs: M40478.470194, 1.1 — Pumped: M40471.556580, 2
** TGWC calculated or determined value*

This report was generated on: December 03, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)
10	0.00
20	0.00
30	0.00
40	0.00
50	0.00
60	0.00
80	0.00
100	0.00
120	0.00
150	0.00
190	0.00
240	0.00
300	0.00
380	0.00
480	0.00
600	0.00
760	0.00
960	0.00
1,130	0.01
1,200	0.01
1,500	0.01
1,900	0.02
2,400	0.02
3,000	0.03
3,800	0.04
4,800	0.06
6,000	0.07
7,600	0.10
9,600	0.13
11,380	0.16

Test Comments:

Test conducted by Mow-Tech Ltd. Data-logger measurements.

Piezometer No. 3-10

Used as Observation Water Well During
Aquifer Test II with Piezometer No. 1-10

05-34-053-03 W5M

Pumped Well: Average Discharge (lpm):	**32.1**	Pre-Test Water Level - NPWL (m):	**13.90**
Pumped Well: Date Test Started:	**November 04, 2010**	Distance From Pumped Well (m):	**1,245**
Pumped Well: Time Test Started (hours):	**15:40**	Test Interval - Top (m):	**15.2**
Pumped Well: Pumping Interval (minutes):	**11,380**	Test Interval - Bottom (m):	**21.3**
Pumped Well: Recovery Interval (minutes):	**4,240**	Top of Main Aquifer (m):*	**N/A**

N/A *- Information Not Available*
Obs: M40478.460727; 1.1 — Pumped: M40471.556580; 2
** TGWC calculated or determined value*

This report was generated on: December 03, 2010 — Data "AS IS", no warranty either expressed or implied. © TGWC — Page 1 of 1

Pumping Interval

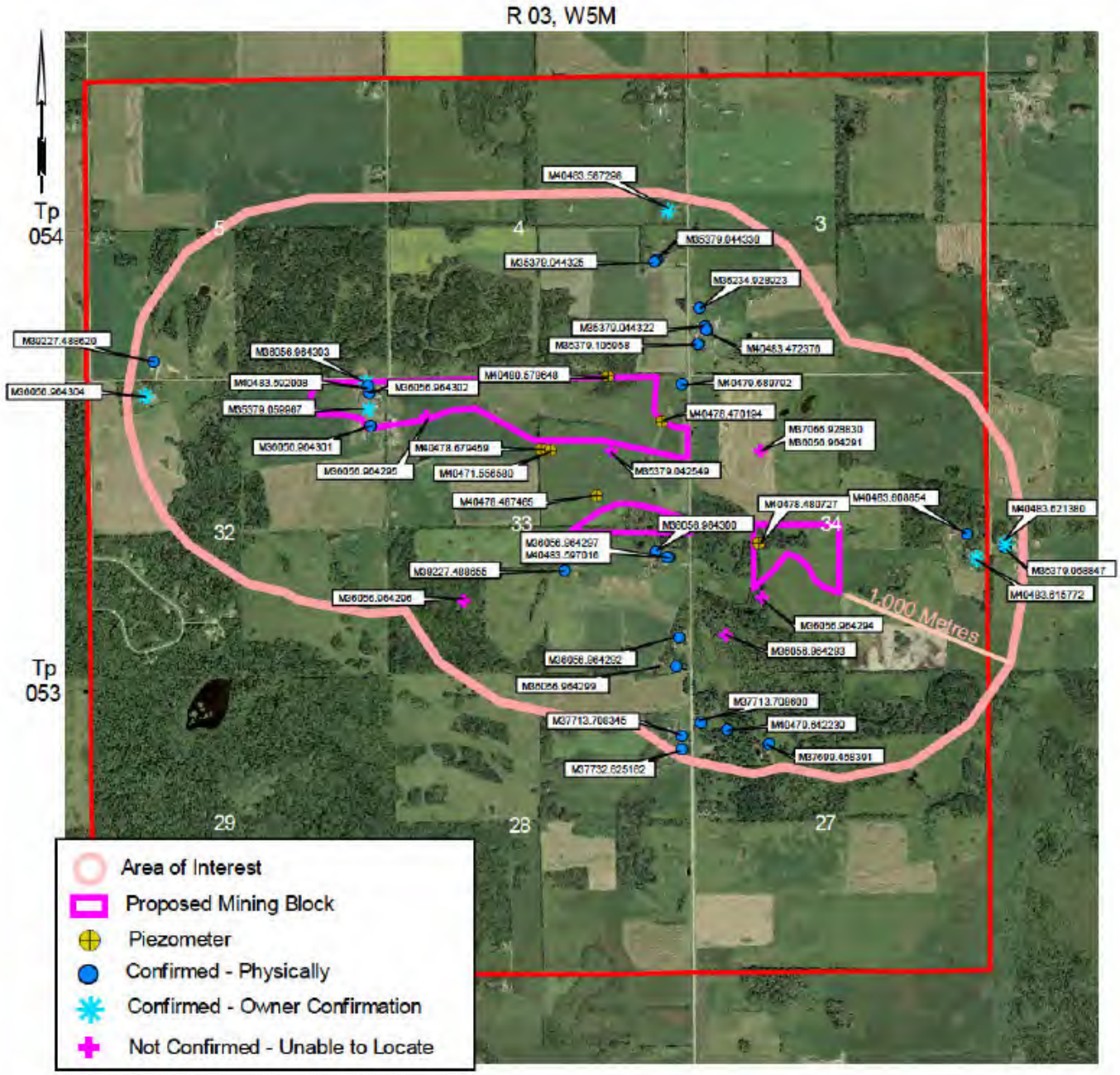
Measurement Point: Top of Casing

Time (t) Since Pumping Started (minutes)	Drawdown (s) (metre)
10	0.00
20	0.00
30	0.00
40	0.00
50	0.00
60	0.00
80	0.00
100	0.00
120	0.00
150	0.00
190	0.00
240	0.00
300	0.00
380	0.00
480	0.00
600	0.00
760	0.00
960	0.00
1,130	0.00
1,200	0.00
1,500	0.00
1,900	0.00
2,400	0.00
3,000	0.00
3,800	0.00
4,800	0.00
6,000	0.01
7,600	0.02
9,600	0.02
11,380	0.03

Test Comments:

Test conducted by Mow-Tech Ltd. Data-logger measurements.

Appendix D – Water Well Survey



Field-Verified Survey
Groundwater Records in Area of Interest (duplicates removed)

Survey Centred on: Piezometer No. 1-10

Page: 1 of 8; Printed on September 21, 2012

Parameter						
Owner / Lessee	1531486 Alberta Ltd.	1531486 Alberta Ltd.	Lany, Ewald	1531486 Alberta Ltd.	1531486 Alberta Ltd.	1531486 Alberta Ltd.
Legal Location	**15-33-053-03 W5M**	**15-33-053-03 W5M**	**NE 33-053-03 W5M**	**10-33-053-03 W5M**	**15-33-053-03 W5M**	**16-33-053-03 W5M**
Ground Elevation	776.6 m	776.9 m	774.8 m	778.0 m	570.3 m	773.3 m
Well Type	Piezometer	Piezometer	New Well	Piezometer	Piezometer	Piezometer
Water Status	Observation	Observation	Producing	Observation	Observation	Observation
Well Depth Drilled	22.9 m	21.9 m	54.9 m	18.3 m	20.7 m	18.3 m
Top of Aquifer	-	-	-	-	-	-
Total Available Head	6.1 m	7.8 m	-	5.6 m	10.3 m	5.5 m
Max. Pumping Rate	32.1 Lpm	32.1 Lpm	90.9 Lpm	32.1 Lpm	37.9 Lpm	32.1 Lpm
Completion Details	17.4 - 20.4 m	15.9 - 19.2 m	36.6 - 54.9 m	15.9 - 17.1 m	11.9 - 18.0 m	12.8 - 15.9 m
Distance	0 m	49 m	335 m	351 m	508 m	621 m
Earliest Water Level	October 20, 2010	November 03, 2010	September 18, 1995	November 02, 2010	November 01, 2010	November 02, 2010
	11.3 m	11.5 m	5.5 m	11.5 m	7.9 m	7.4 m
Latest Water Level	2011-08-30	2011-08-30	1995-09-18	2011-08-30	2011-08-30	2011-08-30
	11.2 m	11.4 m	48.8 m	11.5 m	7.7 m	7.3 m
Daily Use	-	-	~1,364 L	-	-	-
Number of Chemistries	1	1	-	-	1	-
(latest analysis)	October 27, 2010	November 09, 2010			November 08, 2010	
Comments	[Piezometer was developed for 30 minutes at a rate of 32 litres per minute on October 20, 2010. Piezometer surveyed (xyz) Nov 25, 2010 by Altus Geomatics.]	[Piezometer was developed for 35 minutes at 14 litres per minute on October 22, 2010. Piezometer surveyed (xyz) Nov 25, 2010 by Altus Geomatics.]		[Piezometer was developed for 50 minutes at eight litres per minute on October 21, 2010. Piezometer surveyed (xyz) Nov 25, 2010 by Altus Geomatics.]	[Piezometer was developed for 25 minutes at 40 litres per minute on October 28, 2010. Piezometer surveyed (xyz) Nov 25, 2010 by Altus Geomatics.]	[Piezometer developed for 45 minutes at 18 litres per minutes on October 20, 2010. Piezometer surveyed (xyz) Nov 25, 2010 by Altus Geomatics.]
AENV Well ID(s)			0443301			
Licensed/Registered Diversion	-	-	-	-	-	-

Consultant Details						
TGWC ID	M40471.556580	M40478.679459	M35379.042549	M40478.487465	M40480.579648	M40478.470184
Date Verified	October 20, 2010	November 03, 2010	October 18, 2010	November 03, 2010	November 01, 2010	November 03, 2010
Verification Status	(01) Confirmed - Physically	(01) Confirmed - Physically	(04) Not Confirmed - Unable to Locate	(01) Confirmed - Physically	(01) Confirmed - Physically	(01) Confirmed - Physically
Well Name	Piezometer No. 1-10	Piezometer No. 5-10	[unknown]	Piezometer No. 4-10	Piezometer No. 6-10	Piezometer No. 2-10

Field-Verified Survey
Groundwater Records in Area of Interest (duplicates removed)

Survey Centred on: Piezometer No. 1-10

Parameter						
Owner / Lessee	Franczak, Dave	DEMKEES	Franczak, Dave	Drews, Donald	Franczak, Dave	Franczak, Dave
Legal Location	SE 33-053-03 W5M	13-33-053-03 W5M	SE 33-053-03 W5M	16-33-053-03 W5M	SE 33-053-03 W5M	SE 33-053-03 W5M
Ground Elevation	780.4 m	772.5 m	776.8 m	771.5 m	777.1 m	777.1 m
Well Type	New Well	New Well	New Well	Well Inventory	Well Inventory	New Well
Water Status	Producing	Producing	Producing	Not In Use	Not In Use	Producing
Well Depth Drilled	21.9 m	48.8 m	24.4 m	51.8 m	-	18.3 m
Top of Aquifer	-	-	-	-	-	-
Total Available Head	5.5 m	25.0 m	-	-	-	5.7 m
Max. Pumping Rate	40.9 Lpm	36.4 Lpm	27.3 Lpm	-	-	31.8 Lpm
Completion Details	20.4 - 21.9 m	32.3 - 45.7 m	23.5 - 24.4 m			16.2 - 17.7 m
Distance	650 m	701 m	787 m	798 m	856 m	859 m
Earliest Water Level	July 10, 2001	October 07, 1981	November 18, 1979	October 18, 2010	October 18, 2010	August 06, 1987
	12.0 m	7.3 m	9.8 m	10.4 m	10.0 m	8.8 m
Latest Water Level	2011-06-23	1981-10-07	2011-06-23	2010-10-18	2010-10-18	2011-06-23
	14.9 m	7.3 m	11.8 m	10.4 m	10.0 m	10.4 m
Daily Use	~1,818 L	-	-	-	-	-
Number of Chemistries	1	-	1	-	-	1
(latest analysis)	October 27, 2010		October 27, 2010			October 27, 2010
Comments	Original owner: Franczak, Steve. Pack Grain size - Coarse Sand. [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located in shed in pasture. Submersible pump is powered by gen-set.] [53S12 RR 33]		[53S12 RR 33, original owner: Steve Franczak]. [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located in shed in livestock area 100 metres west of house.]	[Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), Hand Pump water well reported by landowner "Donald Drews to have been drilled by a seismic crew. Water well is not in use and is located approx. 50 metres northeast of tower. Landowner reported depth of 170 ft.]	[53S12 RR 33] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), Original water well for farm site. located in a water well pit in shed 25 metres southwest of house. Landowner reports that water well is not in use as there is a hole in the casing. TOC to top of pit: 2.40, Top of pit to GL: 0.24 metres.]	[53S12 RR 33, Original owner: Steve Franczak.] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located 25 metres southwest of house. Water well is primary house water well but can be used for stock purposes if needed.]
AENV Well ID(s)	11046152; 1715127	0470219; 470219	0470214; 470214			0470217; 470217
Licensed/Registered Diversion	-	-	-	-	-	-
Consultant Details						
TGWC ID	M39227.488655	M36056.964295	M36056.964300	M40479.689792	M40483.597016	M36056.964297
Date Verified	July 10, 2001	October 18, 2010	October 18, 2010	October 08, 2010	October 18, 2010	October 18, 2010
Verification Status	(01) Confirmed - Physically	(04) Not Confirmed - Unable to Locate	(01) Confirmed - Physically	(01) Confirmed - Physically	(01) Confirmed - Physically	(01) Confirmed - Physically
Well Name	2001 Franczak Water Well	[unknown]	1979 Franczak Water Well	1970 Drews Hand Pump WW	Franczak Water Well	1987 Franczak Water Well

Field-Verified Survey
Groundwater Records in Area of Interest (duplicates removed)

Survey Centred on: Piezometer No. 1-10

Parameter						
Owner / Lessee	Assenheimer, A. E.	Hickie, Glenn & Annetta	Drews, Donald	Hickie, Glenn & Annetta	Hickie, Glenn & Annetta	Hickie, Glenn & Annetta
Legal Location	SW 33-053-03 W5M	NE 32-053-03 W5M	SW 03-054-03 W5M	NE 32-053-03 W5M	NE 32-053-03 W5M	NE 32-053-03 W5M
Ground Elevation	781.9 m	774.1 m	771.3 m	772.4 m	772.5 m	772.5 m
Well Type	Chemistry	New Well	New Well	New Well	New Well	Well Inventory
Water Status	Producing	Producing	Producing	Producing	Producing	Not In Use
Well Depth Drilled	41.2 m	66.9 m	46.9 m	61.0 m	67.1 m	44.2 m
Top of Aquifer	-	-	-	-	-	-
Total Available Head	-	-	7.2 m	-	25.3 m	-
Max. Pumping Rate	-	18.2 Lpm	31.8 Lpm	13.6 Lpm	27.3 Lpm	-
Completion Details		54.9 - 66.4 m	34.4 - 46.0 m	54.9 - 61.0 m	39.6 - 67.1 m	
Distance	930 m	983 m	988 m	1,015 m	1,030 m	1,051 m
Earliest Water Level	-	October 10, 1985	April 18, 1995	October 24, 1990	June 19, 1980	-
Latest Water Level	-	41.8 m	17.1 m	41.8 m	30.5 m	-
	-	2010-10-15	2010-10-14	1990-10-24	2010-10-15	-
Daily Use	-	41.2 m	17.2 m	53.3 m	41.7 m	-
Number of Chemistries	1	-	~1,818 L	-	-	-
(latest analysis)	June 28, 1982	-	-	-	-	-
Comments		[53532 RR 34] [Original owner: Hickie, Joseph] [Water well is located in pump house 200 metres southwest of house in livestock area. No wellcap on wellhead.]	[54005 RR 33] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located off north side of red barn 150 metres south of house.]	[53532 RR 34] [Original owner: Hickie, Joe] [water well is located in water well pit beside bail shed and is used for stock watering. No access into pit. Water well located 150 metres southwest of house in stock area.]	[53532 RR 34] [Original owner: Hickie, Joe] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is main house water well and is located 75 metres southwest of house beside chop house.]	[53532 RR 34] Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well located in water well pit located beside power pole southwest of house beside pig barn that is not in use. Water resting in pit. Water well is not in use. Joe Hickie reports that water well was drilled in 1955 - 56 to 44.2 metres.]
AENV Well ID(s)	0470218; 470218	0470213; 470213	0406049; 406049	0358404; 358404	0470212; 470212	
Licensed/Registered Diversion	-	3.4 m³/day	2.2 m³/day	6.8 m³/day	6.8 m³/day	-
Consultant Details						
TGWC ID	M36056.964296	M36056.964301	M35379.105958	M35379.059967	M36056.964302	M40483.592008
Date Verified	October 18, 2010	October 15, 2010	October 14, 2010	October 15, 2010	October 15, 2010	October 15, 2010
Verification Status	(04) Not Confirmed - Unable to Locate	(01) Confirmed - Physically	(01) Confirmed - Physically	(02) Confirmed - Owner Confirmation	(01) Confirmed - Physically	(01) Confirmed - Physically
Well Name	[unknown]	1985 Hickie Stock Water Well	1995 Drews Water Well	1990 Hickie Bail Shed Water Well	1980 Hickie Chop House Water Well	1955 Pig House Water Well

Field-Verified Survey
Groundwater Records in Area of Interest (duplicates removed)

Survey Centred on: Piezometer No. 1-10

Parameter						
Owner / Lessee	Hickie, Glenn & Annetta	Drews, Donald	Drews, Donald	Drews, Duane & Ivy	Michel, Allison (Paul Band)	Bearhead, Susan
Legal Location	NE 32-053-03 W5M	SW 03-054-03 W5M	SW 03-054-03 W5M	SW 03-054-03 W5M	NW 34-053-03 W5M	NW 34-053-03 W5M
Ground Elevation	772.6 m	770.8 m	770.9 m	771.2 m	776.8 m	776.9 m
Well Type	Chemistry	Well Inventory	New Well	New Well	New Well	Well Inventory
Water Status	Not In Use	Not In Use	Producing	Producing	Producing	Producing
Well Depth Drilled	44.2 m	-	60.7 m	54.9 m	41.5 m	33.5 m
Top of Aquifer	-	-	-	-	-	-
Total Available Head	-	-	32.3 m	-	14.0 m	-
Max. Pumping Rate	-	-	22.7 Lpm	31.8 Lpm	113.7 Lpm	18.2 Lpm
Completion Details			32.3 - 59.7 m	40.2 - 54.9 m	23.2 - 41.5 m	27.4 - 33.5 m
Distance	1,069 m	1,072 m	1,074 m	1,122 m	1,148 m	1,148 m
Earliest Water Level	November 27, 1978	-	February 04, 1981	May 15, 1997	November 10, 2000	-
	39.6 m	-	27.4 m	27.4 m	9.2 m	-
Latest Water Level	1978-11-27	-	1981-02-04	2010-10-14	2000-11-10	-
	39.6 m	-	27.4 m	31.4 m	9.2 m	-
Daily Use	-	-	-	~1,818 L	~1,818 L	-
Number of Chemistries	2	-	-	-	-	-
(latest analysis)	December 06, 1978					
Comments	[53532 RR 34] [Original owner: Hickie, Joseph] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010). Water well is reported by original owner (Joe Hickie) to have been drilled in 1950-51 to 145 ft. hard water reported WL 32 ft. Landowner reported that casing failed. Water well has not been in use for 20 plus years. Water well is located in water well pit in old garage west	[Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), 54005 RR 33, water well is located in shed 100 metres southeast of house. Landowner reported that WW was drilled in 1965.]	[54005 RR 33] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well located in water well pit 100 meters east of house.]	[54007 RR 33] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located 15 metres southeast of house in back yard.]		
AENV Well ID(s)	0470211; 470211		0445022	0468268; 468268	0497531; 497531	0470223; 470223
Licensed/Registered Diversion	-	-	2.2 m³/day	2.2 m³/day	-	-

Consultant Details						
TGWC ID	M36056.964303	M40483.472376	M35379.044322	M36234.928923	M37066.928830	M36056.964291
Date Verified	October 15, 2010	October 14, 2010	October 14, 2010	October 14, 2010	October 18, 2010	October 18, 2010
Verification Status	(02) Confirmed - Owner Confirmation	(01) Confirmed - Physically	(01) Confirmed - Physically	(01) Confirmed - Physically	(04) Not Confirmed - Unable to Locate	(04) Not Confirmed - Unable to Locate
Well Name	1950 Hickie Water Well	1965 Drews Water Well	1981 Drews Water Well	1997 Drews Water Well	[unknown]	[unknown]

Field-Verified Survey
Groundwater Records in Area of Interest (duplicates removed)

Survey Centred on: Piezometer No. 1-10

Page: 5 of 8; Printed on September 21, 2012

Parameter						
Owner / Lessee	Sonnonberg, Art & Ben	Sonnonberg, Art & Ben	Brad & Amy Warren	1531486 Alberta Ltd.	Fischer, Harold & Ruth	BORLE, A.M.
Legal Location	**SE 04-054-03 W5M**	**SE 04-054-03 W5M**	**01-33-053-03 W5M**	**05-34-053-03 W5M**	**01-33-053-03 W5M**	**04-34-053-03 W5M**
Ground Elevation	771.3 m	771.2 m	778.3 m	780.8 m	778.7 m	777.0 m
Well Type	Well Inventory	New Well	New Well	Piezometer	New Well	New Well
Water Status	Not In Use	Producing	Producing	Observation	Producing	Producing
Well Depth Drilled	45.7 m	57.9 m	61.0 m	24.4 m	68.6 m	15.2 m
Top of Aquifer	-	-	-	-	-	-
Total Available Head	-	16.5 m	23.3 m	7.4 m	49.5 m	7.2 m
Max. Pumping Rate	27.3 Lpm	11.4 Lpm	11.4 Lpm	31.4 Lpm	31.8 Lpm	22.7 Lpm
Completion Details	30.5 - 45.7 m	33.5 - 57.0 m	34.1 - 39.6 m	15.2 - 21.3 m	61.0 - 68.6 m	9.8 - 15.2 m
Distance	1,170 m	1,190 m	1,228 m	1,245 m	1,347 m	1,381 m
Earliest Water Level	August 04, 1959	August 24, 1981	February 15, 1983	November 02, 2010	May 07, 1982	April 28, 1981
	7.3 m	16.8 m	7.0 m	13.9 m	38.1 m	2.6 m
Latest Water Level	1959-08-04	1981-08-24	2011-10-06	2010-11-25	2011-10-06	1981-04-28
	7.3 m	16.8 m	10.8 m	14.0 m	11.4 m	2.6 m
Daily Use	-	-	-	-	-	-
Number of Chemistries	-	-	-	1	1	1
(latest analysis)				November 22, 2010	November 26, 1986	February 25, 1982
Comments	45'-53', 5 GPM. 132'-136', 15 GPM. Seal type listed as 'Driven' but no interval defined. [54012 RR 33] [Original owner: Valking Real Estate] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), Old water we;; is located in water well pit, no access into pit as pit is covered with steel plates and car parts. Water well is not in use.]	[54012 RR 33] [Original owner: Plischke, William] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located 20 metres west of house.]	[Hydrogeological Consultants Ltd. (HCL) field survey (October 2011), original owner: William, B. Water well is located 5 metres south of trailer. (53504 RR 33).]	[Piezometer was developed for 45 minutes at 13 litres per minute on October 21, 2010. Piezometer surveyed (xyz) Nov 25, 2010 by Altus Geomatics.]	[Hydrogeological Consultants Ltd. (HCL) field survey (October 2011), Original driller report placed water well in SW 34. Water well is located in wishing well ornement 15 metres north of house. (53502 RR 33). Original NPWL: 38.10 metres from 1982. NPWL measured Oct 6, 2011: 11.43 metres.]	
AENV Well ID(s)	0445024	0445030	0470215: 470215		0470222: 470222	0470221: 470221
Licensed/Registered Diversion	-	-	-	-	-	-
Consultant Details						
TGWC ID	M35379.044325	M35379.044330	M36056.964299	M40478.480727	M36056.964292	M36056.964293
Date Verified	October 14, 2010	October 14, 2010	October 06, 2011	November 03, 2010	October 06, 2011	October 18, 2010
Verification Status	(01) Confirmed - Physically	(01) Confirmed - Physically	(01) Confirmed - Physically	(01) Confirmed - Physically	(01) Confirmed - Physically	(04) Not Confirmed - Unable to Locate
Well Name	1959 Sonnonberg Water Well	1981 Sonnonberg Water Well	1983 Warren Water Well	Piezometer No. 3-10	1982 Fischer Water Well	[unknown]

Field-Verified Survey
Groundwater Records in Area of Interest (duplicates removed)

Survey Centred on: Piezometer No. 1-10

Page: 6 of 8; Printed on September 21, 2012

Parameter						
Owner / Lessee	PAUL, PETER	Sonnonberg, Art & Ben	Astleford, George	Astleford, George	Astleford, George	Henderson, Denis & Kim
Legal Location	SW 36-053-03 W5M	NE 04-054-03 W5M	NW 27-053-03 W5M	NE 28-053-03 W5M	NE 28-053-03 W5M	NW 27-053-03 W5M
Ground Elevation	778.0 m	770.0 m	778.7 m	778.8 m	778.3 m	778.5 m
Well Type	Well Inventory	Well Inventory	Well Inventory	Well Inventory	New Well	New Well
Water Status	Producing	Producing	Producing	Producing	Producing	Producing
Well Depth Drilled	33.5 m	54.9 m	45.0 m	16.6 m	48.8 m	46.3 m
Top of Aquifer	-	-	-	-	-	-
Total Available Head	-	-	-		23.9 m	-
Max. Pumping Rate	18.2 Lpm	-	-	16.6 Lpm	22.7 Lpm	80.0 Lpm
Completion Details	19.8 - 33.5 m				36.6 - 48.8 m	30.5 - 45.7 m
Distance	1,398 m	1,463 m	1,682 m	1,697 m	1,764 m	1,783 m
Earliest Water Level	March 11, 1978	-	-	October 21, 2010	March 29, 2003	July 19, 2010
	0.9 m	-	-	11.3 m	12.8 m	22.8 m
Latest Water Level	1978-03-11	-	-	2012-08-24	2010-10-18	2010-10-18
	0.9 m	-	-	11.9 m	12.6 m	11.4 m
Daily Use	-	-	-	-	-	-
Number of Chemistries	1	-	-	2	1	-
(latest analysis)	March 15, 1968			October 27, 2010	April 11, 2003	
Comments		[54018 RR 33] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), spoke with Art (Nov 1, 2010) on the phone, rental property, water well is located north of house and is reported to be 54.9 metres deep. Water well would have been drilled in the 70s.]	Well is located in pit. The day, month, and year in the 1950's is estimated.	[Water well is located in livestock area 50 metres northwest of house. Total depth of water well measured October 21, 2010 by Hydrogeological Consultants Ltd. (HCL).] [Submersible pump installed in October 2010, casing extented 0.40 metres.]	Performation size from drill report reports 3 row 0.030 slot.	[53427 RR 33]. [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located 30 metres east of house.]
AENV Well ID(s)	0470220; 470220				1300302	1715525
Licensed/Registered Diversion	-	-	-	-	-	-

Consultant Details						
TGWC ID	M36056.964294	M40483.587298	M37713.708600	M37713.708345	M37732.625162	M40479.642239
Date Verified	March 11, 1968	November 01, 2010	March 14, 2003	March 14, 2003	April 07, 2003	October 18, 2010
Verification Status	(04) Not Confirmed - Unable to Locate	(02) Confirmed - Owner Confirmation	(01) Confirmed - Physically	(01) Confirmed - Physically	(01) Confirmed - Physically	(01) Confirmed - Physically
Well Name	[unknown]	Sonnonberg Water Well	Astleford NW-27 Stock Water Well	1942 Astleford Stock Water Well	2003 Astleford Water Well	2010 Henderson Water Well

Field-Verified Survey
Groundwater Records in Area of Interest (duplicates removed)

Survey Centred on: Piezometer No. 1-10

Parameter						
Owner / Lessee	Astleford, George	Jason & Megan, Hickie	Laniuk, Eugene	Sonnenberg, Fritz & Eva	Sonnenberg, Fritz & Eva	Adams, Gordon
Legal Location	NW 27-053-03 W5M	SW 05-054-03 W5M	NW 32-053-03 W5M	SE 34-053-03 W5M	SE 34-053-03 W5M	SW 35-053-03 W5M
Ground Elevation	777.5 m	781.0 m	783.7 m	779.4 m	779.4 m	779.7 m
Well Type	New Well	New Well	Chemistry	Well Inventory	Well Inventory	Well Inventory
Water Status	Producing	Producing	Producing	Producing	Not In Use	Producing
Well Depth Drilled	50.3 m	82.9 m	57.9 m	68.6 m	68.6 m	22.9 m
Top of Aquifer	-	-	-	-	-	-
Total Available Head	25.9 m	11.4 m	-	-	-	-
Max. Pumping Rate	45.5 Lpm	31.8 Lpm	-	-	-	-
Completion Details	36.6 - 47.5 m	64.0 - 82.9 m				
Distance	1,978 m	2,207 m	2,214 m	2,301 m	2,387 m	2,519 m
Earliest Water Level	July 09, 2001	September 03, 2005	September 27, 1977	-	-	-
	10.4 m	16.2 m	22.9 m	-	-	-
Latest Water Level	2010-10-18	2010-10-18	1977-09-27	-	-	-
	10.7 m	52.6 m	22.9 m	-	-	-
Daily Use	-	-	-	-	-	-
Number of Chemistries	1	-	3	-	-	-
(latest analysis)	April 11, 2003		October 05, 1977			
Comments	Drawdown & recovery stayed at 50'-34' 16-120 minutes. /// Water well is located 30 metres North East of cabin, under blue rain barrel.	[3426 Twp Rd. 540] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located in backyard 35 metres north of trailer.]	[Original owner: Reschke, Len]	[53414 RR 32], [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), Landowner reports that water well was drilled in 1975 by Robert MCGinnis Drilling. Water well is located in water well pit 150 metres northwest of house in pasture. Water well reported to be 68.6 metres deep.]	[53414 RR 32] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), Landowner reports that water well was drilled in 1958 and is 68.6 metres deep. Water well located in shed 50 metres south of house in pit.]	[53513 RR 32] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located in pit 50 metres north of house. Pit covered. Landowner reports water well is 22.9 metres deep. Drilled in 1972 by Dutchy Drilling. Water well was used for stock purposes but now is used for watering the lawn in the summer months.]
AENV Well ID(s)	0340827	11045870; 1715112	0470210; 470210			
Licensed/Registered Diversion	-	-	-	-	-	-

Consultant Details						
TGWC ID	M37699.458391	M39227.488620	M36056.964304	M40483.608654	M40483.615772	M40483.621380
Date Verified	April 17, 2003	October 18, 2010	October 06, 2011	January 01, 1975	October 18, 2010	October 18, 2010
Verification Status	(01) Confirmed - Physically	(01) Confirmed - Physically	(02) Confirmed - Owner Confirmation	(01) Confirmed - Physically	(02) Confirmed - Owner Confirmation	(02) Confirmed - Owner Confirmation
Well Name	2001 Astleford Recreation Area Water Well	2005 Hickie Water Well	Laniuk Water Well	1975 Sonnenberg Water Well	1958 Sonnenberg Water Well	1972 Adams Water Well

Field-Verified Survey
Groundwater Records in Area of Interest (duplicates removed)

Survey Centred on: Piezometer No. 1-10

Page: 8 of 8; Printed on September 21, 2012

Parameter	
Owner / Lessee	Adams, Gordon
Legal Location	SW 35-053-03 W5M
Ground Elevation	779.6 m
Well Type	New Well
Water Status	Producing
Well Depth Drilled	62.5 m
Top of Aquifer	-
Total Available Head	-
Max. Pumping Rate	45.5 Lpm
Completion Details	57.9 - 62.2 m
Distance	2,522 m
Earliest Water Level	July 22, 1992 32.0 m
Latest Water Level	2010-10-18 34.3 m
Daily Use	-
Number of Chemistries (latest analysis)	-
Comments	[S3S13 RR 32] [Hydrogeological Consultants Ltd. (HCL) field survey (October 2010), water well is located 10 metres east of house on front lawn.]
AENV Well ID(s)	0367379; 367379
Licensed/Registered Diversion	-

Consultant Details	
TGWC ID	M35379.068847
Date Verified	October 18, 2010
Verification Status	(01) Confirmed - Physically
Well Name	1992 Adams Water Well

HCL
hydrogeological consultants ltd.

Addendum to 2012 Groundwater Review

Alberta Beach Area
Parts of Sections 28 and 32 to 34, Tp 053, R 03, W5M

Prepared for
1531486 Alberta Ltd.

October 2025

HCL Project No.: 25-0191.01
© 2025 hydrogeological consultants ltd.

1969

Groundwater and Surface Water Solutions for a Changing Environment

17740 – 118 Avenue NW, Edmonton, A berta T5S 2W3 CANADA
780.483.7240 • 800.661.7972 • **hcl.ca**

Signatures

Version	Date	Description	Prepared by	Reviewed by
1	2025-10-07	Final Report		

Jim Touw, P.Geol.
Senior Hydrogeologist

Brad Salter, P.Geo.
Hydrogeologist

PERMIT TO PRACTICE
hydrogeological consultants ltd.

Signature _____

Date _____

PERMIT NUMBER P 385
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

TABLE OF CONTENTS

Signatures i

1. Introduction 1

2. Changes since 2012 2

2.1. New Aggregate Operations 2

2.2. Updated Water Well Survey 3

2.3. Assessment of Monitoring Data 5

3. Conclusions 6

4. Recommendations 6

5. Bibliography 7

6. Supplementary Information 12

6.1. Glossary of Terms 12

6.2. Glossary of Commonly Used Abbreviations, Acronyms, and Symbols 13

6.3. Stratigraphy of the “Undisturbed” Geology of Alberta 14

6.4. Guidelines for Canadian Drinking Water Quality – Summary Table 15

6.5. Conversions 16

LIST OF FIGURES

Figure 1. Index Map 1

Figure 2. Original and Revised Mining Areas 3

Figure 3. Hydrograph 5

LIST OF TABLES

Table 1. New Groundwater Features 4

Table 2. Features of Interest within the Revised AOI 4

1. Introduction

In 2012, Hydrogeological Consultants Ltd. (HCL) completed a groundwater review (HCL, 2012b) for 1531486 Alberta Ltd. (the Client) in support of its proposed aggregate mining operation in Lac St. Anne County (the County). The proposed operation was to include parts of five quarter sections in an area approximately 4 kilometres south of Lac Ste. Anne, as shown in Figure 1. The area of study (AOS) is the 25-section area centred on 33-053-03 W5M; the area of interest (AOI) is the area within 1,000 metres of the proposed development boundary.

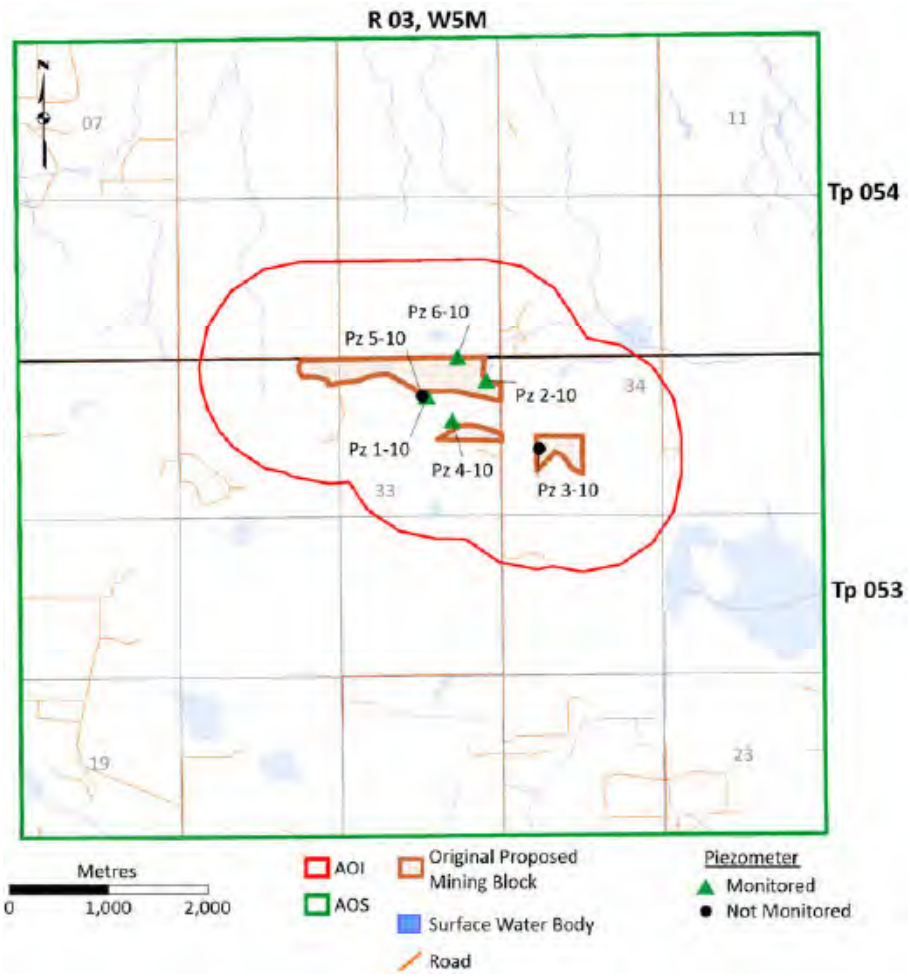


Figure 1. Index Map

The proposed development was to involve seasonal dewatering of aggregate pits, with part of that groundwater to be used for aggregate washing and the remainder to be allowed to flow back into the aggregate aquifer via recharge pits or ponds.

Six monitoring wells (piezometers) were completed on behalf of the Client in 2010; aquifer tests with four of these piezometers and a field-verified water well survey within 1,000 metres of the proposed mining area were conducted as part of the groundwater review (HCL, 2012b). Water levels have been monitored in the four tested piezometers since 2010. The locations of the six piezometers that were completed on behalf of the Client are shown in Figure 1.

Although the proposed mining area is currently undeveloped, the Client remains in a position to move forward with the proposed aggregate mining operation. Because the original groundwater review (HCL, 2012b) was conducted more than 12 years ago, the present addendum has been prepared by HCL at the request of the Client to address if there have been any changes to the conclusions that were presented in the original groundwater review.

2. Changes since 2012

The Client has indicated that the property development boundary, the proposed mining areas, and the proposed mining methodology that were identified in the original groundwater review have changed slightly; therefore, the main changes to be addressed as part of the present addendum are as follows:

- Comment on the significance of any change in the proposed mining area or any new aggregate extraction operations in the AOS
- Provide an update to the field-verified water well survey to identify any new features of interest
- Assess if the water-level data indicate any changes to the local hydrogeological conditions

These three items are addressed in the following sections of this addendum.

2.1. New Aggregate Operations

Information shown in Figure 2 on the following page includes the following:

- The area covered by the original proposed mining blocks (HCL, 2012b)
- The area covered by the revised proposed mining blocks
- The original AOI, which is the area within 1,000 metres of the original proposed mining blocks, and the revised AOI, which is the area within 1,000 metres of the revised proposed mining blocks
- The mining blocks that are owned and operated by Heidelberg Materials Canada Limited (Heidelberg Materials)

Figure 2 shows that there is a slight difference in the two AOIs, which could affect the number of identified features of interest; this assessment is discussed in Section 2.2 of the present addendum.

Since the original groundwater review was completed for the Client (HCL, 2012b), Heidelberg Materials has been mining aggregate within parts of six quarter sections of land more than 1,200 metres south of the Client's proposed mining operation. The Heidelberg Materials operation involves pit-to-pit dewatering to extract aggregate from below the water table and a licensed groundwater diversion of up to 20,100 cubic metres per year (m^3/year) for aggregate washing. A hydrogeological review (HCL, 2023) has shown that the groundwater flow at the Heidelberg Materials site is from the northwest to the southeast. Because the groundwater flow at the Client's proposed mining operation is in the opposite direction, from the southeast to the northwest (HCL, 2012b), a groundwater-flow divide is interpreted as being between the Client's proposed operation and the Heidelberg Materials operation. Aggregate mining by Heidelberg Materials is therefore not expected to adversely affect groundwater conditions in the aggregate to be mined by the Client. Conversely, aggregate mining by the Client is not expected to adversely affect groundwater conditions in the aggregate that is currently being mined by Heidelberg Materials.

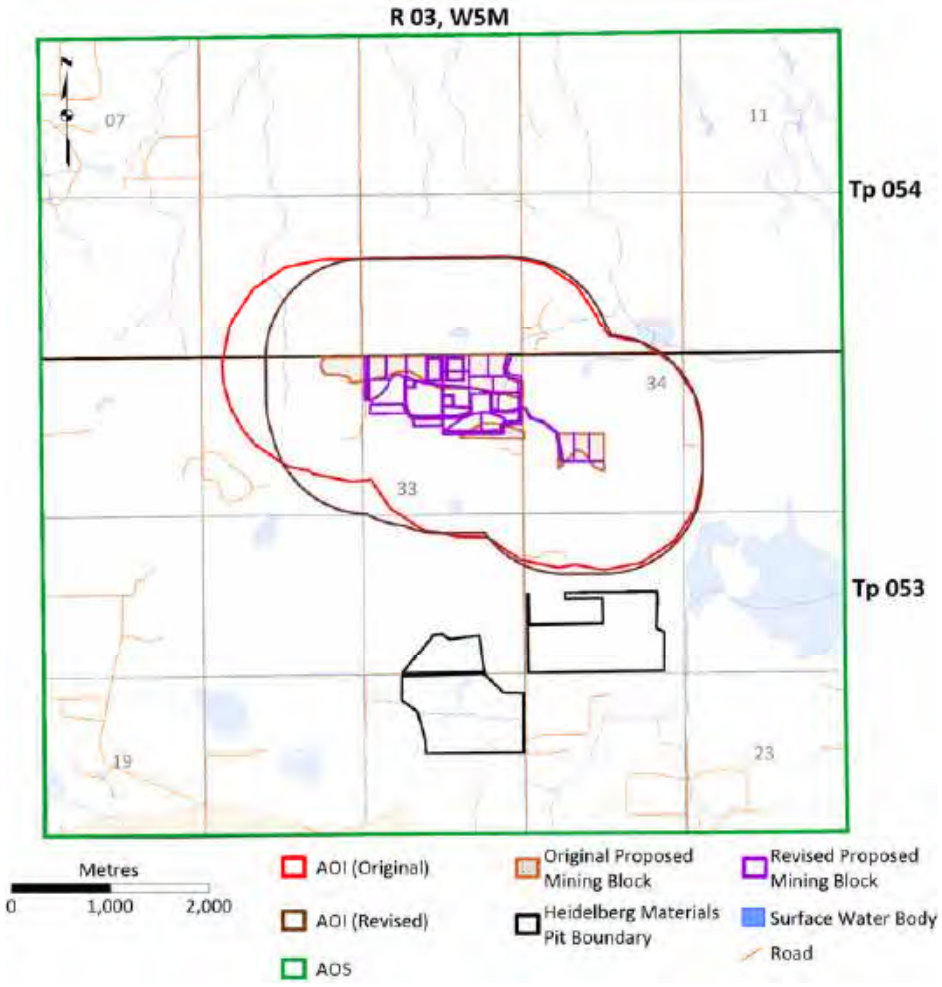


Figure 2. Original and Revised Mining Areas

2.2. Updated Water Well Survey

HCL personnel conducted field-verified water well surveys within the original AOI in 2010 and 2011 (HCL, 2012b). At that time, there were 43 groundwater features within the AOI, consisting of 37 water wells and 6 piezometers. In September 2025, HCL personnel conducted a desktop water well survey within the revised AOI by querying The Groundwater Centre (TGWC) database.[1] The results of the desktop survey showed that one of the water wells that was included in the original water well survey (TGWC ID: M40483.615772) has been reclaimed, and an additional six water wells and one piezometer have been added to TGWC database since 2012; the new piezometer was drilled on behalf of Heidelberg Materials. Summary information for these seven additional groundwater records is in Table 1 on the following page.

Features of interest are those groundwater features that are hydraulically connected to the aggregate to be mined and therefore have the potential to be impacted by the proposed aggregate operation. Based on a re-evaluation of the groundwater features within the revised AOI, none of the groundwater records that have been added since 2012 and are shown in Table 1 are considered to be a feature of interest. Of the nine features of interest that were identified in the original groundwater review (HCL, 2012b), one water well (TGWC ID: M36056.964304 in the NW 32-053-03 W5M) is not within the revised AOI, and a second water well (TGWC ID: M40483.621380) is no longer in use. The seven remaining features of interest within the revised AOI are shown in Table 2 on the following page, all of which were included in the original groundwater review (HCL, 2012b).

[1] TGWC database is an enhanced version of the Alberta Water Well Information Database, which includes information provided by water well drilling contractors.

TGWC ID	Feature	Date Completed	Owner	Legal Location (053-03 W5M)	Elevation (m AMSL)	Verification Type*	Approximate Distance from Proposed Development (m)	Top of Bedrock (m AMSL)	Elevation of Completion Interval (m AMSL)	
									Top	Bottom
M36056.964298	Water Well	-	Fischer, Harold/Ruth	SE 33	779.2	4	400	-	-	-
M44523.377853	Water Well	2021-09-14	Hickie, Jason & Meagan	NE 32	779.8	3	400	750.8	721.9	688.4
M44585.518892	Water Well	2021-11-24	Drews, Eric & Duane	13-34	776.6	2	410	748.6	734.5	705.9
M44523.377975	Water Well	2021-10-13	Hillman, Benjamin	08-04	771.9	3	580	753.6	741.4	709.4
M41917.446719	Water Well	2014-07-29	Sonnenberg, Fritz	SE 34	779.2	1	780	745.7	724.3	708.5
M40973.793245	Water Well	2011-11-24	Harris, Jacob & Amy	SW 35	778.4	1	920	754.3	734.2	711.3
M44760.470599	Piezometer	-	Heidelberg Materials Canada Limited	12-27	777.1	1	1,000	-	-	-

* 1 = Physically confirmed; 2 = Location provided by owner; 3 = Expected location; 4 = Not located

Table 1. New Groundwater Features

Features of Interest										
TGWC ID	Water Well Name	Owner	Legal Location (053-03 W5M)	Verification Type*	Distance from Nearest Mining Area (m)**	Depth Drilled (m)	Well Status	Reported Use	Date Completed	Criteria
M36056.964300	1979 Franczak WW	Dave Franczak	SE 33	1	150	24.4	Producing	Stock	1979-11-18	Lithology, Completion, and Chemical Quality
M36056.964297	1987 Franczak WW	Dave Franczak	SE 33	1	200	18.3	Producing	Domestic & Stock	1987-08-06	
M39227.488655	2001 Franczak WW	Dave Franczak	SE 33	1	250	21.9	Producing	Stock	2001-06-15	
M37713.708345	1942 Astleford Stock WW	George Astleford	NE 28	1	850	16.6	Producing	Stock	1942	Chemical Quality
M40483.608654	1975 Sonnenberg WW	Friz & Eva Sonnenberg	SE 34	1	700	68.6	Producing	Domestic & Stock	1975	Insufficient Information
M37713.708600	Astleford NW 27 Stock WW	George Astleford	NW 27	1	750	45.0	Producing	Stock	1955	
M40483.587298	Sonnenberg WW	Art & Ben Sonnenberg	NE 04	2	900	54.9	Producing	Domestic	Unknown	

* 1 = Physically confirmed; 2 = Location provided by owner

** The mining areas considered are those in Lac Ste. Anne County

Table 2. Features of Interest within the Revised AOI

2.3. Assessment of Monitoring Data

Figure 3 is a hydrograph of the elevations of the measured water levels in the four piezometers that have been monitored since 2010 using pressure transducers and data loggers. The hydrograph shows the following:

- Measured water levels in each piezometer are very similar to each other but are at different elevations.
- The highest water-level elevations are in Piezometer (Pz) No. 4-10, which is located farthest to the south, and the lowest water-level elevations are in Pz 6-10, which is located farthest to the north. This indicates an apparent gradient from the south to the north.
- The water-level data do not show an overall rising or declining trend, although measured water levels since 2021 have trended downward by approximately 1 metre, after unusually high measured water levels in 2020.[2] The water-level fluctuations are therefore considered to represent baseline conditions.
- Current water levels are similar to those measured in 2010, and therefore continue to represent baseline data.

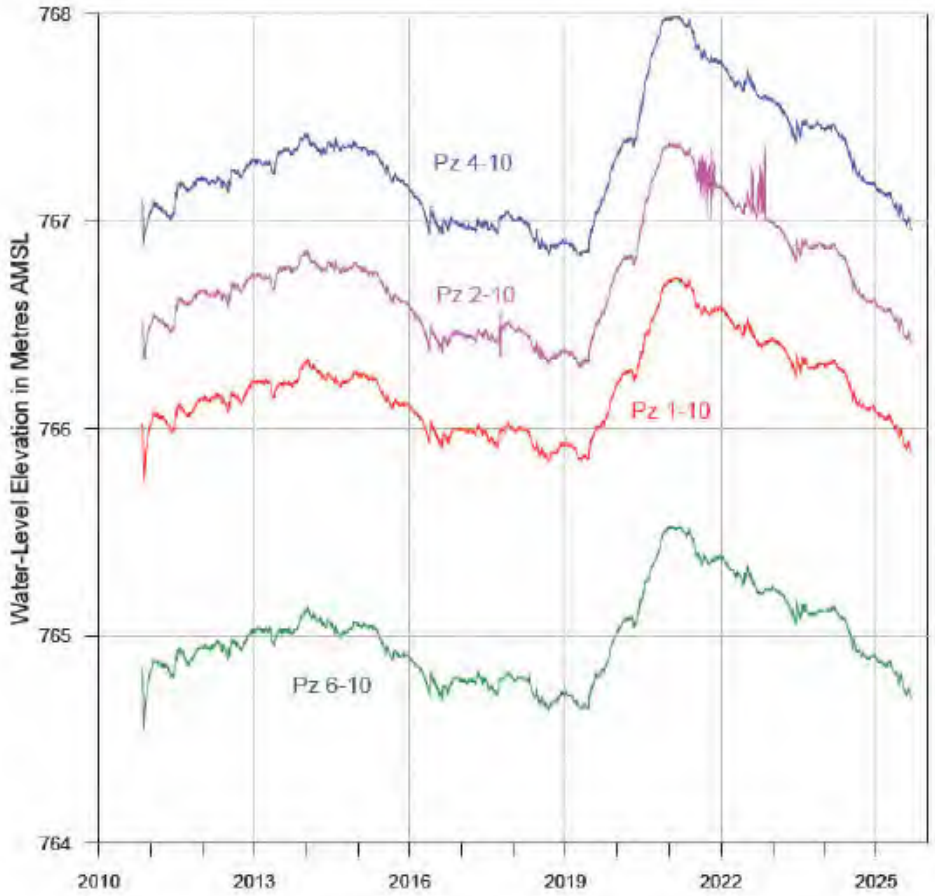


Figure 3. Hydrograph

Because the measured water levels have not shown an overall declining trend, the conclusions related to seasonal dewatering and ongoing annual net groundwater losses that were presented in the original groundwater review (HCL, 2012b) have not changed.

[2] In 2020, unusually high water levels were also measured in piezometers monitored on behalf of an aggregate operation owned by BURNCO Rock Products Ltd. (HCL, 2025), which is approximately 5 kilometres south of the Client's proposed Alberta Beach operation.

3. Conclusions

Based on a review of the available data, there have been no significant changes to the hydrogeological environment or to any nearby groundwater users that would result in changes to the conclusions that were reported in the original hydrogeological review (HCL, 2012b).

4. Recommendations

It is recommended that the present addendum be submitted to the appropriate regulatory bodies, along with the original groundwater review (HCL, 2012b) in support of the proposed aggregate mining operation described herein.

5. Bibliography

Aquality Environmental Consulting Ltd. 2008. Water Quality Assessment of BURNCO's HWY 16 Water Holding Ponds and an Unnamed Creek. K & M Farms Feedlot near Delburne, AB. 053-03 W5M. [83G09 .W3L3 2008/09 K369; L897315]

Carlson, V. A. 1971. Bedrock Topography of the Wabamun Lake Map Area, Alberta, NTS 83G. Wabamun Lake Area. [AGS Map 057; L020396]

Edwards, W. A. D. 1980. Sand and Gravel Resources of the Onoway Area, Alberta. [AGS Open File Report 1984-25; L091356]

Edwards, W. A. D. 1984. Aggregate Resources. Onoway. 83G/9. Onoway Area. [AGS map A83G09; L087607]

Edwards, W. A. D., R. B. Hudson, and D. W. Scafe. 1985. Aggregate Resources of the Edmonton/Lloydminster Region. 83H/73L/73E/83B/73O/83J/83I/83A/83G. [AGS Bulletin 047; L048477]

Government of Alberta. 2023. Guide to Groundwater Authorization. Alberta Environment and Protected Areas. February 3, 2023.

Health Canada. 2025. Guidelines for Canadian Drinking Water Quality—Summary Tables. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

Hydrogeological Consultants Ltd. 1999a. Regional Groundwater Assessment - FINAL. Parts of the North Saskatchewan and Athabasca River Basins. Parts of Tp 053 to 059, R 01 to 09, W5M. Prepared for Lac Ste. Anne County in conjunction with Agriculture and Agri-Food Canada. (Unpublished Contract Report – Revised November 1999) [83G15 .C737544 1998/07 G231; 97-0112.02]

Hydrogeological Consultants Ltd. 1999b. Regional Groundwater Assessment - FINAL. Part of the North Saskatchewan and Athabasca River Basins. Parts of Tp 050 to 054, R 25, W4M to R 08, W5M. Prepared for Parkland County in conjunction with Agriculture and Agri-Food Canada. (Unpublished Contract Report – Revised November 1999) [83G .P375C6 1998/08; 97-0202.03]

Hydrogeological Consultants Ltd. 2001. Regional Groundwater Assessment - FINAL. Part of the North Saskatchewan River Basin. Parts of Tp 053 to 058, R 20 to 28, W4M and Tp 054 to 057, R 01, W5M. Prepared for Sturgeon County in conjunction with Agriculture and Agri-Food Canada. (Unpublished Contract Report – September 2001) [83H .S78C6 2001/01; 01-0110.03]

Hydrogeological Consultants Ltd. 2002. Inland Samide. 27-053-03 W5M. Prepared for Inland Aggregates Limited. (Unpublished Contract Report – December 2002) [83G09 .A42 2002/12 X886; 02-0196.00]

Hydrogeological Consultants Ltd. 2003a. Proposed NW 22 Gravel Pit: Groundwater Review. Wabamun Area. 22-053-03 W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – September 2003) [83G09 .W33 2003/06-005; 02-0252.00]

Hydrogeological Consultants Ltd. 2003b. Astleford Water Wells Testing. Wabamun Area. NW 27 and NE 28-053-03 W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – June 2003) [83G09 .W33 2003/06-002; 02-0252.05]

Hydrogeological Consultants Ltd. 2003c. Hughes Water Well Testing. Wabamun Area. SE 22-053-03 W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – June 2003) [83G09 .W33 2003/06; 02-0252.11]

Hydrogeological Consultants Ltd. 2003d. Kirkland Water Well Testing. Wabamun Area. SE 22-053-03 W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – June 2003) [83G09 .W33 2003/06-009; 02-0252.09]

Hydrogeological Consultants Ltd. 2003e. Phillips Water Well Testing. Wabamun Area. SW 23-053-03 W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – June 2003) [83G09 .W33 2003/06-003; 02-0252.10]

Hydrogeological Consultants Ltd. 2003f. Proposed NW 22 Gravel Pit: Technical Review of Heavy Metals. Wabamun Area. NW 22-053-03 W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – June 2003) [83G09 .W33 2003/06-011; 03-0170.00]

Hydrogeological Consultants Ltd. 2003g. Selte/Thacik Water Well Testing. Wabamun Area. NW 22-053-03 W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – June 2003) [83G09 .W33 2003/06-010; 02-0252.06]

Hydrogeological Consultants Ltd. 2003h. Westland Park Community Water Well Testing. Wabamun Area. SE 22-053-03 W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – June 2003) [83G09 .W33 2003/06-008; 02-0252.07]

Hydrogeological Consultants Ltd. 2003i. Wiskow Water Well Testing. Wabamun Area. SE 22-053-03 W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – June 2003) [83G09 .W33 2003/06-001; 02-0252.08]

Hydrogeological Consultants Ltd. 2007. 2007 Groundwater Assessment. Highway 16 North Gravel Operation. Tp 053, R 03, W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – November 2007) [83G09 .W333 2007/11 Z958; 08-0314.00]

Hydrogeological Consultants Ltd. 2012a. Hydrogeological Review. Highway 16 North Gravel Extraction 2012 Expansion. Parts of Sections 15, 16, 21 and 22, Tp 053, R 03, W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – September 2012) [83G09 .D8 2012/09 G212; 12-0249.00]

Hydrogeological Consultants Ltd. 2012b. Groundwater Review. Lac Ste. Anne Area. Parts of Sections 28 and 32, Tp 053, R 03, W5M. Prepared for 1531486 Alberta Ltd. (Unpublished Contract Report – December 2012) [73E12 .L325S2A5 2012/12 K379; 10-0505.00]

Hydrogeological Consultants Ltd. 2015a. 2014 Groundwater Monitoring Report. Lac Ste. Anne Area. Sections 28 and 32 to 34, Tp 053, R 03, W5M. Prepared for 1531486 Alberta Ltd. (Unpublished Contract Report – January 2015) [83G09 .L325S2A5 2015/01 L437; MR-0266.14]

Hydrogeological Consultants Ltd. 2015b. Highway 16 North Gravel Extraction – 2015 Extension: Hydrogeological Review. Parkland County Area. NW 23-053-03 W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – May 2015) [83G09 .D8 2015/05 K383; 15-0217.01]

Hydrogeological Consultants Ltd. 2017. 2016 Groundwater Monitoring Program. Wabamun Area. 15-33-053-03 W5M. Prepared for 1531486 Alberta Ltd. (Unpublished Contract Report – January 2017) [83G09 .W333 2017/01 V795; MR-0266.16]

Hydrogeological Consultants Ltd. 2019. 2019 Groundwater Monitoring Program. Wabamun Area. 15-33-053-03 W5M. Prepared for 1531486 Alberta Ltd. (Unpublished Contract Report – October 2019) [83G09 .W333 2019/10 O551; MR-0266.19]

Hydrogeological Consultants Ltd. 2022. Hydrogeological Review. Hwy 16 North Gravel Extraction. SW 21-053-03 W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – March 2022) [21-0135.01]

Hydrogeological Consultants Ltd. 2023. Updated Hydrogeological Assessment. Alberta Beach Area. NH 21, SH 27 and SH 28-053-03 W5M. Prepared for Heidelberg Materials Canada Limited. (Unpublished Contract Report – September 2023) [83G09 .A42 2023/09 P605; 22-0109.02]

Hydrogeological Consultants Ltd. 2025. 2024 Groundwater Monitoring Report. Wabamun Area. Tp 053, Rge 03, W5M. Prepared for BURNCO Rock Products Ltd. (Unpublished Contract Report – July 2023) [21-0135.03]

Jones, N. K. 1984. Aggregate Resources. Wabamun Lake. 83G. [AGS Map A83G; L067063]

Millennium EMS Solutions Ltd. 2011. Hydrogeological Assessment. Alberta Beach Road Sand and Gravel Project. Prepared for Inland Aggregates, division of Lehigh Hanson Materials Ltd. November 2011. File # 11-114.

Millennium EMS Solutions Ltd. 2012. The Alberta Beach Road Sand and Gravel Project. Environmental Assessment. Prepared for Inland Aggregates, a division of Lehigh Hanson Materials Limited. October 2012. File # 11-114.

MLM Groundwater Engineering Ltd. 1978. Preliminary Groundwater Evaluation. Near-Surface Water Table Tests and Percolation Tests for SW 1/4 7-53-2 W5. 07-053-02 W5M. [{hc fiche 1978.20}; L092112]

MLM Groundwater Engineering Ltd. 1979. Additional Near-Surface Water Table Tests for SW 1/4 7-53-2 W5. 07-053-02 W5M. [{hc fiche 1979.1}; L054729]

Moell, C. E., and P. Schnurr. 1976. Groundwater Availability in the Onoway Map Area. Onoway Area. Tp 054, R 02, W5M. [83G09 .O58 1976/06; L096661]

North Saskatchewan Watershed Alliance (NSWA). 2016. Assessment of Existing Water Supply and Demand Data for the Sturgeon River Basin. Prepared by S. Figliuzzi and Associates Ltd. for the NSWA. Available at: https://www.nswa.ab.ca/resource/assessment-of-existing-water-supply-demand-data-for-the-sturgeon-river-basin. [83G16 .S787446675847 2016/05 H288; L897453]

North Saskatchewan Watershed Alliance (NSWA). 2017a. Influence of Climate, Landscape Change and Licenced Water Removal on Flows in the Sturgeon River Basin. Available at: https://www.nswa.ab.ca/resource/hydrology-in-the-sturgeon-river-2017. [83G16 .S787446675847 2017/06 P570; L897455]

North Saskatchewan Watershed Alliance (NSWA). 2017b. Isle Lake and Lac Ste Anne State of the Watershed Report. Prepared for the Lake Isle Lac Ste Anne Water Quality Society (LILSA). Available at: https://www.nswa.ab.ca/resource/isle-lake-lacste-anne-sow-report. [83G16 .S787446675847 2017/05 Y928; L897454]

Oiffer, A. 2019. Summary of Groundwater Conditions in the Sturgeon River Basin. Available at: https://www.nswa.ab.ca/resource/groundwater-conditions-sturgeon-river-basin. [83G16 .S787446675847 2019/00 T733; L897456]

Ozoray, G. 1971. Hydrogeological Map. Wabamun Area, Alberta. NTS 83G. Wabamun Area. [RCA.-03; L037475]

Ozoray, G. F. 1972. Hydrogeology of the Wabamun Lake Area, Alberta. Wabamun Lake Area. [QE 186 P7 No. 72-08-002; L005070]

Pawlowicz, J. G., and M. M. Fenton. 1995a. Bedrock Topography of Alberta. [AGS MAP 226; L079262]

Pawlowicz, J. G., and M. M. Fenton. 1995b. Drift Thickness of Alberta. 84J/83B/73M/83H/83D/83A/82H/84A/83P/83M/73E/82H/84C/83C/84L/82P/84P/83L/84F/84E/83N/84O/73O/83F/84M. [AGS MAP 227; L010933]

Province of Alberta. 2024. *Water Act*. Revised Statutes of Alberta 2000. Chapter W-3. Current as of December 12, 2024. Office Consolidation. © Alberta King's Printer.

Province of Alberta. 2025a. *Environmental Protection and Enhancement Act*. Potable Water Regulation. Alberta Regulation 277/2003 (with amendments up to and including Alberta Regulation 199/2025). Current as of August 27, 2025. Office Consolidation. © Alberta King's Printer.

Province of Alberta. 2025b. *Water Act*. Water (Ministerial) Regulation. Alberta Regulation 205/1998 (with amendments up to and including Alberta Regulation 191/2025). Current as of July 29, 2025. Office Consolidation. © Alberta King's Printer.

Puchala, B. 2002. Aggregate Reserve Investigation. Parkland County. Parkland County Area. [83G .P375C6 2002/08; L032940]

Research Council of Alberta. 1972. Hydrogeological Map. 1:250000: Wabamun Lake. Wabamun Lake Area. [83G .W3L3 hydro map; L014749]

Rippon, R. E., G. P. Lakeman, and O. Tokarsky. Geoscience Consulting Ltd. 1977. Water Table Tests, Grain Size Analyses, Groundwater Evaluation. 1-54-3 W5. 01-054-03 W5M. [{hc fiche 1977.1}; L052962]

Shetsen, I. 2002. Quaternary Geology. Central Alberta. [AGS map 213 cd; L062240]

Stewart, Weir, Stewart, Watson, Heinrichs & Dixon. 1977. Application to Subdivide Part of the SE 1/4 11-53-3 W5. 11-053-03 W5M. [L080490]

Sturgeon River Watershed Alliance (SRWA). 2020. Sturgeon River Watershed Management Plan. Available at: https://www.nswa.ab.ca/resource/sturgeon-river-watershed-management-plan. [83G16 .S787446675847 2020/00 K375; L897457]

Suvan, Fettig & Associates Ltd. 1976. Geotechnical Data for Proposed Recreational Subdivision. Part of H.B.R. at Lac Ste. Anne. C of T. 165-174. Summer Village of Sunset Point. County of Lac Ste. Anne No. 28. 054-03 W5M. [L038049]

Tokarsky, O. Geoscience Consulting Ltd. 1976a. Aquifer Test. SW 32-53-3 W5. SW 32-053-03 W5M. [{hc fiche 1976.25}-001; L083778]

Tokarsky, O. Geoscience Consulting Ltd. 1976b. Aquifer Test. SW 23-53-3 W5. 23-053-03 W5M. [{hc fiche 1976.27}; L006841]

Tokarsky, O. Geoscience Consulting Ltd. 1976c. Aquifer Test. SW 32-53-3 W5. 32-053-03 W5M. [{hc fiche 1976.24}; L039454]

Tokarsky, O. Geoscience Consulting Ltd. 1976d. Water Table Tests, Hydrometer Analyses, Groundwater Evaluation. SW 32-53-3 W5. 32-053-03 W5M. [{hc fiche 1976.87}; L066694]

Tokarsky, O. Geoscience Consulting Ltd. 1976e. Water Table Tests, Percolation Tests, Groundwater Evaluation. NW 19-53-2 W5. 19-053-02 W5M. [L032527]

Tokarsky, O. Geoscience Consulting Ltd. 1976f. Water Table Tests, Percolation Tests, Groundwater Evaluation. SW 23-53-3 W5. 23-053-03 W5M. [L088437]

Tokarsky, O. Geoscience Consulting Ltd. 1978a. Aquifer Test. NE 1-54-3 W5. 01-054-03 W5M. [L095934]

Tokarsky, O. Geoscience Consulting Ltd. 1978b. Aquifer Test. SE 1-54-3 W5. 01-054-03 W5M. [L056680]

Tokarsky, O. Geoscience Consulting Ltd. 1979. Aquifer Test. SW 19-53-2 W5. 19-053-02 W5M. [L072271]

Underwood McLellan (1977) Ltd. 1978. Groundwater Evaluations, Water Table Tests and Proposed Surface Drainage Scheme. 054-02 W5M. [L000928]

Various. 1984. Aggregate Resources. Maps. NTS 83G. [AGS Open File Report 1984-15; L007649]

Winner, G., and O. Tokarsky. Geoscience Consulting Ltd. 1977. Water Table Tests, Percolation Tests, Groundwater Evaluation. SW 31-53-2 W5. 31-053-02 W5M. [{hc fiche 1977.19}; L000775]

6. Supplementary Information

6.1. Glossary of Terms

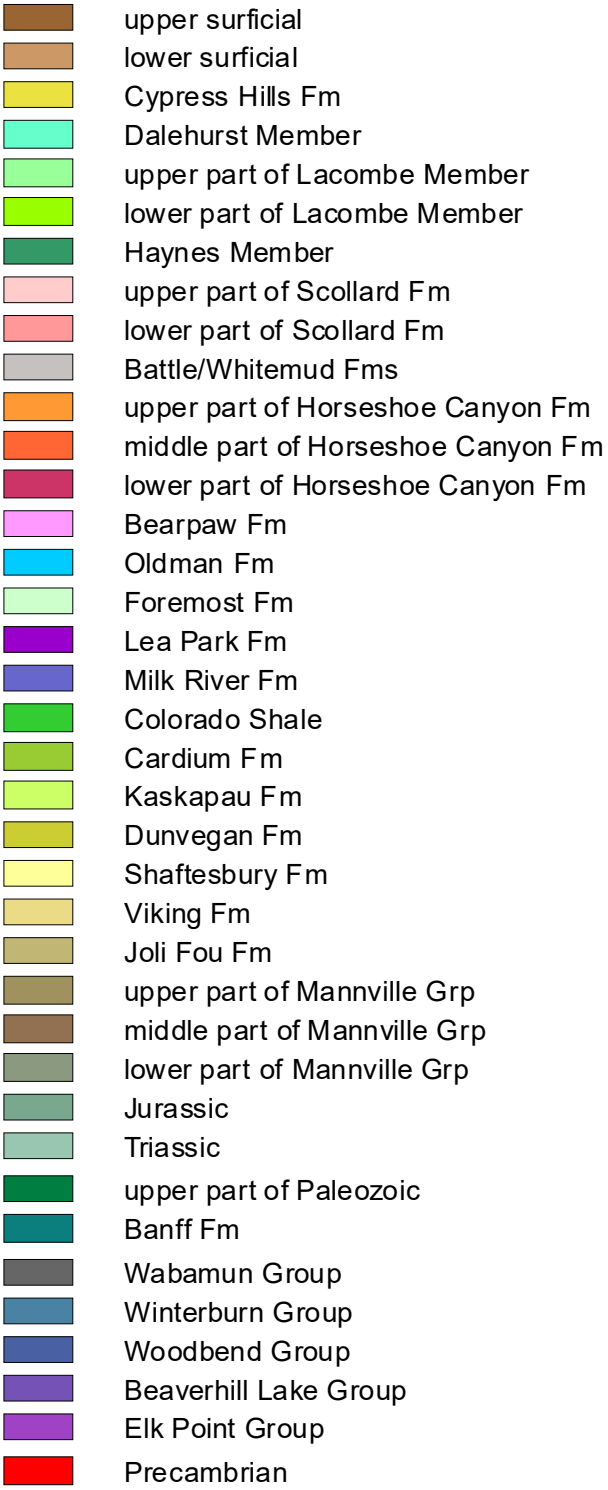
aesthetic objective	Health Canada aesthetic quality guidelines addressing parameters that may affect consumer acceptance of drinking water, such as taste, odour, and colour
aquifer	a formation, group of formations or part of a formation that contains saturated permeable rocks capable of transmitting groundwater to water wells or springs in economical quantities
available drawdown	in a confined aquifer, the distance between the non-pumping water level and the top of the aquifer
base of groundwater protection	the depth below which groundwater is expected to have a total dissolved solids concentration of more than 4,000 milligrams per litre
hydraulic conductivity	the rate of flow of water through a unit cross-section under a unit hydraulic gradient; units are length/time
maximum acceptable concentration	the highest level of chemical substances determined by Health Canada to be allowable in drinking water supplies; these substances are generally only a concern if exposure above guideline levels occurs over an extended time
storativity	the volume of water released from storage by a confined aquifer per unit surface area of aquifer per unit decline in hydraulic head (dimensionless)
surficial deposits	all sediments above the bedrock surface
transmissivity	the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient; a measure of the ease with which groundwater can move through the aquifer apparent transmissivity: the value determined from a summary of aquifer test data, usually involving only two water-level readings effective transmissivity: the value determined from late pumping and/or late recovery water-level data from an aquifer test aquifer transmissivity: the value determined by multiplying the hydraulic conductivity of an aquifer by the thickness of the aquifer
yield	a regional analysis term referring to the rate at which a properly completed water well could be pumped, if fully penetrating the aquifer apparent yield: based mainly on apparent transmissivity long-term yield: based on effective transmissivity sustainable yield: based on aquifer parameters determined from long-term water-level and groundwater diversion monitoring

6.2. Glossary of Commonly Used Abbreviations, Acronyms, and Symbols

AEPA	Alberta Environment and Protected Areas
AER	Alberta Energy Regulator
AMSL	above mean sea level
AO	aesthetic objective
AOI	area of interest
AOS	area of study
BGL	below ground level
BGWP	base of groundwater protection
BTOC	below top of casing
GPS	global positioning system receiver
GWUDI	groundwater under the direct influence of surface water
km	kilometre(s)
Lpm	litre(s) per minute
m	metre(s)
m²	metre(s) squared
m²/day	metre(s) squared per day
m³	cubic metre(s)
m³/day	cubic metre(s) per day
m³/year	cubic metre(s) per year
MAC	maximum acceptable concentration
mg/L	milligram(s) per litre
NAD83	North American Datum of 1983
NPWL	non-pumping water level
TDS	total dissolved solids
TGWC	The Groundwater Centre (www.tgwc.com)
WSW	water source well
W(u)	well function $s = \frac{Q}{4\pi T} \int_{r^2 S/4Tt}^{\infty} \frac{e^{-u}}{u} du$, where $u = r^2 S / 4Tt$

6.3. Stratigraphy of the "Undisturbed" Geology of Alberta

(as used by Hydrogeological Consultants Ltd.)



6.4. Guidelines for Canadian Drinking Water Quality – Summary Table

Constituent	AO	MAC
pH (pH units)	7.0–10.5	–
Conductivity (µS/cm)	–	–
Total Dissolved Solids	500	–
Sodium	200	–
Potassium	–	–
Calcium	–	–
Magnesium	–	–
Total Hardness	–	–
Manganese	0.02	0.12
Carbonate	–	–
Bicarbonate	–	–
Total Alkalinity	–	–
Sulfate	500	–
Chloride	250	–
Fluoride	–	1.5
Iron	0.1	–
Nitrate (as N)	–	10
Nitrate	–	45
Nitrite (as N)	–	1
Nitrite	–	3
Nitrate + Nitrite (as N)	–	10
Total Coliforms (CFU/100 mL)	–	0
Fecal Coliforms (CFU/100 mL)	–	0
Escherichia coli (CFU/100 mL)	–	0
Ionic Balance (%)	–	–

Concentrations are in milligrams per litre (mg/L) unless otherwise stated.

Note: Constituents marked with "–" do not have a recommended maximum concentration associated with them.

CFU/100 mL – Colony Forming Units per 100 millilitres

AO – Aesthetic Objective

MAC – Maximum Acceptable Concentration

GCDWQ–ST – Guidelines for Canadian Drinking Water Quality—Summary Tables (Health Canada, 2025)

6.5. Conversions

Multiply	By	To Obtain
Length/Area		
feet	0.304 785	metres
metres	3.281 000	feet
hectares	2.471 054	acres
centimetres	0.032 808	feet
centimetres	0.393 701	inches
acres	0.404 686	hectares
inches	25.400 000	millimetres
miles (statute)	1.609 344	kilometres
kilometres	0.621 370	miles (statute)
square feet (ft^2)	0.092 903	square metres (m^2)
square metres (m^2)	10.763 910	square feet (ft^2)
square metres (m^2)	0.000 001	square kilometres (km^2)
Concentration		
grains per gallon (UK)	14.270 050	parts per million (ppm)
parts per million (ppm)	0.998 859	milligrams per litre (mg/L)
milligrams per litre (mg/L)	1.001 142	parts per million (ppm)
Volume (capacity)		
acre feet	1,233.481 838	cubic metres
cubic feet	0.028 317	cubic metres
cubic metres	35.314 667	cubic feet
cubic metres	219.969 248	imperial gallons (UK)
cubic metres	264.172 050	gallons (US liquid)
cubic metres	1,000.000 000	litres
cubic metres	6.290 000	barrels of oil equivalent (BOE)
imperial gallons (UK)	0.004 546	cubic metres
imperial gallons (UK)	4.546 000	litres
Rate		
litres per minute	0.219 974	imperial gallons per minute (igpm)
litres per minute	1.440 000	cubic metres per day (m^3/day)
imperial gallons per minute (igpm)	6.546 300	cubic metres per day (m^3/day)
cubic metres per day (m^3/day)	0.152 759	imperial gallons per minute (igpm)
Pressure		
pounds per square inch (psi)	6.894 747	kilopascals (kPa)
kilopascals (kPa)	0.145 038	pounds per square inch (psi)
Miscellaneous		
Celsius	°F = 9/5 (°C + 32)	Fahrenheit
Fahrenheit	°C = (°F – 32) × 5/9	Celsius
degrees	0.017 453	radians

Appendix F

Environmental Impact Assessment in Support of the Alberta Beach Granular Pit (November 2012)

Prepared by Spencer Environmental management Services Ltd

Environmental Impact Assessment in Support Of Alberta Beach Granular Pit

Final Report

Prepared for:

RoJaS Management Ltd.
Canmore, Alberta

Prepared by:

Spencer Environmental Management Services Ltd.
Edmonton, Alberta

Project Number EP 474

November 2012

Table of Contents

1.0 INTRODUCTION 1

1.1 Background 1
1.2 Land Use-Bylaw 1
1.3 Project Description 2
1.3.1 Project Location 2
1.3.2 Project Activities 4
1.4 Scope of Assessment 5

2.0 SETTING 6

2.1 Study Area 6
2.2 Climate 6
2.3 Physiographic Description 6

3.0 METHODS 7

3.1 General Approach 7
3.1.1 Literature and Database Review 7
3.1.2 Historical Aerial Photograph Analysis 7
3.1.3 Field Investigations 8

4.0 EXISTING CONDITIONS 14

4.1 Topography and Geology 14
4.2 Soils 14
4.3 Hydrology 15
4.3.1 Surface Water 15
4.3.2 Groundwater 15
4.4 Vegetation 15
4.4.1 Regional Description 15
4.4.2 Local Area 16
4.4.3 Historical Aerial Photography Review 33
4.5 Wildlife 34
4.5.1 Birds 34
4.5.2 Mammals 36
4.5.3 Amphibians and Reptiles 36
4.5.4 Fish 37
4.5.5 Summary of Wildlife Habitat 37
4.5.6 Special Status Species 38
4.5.7 Ecological Connectivity 41

5.0 CONSERVATION RECOMMENDATIONS 43

5.1 Implications of the Proposed Project 43
5.1.1 Anticipated Wetland Impacts 43
5.2 Proposed Wetland Compensation 43
5.3 Proposed Wetland Compensation Monitoring Program 48
5.4 Additional Recommendations 49

REGULATORY FRAMEWORK 50

5.5 Municipal Regulatory and Approval Processes 50
5.5.1 County of Lac Ste. Anne, Land Use Bylaw 16-08 50
5.6 Provincial Regulatory and Approval Processes 50
5.6.2 Alberta Water Act and Interim Wetland Policy 50
5.6.3 Alberta Public Lands Act 51
5.6.4 Alberta Wildlife Act 51
5.7 Federal Regulatory and Approval Processes 51
5.7.1 Migratory Birds Convention Act 51
5.7.2 Species at Risk Act 51

6.0 SUMMARY AND CONCLUSIONS 53

7.0 REFERENCES 54

APPENDIX A: DEVELOPMENT AND RECLAMATION PLAN (ROJAS 2011) A1

APPENDIX B: STONY PLAIN CLIMATE GRAPH (1967 – 2009) B1

APPENDIX C: HISTORICAL AERIAL PHOTOGRAPH RECORD (1950 – 2010) C1

APPENDIX D: WETLAND COMMUNITY SITE NOTES FOR SELECT SITES (2010) D1

APPENDIX E: PLANT SPECIES INVENTORY (2011) E1

APPENDIX F: ALBERTA BEACH GRANULAR PRE-DISTURBANCE SOIL CHARACTERIZATION (NAVUS, 2011) F1

APPENDIX G: SPECIAL STATUS WILDLIFE SPECIES WITH THE POTENTIAL TO OCCUR IN THE STUDY AREA G1

List of Figures

Figure 1.1. Project Study Area 3
Figure 3.1. Wildlife Survey Locations 13
Figure 4.1. Upland and Wetland Plant Communities 17
Figure 5.1. Wetland Impacts within the Study Area Table 5.1. Total wetland impacts by site 44

List of Tables

Table 3.1. Historical aerial photographs of the study area that were examined (1950-2010) 8
Table 4.1. Wetland plant communities and sites located within the study area 18
Table 4.2. Summary of non-native/exotic plant species within study area wetlands 19
Table 4.3. Upland plant communities located within the study area 30
Table 4.4. Uncommon (S3) plant species recorded in the study area 32
Table 4.5. Species recorded during breeding bird surveys in summer 2011 (13 point count stations) 35
Table 4.6. Amphibian Call Survey Results 37
Table 4.7. Select special status species with potential to occur in the study area 40

Table 5.2. Total wetland impacts by wetland community type 46

List of Plates

Plate 1. Site 43, Burnt landscape (June 2011) 20
Plate 2. Site 41, Black spruce and larch tamarack canopy (June 2011)..... 22
Plate 3. Site 41, Small pools of water observed throughout (June 2011) 22
Plate 4. Site 4, Heavily grazed and weedy (July 2011) 23
Plate 5. Site 25a, Treed fen with shrub understory (July 2011)..... 23
Plate 6. Site 24, shrubby fen (July 2011)..... 25
Plate 7. Site 1b, graminoid fen (July 2011) 25
Plate 8. Site 19, emergent marsh (July 2011) 26
Plate 9. Site 8, treed swamp (July 2011)..... 28
Plate 10. Site 39, shrubby swamp emerging from treed fen (July 2011)..... 29
Plate 11. Site 20, shrubby swamp (July 2011)..... 29
Plate 12. Site 29, deciduous woodland (July 2011)..... 31
Plate 13. Site 27, mixed woodland (July 2011) 32
Plate 14. Western toad, observed in NE 33 (02 June 2011) 38

1.0 INTRODUCTION

1.1 Background

1531486 Alberta Ltd. proposes to develop a gravel extraction operation on three quarter sections of land situated in the southern end of Lac Ste. Anne County, approximately 5 km south of Val Quentin and Alberta Beach (Figure 1.1). The proposed gravel extraction operation will include gravel crushing, screening, washing and pit dewatering. 1531486 Alberta Ltd. retained RoJaS Management Ltd. (RoJaS) as the primary engineering consultant to develop facility and operation plans and to facilitate the acquisition of all necessary gravel extraction related approvals. RoJaS, in turn, retained Spencer Environmental Management Services Ltd. (Spencer Environmental) to prepare a biophysical and wetland assessment report in support of municipal, provincial and federal environmental approval and permitting requirements. Spencer Environmental retained Navus Environmental Inc. (Navus Environmental) to prepare a pre-disturbance soil characterization for the proposed project.

The focus of this biophysical and wetland assessment report is on wetlands and wetland habitats and not upland habitats. Upland habitats do not have the same provincial protection as wetlands do under the *Alberta Water Act* and the upland habitat in the project area was not considered unique or sensitive. We did not conduct extensive upland wildlife surveys including pellet or browse counts or winter wildlife tracking work for this project because it is well-known that deer, moose and coyotes are common and abundant wildlife species in the area. They are not considered to be significantly impacted by the proposed project, which occupies an area with land primarily cleared to accommodate agricultural activities.

This document was prepared as an information document that would simultaneously meet the requirements of Lac Ste. Anne County's Land Use Bylaw (Bylaw 16-08) and the information requirements of Alberta Environment and Water in support of applications for wetland removal pursuant to Alberta's *Water Act* and the related Interim Wetland Policy (1993).

1.2 Land Use-Bylaw

The Lac Ste. Anne County Land Use Bylaw 16-08 requires municipal approval for all granular extraction proposals over 5.0 ha. Any such proposal that will require permitting through the Alberta *Water Act,* will also be subject to an Environmental Impact Assessment (EIA) in accordance with *Section 52(17)* of the Land Use Bylaw. It is County of Lac Ste. Anne's position that such an assessment can be conducted in conjunction with a similar assessment performed in accordance to the Alberta *Water Act* or *Environmental Protection and Enhancement Act*. Lac Ste. Anne will refer EIAs to Alberta Environment and Water for comment and recommendations.

1.3 Project Description

1.3.1 Project Location

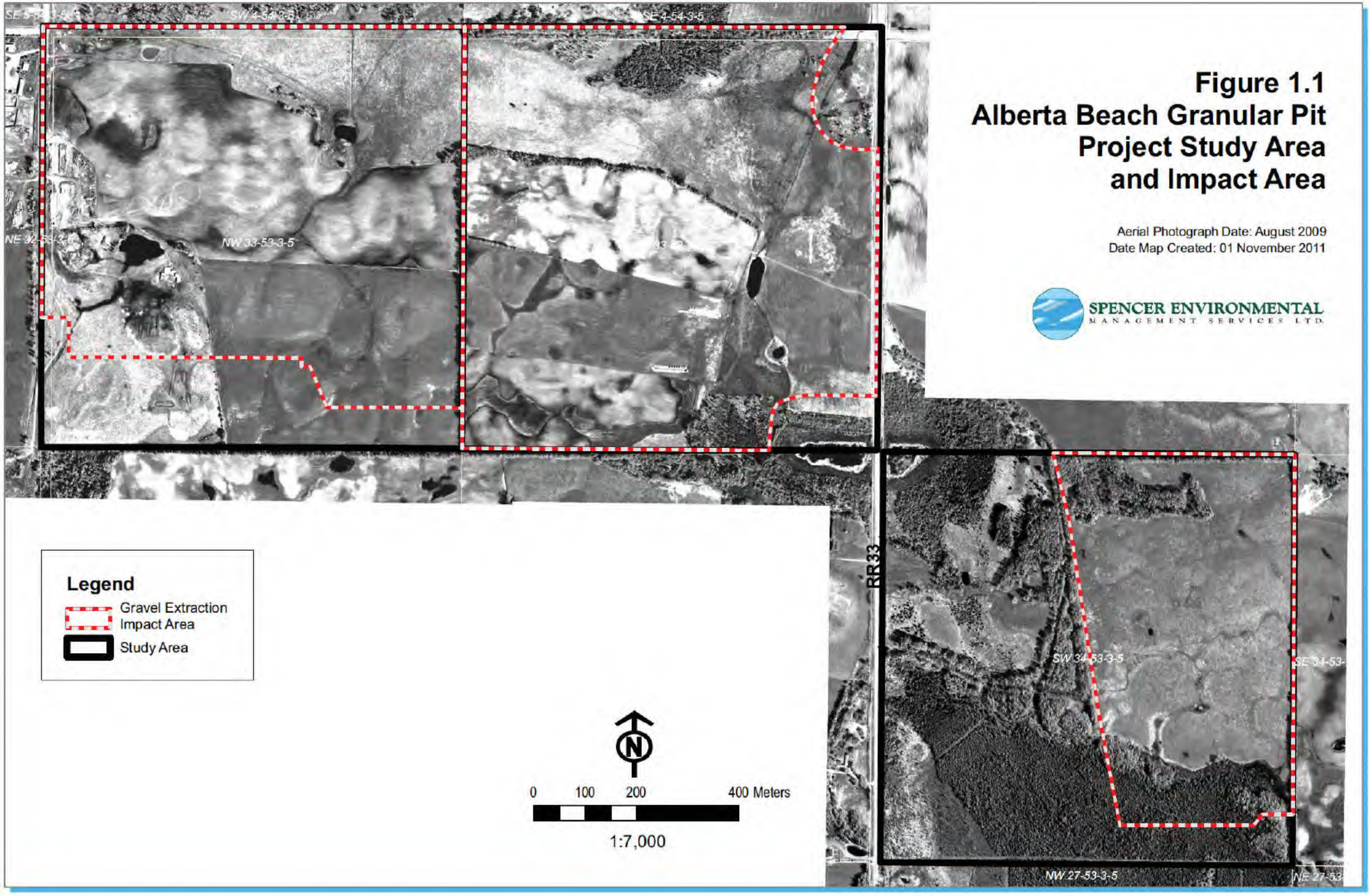
The proposed project is situated in Lac Ste. Anne County, approximately 5 km south of the summer village of Val Quentin. 1531486 Alberta Ltd. has already purchased the lands in question. Specifically, those lands are:

- NE 33-53-03 W5M (NE 33)
- NW 33-53-03 W5M (NW 33)
- SW 34-53-03 W5M (SW 34)

Figure 1.1
Alberta Beach Granular Pit Project Study Area and Impact Area

Aerial Photograph Date: August 2009
Date Map Created: 01 November 2011

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.



1.3.2 Project Activities

Granular extraction will occur over approximately 63 ha. Considering the relatively large project area, development will occur in four phases. Phases I and II will occur in one quarter section (NW 33), where gravel will be extracted and processed. Phase III of the development will expand operations east, encompassing NE 33, while the final phase (Phase IV) will occur in SW 34. The area to be mined contains an estimated 6.56 million tonnes of aggregate. The planned extraction and processing rate is estimated at 300,000 tonnes per year and is expected to span approximately 22 years.

The proposed development will consist of the following main activities: pit dewatering, gravel extraction, washing and processing (Appendix A). Berms will be constructed around the perimeter of the mining property as a visual and auditory buffer. Two portable crushing/screening sites will be used in NW 33 and NE 33; one stationary washing site will be located in NW 33. Approximately 495 m^3 of water per day will be used at the wash plant. Crushing/screening will operate 12 hours per day from Monday to Friday, five months per year. Washing will operate for approximately two months per year, with an estimated 25% of the product being washed.

Due to aggregate deposits occurring below the water table, dewatering activities will be required to extract aggregates. Water from dewatering of the first mining block will be temporarily stored on-site in a surface water storage area. All subsequent mining blocks will be dewatered into an excavated mining block, which has a direct hydraulic connection to the local aquifer. The entire extraction process will result in disturbing the majority of NW 33 and NE 33 and approximately one half of SW 34.

All hauling activities will be conducted on internal roads and will exit onto Range Road 33 from the east side of NE 33. A truck scale will be installed in NE 33 along the access road to RR 33. Adequate space for truck parking will be provided on-site so that trucks will not have to stop on municipal roads. Product will be hauled 12 hours per day from Monday to Saturday. Hauling frequency will vary by season, however, it is expected that an average of 37 loads per day will leave the pit daily for 10 months per year with a peak of approximately 67 loads per day in October each year. No hauling is expected in January or February. The internal haul roads will be sprayed with water to control dust. Hauling off-site will be coordinated with the school bus schedule to avoid hauling during school bus hours.

Range Road 33 will be upgraded to industrial haul road standards from the point of entry southward to the point where it was previously upgraded by another gravel producer in Parkland County (a distance of approximately 3.1 km).

Total disturbed area will be 137.6 ha; the maximum disturbed area at any time will be 35.4 ha and; the maximum extraction area at any time will be 6 ha. Progressive reclamation will be utilized throughout the project. All mined lands will be reclaimed to an agricultural end land use with two end pit waterbodies, suitable for groundwater recharge and waterfowl use, and two depressional areas.

For additional details regarding project activities and the gravel extraction process, please refer to the Mining and Reclamation Plan prepared by RoJaS (Appendix A).

1.4 Scope of Assessment

This document complies with the scope of the Environmental Impact Assessment (EIA) guidelines established by Lac Ste. Anne County's Land Use Bylaw 16-08 and the requirements for Alberta *Water Act* approvals. This document will be used as a resource for development and planning. Accordingly, the objectives of this assessment were to:

- describe and assess the quality of vegetation and wildlife wetland habitat areas for select wildlife species;
- document water bodies and surface drainage within the study area;
- classify and delineate wetlands on the subject property and identify their functions and values;
- determine if any special status wetland species are present or likely to be present within the study area; and
- identify natural wetland features with the highest conservation merit.

2.0 SETTING

2.1 Study Area

The study area used for investigations completed in support of this report is shown on Figure 1.1. Quarter sections NE/NW 33 are situated between Range Road 33 and Range Road 34 while quarter section SW 34 is situated immediately east of Range Road 33. Quarter section SW 34 is situated on the southern border of Lac Ste. Anne County with Parkland County.

Lands within quarter sections NE and NW 33 were agricultural, with small pockets of native vegetation interspersed throughout. Quarter section SW 34 was a mix of cultivated lands and native vegetation. Numerous organic (peatland) and mineral wetlands, as defined by the Boreal Plains Wetland Classification System (Smith et al. 2007), were observed throughout all three quarter sections, situated in both natural and cultivated landscapes.

As displayed in Figure 1.1, the whole of the study area will not be subject to mining. Granular extraction activities will be focused on the northern half of NE and NW 33 and the southern end of NE 33 all of which contain cultivated land, native vegetation and wetlands. Granular extraction in SW 34 will occur in the northeast portion of the quarter section; an area dominated by agricultural land use.

2.2 Climate

The 1971-2000 climate normal for Stony Plain, obtained from Environment Canada's National Climate Data and Information Archive indicate an average yearly temperature of 3.5°C, with an average annual precipitation of 536 mm. Recent wet years included 1980, 1989, 1996 and 2006. Recent dry years included 2001, 2003, 2005 and 2009 indicating a period of prolonged below average precipitation. A climate data graph is available in Appendix B.

2.3 Physiographic Description

The study area lies within the Dry Mixedwood Subregion of the Boreal Forest Natural Region (Natural Regions Committee 2006). Elevations within this subregion range from 200 m at the Peace River, to 1225 m, west of Sundre. Level to gently undulating glacial till or lacustrine plains are the dominant terrain type.

3.0 METHODS

3.1 General Approach

Our general approach to this assessment involved the following:

- Literature and database reviews.
- Review of historical aerial photographs to evaluate the permanency and origin of the wetlands and the influences of past land uses on the wetlands.
- A reconnaissance-level vegetation survey conducted on 1-3 September 2010 of all lands within the study area.
- Amphibian call surveys conducted on 04 May 2011 and 02 June 2011 at select wetlands located throughout the study area.
- Breeding bird surveys conducted on 22 June 2011 at select wetlands located throughout the study area.
- A plant-community typing, wetland classification and rare plant survey conducted on 5-6 July 2011 of all lands within the study area.
- Meetings with Alberta Environment and Water to discuss wetland compensation.
- A public open house on the evening of 29 September 2011 held at the Agricom in Alberta Beach from 5:00 PM to 8:00 PM.

3.1.1 Literature and Database Review

The following information sources were reviewed for data pertinent to the study area:

- Burnco Rock Products Ltd., Highway 16 North Gravel Extraction and Processing Operations - SE ¼ 16-53-03-W5M & NW ¼ 22-53-03-W5M Report (2003).
- Environment Canada's National Climate Data and Information Archive for historical precipitation and temperature data.
- Fish and Wildlife Management Information System (FWMIS) database for listed wildlife species records for the study area and surrounding sections (Alberta Sustainable Resource Development 2010). The search was conducted on 08 September 2011.
- Alberta Conservation Information Management System (ACIMS) database for rare plant species or unusual plant community records within the study area (Alberta Tourism, Parks and Recreation 2011). The search was conducted on 08 September 2011.
- The Alberta Soil Information Viewer (ASIV), online soil information viewer for soil descriptions within the study area (Alberta Agriculture and Rural Development 2000). The search was conducted on 08 September 2011.
- A search of the Canada Land Inventory (CLI) for agricultural land capability for lands within the study area.

3.1.2 Historical Aerial Photograph Analysis

The purpose of the historical aerial photograph analysis was to describe the temporal changes in land use on the study area, investigate the historical extent of wetlands and to

assess the level of disturbance experienced by subject wetlands in the past. To that end, twelve historical aerial photographs were examined spanning the years 1950 to 2010 (Table 3.1; Appendix C). To the degree possible, photographs representing years/periods of low and high wetland water levels were selected based on the Environment Canada National Climate Data and Information Archive 1971-2000 climate normal for Stony Plain (Appendix B); however, the availability of suitable quality aerial photography also influenced the years selected for assessment. Precipitation records were also examined for the year prior to aerial photographic records to account for the influence of winter precipitation on the nature of wetlands the following spring. As no weather station exists in Val Quentin or Alberta Beach, data from Environment Canada's Stony Plain weather station was used as the nearest source of long-term climate data.

Table 3.1. Historical aerial photographs of the study area that were examined (1950-2010)

Year	Month	Scale	Annual Precipitation (mm)[a]	
			Previous Year[b]	Year of Air Photo
1950	September	1:40,000	N/A	N/A
1967	August	1:31,680	N/A	348.9
1973	July	1:31,680	518.6	636.2
1981	August	1:60,000	731.9	393.4
1990	June	1:20,000	637.8	567.1
1995	September	1:30,000	511.5	380.0
2000	August	1:20,000	410.4	510.3
2010[b]	N/A	N/A	307.3	N/A

[a] 1971-2000 average precipitation for Stony Plain = 536 mm
[b] 2010 image taken from Google Earth

3.1.3 Field Investigations

3.1.3.1 Vegetation Investigations

Vegetation Reconnaissance Survey

Based on the historical aerial photography analysis, areas considered to have potential to support native upland or wetland vegetation were targeted for a reconnaissance-level vegetation survey on 1-3 September 2010, to identify and classify all wetland and upland communities throughout the study area. That data was used to conduct preliminary wetland delineation in order to refine the scope of future vegetation surveys (Appendix D).

Vegetation and Rare Plant Survey

On 5-6 July 2011, plant community and rare plant surveys were conducted within the study area. All areas supporting native vegetation were investigated to characterize plant communities and to complete an inventory of vascular plant species. Common names are

used throughout the main body of the report, while common and scientific names are provided for all species identified in Appendix E.

The main objectives of the vegetation surveys were to: delineate and identify plant communities; classify wetlands and; locate rare plants (defined as species ranked as S1 or S2 by ACIMS) and/or unusual plant communities. For each plant community, all vascular plant species observed were recorded and each species was ranked as dominant, frequent, occasional or rare (uncommon) within the site. Qualitative notes regarding strata heights and cover (canopy, shrub and ground layers) were also noted. Plant communities were distinguished based on species composition, assigned an identifier number (Site #) in the field and mapped in the field on a recent (2009) aerial photograph at a scale of approximately 1:4,000. Representative sites were photographed.

Whenever a plant species could not be identified in the field, a specimen was collected. Those specimens were later examined using a dissecting scope and various floras to determine their identity. When necessary, identification of unusual specimens was verified at the University of Alberta Herbarium. When all specimens had been identified, site data were compiled in an Excel spreadsheet for further analysis.

Wetland Delineation

Wetlands were delineated using information collected during the vegetation and rare plant surveys and our aerial photograph analysis. Based on the boundaries of plant communities mapped in the field, wetland boundaries were established at the outer perimeter of all contiguous wetland plant communities. In all cases, wetland boundaries represented the point at which upland vegetation became dominant. Similarly, where cultivation extended to the edge of a wetland, creating an abrupt, un-natural edge to the wetland, the wetland boundary was drawn at the point where cultivated species became dominant. Once established, wetlands boundaries were then digitized into a GIS using a recent (2009), high resolution digital aerial photograph as the base image.

Wetland Classification

We classified wetlands within the study area according to the Boreal Plains Wetland Classification System using the *Guide to the Wetlands of the Boreal Plains Ecozone of Canada* (hereafter referred to as *Smith et al.*). This classification system was used rather than Stewart and Kantrud because the study area is located in the Boreal Forest Natural Region. The Stewart and Kantrud wetland classification system is designed to be used in aspen parkland ecosystems.

Wetlands within the Boreal Plains Wetland Classification System are based on the Canadian Wetland Classification System (CWCS) and modified according to the unique characteristics of the boreal plains ecozone. Wetland classes within Smith et al. were determined based on several environmental characteristics including soils, hydrology, nutrients and vegetation communities. Wetlands in Smith et al. were initially categorized into two major soil groups: mineral and organic (peatland) soil. Based on the major soil group, wetlands were then categorized into five major wetland classes based on the

CWCS: bog, fen, swamp, marsh and open water wetlands. From these categories, wetlands are further subdivided into minor wetland classes, based largely on the overall vegetation cover within the wetlands. Brief descriptions of the five major wetland classes and their associated minor classes that occur within the study area are described below.

Organic (Peatland) Wetlands

Organic wetland types are defined as wetlands with an overall accumulation of weakly decomposed peat greater than 40 cm in depth. Climate, soil, hydrology and vegetation within organic wetlands contribute to a slow decomposition rate in relation to vegetation growth, leading to an accumulation of peat (Smith et al. 2007). Within the study area, organic wetlands were represented by bogs and fens, which are briefly described below.

3.1.3.1.1.1.1 Bogs

The accumulation of peat within bogs is primarily composed of weakly decomposed *Sphagnum* mosses that create a raised surface in relation to the surrounding landscape (Smith et al. 2007). Soils within bogs are separated into two layers; the upper aerobic layer with living *Sphagnum* species, and the lower, anaerobic decomposed layer that is saturated with water. Hydrology within bogs is driven by precipitation inputs, with a water table at or below the surface. Nutrients within bogs are considered to be poor to very poor, with low pH values and dissolved minerals. Depending on the vegetation cover, bogs can be treed, shrubby or open. Bogs are dominated by a variety of *Sphagnum* and feather mosses; common shrubs within bogs include Labrador tea (*Ledum groenlandicum*) and dominant trees include black spruce (*Picea mariana*) with paper birch (*Betula papyrifera*), lodgepole pine (*Pinus contorta*) and Jack Pine (*Pinus banksiana*) often present after wildfires. Overall, vegetation within bogs has relatively low species diversity in comparison to other wetlands.

3.1.3.1.1.1.2 Fens

The composition of organic material within fens consists of decomposing mosses, sedges and some woody material; however, unlike bogs, the surface of fens is not raised in comparison to the surrounding landscape (Smith et al. 2007). Fens typically form in areas when significant groundwater seepage or surface water runoff occurs in peat accumulating areas. Fens receive mineral-rich water inputs and can have contact with surface and/or ground water and also receive surface flow from surrounding landscapes. These factors result in variable water table levels, peat accumulation and nutrient availability within the wetland. While nutrient levels are variable, they are typically higher than bogs, with a nutrient regime of rich to poor. Fens with higher levels of nutrients from mineral-rich waters are known as *rich fens* while fens with lower access to nutrients are called *poor fens*. Depending on the vegetation cover, fens can be treed, shrubby or dominated by graminoids. Vegetation within fens is dependent on the water table and amount of dissolved minerals. *Sphagnum* and brown mosses are typical of fens, with a greater concentration of brown mosses in rich fens and *Sphagnum* in poor fens. Shrubs within fens typically consist of willow (*Salix spp.*) species, American dwarf birch (*Betula glandulosa*) and dwarf birch (*Betula pumila*). Trees within fens are dominated by

larch tamarack (*Larix larcinia*) and black spruce (*Picea mariana*); all fens have at least 5% larch tamarack cover, a distinguishing factor compared to bogs. The herb layer of fens is typically dominated by sedges.

Mineral Wetlands

Mineral wetlands are defined by the presence of mineral soil, where there is little to no organic matter (peat) within 40 cm of the surface (Smith et al. 2007). Landscapes, geology, soils, hydrology and climate all contribute to the development of mineral wetlands. These wetlands form in wet areas, floodplains and other shallow water systems. Within the study area, mineral wetlands were represented by swamps and marshes, which are briefly described below.

3.1.3.1.1.1.3 Swamps

Swamps can occur in both mineral and peat accumulating areas; however, this section will only cover mineral swamps as organic swamps were not located within the study area (Smith et al. 2007). The water table within swamps fluctuates seasonally and sometimes bi-yearly, however, pools of water are often observed throughout. Swamps are distinguished by treed and/or shrubby vegetation in contact with mineral-trophic water. Shrubby swamps are typically wetter than treed swamps. Treed and/or shrub cover within swamps is typically between 30 to 100 %, many of which have a closed canopy. Treed swamps can be deciduous, coniferous or mixed; common species include paper birch (*Betula papyrifera*), Alaskan paper birch (*Betula neoalaskana*), balsam poplar (*Populus balsamifera*), black spruce (*Picea mariana*) and tamarack larch (*Larix laricinia*). Shrub species typically consist of willows (*Salix spp.*) and alder (*Alnus spp.*) species. Understory vegetation is variable in swamps.

3.1.3.1.1.1.4 Marshes

Marshes occur in any area of mineral soil where periods of inundation occur for a sufficient period of time to promote emergent macrophytic vegetation (Smith et al. 2007). The substrate of mineral wetlands may either be exposed or flooded depending on seasonal to annual patterns. These wetlands form due to a variety of hydrological inputs including: surface runoff, inflow, groundwater discharge/seepage, precipitation and flooding. The water table in mineral wetlands is variable and is typically at or above the surface. Mineral wetlands are usually high in dissolved minerals, with a nutrient rating of high to very high. Vegetation is dynamic in response to the variable hydrology of the wetland; emergent aquatic vegetation (reeds, sedges, grasses, broad-leaved forbs along with submerged vegetation and algae) is found throughout. Within these wetlands, vegetation often forms along a gradient depending on water levels with open water/deep marsh grades in the centre and shallow marsh grades/uplands along the periphery. Vegetation subclasses within mineral wetlands are determined based on the dominance of graminoid species or emergent vegetation. Above surface vegetation in marshes is greater than 25%.

3.1.3.2 Wildlife Investigations

Amphibian (Frog/Toad) Survey

A breeding frog/toad call survey was conducted during the nights of 04 May 2011 and 02 June 2011. In total, 14 wetlands and dugouts were surveyed throughout the study area. (Figure 3.1). Following standard Alberta Volunteer Amphibian Monitoring Program protocol (Alberta Conservation Association 2006), surveys were conducted from 30 minutes after sunset until approximately 12:00 midnight during suitable weather conditions (wind no higher than three on the Beaufort wind scale, light or no rain, and temperatures at a minimum of 5º C). The surveyors waited for 2 minutes after arrival at the survey station to allow for any amphibians to settle. That 2-minute waiting period was followed by 5 minutes of listening. The surveyor took note of the species heard, their location (i.e., wetland/dugout site) and estimated the number of individuals present using the following call level codes:

1. Frog(s) or toad(s) can be counted; no overlapping calls (i.e., one to three animals)
2. Individual frogs and toads can be counted; some calls overlapping (i.e., four to seven animals)
3. Individuals cannot be counted, full chorus; calls overlapping (i.e., eight or more animals)

Amphibian species that do not vocalize, such as salamanders, are not detected by this type of survey.

Breeding Bird Survey

To characterize breeding bird abundance and species richness at the subject wetlands, breeding bird surveys were conducted on 22 June 2011. A total of 13 stations were surveyed at wetlands throughout the subject property (Figure 3.1). Although no surveys were specifically conducted in upland habitats, several of the wetland survey locations were positioned to also encompass immediately adjacent areas of upland habitat. Upon arriving at each point count station, the surveyors waited one minute to allow the birds to settle. Following that, an 8-minute, 100m fixed-radius point count survey was completed in which all birds seen and heard were recorded. Birds recorded within the 100 m, but outside of targeted sites (e.g., in an agricultural field surrounding a targeted wetland) were noted as such for consideration during analysis.)

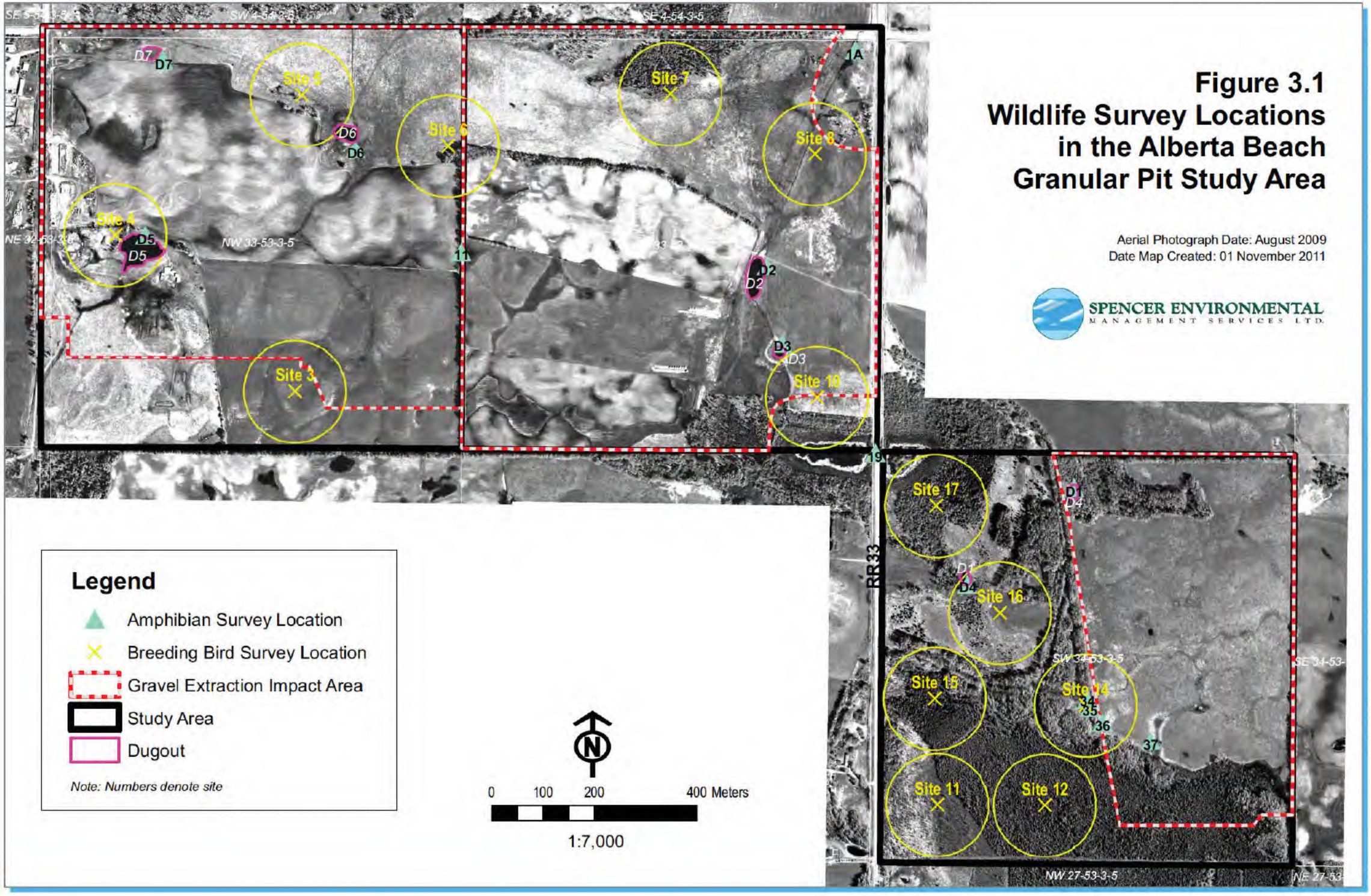
Incidental Wildlife Observations

All incidental wildlife observations made during the various field investigations were recorded.

Figure 3.1
Wildlife Survey Locations in the Alberta Beach Granular Pit Study Area

Aerial Photograph Date: August 2009
Date Map Created: 01 November 2011

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.



4.0 EXISTING CONDITIONS

4.1 Topography and Geology

The Dry Mixedwood Subregion comprises two distinct geological areas; the undulating plains and hummocky uplands in central Alberta, and the level to gently rolling plains of the northern Peace River and Vermillion Lowlands (Natural Regions Committee 2006). Bedrock formations in these two distinct areas include upper cretaceous sandstone, shale and siltstone formations. Surficial materials are moderately to fine textured, with moderately calcareous glacial till in central Alberta. Glaciofluvial sands and organic deposits (10%) with minor inclusions of glaciolacustrine materials also persist throughout the Subregion.

The topography of Lac Ste. Anne County is uneven and ranges from level to undulating and rolling. Considerable portions of the area are occupied by lakes (Navus Environmental 2011).

4.2 Soils

4.2.1.1 Regional

Typical soils for the Dry Mixedwood Subregion are Orthic Gray Luvisols under moderately well drained aspen forests (Natural Regions Committee 2006). Significant areas of Dark Gray Luvisols are dominant, particularly in cultivated areas. Organic soils underlying wetlands are usually Terric Mesisols, while Fibric Mesisols are associated with poor fens and bogs. Peaty and Orthic Gleysols are also common wetland soils, particularly on level to gently undulating Landforms.

4.2.1.2 Study Area

Canadian System of Soil Classification

According to the Alberta Soil Information Viewer (ASIV) (Alberta Agriculture and Rural Development 2000), the soils within the study area consist of the following:

- In all of SW 34, NW 33 and most of NE 33 soils are Typic Mesisol on fen peat and Dark Gray Luvison on medium textured till.
- In the northeast corner of NE 33 soils are Orthic Gray Luvisol on medium textured till which includes poorly drained and Chernozemic soils.
- In the north-central patch of NE 33 soils are Typic Mesisol on sphagnum peat.

Canada Land Inventory (C.L.I.) Soil Rating System

The soils located within the study area comprise three CLI land capability classes. They are as follows:

- Class 3D for all of SW 34 and the southern halves of NW/NE 33.
- Class 0 for the northern halves of NW/NE 33.

Class 3 soils have moderately severe limitations that restrict the range of crops or require special conservation practices. Subclass D indicates undesirable soil structure and/or low permeability. Class 0 soils are listed as organic and are not placed in capability classes (Agriculture and Agri-Food Canada 2008).

4.2.1.3 Site Specific Investigations

Navus Environmental conducted pre-disturbance soil investigations between 31 May and 1 June 2011 (Navus Environmental; Appendix F). Topsoil assessment points were conducted every 100 m throughout the three quarter sections with a total of 190 points throughout the study area. A total of 115 assessment points contained mineral soil while 75 contained organic soil. The majority of organic soil points were situated in the northeastern portion of NW 33, the north portion of NE 33 and the southern portion of SW 34 (Navus Environmental 2011). Please see the Pre-Disturbance Soil Characterization report in Appendix F for complete analysis and results.

4.3 Hydrology

4.3.1 Surface Water

There are no permanent watercourses within the study area. Two permanent waterbodies are present within the study area: Site 19 in the southeast corner of NE 33 and Site 23 in the northwest corner of SW 34. Depending on climatic conditions and annual precipitation totals, wetlands may contain surface water for as little as a couple of weeks following spring snowmelt, or may hold surface water into the fall and even through to winter freeze up. Wetlands within the study area receive their water either from surface water flow within individual, local catchments and/or groundwater sources. Wetlands are discussed in greater detail in *Section 4.4.3.1*.

4.3.2 Groundwater

Groundwater movement within the study area is from southeast to northwest (Navus 2011; Appendix F)

4.4 Vegetation

4.4.1 Regional Description

Within the Dry Mixedwoods Subregion, dominant native vegetation is represented by aspen forests with fens commonly occurring in low-lying areas (Natural Regions Committee 2006). Sites of average moisture and nutrients in the southern portion of the Dry Mixedwoods Subregion typically support understories of beaked hazelnut, prickly rose, wild sarsaparilla, cream-coloured vetchling, purple peavine and bluejoint. Poorly drained sites support a variety of bog and fen communities with treed and shrubby fens being the most common. Moist, rich sites typically host balsam poplar, aspen poplar and white spruce stands; either as pure or mixed. Cultivated landscapes are typical throughout this region.

4.4.2 Local Area

4.4.2.1 Wetlands

A total of 47 wetland plant community sites covering an area of 67.05 ha were identified throughout the study area during the summers of 2010 and 2011 (Figure 4.1; Table 4.1). Due to haying activity during the July 2011 vegetation and rare plant surveys, certain wetlands previously identified in the September 2010 were not able to be surveyed. While vegetation and rare plant surveys conducted in the July 2011 were more extensive than the previous year's reconnaissance survey, the September 2010 surveys provided sufficient information to accurately delineate wetlands and allow for wetland classification.

Combined, the 47 wetland plant sites supported 192 plant species. Of those, 23 (12%) were non-native/exotic species, including one (orange hawkweed) designated as *Prohibited Noxious* and three (Canada thistle, tall buttercup and white cockle) designated as *Noxious* by the Alberta's *Weed Control Act Regulations* (2010) (Table 4.1). All remaining 168 (88%) plant species identified were native to Alberta with the exception of one species, broad-leaved water-plantain, whose native/non-native status is unknown. At a plant community level, non-native/exotic species contributed, on average, 14% to total species richness. Non-native/exotic species ranged from a high of 67% to a low of 0%. Common dandelion was the most prevalent non-native species throughout the study area. It was observed at 20 wetland sites and was abundant/dominant at eight. When considering *Noxious* species regulated under the *Weed Control Act,* creeping thistle was present in 16 wetland sites and abundant/dominant in eight; tall buttercup was present in three and abundant/dominant in one and; white cockle was present in four and abundant/dominant in none. Orange hawkweed (a *Prohibited Noxious* species) was present in four wetland sites and abundant/dominant in one.

Where present, the high frequency and abundance of non-native species at certain sites was representative of the generally degraded nature of wetlands situated within agricultural areas in the study area. In such areas, cultivation had extended to the wetland edge and, in some cases, cultivation and/or tilling had extended through portions of wetlands. In areas utilized for pasture, livestock had impacted wetlands through grazing and trampling. The low presence and abundance of non-native species coupled with high species richness at other sites is representative of relatively undisturbed wetland communities with high quality habitat.

Figure 4.1
Existing Upland and Wetland Plant Communities in the Alberta Beach Granular Pit Project Area

Aerial Photograph Date: August 2009
Date Map Created: 01 November 2011

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.

Legend

- Gravel Extraction Impact Area
- Study Area
- Dugout

Upland Forest
- Upland - Deciduous
- Upland - Mixedwood

Note: Numbers denote site

Peatland Wetlands
- Fen - Treed
- Fen - Shrub
- Fen - Graminoid

Mineral Wetlands
- Marsh - Emergent
- Marsh - Graminoid
- Swamp - Treed
- Swamp - Shrub

0 100 200 400 Meters

1:7,000

Table 4.1. Wetland plant communities and sites located within the study area

Site ID[1,2]	Wetland Community Type[3]	Size (ha)	Total Species Richness	# of non-native species	% non-native species
001a	Fen – Graminoid (org.)	2.41	22	7	32%
001b	Fen – Graminoid (org.)	19.81	26	11	42%
004	Fen – Treed (org.)	3.02	16	2	13%
005	Marsh – Graminoid (min.)	0.64	9	6	67%
008	Swamp – Treed (min.)	0.03	20	4	20%
009	Marsh – Graminoid (min.)	0.19	22	7	32%
010*	Marsh – Graminoid (min.)	0.04	-	-	-
011	Marsh – Graminoid (min.)	0.22	5	2	40%
012	Marsh – Graminoid (min.)	0.64	20	5	25%
013*	Marsh – Graminoid (min.)	0.09	-	-	-
014*	Fen – Graminoid (org.)	1.07	-	-	-
015*	Marsh – Graminoid (min.)	0.03	-	-	-
016	Marsh – Graminoid (min.)	0.32	29	5	17%
018	Fen – Treed (org.)	1.71	39	13	33%
019	Marsh – Emergent (min.)	0.21	8	0	0%
020	Swamp – Shrub (min.)	1.18	54	1	2%
021*	Fen – Graminoid (org.)	1.55	-	-	-
022	Marsh – Graminoid (min.)	1.75	10	4	40%
023	Marsh – Emergent (min.)	0.35	10	1	10%
024	Fen – Shrub (org.)	0.36	28	2	7%
025a	Fen – Treed (org.)	1.37	33	2	6%
025b	Fen – Treed (org.)	1.11	18	0	0%
030	Fen – Graminoid (org.)	1.12	16	3	19%
032a	Swamp – Shrub (min.)	0.15	33	6	18%
032b	Swamp – Shrub (min.)	1.04	30	4	13%
032c	Swamp - Shrub(min.)	0.09	24	5	21%
033	Marsh – Graminoid (min.)	0.45	27	4	15%
034	Marsh – Graminoid (min.)	0.04	18	1	6%
035	Marsh – Graminoid (min.)	0.08	9	1	11%
036	Fen – Graminoid (org.)	0.09	23	3	13%
037	Marsh – Graminoid (min.)	0.54	40	6	15%
039	Swamp – Treed (min.)	0.84	20	0	0%
041	Fen - Treed (org.)	11.97	34	0	0%
042	Fen – Treed (org.)	2.60	44	0	0%
043	Fen – Treed (org.)	1.35	54	1	2%
044	Fen – Treed (org.)	1.06	35	1	3%
045	Marsh – Graminoid (min.)	2.14	53	9	17%
048*	Marsh – Graminoid (min.)	0.11	-	-	-
049*	Marsh – Graminoid (min.)	0.15	-	-	-
050*	Marsh – Graminoid (min.)	0.67	-	-	-

Site ID	Wetland Community Type	Size (ha)	Total Species Richness	# of non-native species	% non-native species
051*	Marsh – Graminoid (min.)	3.18	-	-	-
100	Marsh – Graminoid (min.)	0.05	21	3	14%
101	Marsh – Graminoid (min.)	0.02	15	4	27%
102	Marsh – Graminoid (min.)	0.02	10	2	20%
103	Marsh – Graminoid (min.)	0.13	47	3	6%
104	Marsh – Graminoid (min.)	0.18	25	0	0%
113*	Marsh – Graminoid (min.)	0.72	-	-	-
Totals		**67.05**	**192**	**23**	**12%**

[1] Site numbers with asterisks indicate 2010 reconnaissance surveys.
[2] 2010 survey data not used in calculations; individual sites notes available in Appendix D.
[3] (org.) indicated organic wetlands, (min.) indicated mineral wetlands.

Table 4.2. Summary of non-native/exotic plant species within study area wetlands

Scientific Name	Common Name	# of sites where present	% of sites where present	# of sites where dominant or abundant
Axyris amaranthoides	Russian pigweed	4	9%	0
Cerastium vulgatum	common mouse-ear chickweed	3	7%	0
Chenopodium album	lamb's-quarters	2	4%	0
Cirsium arvense	**creeping thistle**	16	35%	8
Descurainia sophia	flixweed	2	4%	0
Galeopsis tetrahit	hemp-nettle	13	28%	10
Gnaphalium uliginosum	low cudweed	1	2%	0
Hieracium aurantiacum	**orange hawkweed**	4	9%	1
Kochia scoparia	summer-cypress	1	2%	0
Plantago major	common plantain	6	13%	0
Ranunculus acris	**tall buttercup**	3	7%	1
Rumex crispus	curled dock	5	11%	0
Silene pratensis	**white cockle**	3	7%	0
Sonchus uliginosus	smooth perennial sow-thistle	4	9%	2
Stellaria media	common chickweed	4	9%	1
Taraxacum officinale	common dandelion	20	43%	8
Trifolium hybridum	alsike clover	3	7%	1
Trifolium pratense	red clover	5	11%	1
Alopecurus pratensis	meadow foxtail	3	7%	2
Bromus inermis ssp. inermis	smooth brome	8	17%	5
Elytrigia repens var. repens	quack grass	8	17%	6
Phleum pratense	timothy	10	22%	3
Poa compressa	Canada bluegrass	1	2%	0

Note: species in bold are regulated under the Alberta *Weed Control Act Regulations* (2010)

Organic (Peatland) Wetlands

Fourteen organic wetlands were located within the study area totaling 50.61 ha. The majority of these wetland sites were situated on the southern and western portions of SW 34-53-03 W5M; the northern and southeastern portions of NE 33-53-03 W5M and; the northeast portion of NW 33-53-03-W5M (Figure 4.1). Organic wetland communities included eight treed fens, one shrubby fen and five graminoids-dominated fens; no bog communities were found in the study area. These communities are discussed in further detail below.

Fens - Treed

Eight treed fens were identified in the study area, totaling 24.20 ha. Canopy species in the treed fen communities included larch tamarack, black spruce, white spruce, lodgepole pine, and Alaskan birch (Appendix E).

There was evidence that Sites 42 and 43 had previously experienced wildfire (Plate 1) and the resulting vegetation differed from other treed fens. The canopy at Site 43 was dominated by Alaskan birch, approximately 10 m in height with an open canopy (15 % cover). The shrub layer was dominated by bracted honeysuckle and beaked willow with abundant basket willow and red-oiser dogwood. Dominant species in the ground layer included marsh marigold, bluejoint Schreber's feathermoss and stair step moss. Small pools of water were observed throughout the site. Site 42 had few trees of canopy height; Alaskan birch with an approximate height of 2 m and 10% cover was present. The shrub layer was diverse with Alaskan birch saplings, wild red raspberry, Labrador tea, bracted honeysuckle and red-oiser dogwood being the most common species. Common ground species included twin flower, cloudberry, bluejoint, water sedge, and sphagnum species.

Plate 1. Site 43, Burnt landscape (June 2011)

Sites 41 and 44 were situated adjacent to each other and were similar in species composition. Site 41 was the second largest site in the study area, occupying 11.97 ha. The canopy was dominated by black spruce and larch tamarack (Plate 2); Alaskan birch was interspersed throughout and lodgepole pine was an uncommon species. Average heights were approximately 10 m with a closed canopy (75% cover). The shrub layer was dominated by Labrador tea and Alaskan birch saplings. The ground layer was dominated by sphagnum mosses; small pools of water were encountered throughout the site (Plate 3). Site 44 was also dominated by black spruce and larch tamarack with Alaskan birch being found less frequently throughout. The canopy was higher at approximately 15 m and more open (25% cover). No shrub species were dominant; however, Labrador tea was encountered frequently. Twin flower and Schreber's feathermoss were dominant ground species with small pools of standing water covering approximately 25 % of the ground.

Site 4 was degraded due to active cattle grazing (Plate 4). The canopy was dominated by larch tamarack and black spruce, the majority of which were moribund; numerous standing dead trees were situated throughout the site. The shrub layer was largely absent due to grazing. Alaskan birch saplings and northern gooseberry were encountered occasionally. The ground layer was trampled and grazed, with non-native species including hemp-nettle and timothy grass forming dominant components. Site 18 was also degraded by grazing; larch tamarack was the dominant canopy species with abundant Alaskan birch; individual trees appeared healthy with a canopy height of approximately 10 m and 20% cover. The shrub layer was largely absent due to grazing with abundant elderberry and occasional pussy willow. The ground layer was heavily trampled and dominated by non-native species including creeping thistle, smooth perennial sow thistle, hemp-nettle, common chickweed, common dandelion and alsike clover, all of which were either abundant or dominant throughout the site.

Site 25b was dominated by black spruce and larch tamarack while Site 25a was a mix of tamarack and white spruce with a dominant shrub layer consisting of Alaskan birch saplings, pussy willow, wild red raspberry, river alder, red-oiser dogwood (Plate 5). Site 25a had a more diverse ground layer, with moschatel, jewelweed, bishop's-cap, common nettle and the non-native hemp-nettle being abundant/dominant throughout. The ground layer of 25b consisted largely of moschatel, jewelweed, western Canadian violet and drooping wood reed. Both sites were undisturbed, Site 25b had no non-native species present.

Plate 2. Site 41, Black spruce and larch tamarack canopy (June 2011)

Plate 3. Site 41, Small pools of water observed throughout (June 2011)

Plate 4. Site 4, Heavily grazed and weedy (July 2011)

Plate 5. Site 25a, Treed fen with shrub understory (July 2011)

Fens - Shrubby

One shrubby fen (Site 24; Plate 6) was identified in the study area, totaling 0.36 ha. The site served as a transition zone between an emergent marsh (Site 23) and a treed fen (Site 25a). The canopy contained occasional tamarack and balsam poplar, but was dominated by a diverse mix of willow species including pussy willow, bog willow, basket willow, beaked willow and balsam willow. Alaskan birch saplings and Saskatoon also formed occasional components of the shrub layer. The ground layer consisted largely of small bottle sedge, water sedge, bluejoint and swamp horsetail. Non-native species were low in abundance and comprised 7% of total species identified.

Fens - Graminoid

Six graminoid fens were identified in the study area, totaling 26.06 ha; four (Sites 1a, 1b, 14, 30) were located in active cow pasture while one was located in an open pocket adjacent to a pasture (Site 36). Due to haying activity during the 2011 vegetation survey, one site, Site 21, was not surveyed; 2010 site notes (Appendix D) were used to classify this wetland. Due to the disturbed nature of many of these sites, non-native species often formed dominant and/or abundant components of vegetative cover.

Sites 1a and 1b (Plate 7) were situated along the northern extent of NE 33 and the northeastern portion of NW 33; 1b was the largest site in the study area at 19.81 ha. Both sites were disturbed by active livestock grazing. Site 1a served as a transition community between Sites 1b and 4 and contained a few larch tamarack and balsam poplar throughout. Pussy willow, beaked willow and northern gooseberry were listed as rare shrub components within Site 1a. Dominant species in 1a were reed canary grass and Kentucky bluegrass with abundant creeping thistle and common dandelion throughout. Site 1b had no tree species, with twinning honeysuckle found occasionally and Alaskan birch saplings, pussy willow and beaked willow listed are rare species. Non-native species dominated the ground cover and included creeping thistle, meadow foxtail, common dandelion and quack grass. Water sedge and reed canary grass were the only native species listed as abundant.

Similar to Sites 1a and 1b, Site 14 was another weedy graminoid dominated fen situated in cattle pasture. Due to harvesting activity in 2011, 2010 site notes (Appendix D) were used to classify this wetland. This site was dominated by reed canary grass and common dandelion.

Site 30 included occasional white spruce with a shrub component consisting of Alaskan birch saplings, dwarf birch, wild red raspberry, pussy willow and basket willow. The ground layer was dominated by Kentucky bluegrass with abundant bottle sedge, arrow-leaved coltsfoot and the non-native common dandelion and creeping thistle. While Site 30 did not appear actively grazed at the time of our survey, the abundance of weed species and the trampled landscape indicated previous usage as pasture.

Site 36 was situated adjacent to active cattle pasture to the northeast and forested upland to the southwest. The shrub layer consisted of frequent balsam poplar saplings with aspen poplar and basket willow listed as rarely occurring species. The ground layer was

dominated by awned sedge, bluejoint and fowl bluegrass with abundant purple-stemmed aster, arrow-leaved coltsfoot and the non-native hemp-nettle.

Plate 6. Site 24, shrubby fen (July 2011)

Plate 7. Site 1b, graminoid fen (July 2011)

Mineral Wetlands

Thirty-two mineral wetlands were located within the study area, totaling 16.44 ha. Mineral wetlands included two emergent marshes and 24 graminoid marshes, most of which were situated in agricultural fields. Other mineral wetlands included two treed swamps and four shrubby swamps found throughout the study area. These communities are discussed in further detail below.

Marshes – Emergent

Two emergent marshes (Sites 19, 23; Figure 4.1) were located within the study area, totaling 0.57 ha. Sites 19 and 23 originally formed one large open marsh, as observed in the 1950 historical aerial photograph; however, the development of RR 33 split this wetland into two separate communities east and west of the road. While both sites appear to have some open water components throughout much of the historical analysis, emergent vegetation dominated the centre of both wetlands during the 2010 and 2011 vegetation surveys (Plate 8).

No tree or shrub species were noted at either site. The vegetation composition of both wetlands was similar. Common cattail, water sedge, small bottle sedge were all dominant species at both sites. Water arum was dominant at Site 29 and frequent at Site 23. Site 19 had no non-native species present while Site 23 had one (curled dock), which was noted as being rare within the site.

Plate 8. Site 19, emergent marsh (July 2011)

Marshes – Graminoid

Twenty-four graminoid marshes were located within the study area, totaling 12.54 ha. Twenty-two graminoid marshes were situated in agricultural land including active

pasture, inactive pasture and cultivated fields, while two (Sites 103 and 104) were located in naturally vegetated areas. The abundance of non-native species in wetlands situated in agricultural lands varied considerably, from a low of 6% of species identified to a high of 67%. Wetlands situated in undisturbed areas had a low non-native abundance of 6% (Site 103) and 0% (Site 104).

Due to haying activity during 2011, the vegetation survey, eight of the graminoid marshes (Sites 10, 13, 15, 48, 49, 50, 51, 113) were not surveyed; 2010 site notes (Appendix D) were used to classify these wetlands. Many of these wetlands had common components with reed canary grass recorded as a dominant species at all the sites. Dandelion was dominant at all sites except Site 113. Alsike clover was dominant at Sites 10, 15, 50 and 51; fowl bluegrass was dominant at Sites 48 and 50; creeping thistle was dominant at Sites 48 and 51; smooth brome was dominant at Sites 51 and 113; quackgrass was dominant at Sites 49 and 113, and; smooth perennial sow thistle was dominant at Site 48. Overall, wetlands exclusively surveyed in 2010 were heavily disturbed and weedy communities.

Sites 33, 34 and 37 were all situated in cattle pasture and were either adjacent to or near treed/shrubby communities. Sites 33, 34 and 37 had shrub components. Basket willow was observed occasionally at Site 33. Balsam poplar saplings, wild black currant, northern gooseberry and basket willow were noted at Site 34 and numerous willows including basket willow, shining willow, beaked willow and flat-leaved willow were noted at Site 37. Reed canary grass was dominant and awned sedge was either abundant or dominant at all three sites.

Swamps – Treed

One treed swamp (Site 8) was located within the study area, totaling 0.02 ha. Site 8 was a small swamp situated within an upland shelter belt (Site 7; Plate 9). Aspen poplar were abundant throughout the swamp and formed an open canopy with a shrub layer dominated by Alaskan birch saplings and wild red raspberry. Northern gooseberry, wild red currant and wild red raspberry were also found occasionally throughout the shrub layer. The ground layer was dominated by jewelweed, common nettle and the non-native smooth brome. Overall, non-native species at Site 8 accounted for 20% of all species identified.

Swamps – Shrubby

Five shrubby swamps were located within the study area, totaling 3.30 ha. Four of the shrubby swamps (Sites 32a, 32b, 32c, 39) were associated with larger upland and treed fen complexes while one (Site 20) was situated adjacent to an emergent marsh.

Sites 32a, 32b and 32c were situated adjacent to and within a larger deciduous upland site (Site 29). Sites 32a and 32b had some Alaskan birch and balsam poplar in their canopies while Site 32c had no mature tree species. Common shrub species found throughout the three sites included pussy willow, wild red raspberry, northern gooseberry, balsam poplar

Plate 9. Site 8, treed swamp (July 2011)

saplings and bracted honeysuckle, found in varying abundances within the sites. Common nettle was a dominant ground species throughout the three sites; the non-native quackgrass was occasionally dominant in 32a and 32c; jewelweed was abundant in 32a and 32b and; smooth brome and Kentucky bluegrass was found in varying abundances throughout the three sites.

Site 39 (Plate 10) was a narrow band of treed swamp situated in two locations along the northern border of a large treed fen (Site 41). The wetland community was undisturbed by cattle grazing and no non-native species were recorded within it. No tree species were present within the site; willow dominated the shrub layer with beaked willow and an unidentified willow species as the main species and balsam willow, basket willow and velvet-fruited willow were occasionally observed throughout the site. The ground layer was dominated by bluejoint with wild mint, marsh-marigold and bitter cress found frequently.

Site 20 (Plate 11) was situated adjacent to an emergent marsh (Site 19) to the south and a graminoid fen (Site 21) to the north. Species richness was very high at 54 with only one non-native species (common dandelion) found occasionally. Tree species present within the shrubby swamp included tamarack and white spruce, however, neither formed a large component of the community. The presence of these species indicates that the swamp may serve as a transition zone between the mineral wetland to the south and organic wetland to the north. The shrub layer at Site 20 was very diverse with dominant species including beaked willow, pussy willow, basket willow, flat-leaved willow and an unidentified willow species along with dwarf birch and wild red raspberry. Other shrub species found occasionally, frequently and abundantly, respectively included Saskatoon,

red-oiser dogwood, bracted honeysuckle, northern gooseberry and shining willow. Surface water was observed throughout the site.

Plate 10. Site 39, shrubby swamp emerging from treed fen (July 2011)

Plate 11. Site 20, shrubby swamp (July 2011)

4.4.2.2 Uplands

A total of six upland communities were identified within the study area totaling 13.79 ha. Five of the communities (Sites 6, 7, 29, 40, 112) were deciduous woodlands while one (Site 27) was a mixed woodland (Table 4.3).

Table 4.3. Upland plant communities located within the study area

Site ID[1,2]	Wetland Community Type	Size (ha)	Total Species Richness	# of non-native species	% non-native species
6	Deciduous Woodland	0.55	8	2	25%
7	Deciduous Woodland	1.02	23	2	9%
27	Mixed Woodland	0.74	11	4	36%
29	Deciduous Woodland	11.50	60	6	10%
40	Deciduous Woodland	0.70	47	2	4%
112*	Deciduous Woodland	1.38	--	--	--

[1] Site numbers with asterisks indicate 2010 reconnaissance surveys.
[2] 2010 survey data not used in calculations; individual sites notes available in Appendix D.

Deciduous Woodlands

Of the five deciduous woodlands, Site 6 was a patch of woodland on the northern border of NE 33-53-03-W5M; Site 7 was a shelterbelt within the same quarter section; Site 29 (Plate 12) was a large mosaic of deciduous woodland within SW 34-53-03-W5M; Site 40 was a small patch of woodland in the southeast corner of the same quarter section and; Site 112 were four small patches of trees situated in cow pasture in NW 33-53-03-W5M. Deciduous woodlands totaled 13.79 ha.

Aspen poplar and balsam poplar were the most common tree species, and were dominant in all deciduous upland sites. Site 7 had occasional Alaskan birch interspersed throughout. Mature canopy heights were approximately 20 m. Site 6 was degraded due to cattle grazing while Site 112 was situated in open pasture and had no shrub components. Common shrub species included prickly rose, red-oiser dogwood, northern gooseberry and wild red raspberry. Twinning and bracted honeysuckle along with white spruce saplings formed part of the shrub layer of both Sites 29 and 40. Labrador tea was noted as an uncommon species in Site 40. Site 29 had the highest species diversity in the study area with a total of 60 species identified.

Non-native species varied considerably within the deciduous uplands, ranging from a high of 36% of all species identified to a low of 4%. Sites 6 recorded the highest percentage of non-native species, reflecting the disturbed nature of the community. Common dandelion was the most pervasive non-native species as it was observed in all deciduous woodlands and was abundant/dominant at Sites 6 and 29.

Mixed Woodlands

One mixed woodland (Site 27; Plate 13) was identified within the study area, totaling 0.59 ha. The canopy was dominated by white spruce, balsam poplar and trembling aspen. Due to grazing by cattle, the shrub layer was reduced and consisted only of wild black-currant and northern gooseberry, both observed occasionally. Non-native species formed a large component of the ground layer with hemp-nettle, white cockle and dandelion observed throughout.

Plate 12. Site 29, deciduous woodland (July 2011)

4.4.2.5 Rare and Uncommon Plant Species

Database Review

A search of the Alberta Conservation Information Management System (Alberta Tourism, Parks and Recreation 2011) database revealed no existing records of listed plant species (species designated by authorities as being rare or of conservation concern) within the study area or adjacent quarter sections.

Rare Plant Survey

No rare (S1 or S2) plant species were observed during the rare plant survey. Twelve species classified as S3 by ACIMS were observed within the study area (Table 4.4). S3 species are defined as species known to have 20-100 occurrences in the province or are somewhat vulnerable because of a restricted range, relatively small population sizes, or other factors; and are often considered uncommon in areas where they are found.

Plate 13. Site 27, mixed woodland (July 2011)

Table 4.4. Uncommon (S3) plant species recorded in the study area

Scientific Name	Common Name	Plant Type	# of Sites	Sites	S RANK (ACIMS)
Corallorhiza maculate	spotted coralroot	Forb	2	42, 104	S3
Epilobium palustre	marsh willowherb	Forb	1	23	S3
Galium labradoricum	Labrador bedstraw	Forb	5	16, 18, 43, 45, 103	S3
Impatiens noli-tangere	western jewelweed	Forb	1	4	S3
Lycopus uniflorus	northern water-horehound	Forb	6	12, 18, 20, 24, 43, 45	S3
Lysimachia thyrsiflora	tufted loosestrife	Forb	10	12, 16, 18, 20, 24, 36, 43, 44, 45, 103	S3
Carex interior	inland sedge	Sedge	2	42, 44	S3
Carex loliacea	rye-grass sedge	Sedge	1	103	S3
Carex stipata	awl-fruited sedge	Sedge	1	37	S3
Carex trisperma	three-seeded sedge	Sedge	3	41, 44, 104	S3
Glyceria pulchella	graceful manna grass	Grass	1	32	S3
Chrysosplenium iowense	golden saxifrage	Forb	2	25a, 25b	S3

4.4.3 Historical Aerial Photography Review

Land use within the study area remains largely consistent over the period of analysis. In the first image (1950; Appendix C), the area was dominated by natural vegetation with limited clearing for agriculture; however, by 1967 the three quarter sections had been cleared to their current extent. Naturally vegetated areas appeared to mature and thicken over time. Below is an analysis of historical aerial photography by date. Please refer to Appendix C for the respective aerial photographs.

1950

RR 33 meanders through the eastern side of the study area, forming a large S-shape, which cuts into SW 34, avoiding a large wetland currently split into Sites 19 and 23 (Figure 4.1). SW 34 appears to have no agricultural activity; a small square is cleared along the northern border. NE 33 is dominated by natural vegetation, with the central-west portion cleared for agriculture; approximately one half of NW 33 is cleared for agriculture with the northeast portion (Site 1B) and the southwest portions naturally vegetated. Naturally vegetated areas appear to be a mosaic of graminoid dominated wetlands and shrubby/treed vegetation.

1967

The 1967 air photo represents a year of low precipitation. RR 33 has been realigned to its current north-south orientation, splitting the large wetland (Sites 19, 23) into east and west portions. The S-shape curve through SW 34 exists as a secondary road. Clearing for agriculture has occurred, and largely reflects the current composition of the quarter sections.

1973

The 1973 air photo represents a year of high precipitation following a year of average precipitation. The access road through SW 34 is removed and defines a current fence line through the property. The overall composition of the quarter sections remains consistent; wetlands in open fields appear as minor stains across the landscape. Open is water present at Sites 19 and 23 and the constructed dugouts situated throughout the study area (Figure 4.1).

1981

The 1981 air photo represents a year of low precipitation following a year of very high precipitation. The overall composition of the quarter sections remains consistent; vegetation within naturally vegetated areas appears to have matured/thickened. Open water present at Sites 19 and 23 and the constructed dugouts situated throughout the study area (Figure 4.1).

1990

The 1990 air photo represents a year of higher than average precipitation after a year of average precipitation. A drainage course in NW 33 between Site 1B and a constructed

dugout in the central-west portion of the quarter section is prominent. Open water is present in Sites 19 and 23 and the constructed dugouts situated throughout the study area (Figure 4.1). The overall composition remains consistent.

1995

The 1995 air photo represents a year a low precipitation following a year of average precipitation. The drainage course in NW 33 is no longer prominent. Open water is present in Sites 19 and 23 and the constructed dugouts situated throughout the study area (Figure 4.1). The overall composition remains consistent.

2000

The 2000 air photo represents a year of average precipitation following a year of low precipitation. This is the first year where planted white spruce saplings appear visible in Site 45 (SW 34). Open water present in Sites 19 and 23 and the constructed dugouts situated throughout the study area (Figure 4.1). The overall composition remains consistent.

2010

The 2010 air photo represents a year of very low precipitation. The area of planted white spruce in Site 45 has expanded. Open water present in Sites 19 and 23 and the constructed dugouts situated throughout the study area (Figure 4.1). Emergent vegetation is prominent in Site 23. The overall composition remains consistent.

4.5 Wildlife

4.5.1 Birds

A total of 30 bird species at 13 survey stations were recorded at wetlands and immediately surrounding upland habitat during the 22 June 2011 breeding bird survey (Table 4.5). Of the 30 bird species identified, three are listed as special status species: the barn swallow, common yellowthroat and sora. The barn swallow is listed provincially as *Sensitive* and federally as *Threatened*. The federal designation is due to large, poorly understood declines in populations, possibly due to habitat loss (COSEWIC 2011) while the provincial designation is due to declining populations within the province and neighbouring jurisdictions (Alberta Sustainable Resource Development 2010). The common yellowthroat is listed provincially as *Sensitive* and is not listed federally. This designation is due to declining populations and threats to habitat (Alberta Sustainable Resource Development 2010). The sora is listed provincially as *Sensitive* and is not listed federally. This designation is due to the loss of wetland habitat resulting in large population declines (>50%) throughout Alberta since 1994 (Alberta Sustainable Resource Development 2010).

Table 4.5. Species recorded during breeding bird surveys in summer 2011 (13 point count stations)

Species Name	Total Count	# of Sites Where Present	% of Sites Where Present
Alder flycatcher	1	1	8
American crow	5	3	23
American robin	5	4	31
Barn swallow[1]	1	1	8
Black-billed magpie	4	4	31
Brown-headed cowbird	4	4	31
Bufflehead	1	1	8
Clay-coloured sparrow	5	4	31
Chipping sparrow	10	4	31
Common goldeneye	5	1	8
Connecticut warbler	1	1	8
Common yellowthroat[2]	1	1	8
Eastern kingbird	2	2	15
European starling	1	1	8
Hairy woodpecker	1	1	8
House wren	4	4	31
LeConte's sparrow	1	1	8
Pine siskin	1	1	8
Rose-breasted grosbeak	1	1	8
Ruby-crowned kinglet	1	1	8
Red-eyed vireo	6	5	38
Red-tailed hawk	1	1	8
Red-winged blackbird	2	2	15
Savannah Sparrow	6	3	23
Sora[2]	1	1	8
Song sparrow	6	5	38
Swainson's thrush	7	4	31
Western meadowlark	1	1	8
Yellow warbler	2	2	15
Yellow-rumped warbler	1	1	8
Total # Species	**30**	-	-

[1]species listed as *Sensitive* by ASRD (2010) and *Threatened* by COSEWIC (2011)
[2]species listed as *Sensitive* by Alberta Sustainable Resource Development (2010)

Considering the patchy and disturbed habitat in the study area, a total species richness of 30 is generally representative of the diversity of habitat available; however, species diversity across survey stations ranged widely from 1 to 11 species. The highest species richness for a single survey site was 11, recorded at one location (survey station 10, Figure 3.1), which encompassed an area comprised of an emergent marsh, shrub swamp and a graminoid fen (Sites 19, 20 and 21, Figure 4.1). Bird species observed included

alder flycatcher, common yellowthroat, ruby-crowned kinglet, red-winged blackbird, sora, song sparrow and yellow warbler. Survey stations 4, 11 and 12 each had 7 species, the next highest species richness. While habitat at survey station 4 comprised only a few trees and shrubs adjacent to a dugout, survey stations 11 and 12 were surprising low in species richness considering the habitat comprised a large, undisturbed treed fen (Figure 4.1). Bird species observed at stations 11 and 12 included typical boreal forest species such as rose-breasted grosbeak, Swainson's thrush, yellow warbler, yellow-rumped warbler, red-eyed vireo, pine siskin and Connecticut warbler. Only one bird species, clay-colored sparrow, was observed at survey station 3, however, that was expected considering the station was located in a cultivated field, which did not comprise much vertical habitat diversity because of the tall, lush hay crop (Figure 3.1).

The most abundant species throughout the study area were chipping sparrow and Swainson's thrush, with 10 and seven individuals noted, respectively. The most widespread species within the study area were the song sparrow and red-eyed vireo, being observed in 38% of all survey stations. Common species within the more disturbed, agricultural survey stations (Sites 3-8) included the clay-coloured sparrow, song sparrow and savannah sparrow. The savannah sparrow is an abundant species common to a wide variety of open, field-like habitats; the clay-coloured sparrow is a species common to open, shrubby habitats and; the song sparrow prefers shrubby habitats surrounding wetlands and other water bodies.

The remainder of the recorded bird community composed of generalist species that are capable of inhabiting wide range of natural or semi-natural habitat in heavily agricultural environments.

4.5.2 Mammals

No project specific surveys were completed for mammals. Incidental observations made within the study area during other fieldwork included coyote activity and possible denning in SW 34. Animal trails were noted throughout the study area, however, many may have been made by cattle, which were numerous throughout. Ungulates such as white-tailed deer and moose may be found within the study area, particularly at the large fens in the southern half of SW 34, which were not accessible by cattle. These areas would represent one part of a larger home range for these species.

In addition to large-bodied, wide-ranging species, the study area likely provides suitable habitat for a variety of small to medium-bodied species (snowshoe hare, porcupine, northern pocket gopher). In particular, small-mammal species such as the deer mouse, meadow vole and Richardson's ground squirrel are well-adapted to agricultural habitats and are likely the most common and abundant mammal species within the study area.

4.5.3 Amphibians and Reptiles

Amphibian call surveys were conducted on 04 May and 02 June 2011; the 04 May 2011 survey covered SE 34 and NE 33, the 02 June 2011 survey covered NW 33 in the study area. Surveys were conducted at seven wetlands and seven dugouts that supported visible

water or moist soils. Surveys recorded three species of amphibians: wood frog, boreal chorus frog and western toad (Table 4.6). Boreal chorus frogs were most common, recorded at 10 of 14 sites; wood frogs were recorded at six sites and; western toads (Plate 14) were recorded at three sites, exclusively in NW 33.

Both the boreal chorus frog and wood frog are common and abundant throughout central Alberta in wetlands that maintain surface water until late spring or later. The western toad is listed provincially as *Sensitive* and federally as a species of *Special Concern* and is typically found around ponds, streams, rivers and lakes (Russell and Bauer 2000). Western toad populations are declining outside and possibly within Alberta and require long-term monitoring (Alberta Sustainable Resource Development 2010). The species is also relatively intolerant of urban expansion and conversion of land to agriculture (COSEWIC 2002). Due to the relatively late timing (02 June) of amphibian surveys in NW 33, it is likely that additional wetlands within the quarter section may support breeding frog/toad habitat.

No project specific surveys were completed for reptiles. Based on provincial ranges, the only reptile species with the potential to occur within the study area are the plains and red-sided garter snakes. Both species have wide habitat preferences, but are most often found in close proximity to bodies of water such as wetlands, streams and dugouts (Russel and Bauer 2000). Based on the available habitat, it is possible that either species may occur within the study area.

Table 4.6. Amphibian Call Survey Results

	Site Number													
Species	**1A**	**11**	**19**	**34**	**35**	**36**	**37**	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**
Wood frog	0	0	3	1	0	0	3	3	0	1	2	0	0	0
Boreal chorus frog	2	2	3	0	0	0	3	2	0	2	3	2	1	1
Western toad	0	0	0	0	0	0	0	0	0	0	0	1	1	1

4.5.4 Fish

The only water bodies present within the study area are shallow, isolated wetlands dominated by emergent vegetation (Sites 19 and 23). Any water present within these wetlands would almost certainly freeze completely each winter, and the prominence of emergent vegetation would reduce viable fish habitat. Due to these factors, fish are not expected to occur within the study area.

4.5.5 Summary of Wildlife Habitat

The study area contains numerous isolated mineral wetlands scattered throughout agricultural fields. The majority of these wetlands are relatively small, temporary to seasonal in nature, degraded as a result of agricultural activity and characterized by a

high proportion of non-native, weedy plant species. Significant stands of treed upland and fen are also situated within the study area, particularly in NE 33 and SW 34. The majority of treed upland and fen habitat in NE 33 is situated along the northern border of the quarter section. These communities are largely degraded by cattle grazing, populated standing dead and moribund trees and dominated by non-native weedy species. As such, the habitat value to wildlife is low. The most significant habitat is situated in SW 34, where large, undisturbed fen habitats are located in the southern half of the quarter section. Unlike much of the study area, cattle grazing is not present, and the presence of non-native, weedy species is low. Based on these factors, habitat value in this area is high. A mixture of deciduous uplands, marshes and fens is situated in the northwestern portion of SW 34, cattle grazing is evident throughout this area and a network of cattle fences is found throughout. Habitat value for this area is rated as medium.

Overall, habitat abundance and quality is low throughout the study area, due to agricultural disturbance throughout. The most notable exception to this is in the southern and western ends of SW 34 where habitat is abundant and quality is high to medium, respectively.

Plate 14. Western toad, observed in NE 33 (02 June 2011)

4.5.6 Special Status Species

4.5.6.1 Observed

Four special status species were observed during the course of fieldwork completed in support of this assessment. These species included one amphibian (western toad) and

three bird species (barn swallow, common yellowthroat and sora), which have been described in *Section 4.5.1.* and *4.5.3*.

4.5.6.2 Database Review

A search of the Fish and Wildlife Information Management System (FWMIS) revealed no existing records of listed wildlife species within the study area (Alberta Sustainable Resource Development 2010). The lack of records does not indicate that no special status species are present within the study area, but rather that none have been formally recorded. This lack of records could be a function of private land ownership in the study area, which typically precludes access for data collection.

4.5.6.3 Potential Occurrences

Based on habitat requirements, habitat availability in the study area and provincial distributions, we identified 33 special status species that have the potential to occur within the study area (Appendix G). Of the 33 species, 17 species are listed provincially as *Sensitive* but have no federal designation. The likelihood of the 33 identified species to occur within the study area was assessed as low, moderate or high, based on several factors including, but not limited to, the limited distribution of the species, the area and quality of available habitat, local records of occurrence and species' sensitivities to human disturbance. Table 4.7 lists a subset of the 33 species that includes any special status species recorded within the study area during fieldwork (see *Section 4.5.1* and *4.5.3*) and all species that have the more vulnerable provincial designations of *May Be At Risk* or *At Risk* and/or federal designations of *Special Concern*, *Threatened* or *Endangered* [i.e. according to the *Species at Risk Act* and/or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)] and were assessed as having a moderate to high potential for occurrence within the study area. The remaining special status species, those considered to have a low potential for occurrence, are referenced only in Appendix G. The five special status species having moderate to high potential for occurrence are discussed in the following sections.

4.5.6.4 Avifauna

Three of the six special status species listed in Table 4.7 are birds. The occurrence of the barn swallow was previously discussed in *Section 4.5.1*. The short-eared owl prefers open country including grasslands, wet meadows and cleared forests (Fisher and Acorn 1998). These habitat types occur throughout the study area, however, many such areas have been degraded by cattle grazing and thus, the likelihood of occurrence is considered moderate. The olive-sided flycatcher prefers mature spruce/fir, riparian and burned-over woodlands (Fisher and Acorn 1998). Based on the presence of mature, spruce dominated fens (Sites 25a, 25b, 41 and 44) and fens subject to wildfire (Sites 42 and 43), the likelihood of occurrence is considered moderate. Treed fens 4 and 18 were too heavily degraded by cattle grazing to be considered potential habitat.

Table 4.7. Select special status species with potential to occur in the study area

Common Name	Scientific Name	Provincial Status (General Status of AB Wild Species)	Wildlife Act Designation and New Species Assessed by ESCC[a]	COSEWIC Designation[b]	SARA Designation[c]	Species Recorded in Study Area	Potential Habitat Use	Likelihood of Occurrence[d]
Barn swallow	*Hirundo rustica*	Sensitive		Threatened	Schedule 1 (Threatened)	x	B	High
Short-eared owl	*Asio flammeus*	May be at Risk	Threatened	Special Concern	Schedule 3 (Special Concern)		B	Moderate
Olive-sided flycatcher	*Contopus cooperi*	Secure		Threatened	Schedule 1 (Threatened)		B	Moderate
Canadian toad	*Bufo hemiophrys*	May be at Risk	Data Deficient	Not at Risk			R	Moderate
Western toad		Sensitive		Special Concern	Schedule 1 (Special Concern)	x	R	High
Long-tailed weasel	*Mustela frenata*	May be at Risk		Not at Risk			R	Moderate

[a] Alberta Endangered Species Conservation Committee
[b] Federal ranking by Committee on the Status of Endangered Wildlife in Canada (COSEWIC)
[c] Federal *Species at Risk Act* designation
[d] Assessed qualitatively relative to their status as a special status species, seasonal behaviour and habitat availability in the local study area.

4.5.6.5 Mammals

The long-tailed weasel is the only special status mammal considered to have a moderate to high chance of occurring within the study area. The long-tailed weasel prefers open country, including agricultural lands (Pattie and Fisher 1999) and is considered to have a moderate likelihood of occurring within the study area.

4.5.6.6 Herpetiles

The western toad and Canadian toad are the only special status herpetiles considered to have a moderate to high chance of occurring within the study area. The occurrence of the western toad was previously discussed in *Section 4.5.3* and has a high likelihood of occurring again the study area. The Canadian toad is found and breeds in lake shallows, ponds, ditches, marshes and other temporary bodies of water (Russell and Bauer 2000). Western toads were previously noted in several dugouts and at emergent wetland Site 19; however, no Canadian toads were noted during amphibian call surveys. Based on this information, the likelihood of occurrence of the Canadian toad is considered moderate.

4.5.7 Ecological Connectivity

Ecological connectivity allows for wildlife movement between patches of required habitat, genetic exchange for flora and fauna and nutrient circulation between ecosystems. Habitat patches are connected through habitat corridors and/or permeable matrices which function as travel pathways for organisms. Since the specific habitat choices, nutrient requirements, methods and distances of movement differ between organisms, ecological connectivity in any given area is variable, dynamic and species-specific (Hilty, *et al*. 2006).

When considering the study area in relation to the surrounding region, numerous large, forested areas (over one quarter section in size) are situated within 3 km to the east, west and south, with smaller patches of vegetation scattered throughout.

The study area contains significant natural habitat patches varying from small, degraded patches to large undisturbed habitat. The majority of large undisturbed natural habitat is situated in SW 34. Within this quarter section, the southern half is dominated by undisturbed fen habitat; the northwest portion is a mosaic of wetland, wooded upland and pasture and; most of the eastern half is cattle pasture with degraded wetlands scattered throughout. Quarter sections NE 33 and NW 33 are dominated by agricultural land use. Numerous degraded wetlands are scattered throughout these agricultural lands, with degraded fen and woodland habitat situated along the northern border of NE 33. Swamp and emergent wetland habitat is situated in the southeastern corner of NE 33 and small patches of trees and shelter belts can be found throughout both quarter sections.

Despite the generally degraded nature of many of the wetlands situated in agricultural fields, many are close enough that seeds are likely transferred between sites through wind-based and/or animal based seed dispersal. Shelter belts may serve as travel corridors for small mammals and some songbirds. The smaller patches of trees (i.e. Sites 112 and 7) along with the numerous small wetlands throughout the study area, likely

function as ecological stepping stones for a restricted number of wildlife species. A stepping stone can be defined as a vegetated area that may provide resources to sustain an organism, for some time, but is generally used as a temporary stop while moving through the matrix route toward more suitable habitat patches (modified from Forman 1995). As mentioned earlier, such larger, more suitable habitat patches are available within SW 34 and throughout the surrounding region. Much of the agricultural land within the study area is pastoral with some crop production in NW 33 and NE 33. This agricultural land forms a matrix between habitat patches and is relatively permeable to wildlife movement. In this context, many medium to large-bodied wildlife species common to the study area can travel easily within and across such landscapes. Thus, scattered wetlands and smaller habitat patches throughout the study area may provide temporary resources that contribute to their function.

Larger areas of natural vegetation found in SW 34 may serve as important movement corridors for a variety of small to large wildlife. The undisturbed nature of the treed fens (Sites 41, 42 and 43) and their relative size may provide breeding habitat for interior boreal bird species less adapted to human disturbance and provide core habitat for a variety of medium to large-bodied wildlife. Discussions with local residents have indicated that moose have been observed in the treed fens and that white-tailed deer and coyotes are regularly observed in the area. A ruffed grouse, great-horned owl and female coyote were heard in the vicinity of Dugout 1 and Site 29 respectively, during field surveys in summer 2011. When considering this habitat from a regional perspective, it likely serves as part of a large, year-round wildlife movement corridor that runs from Wabamun Lake to Lac St. Anne and to the North Saskatchewan River to the east.

5.0 CONSERVATION RECOMMENDATIONS

5.1 Implications of the Proposed Project

The proposed project is a gravel extraction operation. Because of the inherent nature of the gravel extraction process, all lands located within the boundaries of the areas identified as lands to be mined will be disturbed during gravel extraction and processing (Figure 5.1). Accordingly, it will not be feasible to retain any natural features situated within the operational boundary in Figure 5.1. Because of this, the focus of our conservation recommendations is on effective wetland compensation and reclamation, rather than retention and integration of natural features. Further, the land is already extensively developed to agricultural uses.

5.1.1 Anticipated Wetland Impacts

The proposed gravel extraction and processing operation would ultimately result in the removal of 37.54 ha of wetlands; this represents approximately 56% of the total 67.05 ha of wetlands situated within the study area (Figure 5.1; Table 5.1). The removal of wetlands would affect 33 of the 47 identified wetland communities within the study area. Of the 37.54 ha of wetlands that would be removed, 7.00 ha are mineral wetlands and 30.54 ha are organic wetlands (Table 5.2). At a community level, 25 mineral wetlands consisting of 19 graminoid marshes, one treed swamp and five shrubby swamps would be affected along with eight organic wetlands including three treed fens and five graminoids fens.

Pursuant to the Province's *Interim Wetland Policy* and related *Wetland Compensation Guide*, the proponent would be required to compensate only for the loss of mineral wetland habitats at a ratio of 3:1 (wetland area created/restored : wetland area lost). Normally, organic (peatland) wetlands with no open water components are not subject to compensation. A 3:1 ratio means that the proponent would be responsible for the creation/restoration of 21.00 ha of compensatory wetland habitat.

5.2 Proposed Wetland Compensation

The following provides details relating to the proposed compensation/restoration of 21.00 ha of wetland habitat. In total, 1.2 ha of compensation is proposed as end pit lakes (EPLs), situated within the reclaimed surface of the project area; 19.8 ha is proposed as restoration through a monetary contribution to an approved provincial wetland restoration agency, Ducks Unlimited Canada.

5.2.1.1 End Pit Lakes

As a necessary by-product of the proposed gravel extraction project, the post-mining landscape would include end pit lakes (EPLs). In total, two EPLs are proposed in the reclamation plan at mining block 24 and 26 (Appendix A). The first EPL would be situated in NW 33, with a total surface area of 0.88 ha; the second EPL would be situated in SW 34, with a total surface area of 0.4 ha. Combined, the creation of EPLs would contribute 1.2 ha of the required 21.00 ha of compensable wetland

Figure 5.1
Alberta Beach Granular Pit
Wetland Impacts

Aerial Photograph Date: August 2009
Date Map Created: 01 November 2011

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.

SW 4-53-3-5
SE 4-54-3-5
NE 32-53-3-5
NW 33-53-3-5
SW 34-53-3-5
SE 34-53-
NW 27-53-3-5
NE 27-53-
RR33

D7 D6 D5 D2 D3 D4

1B 1A 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

32A 32B 32C 33 34 36 37 39 41 100 101 102

Legend

- Gravel Extraction Impact Area
- Study Area
- Dugout

Note: Numbers denote site

Impacted Peatland Wetlands
- Fen - Treed
- Fen - Graminoid

Impacted Mineral Wetlands
- Marsh - Graminoid
- Swamp - Treed
- Swamp - Shrub

N

0 100 200 400 Meters

1:7,000

Table 5.1. Total wetland impacts by site

Site #	Wetland Community Type	Wetland Area (ha)	Impact Area (ha)	Percentage Impact (%)
001a	Fen - Graminoid	2.41	1.77	**73.41**
001b	Fen - Graminoid	19.81	19.76	**99.72**
004	Fen - Treed	3.02	3.02	**100**
005	Marsh - Graminoid	0.64	0.64	**100**
008	Swamp - Treed	0.03	0.03	**100**
009	Marsh - Graminoid	0.19	0.19	**100**
010	Marsh - Graminoid	0.04	0.04	**100**
011	Marsh - Graminoid	0.22	0.22	**100**
012	Marsh - Graminoid	0.64	0.64	**100**
013	Marsh - Graminoid	0.24	0.24	**100**
014	Fen - Graminoid	1.07	1.07	**100**
015	Marsh - Graminoid	0.03	0.03	**100**
016	Marsh - Graminoid	0.32	0.30	**91.39**
018	Fen - Treed	1.71	1.59	**92.86**
019	Marsh - Emergent	0.21	0.00	0.00
020	Swamp - Shrub	1.18	0.00	0.00
021	Fen - Graminoid	1.55	1.00	**64.19**
022	Marsh - Graminoid	1.75	1.60	**91.65**
023	Marsh - Emergent	0.35	0.00	0.00
024	Fen - Shrub	0.36	0.00	0.00
025a	Fen - Treed	1.37	0.00	0.00
025b	Fen - Treed	1.11	0.00	0.00
030	Fen - Graminoid	1.12	0.00	0.00
032a	Swamp - Shrub	0.15	0.15	**100**
032b	Swamp - Shrub	1.04	1.03	**99.97**
032c	Swamp - Shrub	0.09	0.09	**100**
033	Marsh - Graminoid	0.45	0.45	**100**
034	Marsh - Graminoid	0.04	0.04	**100**
035	Marsh - Graminoid	0.08	0.00	0.00
036	Fen - Graminoid	0.09	0.03	**36.93**
037	Marsh - Graminoid	0.54	0.52	**96.30**
039	Swamp - Treed	0.84	0.69	**82.13**
041	Fen - Treed	11.97	2.30	**19.23**
042	Fen - Treed	2.60	0.00	0.00
043	Fen - Treed	1.35	0.00	0.00
044	Fen - Treed	1.06	0.00	0.00
045	Marsh - Graminoid	2.14	0.00	0.00
048	Marsh - Graminoid	0.11	0.00	0.00
049	Marsh - Graminoid	0.15	0.00	0.00
050	Marsh - Graminoid	0.67	0.00	0.00
051	Marsh - Graminoid	3.18	0.00	0.00

100	Marsh - Graminoid	0.05	0.05	**100**
101	Marsh – Graminoid	0.02	0.02	**100**
102	Marsh – Graminoid	0.02	0.02	**100**
103	Marsh – Graminoid	0.13	0.00	0.00
104	Marsh – Graminoid	0.18	0.00	0.00
113	Marsh – Graminoid	0.72	0.00	0.00
Totals		**67.05 ha**	**37.54 ha**	**55.99%**

Table 5.2. Total wetland impacts by wetland community type

Wetland Community Type	Total # of Wetlands	Total Area (ha)	Total # of Wetlands Impacted	Total Area of Impact (ha)	Total Percentage Impact (%)
Mineral Wetlands					
Marsh – Emergent	2	0.57	0	0.00	0.00
Marsh- Graminoid	24	12.54	19	5.00	39.87
Swamp – Treed	1	0.03	1	0.03	100
Swamp – Shrubby	5	3.30	5	1.97	59.67
Overall Totals	**32**	**16.44**	**25**	**7.00**	**42.58**
Organic Wetlands					
Fen – Treed	8	24.20	3	6.91	28.55
Fen - Shrub	1	0.36	0	0.00	0.00
Fen – Graminoid	6	26.06	5	23.63	90.68
Overall Totals	**15**	**50.62**	**8**	**30.54**	**60.33**

habitat, thus requiring an additional 19.8 ha of compensation (see *Section 5.2.1.2* for further details).

EPLs would be landscaped in such a manner that there is a shallow portion suitable for vegetation growth and waterfowl use and a deeper portion through which water will infiltrate into the groundwater (RoJaS 2011; Appendix A). The presence of EPLs as permanent, open water bodies and the need to create wetland habitat on site provides an opportunity to design the EPLs with wetland margins, thus creating complementary open water and wetland habitat. Wetland habitat should be created through a combination of shoreline slope contouring and active efforts to facilitate naturalized wetland habitat creation. In addition, each EPL should include a naturalized wetland buffer (functional upland zone) around its periphery.

The following provides additional specific details on the recommended design of EPLs:

- Shoreline slopes of 10:1 (horizontal run : vertical run), extending from 2 m below the anticipated full supply level (FSL) to 1 m above the FSL. Such slopes would result in areas of shallow water around the periphery of the EPL, which (with the

influences of additional methods below) should be capable of supporting a wetland plant community dominated by robust, native, emergent vegetation and submerged aquatic plants below FSL.

- Above the FSL, the 10:1 slopes will extend inland for 10 m. This area will be seeded with a native wet meadow seed mix and/or planted with some native wetland/riparian shrubs, primarily willow. Along the shoreline, these 10:1 slopes would likely result in a narrow strip of land that would become occasionally flooded in response to fluctuating EPL water levels following spring melt and heavy rains. Because of its periodic inundation and/or saturated soil conditions, this narrow band of land would likely develop into a transitional plant community with a species composition that may be similar to a shallow marsh or wet meadow (i.e. dominated by sedges, wetland grasses and forbs).

- Native wetland soils salvaged from wetlands removed during earlier stages of gravel extraction will be placed along the shoreline of EPLs in a band extending from 1 m above the FSL to 1 m below. If wetland soils are in short supply, they will be place in wide nodes spread regularly throughout that zone. Salvaged soils and, to the extent possible, wetland plants, will be places directly from their source whenever possible, but some stockpiling of soils before use in landscaping may be necessary. Placement of salvaged soils and wetland plants should help to inoculate the EPLs with native wetland plant species as the soil should contain an abundant seed bank. Not all currently existing wetlands are, however, suitable for soil salvage (some have too many weeds). Before salvaging soils, the proponent should consult with a biologist regarding appropriate sources of wetland soils and to help identify the best location for their placement during reclamation.

- The band of naturalized vegetation surrounding the EPLs will be protected from future disturbance using some type of land protection easement, such as a Conservation Easement. The actual protection mechanism employed will require further discussion with Lac Ste. Anne County and possibly Alberta Environment and Water. Lands outside the protected zone will support agricultural land uses in the post-mining landscape. Protection of the lands immediately surrounding EPLs will help to ensure that they remain undisturbed and are allowed to establish into healthy riparian and/or wet meadow communities.

- Slopes of 20:1 will extend out from 1 m above the FSL to feather into existing ground levels at the periphery of the study area.

- Slopes of 3:1 will extend from 2 m below FSL down to bedrock.

- Once the land surrounding the EPLs is recontoured to the appropriate slope grades, topsoil will be placed to an appropriate depth to mimic current topsoil depths.

5.2.1.2 Wetland Restoration

The proponent wishes to compensate for the remaining (19.8 ha) wetland loss by collaborating with Ducks Unlimited Canada (DUC). DUC is the primary wetland restoration agency used throughout central Alberta for wetland compensation purposes. Compensation through DUC typically takes the form of a monetary contribution for the implementation of a wetland restoration project on degraded wetlands in a rural municipality within the nearest DUC Initiative. In this case, the Parkland Initiative is the nearest DUC program area where potential restoration projects are available.

DUC currently assumes costs for projects in their Parkland Initiative area to be approximately $10,000/ha. Working with DUC, compensation costs for wetland loss are, therefore, estimated to be approximately $198,000 (i.e., 19.80 ha x $10,000/ha).

5.3 Proposed Wetland Compensation Monitoring Program

Alberta Environment and Water typically requires that all wetland compensation plans associated with a *Water Act* approval includes a monitoring program component. To that end, the proponent is committed to developing a wetland monitoring program to the satisfaction of Alberta Environment and Water. A detailed monitoring program will be submitted to Alberta Environment and Water under separate cover prior to completion of extraction activities in the first full quarter section or according to dates outlined in the approval.

The following is provided as an initial indication of what a wetland monitoring program might look like.

In general, the objective of the monitoring program, as with most wetland compensation monitoring programs, will be to assess the level of wetland function provided by the naturalized EPLs. Because many of the chemical and hydrological function of wetlands are difficult and costly to monitor, the wetland monitoring program will focus on biological functions, generally more suited to efficient monitoring. Monitoring programs typically focus on a few, very specific elements of the biological community. The chosen components act as indicators of the overall biological community and, by extension, can be used as a surrogate measure for the condition of the entire wetland. The specific biological indicators and parameters that will be monitored as part of this program will be identified during preparation of the monitoring plan report. Other details regarding the sampling intensity, schedule and duration of monitoring will also be determined at that time and will be guided by the conditions outlined in the *Water Act* approval. In general, however, the initiation of monitoring would closely follow the timing of the reclamation process. Monitoring in parallel with the reclamation process would also allow for monitoring results to be interpreted and applied to improving reclamation success for EPLs to be created later on in the reclamation process.

5.4 Additional Recommendations

The following recommendations address measures that should be undertaken to facilitate environmentally-sensitive development and compliance with all environmental legislation and policies:

- Do not clear vegetation during the period 15 April to 31 July to avoid disturbance to breeding wildlife protected under the provincial *Wildlife Act* and the federal *Migratory Birds Convention Act*. If these dates cannot be complied with, removal of vegetation should only occur if a qualified biologist has inspected each site to be cleared and determined that no active nests or dens are present. If an active nest/den was discovered, a buffer protecting the nest site would be established where clearing would not be allowed to proceed until the young have successfully fledged and are no longer dependent on the nest site.

- Do not disturb mineral wetlands during the period 15 April to 01 September, inclusive, unless in the opinion of a wetlands specialist the areas to be disturbed do not support breeding or young bird or amphibians.

- Prior to the initiation of any soil stripping and/or grading, we suggest contacting Lac Ste. Anne County regarding whether or not clubroot fungus is known to exist within the areas to be mined. Should clubroot fungus be known to exist within the project area, best management practices detailed in the Alberta Clubroot Management Plan should be implemented.

- If wetlands supporting any S3 plant species are to be removed (see Table 4.4), attempt to salvage the soils from those sites and re-use the soils as part of the EPL reclamation with the intention of creating opportunities for those plants to reestablish.

REGULATORY FRAMEWORK

In addition to the requirement for this Environmental Impact Assessment for the County of Lac Ste. Anne, any plans to disturb/alter wetlands within the proposed gravel extraction and processing area will trigger a need for approvals from municipal, provincial and federal authorities, as detailed below.

5.5 Municipal Regulatory and Approval Processes

5.5.1 County of Lac Ste. Anne, Land Use Bylaw 16-08

The Lac Ste. Anne County Land Use Bylaw 16-08 requires municipal approval for all granular extraction proposals over 5.0 ha. Any such proposal that will also require permitting through the Alberta *Water Act*, will also be subject to an Environmental Impact Assessment (EIA) in accordance with *Section 52(17)* of the Land Use Bylaw. Such an assessment can be conducted in conjunction with a similar assessment performed in accordance to the Alberta *Water Act*. Lac Ste. Anne will refer EIAs to Alberta Environment and Water for comment and recommendations. In the case of this project, approvals under the *Alberta Water Act* are required and discussed in further detail below.

5.6 Provincial Regulatory and Approval Processes

5.6.1.1 Code of Practice for Pits

A gravel pit greater than or equal to 5 ha in size requires registration pursuant to the *Activities Designation Regulation* of Alberta's *Environmental Protection and Enhancement Act's Code of Practice for Pits* (Alberta Environment 2004). Considering that the proposed gravel extraction area is approximately 63 ha, it will be considered a Class I pit and will be subject to the requirements of the *Code of Practice for Pits* as well as the *Conservation and Reclamation Regulation.*

5.6.2 Alberta Water Act and Interim Wetland Policy

Alberta's *Water Act* is the primary piece of legislation governing the use and management of Alberta's water resources, including water held in permanent and temporary wetlands, irrespective of land ownership. Approval is required for all activities that may impact water and the aquatic environmental, including wetlands. In the case of the proposed project, approval would be required for any draining/filling of mineral wetlands within the study area. Approval to remove organic (peatland) wetlands with no open water is not normally required.

Linked to the *Water Act* is the *Wetland Management in the Settled Area of Alberta – An Interim Policy* (1993), which states that, when destruction or disturbance of wetlands is authorized under the *Water Act*, compensation is required. In recognition of the integral relationship between wetlands and surrounding uplands, it also states that the upland areas surrounding a wetland as well as the wetland margins will be considered in wetland management decisions.

5.6.3 Alberta Public Lands Act

The province owns the bed and shore of all waterbodies that are permanent and naturally occurring, unless the title has been specifically granted to a private landowner. This includes permanent and naturally-occurring wetlands and watercourses. The *Public Lands Act* defines a permanent water body as one that exhibits persistent evidence of a bank, bed and shore and a tendency to return to normal water levels under the ordinary circumstances after periods of drought or flood. Development with a Crown-owned wetland or other waterbody can be authorized under the *Act*, however, compensation for any loss would be required and any wetlands or watercourses created as compensation must revert to Crown ownership. In the case of the proposed development, the *Public Lands Act* should be considered in the context of draining/filling of wetlands.

5.6.4 Alberta Wildlife Act

The Alberta *Wildlife Act* prohibits disturbance to a nest or den of prescribed wildlife species. Although permitting is not required under the *Act*, violations may result in fines. To avoid violations, Alberta Sustainable Resource Development (ASRD) recommends avoiding clearing vegetation during 15 April to 15 July. If it becomes apparent this restricted period cannot be complied with, removal of vegetation should only occur if a qualified biologist has inspected each site to be cleared and determined that no active nests or dens are present. If an active nest is found, ASRD should be contacted to determine if a buffer around the nest can be established to allow partial clearing of the area.

5.7 Federal Regulatory and Approval Processes

5.7.1 Migratory Birds Convention Act

Environment Canada administers the *Migratory Birds Convention Act (MBCA)*, which prohibits the disturbance of active nests of bird species covered under the *Act*, many of which could potentially occur within the study area. With respect to construction, the *Act* provides guidelines for enforcement only; it is not linked to formal approvals. Violation of the *Act* may, however, result in penalties. An amendment to the *MBCA* further protects disturbances to individual migratory birds and prohibits release of deleterious substances into waters or areas frequented by migratory birds. To ensure compliance with the *Act*, Environment Canada recommends vegetation clearing in this area be scheduled for dates outside of the spring and summer breeding season (01 May to 31 July). If it becomes apparent that this schedule cannot be met, removal of vegetation should only occur if a qualified biologist has inspected each site to be cleared and determined that no active nests or dens are present. If an active nest is found, clearing should not commence in that vicinity until after the young have fledged, appropriate buffers should be established in consultation with ASRD.

5.7.2 Species at Risk Act

The *Species At Risk Act (SARA)* is administered by Environment Canada. It prohibits disturbance to listed species and, in some instances, listed species' habitat. Habitat is defined not only as the area where a species naturally occurs and on which it depends to

carry out its life processes, but also areas where that species formerly occurred and had the potential to be reintroduced. The *SARA* emphasized guidelines for enforcement, and harming a Schedule 1 species (Threatened, Endangered or Extirpated) is prohibited. The vegetation and wildlife surveys undertaken for this study complies with the requirements of *SARA*.

6.0 SUMMARY AND CONCLUSIONS

1531486 Alberta Ltd. proposed to develop a gravel extraction operation on three quarter sections of land situated in the south of Lac Ste. Anne County, along Range Road 33, approximately 5 km south of the Summer Villages of Val Quentin and Alberta Beach. The lands to be mined contain several wetlands and areas of upland vegetation, but are primarily agricultural in nature. Numerous wetland communities are situated within the study area. Of these wetlands, a total of 50.62 ha are organic (peatland) wetlands and and a total of 16.44 ha are be mineral wetlands. The proposed project would remove wetlands from the study area, the majority of which are degraded marshes (mineral wetlands) and graminoid dominated fens (organic wetlands) in agricultural fields. Other wetlands to be removed would include shrubby swamps, a treed swamp and tree fens, some of which have been degraded by agricultural activities.

Habitat quality within impacted areas is mostly rated as low due to agricultural activities, however, some treed fen habitat in SW 34 that is rated as medium to high will also be impacted. In total four special status species were observed within the study area: barn swallow, common yellowthroat, sora and western toad. Observations of common yellowthroat and sora were located outside the proposed impact area while observations of barn swallow and western toad were within the proposed impact area.

Because of the inherent nature of the gravel extraction process, the proposed development plan would ultimately result in the complete removal of all natural features identified within the boundaries of the lands to be mined. In total, the area of wetland loss would be 37.54 ha. Of the 37.54 ha of impacted wetlands, 7.00 ha is mineral wetlands and 30.54 ha is organic (peatland) wetlands. Alberta Environment and Water requires compensation of mineral wetlands at a 3:1 ratio, resulting in a required compensation of 21.00 ha (i.e., 7.00 ha x 3) of wetland habitat. Normally, compensation for organic (peatland) wetlands with no open water is not required.

By necessity, the post-mining landscape would include two end pit lakes (EPLs). To achieve partial compensation for the loss of 7.00 ha of mineral wetlands, the EPLs would be naturalized so the shoreline of each EPL would be constructed and reclaimed to encourage the establishment of deep marsh, shallow marsh and wet meadow vegetation. Each EPL would also include an area of naturalized vegetation along the shoreline. As proposed, the EPLs would contribute 1.2 ha of the required 21.00 ha of compensable wetland habitat, thus requiring an additional 19.8 ha of compensation. In order to achieve this, the proponent wishes to compensate for the remaining wetland loss by collaborating with Ducks Unlimited Canada (DUC). Working with DUC, compensation costs for wetland loss are estimated to be approximately $198,000 (i.e. 19.8 ha x $10,000/ha).

7.0 REFERENCES

Agriculture and Agri-Food Canada. 2008. Canada Land Inventory (CLI) Level-I Digital Data: Soil Capability For Agriculture. Retrieved from http://res.agr.ca/cansis/nsdb/cli/intro.html

Alberta Agriculture and Rural Development. 2000. Alberta soil information viewer. Accessed 08 September 2011.

Alberta Environment. 2004. A guide to the code of practice for pits. Edmonton, Alberta.

Alberta Tourism, Parks and Recreation. 2011. Alberta conservation information management system. Accessed 08 September 2011.

Alberta Sustainable Resource Development. 2010. Fish and wildlife information management system. Accessed 08 September 2011.

Canada Land Inventory, National Soil DataBase, Agriculture and Agri-Food Canada. 1998. Accessed 08 September 2011.

Committee on the Status of Endangered Wildlife in Canada. 2011. Database of wildlife species assessed by COSEWIC. Updated 3 October 2011. Gatineau, Quebec.

Committee on the Status of Endangered Wildlife in Canada. 2002. Western toad (*Anaxyrus boreas*). Updated November 2002. Gatineau, Quebec.

Fisher, Chris, Acorn, John. 1998. Birds of Alberta. Lone Pine Publishing. Edmonton, Alberta.

Hilty, JA, Lidicker Jr., WZ, Merenlender, AM. 2006. Corridor ecology. Island Press. Washington. 50 pp.

Natural Regions Committee. 2006. Natural regions and subregions of Alberta. Edmonton, Alberta.

Navus Environmental. 2011. Alberta beach granular pre-disturbance soil characterization N1/2 33-53-03 W5M and SW1/4 34-53-03 W5M. Prepared for Spencer Environmental. Edmonton , Alberta.

Pattie, Don, Fisher, Chris. 1999. Mammals of Alberta. Lone Pine Publishing. Edmonton, Alberta.

RoJaS Management Ltd. 2011. 1531486 Alberta Ltd. Alberta beach gravel pit mining and reclamation plan. Canmore, Alberta.

Russell, A.P.; Bauer, A.M. 2000. The amphibians and reptiles of Alberta. University of Calgary Press. Calgary, Alberta.

Smith KB, Smith CE, Forest SF, Richard AJ. 2007. A field guide to the wetlands of the boreal plains ecozone of Canada. Ducks Unlimited Canada, Western Boreal Office. Edmonton, Alberta.

Weed Control Act Regulation, Alberta Regulation 19/2010. Retrieved from http://www.qp.alberta.ca/574.cfm?page=2010_019.cfm&leg_type=Regs&isbncln=9780779748150.

Appendix A: Development and Reclamation Plan (RoJaS 2011)

1531486 ALBERTA LTD.

ALBERTA BEACH GRAVEL PIT

DEVELOPMENT AND RECLAIMATION PLAN

FOR AGGREGATE EXTRACTION AND PROCESSING

NE & NW of section 33 and SW of section 34
Township 54, range 3 west of the 5th meridian

Prepared by : R. J. (Bob) Sanderson, P.Eng.
RoJaS Management Ltd.
September, 2011

The Operations

This property was tested by a series of 43 flight auger drill holes and a test pit to determine the quantity and quality of aggregate. The whole area is underlain by an aggregate deposit but in many locations the aggregate is covered with too much overburden to be economically extracted in the foreseeable future. To determine the areas on this property from which aggregate can economically be extracted, an overburden to aggregate ratio of 3:1 was used. That is any area with an overburden to aggregate ratio of greater than 3:1 was deemed uneconomical to extract and was not included in the mining plan. A summary of the drill hole information is attached.

The areas that will be mined contain an estimated 6.56 million tonne of aggregate products. This mining development is planned to primarily supply construction aggregates to a sister company, G & J Parking Lot Maintenance, an Edmonton based heavy construction company. The expected annual quantity removed from this property is 300,000 tonne. The life of this project is expected to be approximately 22 years.

The majority of the products will be produced by portable crushing and screening operations. Two crushing sites will be used; one on each of the NW and NE quarters of section 33. An estimated 25% of the products will be washed. A stationary wash plant operation will be set up on the NW quarter of section 33. The wash plant will recirculate the wash water and will use a series of settling ponds to remove the silt. Approximately 495 cubic meters of water per day will be used at the wash plant. We estimate approximately 10% of this will be lost to evaporation. Adsorption of water into the product will be minimal as the material comes from below water and the pores are already saturated. Water consumption is estimated to be 49.5 cubic meters per day or 1,980 cubic meters per year.

The crushing operation will use a conventional one stage crushing and screening process. A primary crusher is not expected to be required as the amount of boulders too large to be crushed by secondary crushing is expected to be very small. These boulders will be scalped off and sold as rock products. The crushing sites are situated well away from any residents. All the pit run aggregate will be extracted in a damp to wet condition and dust created by crushing will be minimal.

The crushing/screening operation will operate 12 hours per day from Monday to Friday. Approximately 2,880 tonne of product per day will be produced. The crushing/screening operation will occur for 5 months each year. Approximately 75,000 tonne per year of the crushed product will be hauled to the wash plant site and washed. The wash plant will operate for approximately 2 months per year.

A truck scale will be installed on the NE quarter of section 33 along the access road to Range Road 33. Adequate space for truck parking will be provided on site in order that trucks will not have to stop on municipal roads. Hauling of product will occur for 12 hours per day from Monday to Saturday. Hauling frequency will vary by season with the peak of approximately 67 loads per day leaving the pit expected in October of each year.

No hauling is expected in January or February. It is expected that an average of 37 loads per day will leave the pit daily for 10 months per year. The internal haul roads will be sprayed with water to control dust. The school bus schedule will be acquired and no trucks will leave the pit while school buses are on the road.

Range Road 33 will be upgraded to industrial haul road standards from the point of entry southward to the point where it was previously upgraded by another gravel producer in Parkland County, a distance of 3.1 kilometers.

Overburden removal will occur for approximately 1.3 months each year. The initial year when the pit is being developed earthworks will occur for approximately 4 months.

The manpower on site will peak at 16 persons if all operations coincide. An additional 13 truck drivers would haul from the site at peak times. This is equivalent to 12 full time jobs created. The royalty payment to Lac Ste Anne County would be $75,000 per year or $1.64 million over the life of the project. This royalty is over and above property taxes.

The domestic water supply will be hauled and stored on site. All sewage will be collected in holding tanks and hauled from site for disposal. All other wastes will be hauled from site for disposal. All petroleum products will be stored in CSA approved fuel vault containers. Spill containment products will be on site at all times and employees will be trained in their use.

The site will be fenced along all sides where public access is possible and gates will be installed and locked during non-operating times. Signs will be installed to conform to municipal and provincial requirements.

A continuous air quality monitoring station exists on the SE of 6-54-3-W5M and is operated by the West Central Airshed Society. Air quality background information is available and air quality changes due to this development will be monitored.

All the material in this deposit can be made into aggregate products. If more sand is produced than market demand will accommodate the surplus will be placed into the bottom of the excavations.

The total disturbed area of this development will be 137.6 hectares. The maximum disturbed area at any time will be 35.4 hectares including all berms, stockpiles, access roads, mining areas and processing areas. The maximum extraction area at any time will be 6 hectares.

Basic Mining Parameters

This mining and reclamation plan has been designed using basic parameters which comply with Lac Ste Anne County regulations, with Alberta Environment Code of Practice and with industry acknowledged best practices.

All excavated materials will be treated in six categories which are mineral topsoil, organic topsoil, subsoil, overburden, sand and gravel. Each type of excavated material will be handled separately. If stockpiled, the categories of material will be kept separate. All stockpiles with duration of more than one year will be vegetated by an appropriate grass mixture.

The aggregates will be mined in a succession of mining blocks. As much as possible the categories of excavated material will be directly placed in a previously mined block. As much as possible the materials excavated will be replaced near the same location they originated from. This procedure will minimize the disturbed area at any time.

The aggregate deposits on this property occur below water table. De-watering is necessary to extract the aggregates. For de-watering of the first mining block the water will be temporarily stored on surface in a water storage area. All subsequent mining blocks will be de-watered into an excavated mining block which has direct hydraulic connection to the aquifer. When the aggregate is extracted from the first mining block the temporarily stored water will be pumped into the empty mining block. The water from de-watering mining blocks 25 & 26 will also be temporarily stored on surface and then pumped into mining block 26 after the gravel has been extracted.

A reclaimed surface topography will be established for the entire mining area. Several areas on the property will not be mined and will be used for overburden, topsoil, and subsoil stockpiling. As successive mining blocks are excavated and reclaimed materials will be taken from or added to these stockpiles to maintain the final reclaimed topography. The various materials will be replaced in the same layers of material categories as they were excavated. The top of each material type will be scarified before the next material type is placed upon it.

The product will be hauled from the property on internal haul roads and will exit the development on the east side of the north east quarter of section of 33-53-3-W5 on to Range Road 33. The product will be hauled southward to Highway 16 and the majority will proceed eastward into the Edmonton area. Range Road 33 will be upgraded to industrial haul road standards through Lac Ste Anne County southward from the point of entry and through Parkland County to the point where it was previously upgraded by another gravel pit operator.

Berms will be constructed at the perimeter of the mining property to act as visual and sound barriers at all locations where the public could reasonably access the property.

The surface of the property is generally sloped toward the north with an elevation differential of only 7 meters across the property. The only clearly defined drainage channel on the property is a ditch which has been excavated across the NE of 33-54-3-W5.

Several wetlands have been identified on the property and care has been taken to minimize wetland disturbance. The wetland disturbance will be mostly on Class III wetlands.

Ground water movement is from south-east to north-west. The mining blocks will generally be staged from the north-west to the south-east to minimize the quantity of de-watering required.

A Ste. Anne Gas Co-op pipeline is located through the NE and NW of 33-53-3-W5. This pipeline will be relocated prior to any development.

The areas to be mined contain an estimated 6,559,650 tonne of aggregate products. The planned extraction and processing rate is 300,000 tonne per year. This project is expected to span approximately 23 years.

After reclamation two water bodies will remain. The water body on the NW of 33-53-3-W5M will have a full supply surface area of 0.88 hectares and will have a drainage area of 104.1 hectares. The water body on the SW of 34-53-3-W5M will have a full supply surface area of 0.4 hectares and will have a drainage area of 2.4 hectares.

The average depth of the total excavations on this development will be 19.8 meters.

Mining and Reclamation Sequence

Phase 1 Development

Block 1 in the north-west portion of the north-west of 33-53-3-W5 is approximately 4.0 ha. in surface area and is typified by test hole BH 08-1439 & BH 08-1440. The average material thickness and quantities are :

	Thickness (meters)	Quantity (cubic meters)
Topsoil	0.23	9,200
Sub-soil	0.55	22,000
Overburden	12.17	486,800
Coarse Gravel	4.85	194,000

The topsoil, sub-soil, and overburden will all have to be stockpiled as this mining block will act as the recharge area for de-watering from the subsequent mining blocks in the north-west and north-east quarters of section 33-53-3-W5. The area immediately to the

south of the mining block will be used as the crushing site for the aggregate from the mining block and will later be used as a washing plant site.

Mining block 2 immediately west of mining block 1 will be mined next. It is approximately 1.87 ha. in surface area and is typified by test holes BR 08–1439 & BR 08–1440. The average material thickness and quantities are:

	Thickness (meters)	Quantity (cubic meters)
Topsoil	0.47	8,790
Sub-soil	0.72	13,460
Overburden	11.76	219,910
Coarse gravel	4.85	90,695

There are two distinct types of topsoil present; mineral topsoil and organic topsoil. These types of topsoil will be stockpiled separately.

The areas and quantities of topsoil and subsoil that will have to be stockpiled are listed below.

Mineral topsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 1	40,000	9,200
Processing Site	60,000	13,200
Overburden Berm	16,420	2,960
Water Storage Dykes	8,500	2,980
Subsoil Stockpile	25,600	14,080
Haul Road	31,590	7,900
Mining Block 2	18,700	22,000
Area A	40,000	9,200
Area B	45,000	13,500
Mining Block 3	19,000	7,600
Mining Block 4	18,500	3,700
Total	323,310	106,320

Organic topsoil

Location	Area (square meters)	Quantity (cubic meters)
Overburden Berm	19,700	21,280
Water Storage Dykes	8,500	9,780
Total	28,200	31,060

Subsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 1	40,000	22,000
Processing Site	60,000	39,600
Overburden Berm	16,420	5,580
Water Storage Dykes	8,500	1,700
Haul Road	31,290	25,970
Mining Block 2	18,700	13,460
Mining Block 3	19,000	11,590
Area A	40,000	18,000
Area B	45,000	13,500
Total	278,910	151,400

The mineral topsoil will be stockpiled to the south of the processing site. This stockpile will be 5 meters in height with 3:1 side slopes. The area of the stockpile will be 1.90 hectares.

The organic topsoil will be stockpiled between the processing site and area A. It will be 5 meters in height with 2:1 side slopes. The area of the stockpile will be 0.38 hectares.

The subsoil will be stockpiled to the south of area B. It will be 5 meters in height with 2:1 side slopes. The area of the stockpile will be 2.56 hectares.

Step 1: The topsoil and subsoil will be removed from mining block 1, the processing site, the overburden berm, the water storage dykes and the haul road and stockpiled at the appropriate locations.

The overburden will be removed from mining block 1 and used to construct the water storage dykes, the overburden berm and the haul road. The remainder of overburden will be stockpiled at area A.

The water storage dykes will be 3.5 meters in height with a 4 meter wide top and 3:1 side slopes. This area will hold 150,000 cubic meters of water with a 0.8 meter freeboard. A 600mm CSP culvert will be installed as an emergency spillway to provide for an extraordinary precipitation event which may occur when the storage area is at full supply level.

The overburden berm will be 4 meters in height with a 4 meter wide top and 3:1 side slopes. The overburden berm is designed to be partially on top of the undeveloped road allowance along the north side of the property.

The haul road will be constructed without ditches. It will be 1 meter in height with 3:1 side slopes and have a 10 meter wide top. A 600mm CSP culvert will be installed to

accommodate any surface water drainage. The best clay from the overburden will be used to construct the Water Storage Dykes and Haul Road.

A drainage ditch will be constructed along the west and north outside of the overburden berm to drain surface water from the Hickie Property.

The pit run aggregate will be extracted from mining block 1 and processed at the processing site. Water from de-watering mining block 1 will be temporarily stored at the water storage area.

Step 2 : The topsoil and subsoil will be removed from mining block 2 and area B and stockpiled at the appropriate locations.

The overburden from mining block 2 will be excavated next. A clay dyke will be constructed along the west side of mining block 1 with a top width of 4 meters. The water from the water storage area will now be pumped into the empty mining block 1. The remaining overburden from Mining Block 2 will be stockpiled on Area B.

Ground water from de-watering of mining block 2 will be pumped into mining block 1 where it will re-enter the ground water.

This phase of development along with the stockpiling of topsoil and subsoil from mining block 3 and stockpiling of topsoil from mining block 4 will be the maximum disturbance of the project. The estimated cost of reclamation will reflect this situation.

Phase 2 Development

In Phase 2 the overburden from each successive mining block will be placed into the previously extracted mining block. Ground water from de-watering of each mining block will be pumped into the former mining block 1 which is now the ground water recharge area.

The topsoil and subsoil from mining block 3 will be excavated and stockpiled at the appropriate locations. The overburden will be placed directly in mining block 2.

After the gravel has been extracted from mining block 3, the stripping of mining block 4 will begin. The topsoil will once again be stockpiled in the appropriate area but the sub-soil will now be placed directly onto mining block 2.

All materials from excavation of the remaining mining blocks in phase 2 development will now be placed directly on previously filled in mining blocks.

Upon completion of mining block 6 operations will relocate to the NE quarter of 33-53-3-W5. This re-location is necessary to have the end pit water body remaining after reclamation located on the NW of 33-53-3-W5 as this land is owned by the developer rather than leased.

Overburden will be taken from the temporary water storage dykes and from area A to backfill mining block 6; subsoil and topsoil will be taken from the stockpiles to complete reclamation of mining blocks 2,3,4,5 & 6.

Phase 3 Development

Mining block 7 will be located in the south west portion of the NE quarter of 33-53-3-W5. It is typified by BH 07-1124. It will be 1.94 ha. in size and the average material thickness and quantities are as follows :

	Thickness (meters)	Quantity (cubic meters)
Topsoil	0.28	5,430
Subsoil	0.45	8,730
Overburden	11.27	218,640
Coarse Gravel	5.40	104,760

The areas and quantities of topsoil and subsoil that will have to be stockpiled are listed below.

Mineral topsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 7	19,400	5,430
Crushing Plant Site	40,000	9,600
Overburden Berm	28,190	11,280
Area C	36,900	12,550
Subsoil Stockpile	15,200	3,040
Mining Block 8	19,800	6,530
Total	159,490	48,430

Organic topsoil

Location	Thickness (meters)	Quantity (cubic meters)
Overburden Berm	35,230	35,930
Mining Block 9	18,700	16,640
Totals	53,930	52,570

Subsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 7	19,400	8,730
Crushing Plant Site	40,000	27,200
Overburden Berm	28,190	16,350
Area C	36,900	24,720
Mining Block 8	19,800	13,270
Totals	144,290	90,270

The mineral topsoil will be placed in a stockpile north of the haul road. This stockpile will be 5 meters high with 2:1 side slopes. It will cover 0.82 hectares.

The organic topsoil will be stockpiled to the east of the crushing plant site. The stockpile will be 5 meters in height with 2:1 side slopes and will cover 0.89 hectares.

The subsoil will be stockpiled south of the haul road. The stockpile will be 5 meters in height with 2:1 side slopes and will cover 1.52 hectares.

The overburden from mining block 7 will be used to complete the overburden berm along the north, east and south sides of the NE quarter of 33-53-3-W5. The berm will go around the wetland in the south east corner of the quarter section and around the wetland and the communication tower in the north east corner. The remaining overburden will be stockpiled at Area C.

A drainage ditch must be excavated from the existing dugout to the property line south of mining block 11. A 600mm CSP culvert will be placed under the perimeter berm to the ditch on Range Road 33. This will accommodate any surface drainage issues in the NE of 33-53-3-W5.

The gravel from this mining block and subsequent ones will be crushed at the crushing plant site. Aggregates designated for washing will be hauled to the wash plant site and processed.

The topsoil from mining blocks 8 & 9 will be stockpiled at the designated sites as will the sub-soil from mining block 8. After this all materials excavated from mining blocks 10 to 24 will be placed directly on previously excavated mining blocks. The final reclamation topography will have been determined and material will be added to or taken away from areas A, B & C to achieve this. As soon as each mining block has received topsoil it will be seeded to the desired crop or pasture.

All of the NE and NW of 33-53-3-W5 will now be reclaimed except for the crushing plant site, the haul road from Range Road 33 to the site and the sub-soil and topsoil berms kept for reclaimation of the crushing plant site. An end pit water body will be left

in the area of mining block 24. The overburden from the perimeter berms and the remaining overburden stockpiles will be used to fill in the ground water discharge area.

Phase 4 Development

The area in the SW of 34-53-3-W5 with gravel deemed economical to mine will be mined in two blocks; mining blocks 25 & 26. The gravel will be extracted from here and hauled to the NE of 33-53-3-W5 for processing. It will be processed into crushed and screened products, no washed products will be produced from here.

The gravel in mining block 26 is typified by BH08-1500. It is 3.0 hectares in size with overburden and pit run gravel as follows:

	Thickness (meters)	Quantity (cubic meters)
Topsoil	0.21	6,300
Sub-soil	0.55	16,500
Overburden	2.74	82,200
Fine Gravel	4.9	147,000
Coarse Gravel	0.9	27,000
Overburden	6.4	192,000
Sand	2.2	66,000
Coarse Gravel	1.5	45,000
Sand	1.5	45,000
Coarse Gravel	1.5	45,000

The gravel in mining block 26 is typified by BH08-1498. It is 2.9 hectares in size with overburden and pit run gravel as follows:

	Thickness (meters)	Quantity (cubic meters)
Topsoil	0.22	6,380
Sub-soil	0.53	15,370
Overburden	11.65	337,850
Sand	0.6	17,400
Coarse Gravel	0.6	17,400
Sand	2.1	60,900
Coarse gravel	4.3	124,700

All of the ground water from de-watering of the two mining blocks will have to be temporarily stored on surface. This quantity of water is estimated to be a maximum of 450,000 cubic meters. A storage area will be constructed on an area of 11.2 hectares. The dykes will be 4.8 meters in height have a 4 meter wide top and 3:1 side slopes. This will contain the maximum estimated quantity of water and have 0.8 meters of freeboard. A 600 mm diameter CSP culvert will be installed for an emergency spillway to provide for an extraordinary precipitation event.

A small berm of 2 meters in height will be constructed along the property lines in the north east half of the property. This berm will have a 4 meter wide top and 3:1 sideslopes.

The mineral topsoil, organic topsoil and subsoil from the following areas will have to be stockpiled.

Mineral topsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 25	30,000	6,300
Perimeter Berms	8,480	1,700
Water Storage Dykes	14,500	2,900
Overburden Stockpile	26,900	6,190
Sand Stockpile	18,700	3,180
Subsoil Stockpile	9,500	2,090
Total	108,080	22,360

Organic Topsoil

Location	Area (square meters)	Quantity (cubic meters)
Perimeter Berms	2,820	2,820
Water Storage Dykes	29,500	35,400
Total	32,320	38,220

Subsoil

Location	Area (square meters)	Quantity (cubic meters)
Mining Block 25	30,000	16,500
Perimeter Berms	8,480	4,490
Water Storage Dykes	14,500	10,150
Overburden Stockpile	26,900	14,800
Sand Stockpile	18,700	10,280
Total	98,580	56,220

The overburden will be removed from mining block 25 and used to construct the perimeter berms and the temporary water storage dyke. The remaining overburden will be stockpiled. The 111,000 cubic meters of sand will be excavated and stockpiled.

The organic overburden will be stockpiled in a berm to the south of the temporary water storage area. Care will be taken not to construct the water storage dykes on top of any organic topsoil to eliminate any leakage from the reservoir.

The 147,000 cubic meters of fine gravel and the 117,000 cubic meters of coarse gravel will be hauled to the processing area on the NE of 33-53-3-W5. An abandoned municipal

road allowance exists along the edge of the Franczak property in the NW of 34-53-3-W5. It will be upgraded and used as a haul road for the pit run.

Upon completion of the gravel extraction from mining block 25, the stockpiled sand will be placed at the bottom of the excavation. The topsoil and subsoil will be removed from mining block 26 and stockpiled in the appropriate locations. The overburden will be removed and placed on top of the sand in the excavated mining block 25. The sand from mining block 26 will be stockpiled at the appropriate location.

The 142,100 cubic meters of coarse gravel from mining block 27 will be hauled to the processing area on the NE of 33-53-3-W5.

The water from the temporary water storage area will be pumped back into mining block 26 and will be allowed to infiltrate back into the groundwater. The stockpiled sand will be placed at the bottom of the excavation and the stockpiled overburden placed on top of it.

The temporary water storage dykes, the perimeter berms and the haul road will be excavated and the material used to contour the mined area. The sub-soil and topsoil will be replaced and seeded.

The crushing plant site and washing plant site will now be reclaimed.

Reclamation Plan

Progressive reclamation will be a feature of this development plan. The overburden from the first two mining blocks will be used to construct berms and roads and the remainder will be stockpiled. Care will be taken to stockpile the mineral topsoil, organic topsoil, subsoil and other overburden separately. The overburden from the third mining block will be directly placed into the second mining block and all subsequent mining blocks will have the overburden directly placed into the previously mined block. The sub-soil from the fourth mining block will be placed on top of the replaced overburden in mining block 2. The topsoil from mining block 5 will be placed on top of the sub-soil on mining block 2. The following table shows the movement of the topsoil, sub-soil and overburden.

Mining Block	Top Soil	Sub Soil	Overburden
1	Stockpiled	Stockpiled	Stockpiled
2	Stockpiled	Stockpiled	Stockpiled
3	Stockpiled	Stockpiled	Mining Block 2
4	Stockpiled	Mining Block 2	Mining Block 3
5	Mining Block 2	Mining Block 3	Mining Block 4
6	Mining Block 3	Mining Block 4	Mining Block 5
7	Stockpiled	Stockpiled	Stockpiled
8	Stockpiled	Stockpiled	Mining Block 7

9	Stockpiled	Mining Block 7	Mining Block 8
10	Mining Block 7	Mining Block 8	Mining Block 9
11	Mining Block 8	Mining Block 9	Mining Block 10
12	Mining Block 9	Mining Block 10	Mining Block 11
13	Mining Block 10	Mining Block 11	Mining Block 12
14	Mining Block 11	Mining Block 12	Mining Block 13
15	Mining Block 12	Mining Block 13	Mining Block 14
16	Mining Block 13	Mining Block 14	Mining Block 15
17	Mining Block 14	Mining Block 15	Mining Block 16
18	Mining Block 15	Mining Block 16	Mining Block 17
19	Mining Block 16	Mining Block 17	Mining Block 18
20	Mining Block 17	Mining Block 18	Mining Block 19
21	Mining Block 18	Mining Block 19	Mining Block 20
22	Mining Block 19	Mining Block 20	Mining Block 21
23	Mining Block 20	Mining Block 21	Mining Block 22
24	Mining Block 21	Mining Block 22	Mining Block 23
25	Stockpiled	Stockpiled	Stockpiled
26	Stockpiled	Stockpiled	Mining Block 25

The two distinct types of overburden which have been stockpiled separately will be replaced separately at as near as possible to the same location it originated from.

When the gravel from mining block 6 has been extracted overburden from the temporary water storage area dykes and from the stockpile at area A will be used to backfill it. Sub-soil and topsoil will be taken from the stockpiles and used to reclaim it. Mining Blocks 2, 3, 4, 5 & 6 will all have been reclaimed at this time.

When the gravel from mining block 24 has been extracted an end pit water body will remain. At this time the wash plant will be removed and the site reclaimed. The water from the Ground Water Recharge Area will be pumped into the end pit water body and the overburden from the perimeter dikes and the remaining stockpiles will be used to reclaim this area.

All the north half of 33-53-3-W5 except the crushing plant site, the topsoil and subsoil berms and the road to the crushing plant site will have been reclaimed.

When the gravel from mining block 26 has been extracted an end pit water body will remain. The water from the Temporary Water Storage Area will be pumped into the water body and all berms and remaining stockpiles will be used for final contouring and reclamation.

In some areas on the NE of 33-53-3-W5 and the NW of 34-53-3-W5 the testing logs indicate a layer of sand on top of the gravel. This sand will be stockpiled and placed at the bottom of the excavation as a partial aquifer replacement. The pit run from this gravel deposit appears to contain approximately 70% sand and 30% stone. If a surplus of sand

occurs more than can be marketed, the surplus sand will be placed at the bottom of the excavations.

The final reclaimed topography of the site has been determined and the stockpiles of overburden will be utilized to maintain this topography during progressive reclamation. The property has CSI classification of Class 3, Subclasses H & T and Class 7, Subclasses W & V. Final reclamation will have maximum slopes of 10 : 1 except below water at the end pit water bodies.

Two end pit water bodies are included in the reclamation plan along with two other depressions which will be above groundwater level. The end pit water bodies will be landscaped in such a manner that there is a shallow portion suitable for vegetation growth and waterfowl use and a deeper portion through which water will infiltrate into the groundwater.

The areas of depression are expected to pond surface runoff for short periods of time in spring and after heavy precipitation events. The ponded water is expected to infiltrate down to ground water level and to evaporate and these areas are expected to remain dry for most of the year.

To counteract soil compaction caused by earthmoving equipment, the surface of the overburden and of the subsoil will be scarified before placing the next material. The topsoil surface will be cultivated and seeded as required for the next land use.
will be controlled by mowing and/or spraying.

The CLI soil capacity for agriculture of the pre-disturbed landscape is 60% 3HT and 40%

It is not anticipated that any portion of this pit will be inactive and un-reclaimed for any period of time. If this does occur all pit walls will be sloped to a minimum 3:1 and weeds 7W. The expected soil capacity of the reclaimed landscape will remain near the pre-disturbed.

Development and Reclamation Schedule

This schedule is based on a material processing rate of 300,000 tonne per year. Market conditions may cause deviations from this schedule.

Year 1 – Relocate Ste. Anne Gas Co-op pipeline

- Remove topsoil from mining blocks 1 & 2, berms, dikes, roads, process area and stockpile areas and stockpile.
- Remove subsoil from mining blocks 1 & 2, berms, dikes, roads, process area and stockpile areas and stockpile.
- Remove overburden from mining blocks 1 & 2 and construct roads, berms, dikes and stockpiles.

- Extract and process gravel from mining block 1

Year 2 -
- Extract and process gravel from mining block 2
- Remove topsoil from mining block 3 and stockpile.
- Remove subsoil from mining block 3 and stockpile
- Remove the overburden from mining block 3 and place in mining block 2.
- Extract and process gravel from mining block 3.
- Remove topsoil from mining block 4 and stockpile.
- Remove subsoil from mining block 4 and place on mining block 2.
- Remove overburden from mining block 4 and place in mining block 3

Year 3 -
- Extract and process gravel from mining block 4.
- Remove topsoil from mining block 5 and place on mining block 2.
- Remove subsoil from mining block 5 and place on mining block 3.
- Remove overburden from mining block 5 and place in mining block 4.
- Cultivate and seed mining block 2.

Year 4 -
- Extract and process gravel from mining block 5.
- Remove topsoil from mining block 6 and place on mining block 3.
- Remove subsoil from mining block 6 and place on mining block 4.
- Remove overburden from mining block 6 and place in mining block 5.
- Cultivate and seed mining block 3.
- Extract and process gravel from mining block 6.
- Remove topsoil from mining block 7, berms, process area and stockpile areas and stockpile.
- Remove subsoil from mining block 7, berms, process area, and stockpile area and stockpile.
- Remove overburden from mining block 7 and construct berms and stockpiles.

Year 5 –
- Remove overburden from stockpiles and place in mining block 6.
- Remove subsoil from stockpiles and place on mining blocks 5 & 6.
- Remove topsoil from stockpiles and place on mining blocks 4, 5 & 6.
- Cultivate and seed mining blocks 4, 5 & 6.
- Extract and process gravel from mining block 7.
- Remove topsoil from mining block 8 and stockpile.
- Remove subsoil from mining block 8 and stockpile.
- Remove overburden from mining block 8 and place in mining block 7.

Year 6 -
- Extract and process gravel from mining block 8.
- Remove topsoil from mining block 9 and stockpile.
- Remove subsoil from mining block 9 and place on mining block 7.
- Remove overburden from mining block 9 and place in mining block 8.

Year 7 -
- Extract and process gravel from mining block 9.
- Remove topsoil from mining block 10 and place on mining block 7.
- Remove subsoil from mining block 10 and place on mining block 8.

- Remove overburden from mining block 10 and place in mining block 9.
- Cultivate and seed mining block 7.

Year 8 - Extract and process gravel from mining block 10.
- Remove topsoil from mining block 11 and place on mining block 8.
- Remove subsoil from mining block 11 and place on mining block 9.
- Remove overburden from mining block 11 and place in mining block 10.
- Cultivate and seed mining block 8.
- Extract and process gravel from mining block 11.
- Remove topsoil from mining block 12 and place on mining block 9.
- Remove subsoil from mining block 12 and place on mining block 10.
- Remove overburden from mining block 12 and place in mining block 11.
- Cultivate and seed mining block 9.

Year 9 - Extract and process gravel from mining block 12.
- Remove topsoil from mining block 13 and place on mining block 10.
- Remove subsoil from mining block 13 and place on mining block 11.
- Remove overburden from mining block 13 and place in mining block 12.
- Cultivate and seed mining block10.

Year 10 - Extract and process gravel from mining block 13.
- Remove topsoil from mining block 14 and place on mining block 11.
- Remove subsoil from mining block 14 and place on mining block 12.
- Remove overburden from mining block 14 and place in mining block 13.
- Cultivate and seed mining block 11.

Year 11 - Extract and process gravel from mining block 14.
- Remove topsoil from mining block 15 and place on mining block 12.
- Remove subsoil from mining block 15 and place on mining block 13.
- Remove overburden from mining block 15 and place in mining block 14.
- Cultivate and seed mining block 12.

Year 12 - Extract and process gravel from mining block 15.
- Remove topsoil from mining block 16 and place on mining block 13.
- Remove subsoil from mining block 16 and place on mining block 14.
- Remove overburden from mining block 16 and place in mining block 15.
- Cultivate and seed mining block 13.
- Extract and process gravel from mining block 16.
- Remove topsoil from mining block 17 and place on mining block 14.
- Remove subsoil from mining block 17 and place on mining block 15.
- Remove overburden from mining block 17 and place in mining block 16.
- Cultivate and seed mining block 14.

Year 13 - Extract and process gravel from mining block 17.
- Remove topsoil from mining block 18 and place on mining block 15.
- Remove subsoil from mining block 18 and place on mining block 16.

- Remove overburden from mining block 18 and place in mining block 17.
- Cultivate and seed mining block 15.

Year 14 - Extract and process gravel from mining block 18.
- Remove topsoil from mining block 19 and place on mining block 16.
- Remove subsoil from mining block 19 and place on mining block 17.
- Remove overburden from mining block 19 and place in mining block 18.
- Cultivate and seed mining block 16.

Year 15 - Extract and process gravel from mining block 19.
- Remove topsoil from mining block 20 and place on mining block 17.
- Remove subsoil from mining block 20 and place on mining block 18.
- Remove overburden from mining block 20 and place in mining block 19.
- Cultivate and seed mining block 17.

Year 16 - Extract and process gravel from mining block 20.
- Remove topsoil from mining block 21 and place on mining block 18.
- Remove topsoil from mining block 21 and place on mining block 19.
- Remove overburden from mining block 21 and place on mining block 20.
- Cultivate and seed mining block 18.

Year 17 - Extract and process gravel from mining block 21.
- Remove topsoil from mining block 22 and place on mining block 19.
- Remove subsoil from mining block 22 and place on mining block 20.
- Remove overburden from mining block 22 and place in mining block 21.
- Cultivate and seed mining block 19.

Year 18 - Extract and process gravel from mining block 22.
- Remove topsoil from mining block 23 and place on mining block 20.
- Remove subsoil from mining block 23 and place on mining block 21.
- Remove overburden from mining block 23 and place in mining block 22.
- Cultivate and seed mining block 20.

Year 19 - Extract and process gravel from mining block 23.
- Remove topsoil from mining block 24 and place on mining block 21.
- Remove subsoil from mining block 24 and place on mining block 22.
- Remove overburden from mining block 24 and place in mining block 23.
- Cultivate and seed mining block 21.

Year 20 - Extract and process gravel from mining block 24.
- Remove overburden from berms, roads and stockpiles and place in ground water recharge area.
- Remove subsoil from stockpiles and place on berms, roads, stockpile areas, process area and ground water recharge area.
- Remove topsoil from stockpiles and place on berms, roads, stockpile areas, process area and ground water recharge area.

- Cultivate and seed all disturbed areas in NW 33-53-3-W5.
- Remove the topsoil from mining block 25 and stockpile.
- Remove the subsoil from mining block 25 and stockpile.
- Remove the overburden from mining block 25 and construct berms, dikes, roads, and stockpiles.

Year 21 - Extract and process the gravel from mining block 25.
- Remove topsoil from mining block 26 and stockpile.
- Remove subsoil from mining block 26 and stockpile.
- Remove the overburden from mining block 26 and place in mining block 25.

Year 22 - Extract and process the gravel from mining block 26.
- Remove overburden from berms, dikes, roads and stockpiles and place in mining block 26.
- Remove subsoil from stockpiles and place on mining blocks 25 & 26, berms, dikes, roads and stockpile areas.
- Remove topsoil from stockpiles and place on mining blocks 25 & 26, berms, dikes, roads, and stockpile areas,
- Cultivate and seed disturbed areas in SW 34-53-3-W5.

Year 23 – Remove subsoil from stockpiles and place on process area and roads.
- Remove topsoil from stockpiles and place on process area and roads.
- Cultivate and seed remaining disturbed areas in NE 33-53-3-W5.

TOWNSHIP ROAD 540

RANGE ROAD 34

DETAIL B

DRAINAGE DITCH

LIMIT OF EXTRACTION PHASE 1

N

HICKIE PROPERTY

LIMIT OF GRAVEL ECONOMICAL TO EXTRACT

BLK. 2

BLK. 1

WATER STORAGE AREA

600mm ϕCSP EMERGENCY SPILLWAY

PIT BOUNDARY PHASE 1

OVERBURDEN BERM

PROCESSING SITE

ORGANIC TOPSOIL

DETAIL A

AREA A

NE 32-53-3-W5

NW 33-53-3-W5

HAUL ROAD

MINERAL TOPSOIL

AREA B

600mm ϕCSP CULVERT

SUBSOIL

WETLANDS

ROAD ALLOWANCE

This information redacted as per Protection of Privacy Act (POPA)

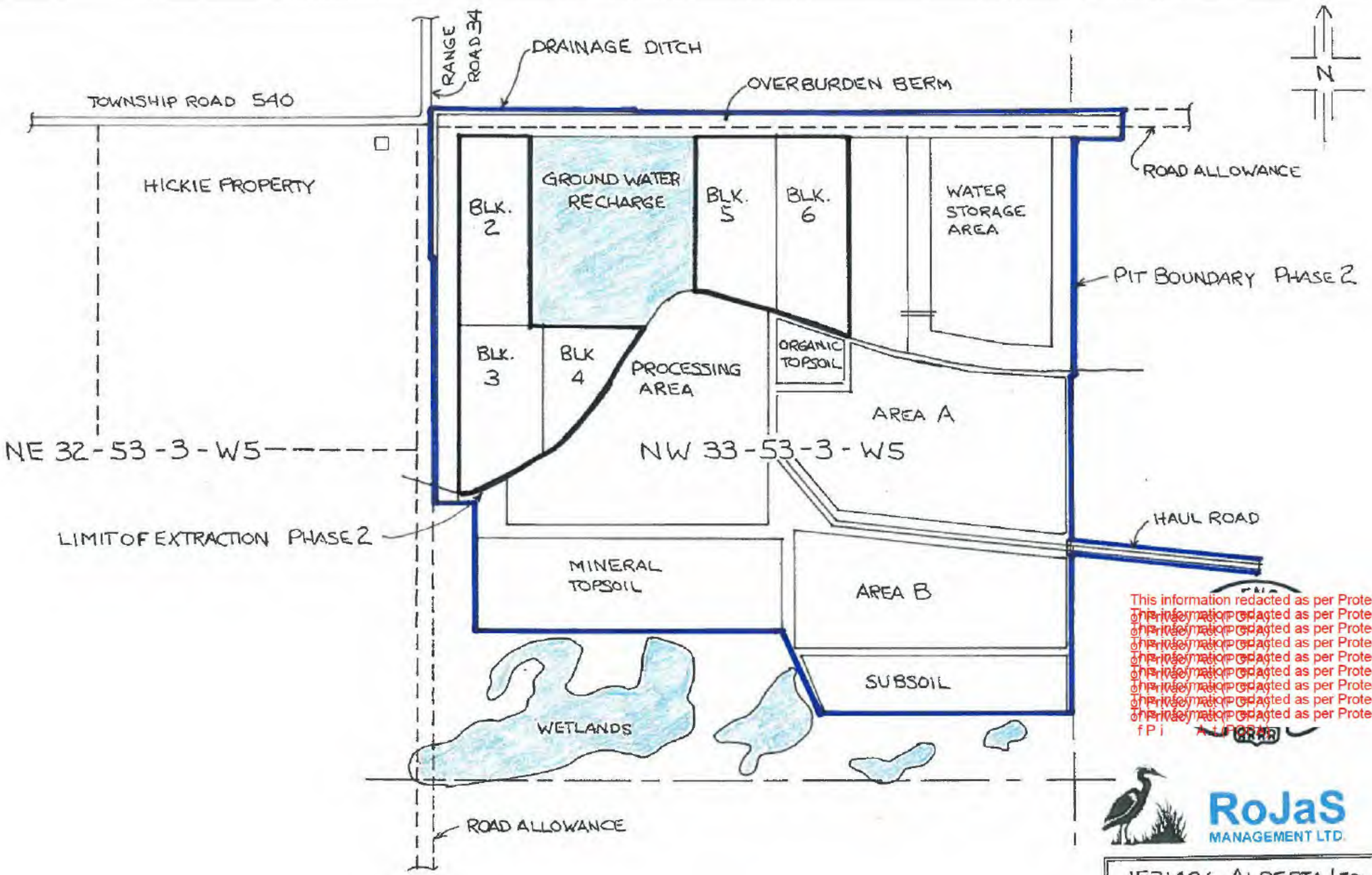
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

PLAN
PHASE 1 DEVELOPMENT

SCALE 1:5000

DRWG. 1 OF 18 REV. 2



This information redacted as per Protection of Privacy Act FOIP

RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

PLAN
PHASE 2 DEVELOPMENT

SCALE 1:5000

DRWG. 2 OF 18 REV. 2

RANGE ROAD 34

DRAINAGE DITCH

LIMIT OF EXTRACTION PHASE 3

TOWNSHIP ROAD 540

COMMUNICATION TOWER

GROUND WATER RE-CHARGE AREA

BLK. 6

BLK. 24

BLK 22

BLK 23

BLK. 21

BLK. 20

BLK. 18

BLK. 19

BLK. 17

BLK. 16

BLK. 14

BLK. 15

BLK. 13

BLK. 12

BLK. 11

WETLAND

DRAINAGE DITCH

ORGANIC TOPSOIL

WASH PLANT SITE

AREA A

NW 33-53-3-W5

AREA C

MINERAL TOPSOIL

NE 33-53-3-W5

CRUSHING PLANT SITE

600 mm ϕ CSP CULVERT

DETAIL C

DUGOUT

ORGANIC TOPSOIL

MINERAL TOPSOIL

AREA B

SUBSOIL

TOPSOIL BERM

SUB-SOIL BERM

SCALE

RANGE ROAD 33

BLK. 7

BLK. 8

BLK. 9

BLK. 10

WETLAND

WETLAND

PIT BOUNDARY PHASE 3

OVERBURDEN BERM

FRANCZAK RESIDENCE

This information redacted as per Protection of Privacy Act (POPA)

RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

PLAN
PHASE 3 DEVELOPMENT

SCALE 1:5000

DRWG. 3 OF 18 REV. 3

SCALE

CRUSHING PLANT SITE

HAUL ROAD

OVERBURDEN BERMS

FRANCZAK RESIDENCE

FRANCZAK PROPERTY

BLK.26

TOP SOIL

SUBSOIL

BLK.25

LIMIT OF EXTRACTION PHASE 4

OVERBURDEN

SAND

600mm CSP EMERGENCY SPILLWAY

PIT BOUNDARY PHASE 4

RANGE ROAD 33

TEMPORARY WATER STORAGE

FEN

SW 34-53-3-W5

BOG

ORGANIC TOPSOIL

SWAMP

This information redacted as
This information redacted as
This information redacted as

RANGE ROAD 34

772

B

773

774

A

775

C

NW 33-53-3-W5

776

777

778

779

780

WETLANDS

SURFACE WATER FLOW

D

772

FEN

TOWNSHIP ROAD 540

772

773

C

NE 33-53-3-W5

774

RANGE ROAD 33

775

WETLANDS

776

777

778

FRANCZAK RESIDENCE

This information redacted
Privacy Act (FOIPA)

RoJaS
MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

EXISTING
SURFACE TOPOGRAPHY

SCALE 1:5000

DRWG. 5 OF 18

RANGE ROAD 34

TOWNSHIP ROAD 540

RANGE ROAD 33

NW 33-53-3-W5

NE 33-53-3-W5

WETLANDS

WETLANDS

SURFACE WATER FLOW

FRANCZAK RESIDENCE

This information redacted as per Protection of Privacy Act (POPA)

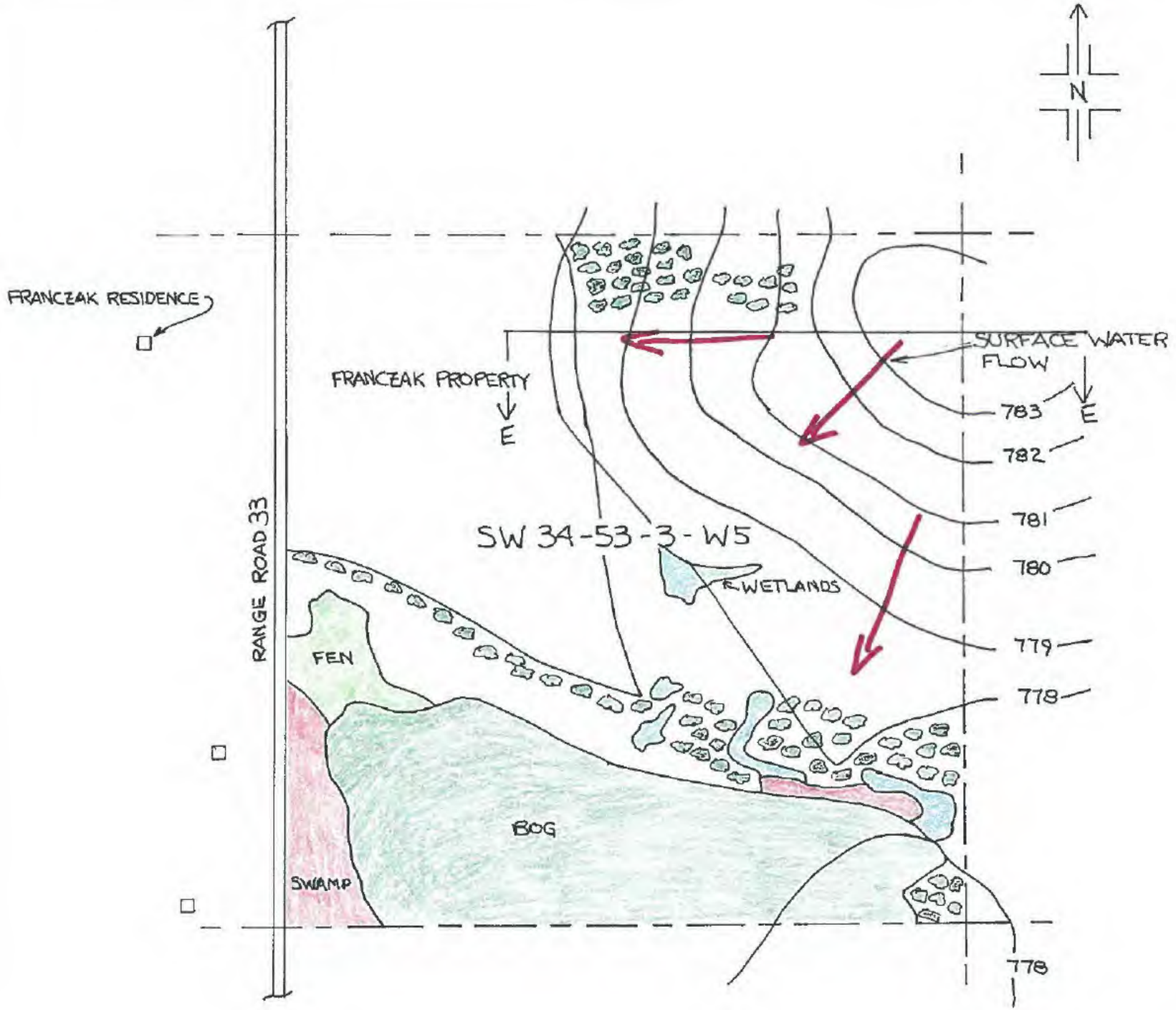
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

RECLAIMED
SURFACE TOPOGRAPHY

SCALE 1:5000

DRWG. 6 OF 18



This information redacted as per Protection of Privacy Act (POPA)

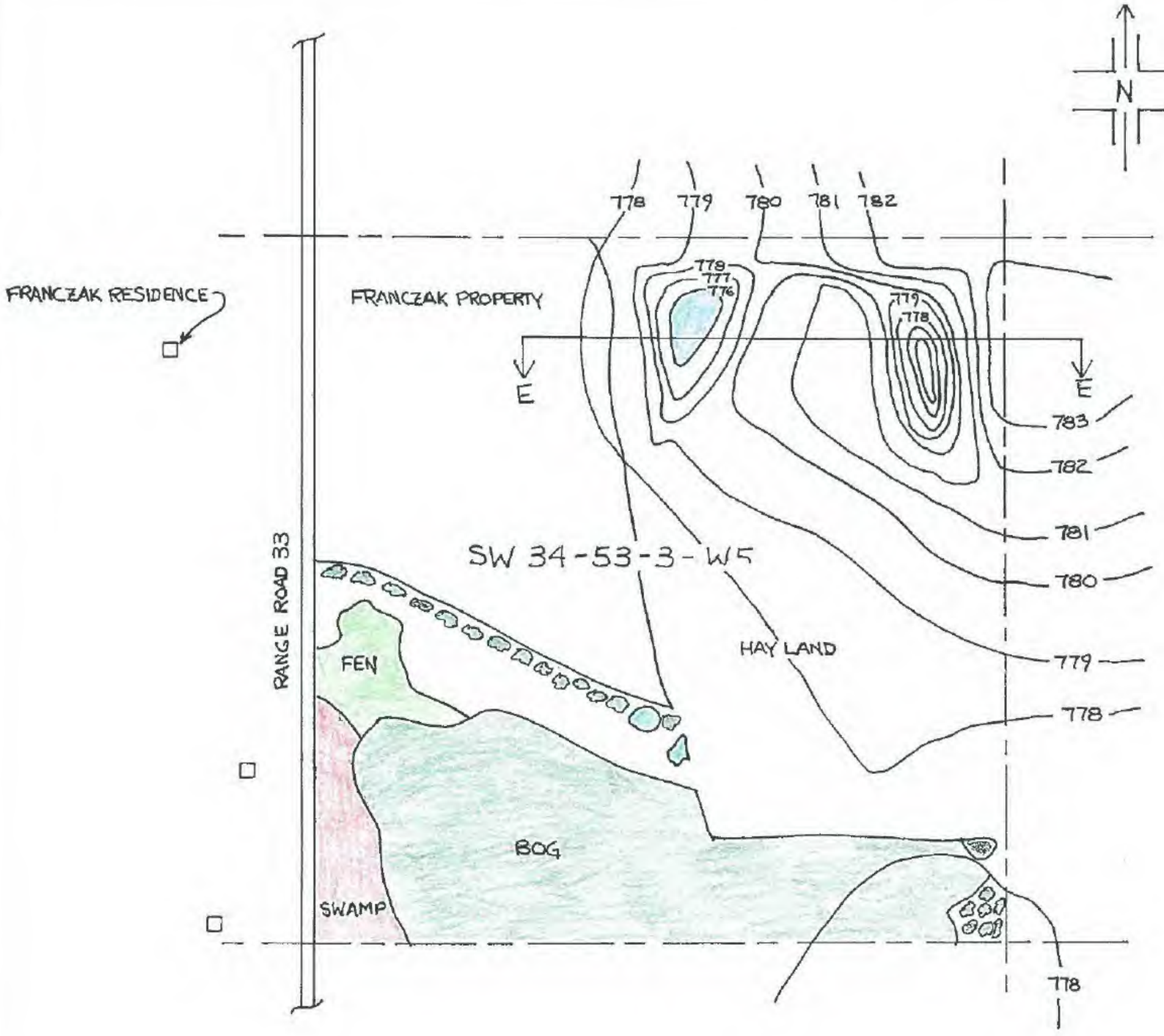
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

EXISTING SURFACE TOPOGRAPHY

SCALE 1:5000

DRWG. 7 OF 18



This information redacted as per Protection of Privacy Act (POPA)

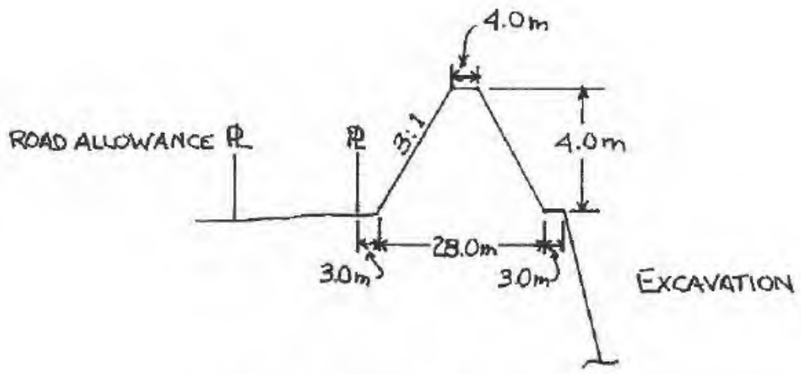
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD
ALBERTA BEACH GRAVEL PIT

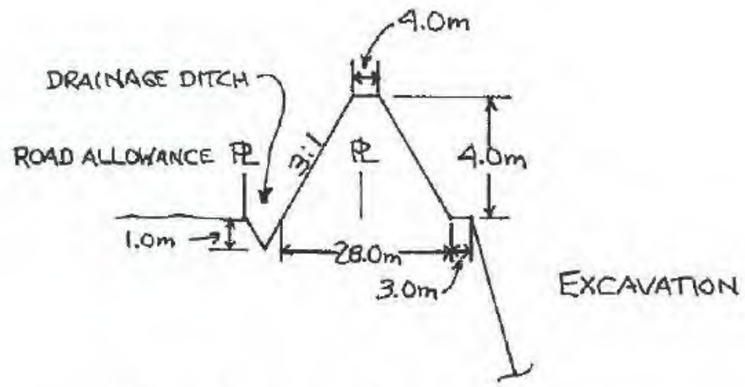
RECLAIMED
SURFACE TOPOGRAPHY

SCALE 1:5000

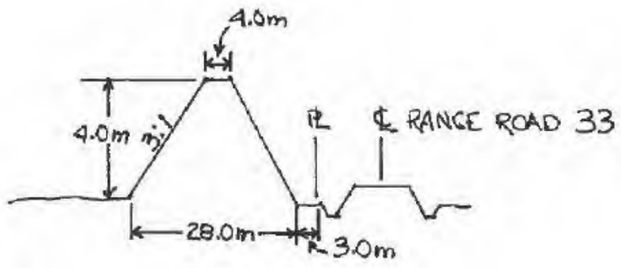
DRWG. 8 OF 18



CROSS SECTION DETAIL A



CROSS SECTION DETAIL B



CROSS SECTION DETAIL C

This information redacted as per Protection of Privacy Act (POPA)

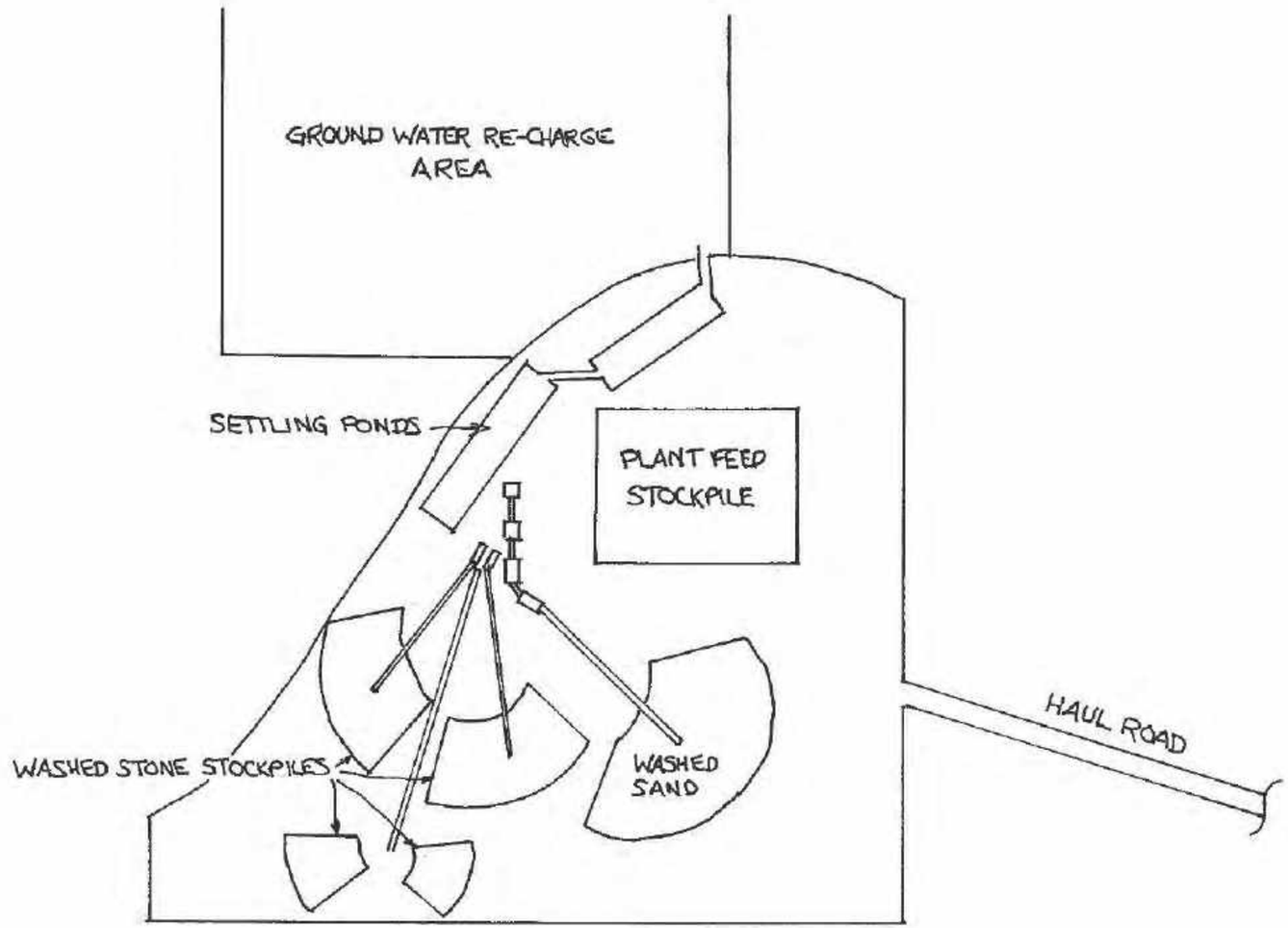
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

BERMS AND SETBACK DETAILS

SCALE HORIZ. 1:1000
VERT. 1:200

DRWG. 9 OF 18



This information redacted as per Protection of Privacy Act (POPA)

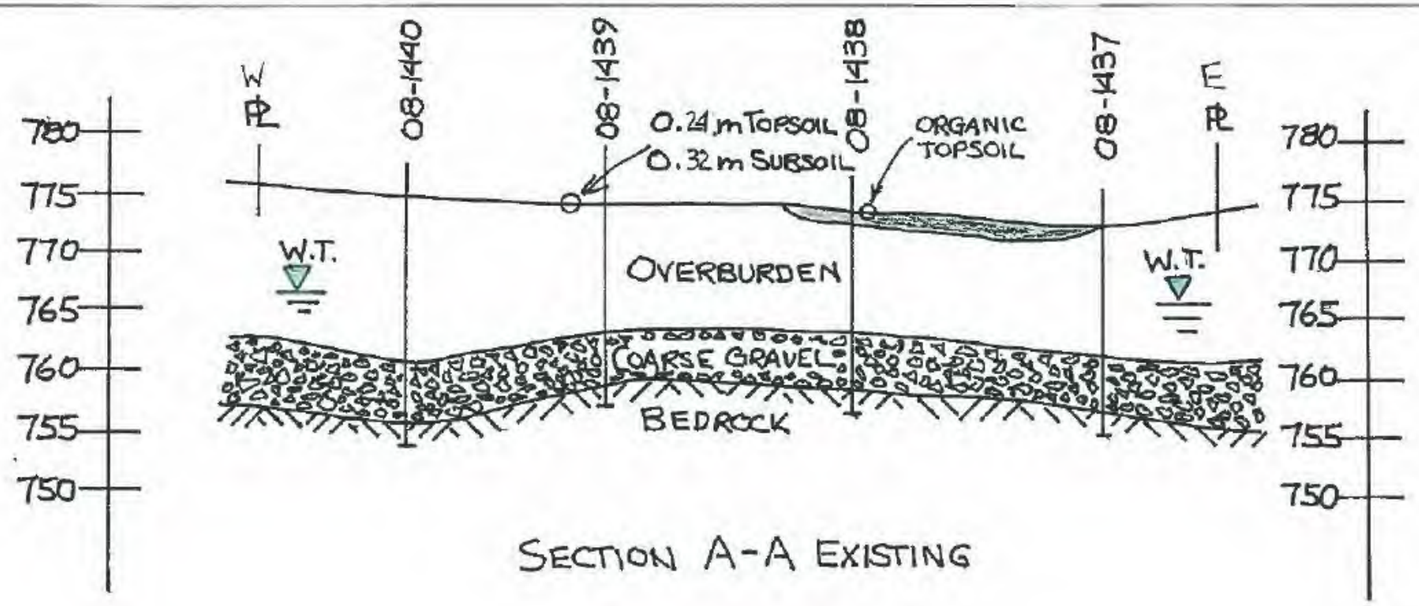
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

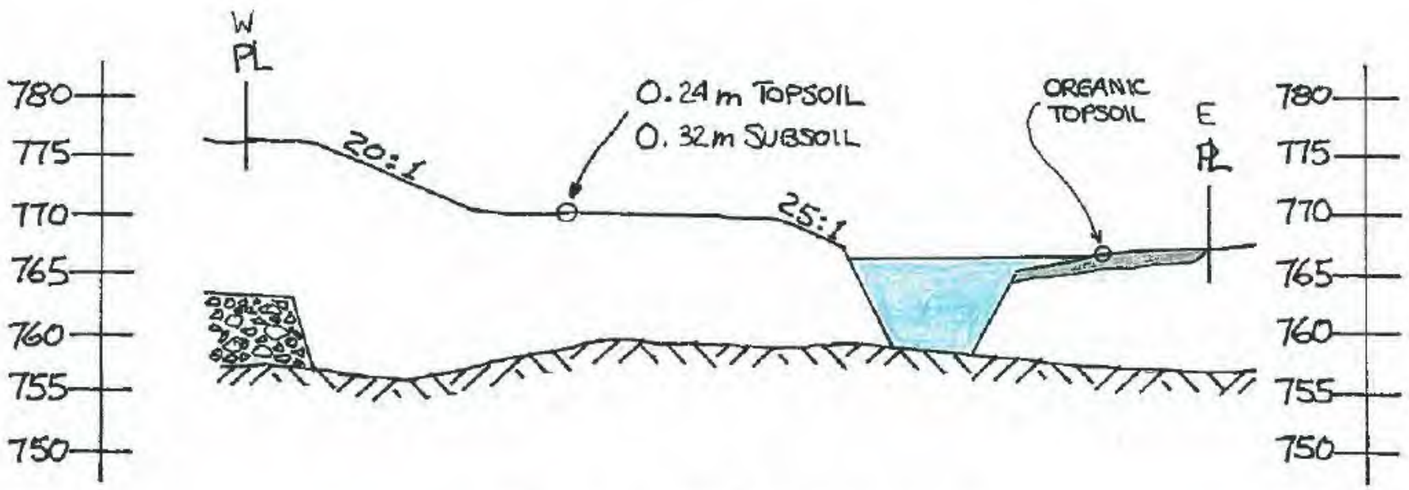
WASH PLANT SITE DETAILS

SCALE 1:2500

DRWG. 10 OF 18



SECTION A-A EXISTING



SECTION A-A RECLAIMED

This information redacted as per Protection of Privacy Act (POPA)

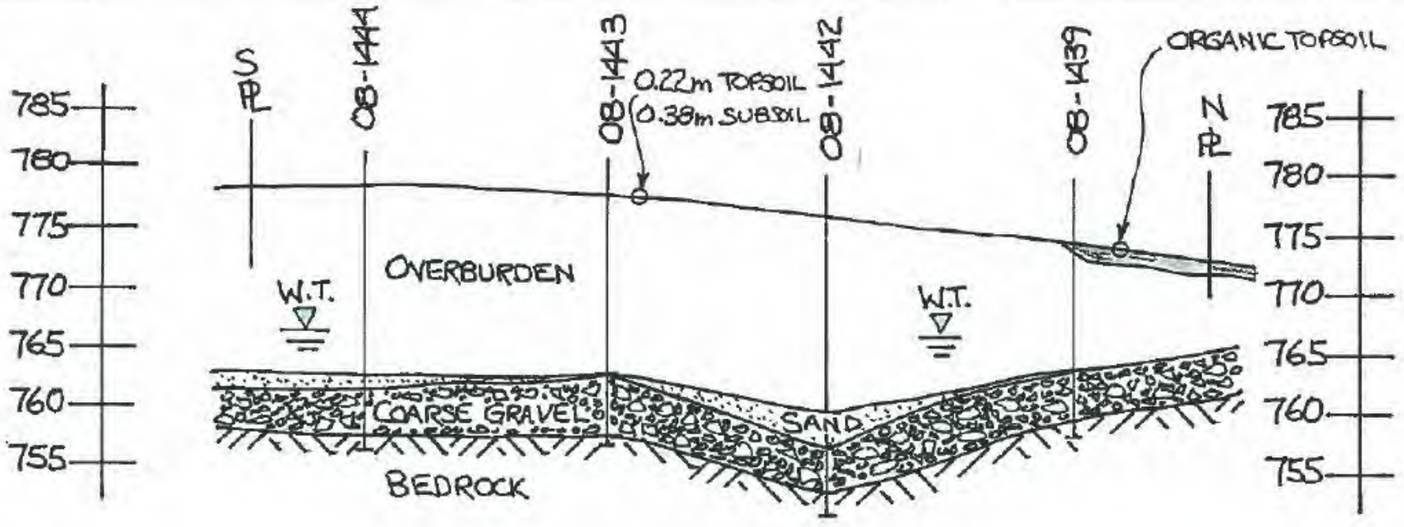
RoJaS MANAGEMENT LTD

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

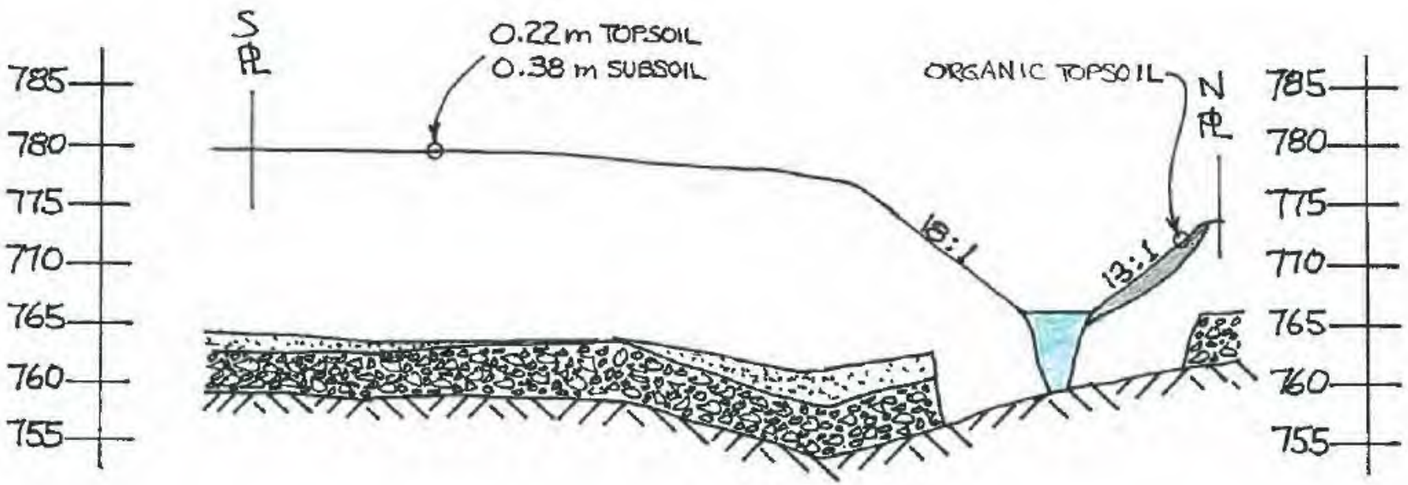
NW 33-53-3-W5
CROSS SECTIONS

SCALE HORIZ. 1:5000
VERT. 1:500

DRWG. 11 OF 18 REV.1



SECTION B-B EXISTING



SECTION B-B RECLAIMED

This information redacted as per Protection of Privacy Act (POPA)

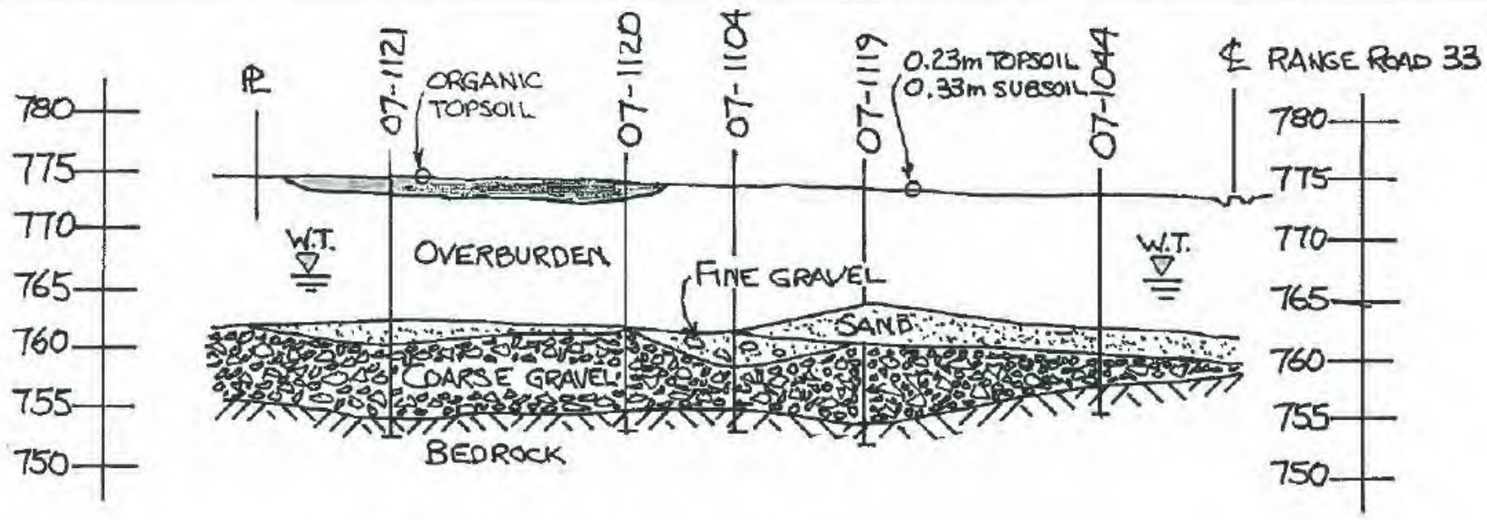
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

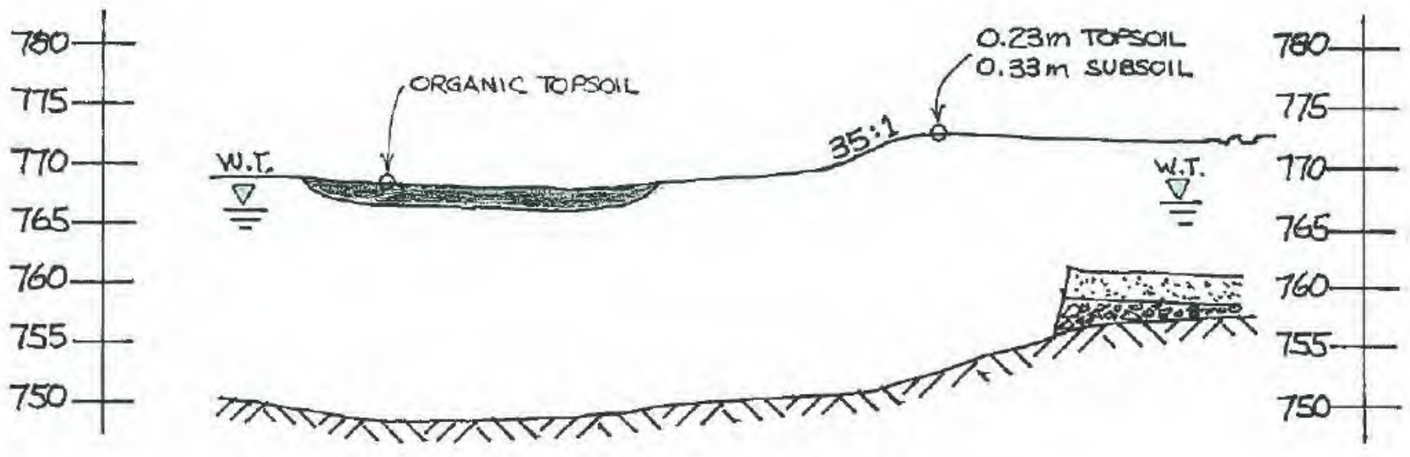
NW 33-53-3-W5
CROSS SECTIONS

SCALE HORIZ. 1:5000
VERT. 1:500

DRWG. 12 OF 18 REV.1



SECTION C-C EXISTING



SECTION C-C RECLAIMED

This information redacted as per Protection of Privacy Act (POPA)

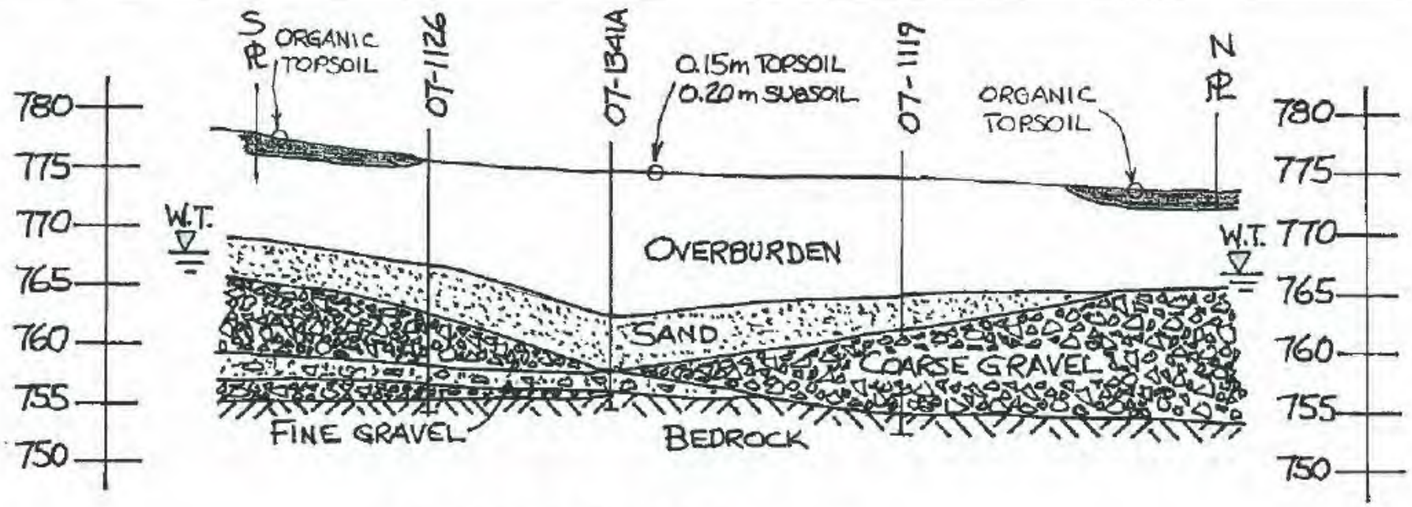
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

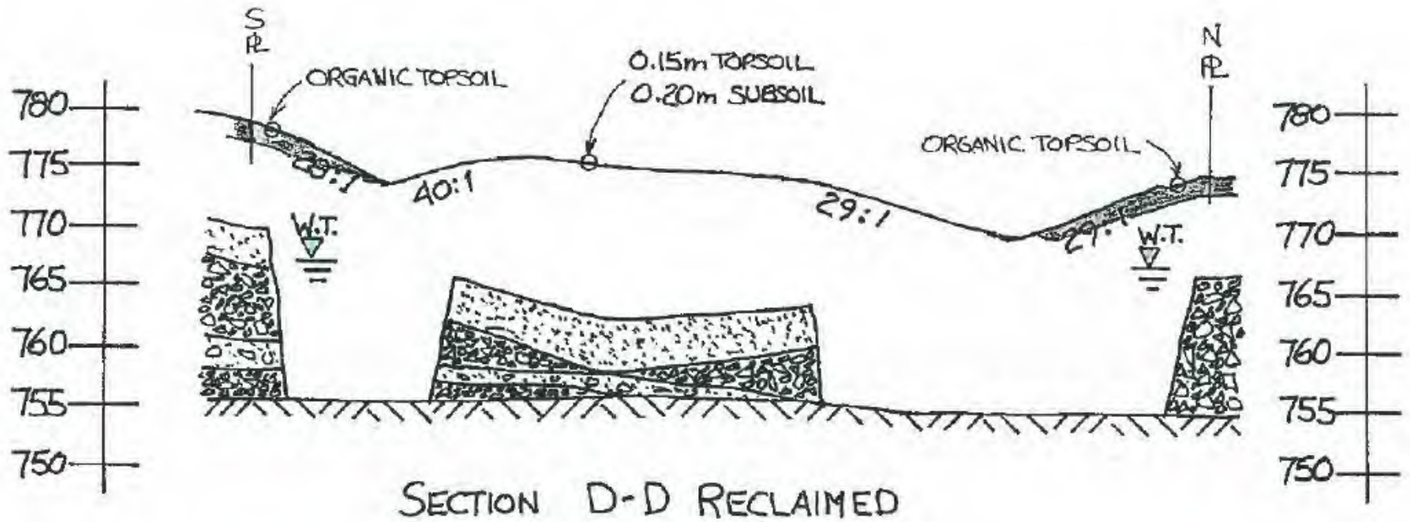
NE 33-53-3-W5
CROSS SECTIONS

SCALE HORIZ. 1:5000
VERT. 1:500

DRWG. 13 OF 18 REV. 1



SECTION D-D EXISTING



SECTION D-D RECLAIMED

This information redacted as per Protection of Privacy Act (POPA)

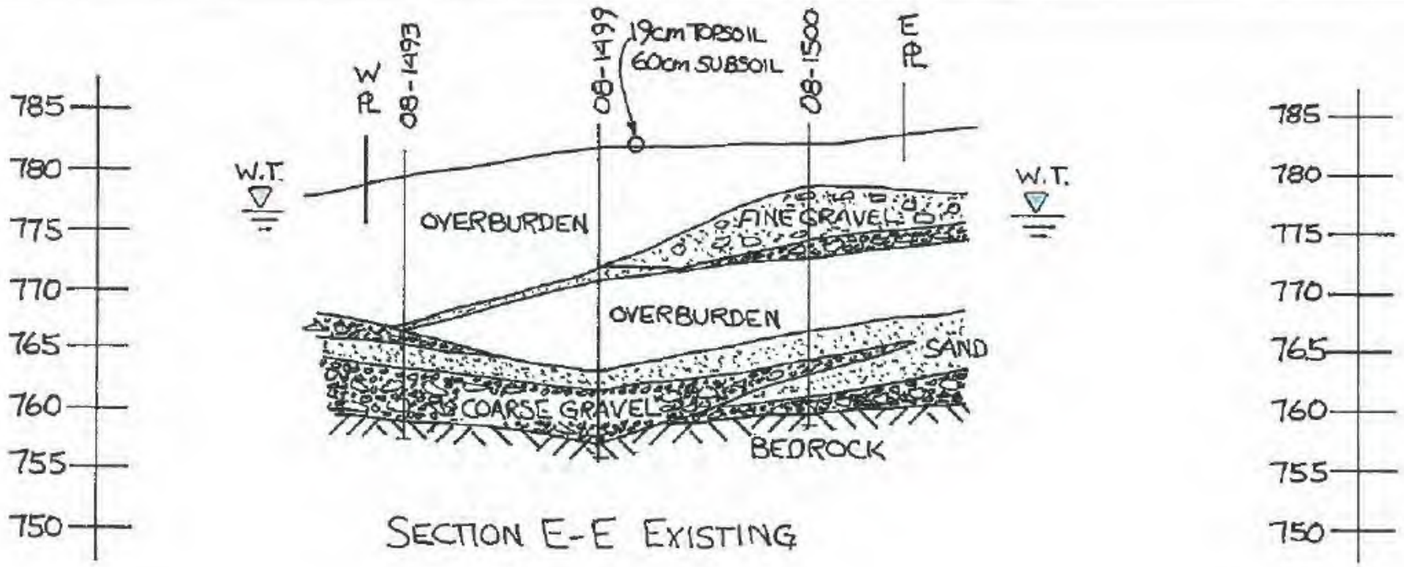
RoJaS MANAGEMENT LTD

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

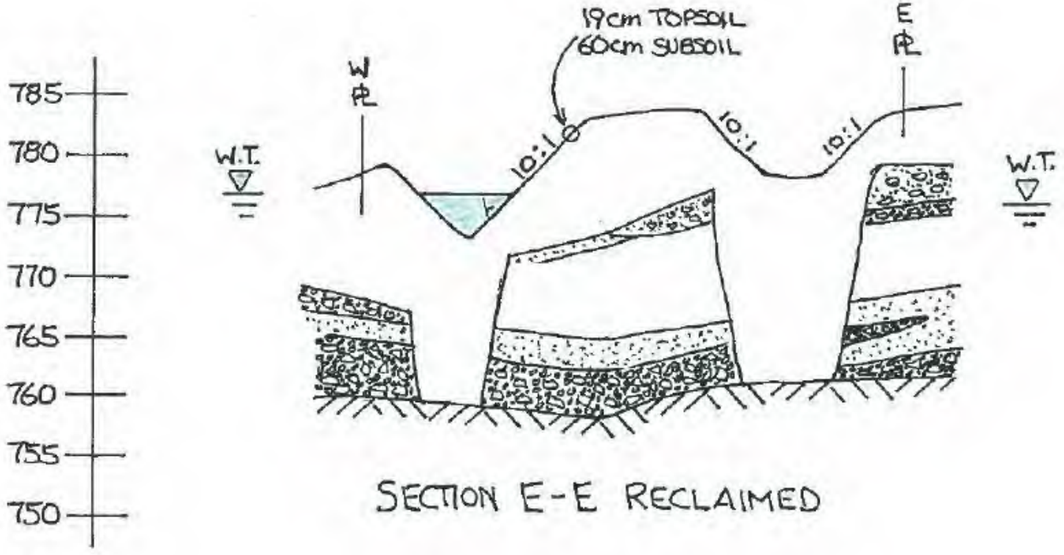
NE 33-53-3-W5
CROSS SECTIONS

SCALE HORIZ. 1:5000
VERT. 1:500

DRWG. 14 OF 18 REV. 1



SECTION E-E EXISTING



SECTION E-E RECLAIMED

This information redacted as per Protection of Privacy Act (POPA)

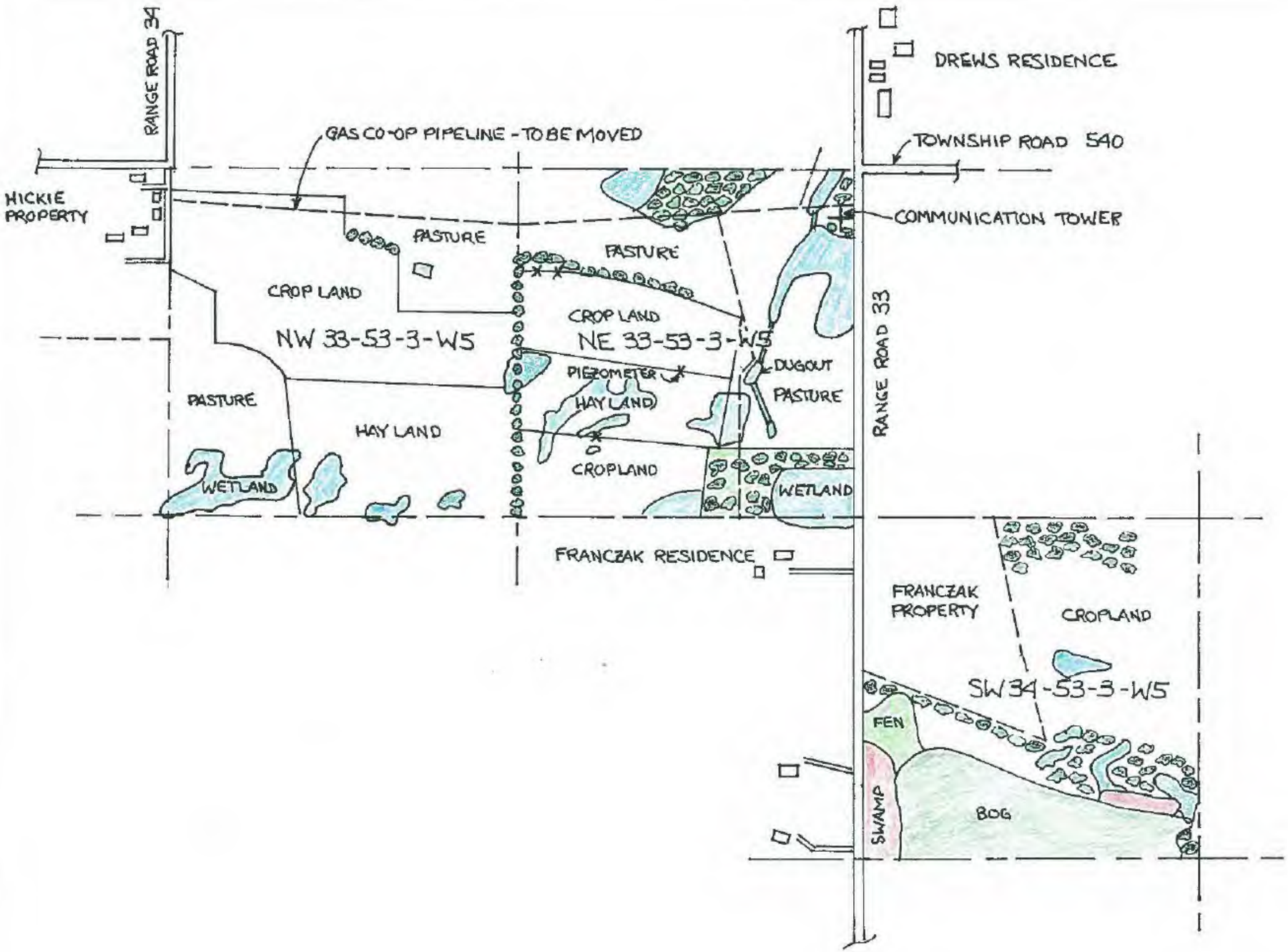
RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

SW 34-53-3-W5
CROSS SECTIONS

SCALE HORIZ. 1:5000
VERT. 1:500

DRWG. 15 OF 18



SCALE 1: 10,000

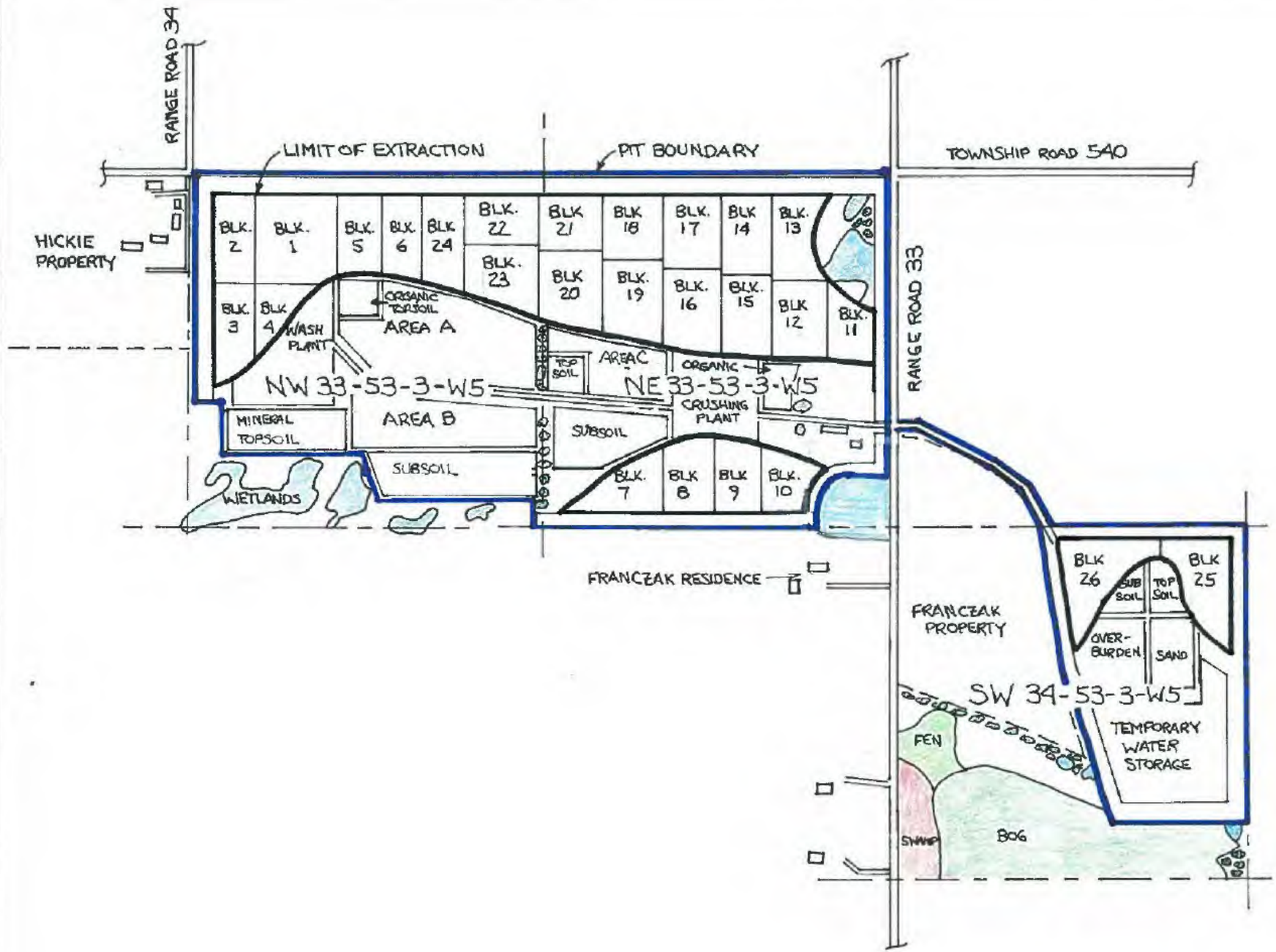
This information redacted as per Protection of Privacy Act (POPA)

RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

EXISTING PLAN

DRWG. 16 OF 18



SCALE 1:10,000

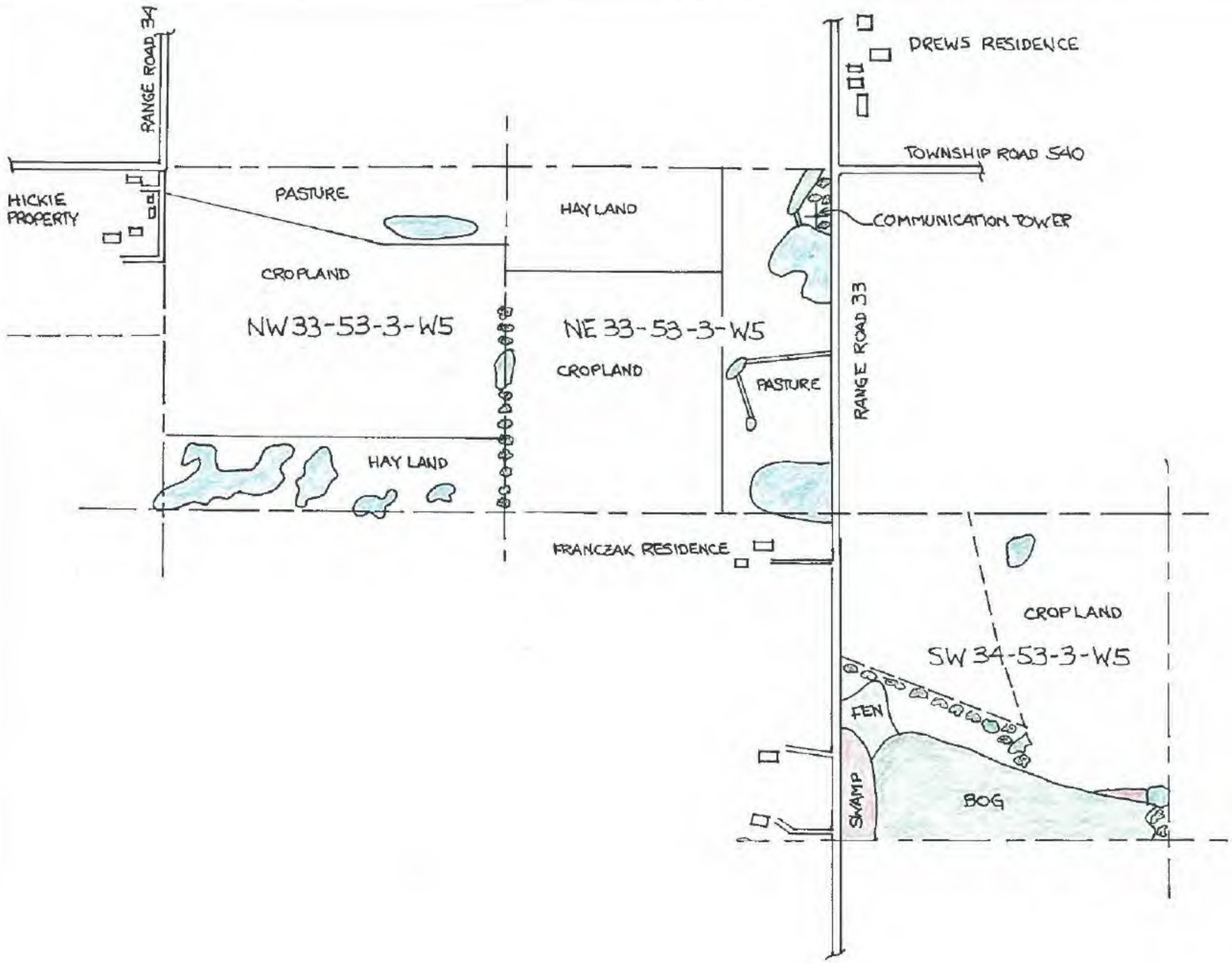
This information redacted as per Protection of Privacy Act (POPA)

RoJaS MANAGEMENT LTD.

1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

OVERALL DEVELOPMENT PLAN

DRWG. 17 OF 18 REV. 1



This information redacted as per Protection of Privacy Act (POPA)

RoJaS MANAGEMENT LTD.

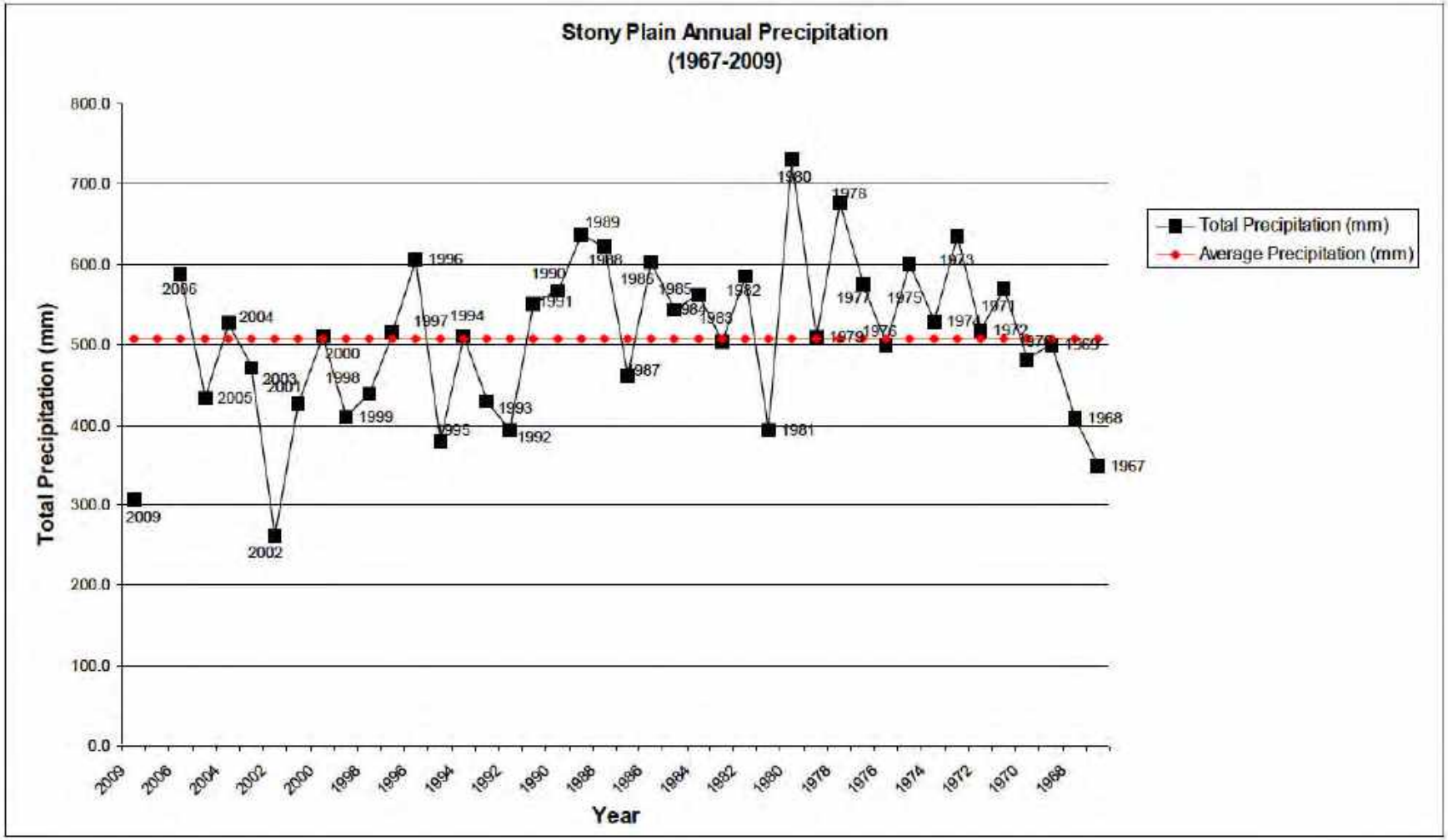
1531486 ALBERTA LTD.
ALBERTA BEACH GRAVEL PIT

RECLAIMED PLAN

SCALE 1:10,000

DRWG. 18 OF 18

Appendix B: Stony Plain Climate Graph (1967 – 2009)


Stony Plain Annual Precipitation
(1967-2009)
Total Precipitation (mm)
Average Precipitation (mm)
Total Precipitation (mm)
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
2009
2006
2004
2002
2000
1998
1996
1994
1992
1990
1988
1986
1984
1982
1980
1978
1976
1974
1972
1970
1968
Year

Appendix C: Historical Aerial Photograph Record (1950 – 2010)

Year 1950

No precipitation data available

Date Map Created: 01 November 2011

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.

SW 4-54-3-5

SE 4-54-3-5

E 32-53-3-5

NW 33-53-3-5

RR33

SW 34-53-3-5

SE 34-53-3-

NW 27-53-3-5

NE 27-53-3-

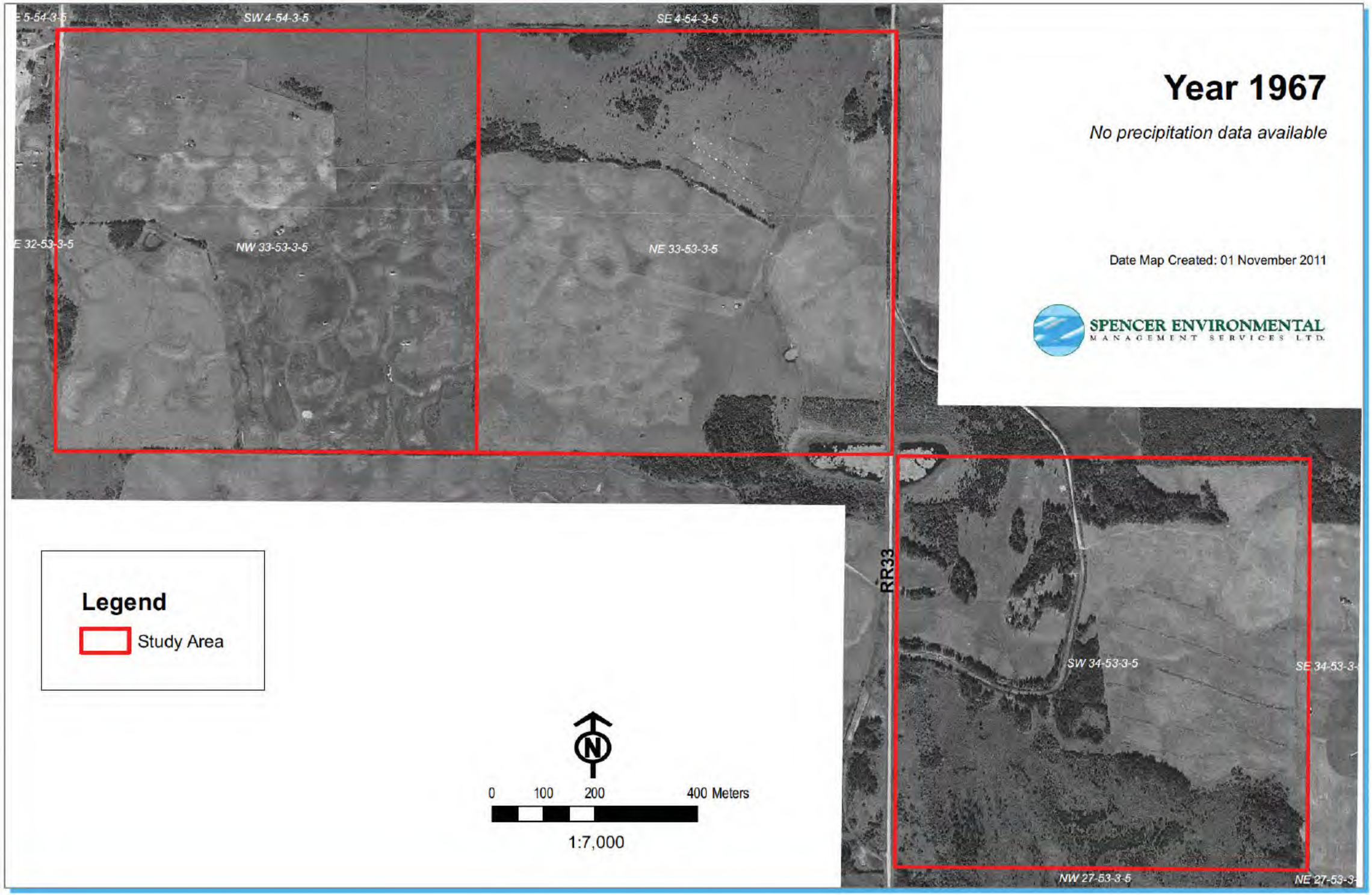
Legend

Study Area

N

0 100 200 400 Meters

1:7,000



Year 1967

No precipitation data available

Date Map Created: 01 November 2011

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.

July 1973

Year following slightly below-average precipitation year

Date Map Created: 01 November 2011

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.

SW 4-54-3-5

SE 4-54-3-5

E 32-53-3-5

NW 33-53-3-5

NE 33-53-3-5

RR33

SW 34-53-3-5

SE 34-53-3-5

NW 27-53-3-5

NE 27-53-3-5

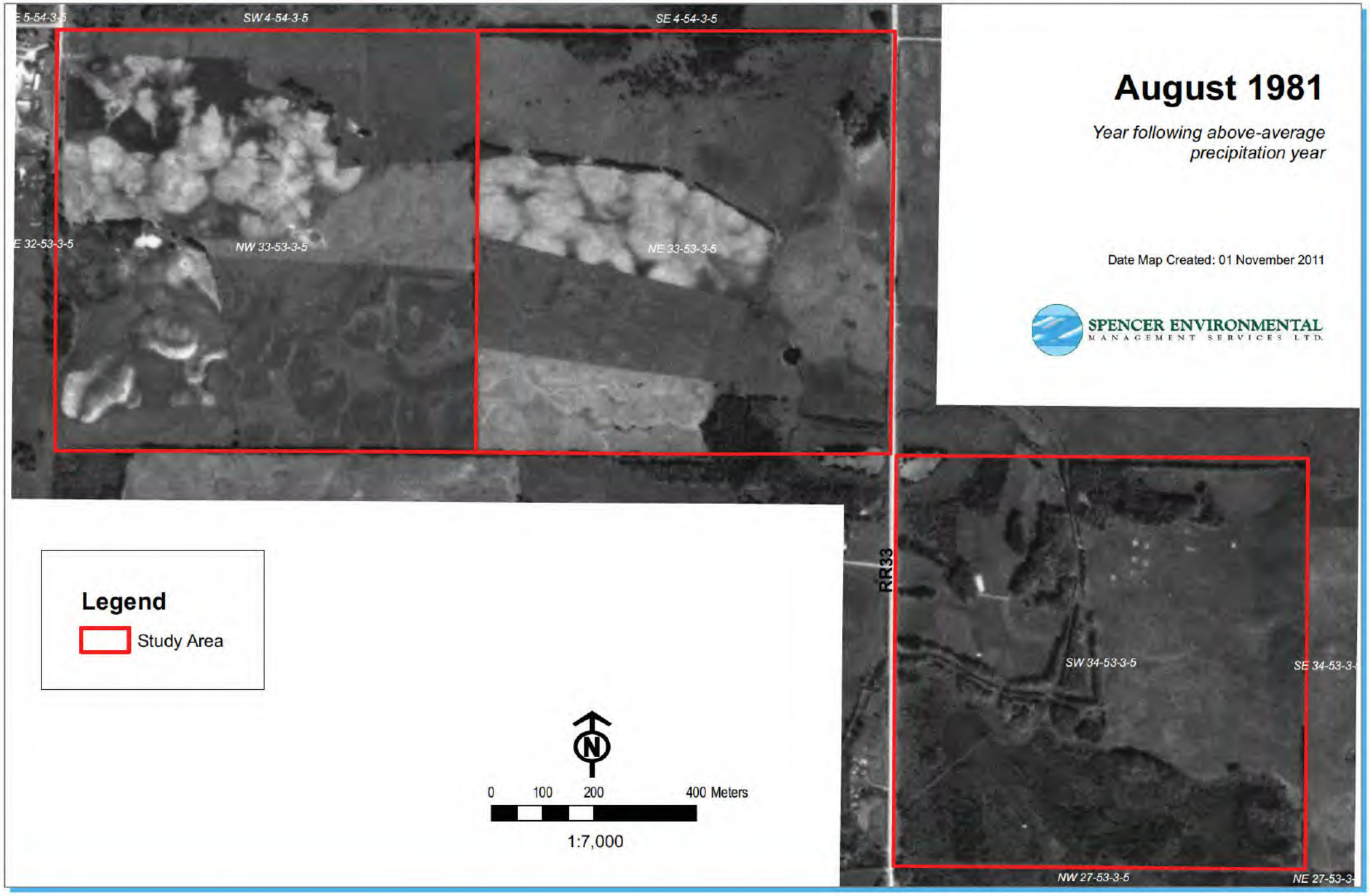
Legend

Study Area

N

0 100 200 400 Meters

1:7,000



August 1981

Year following above-average precipitation year

Date Map Created: 01 November 2011

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.

June 1990

Year following above-average precipitation year

Date Map Created: 01 November 2011

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.

SW 4-54-3-5

SE 4-54-3-5

NW 33-53-3-5

NE 33-53-3-5

SW 34-53-3-5

NW 27-53-3-5

RR33

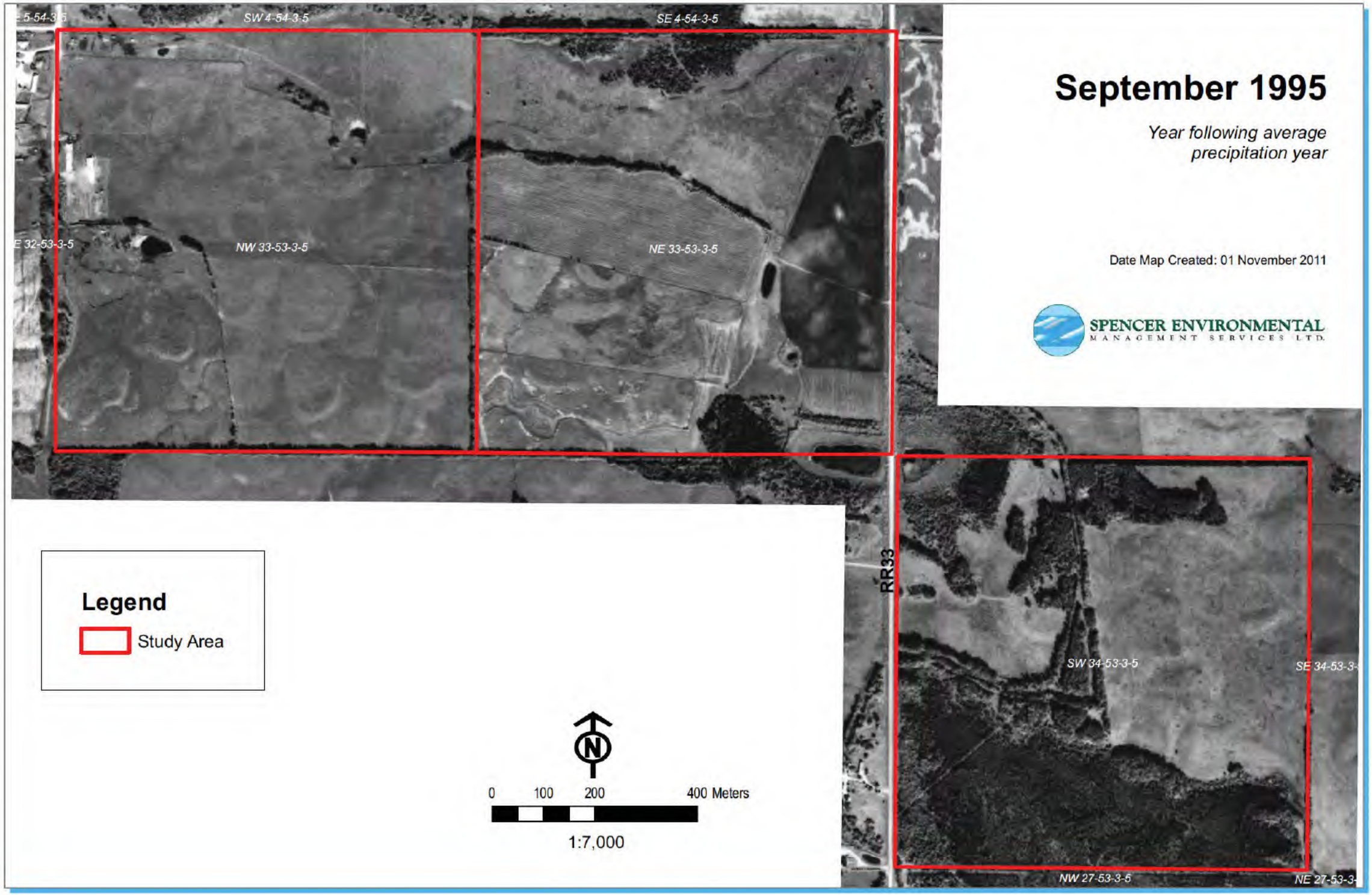
Legend

Study Area

N

0 100 200 400 Meters

1:7,000



September 1995

Year following average precipitation year

Date Map Created: 01 November 2011

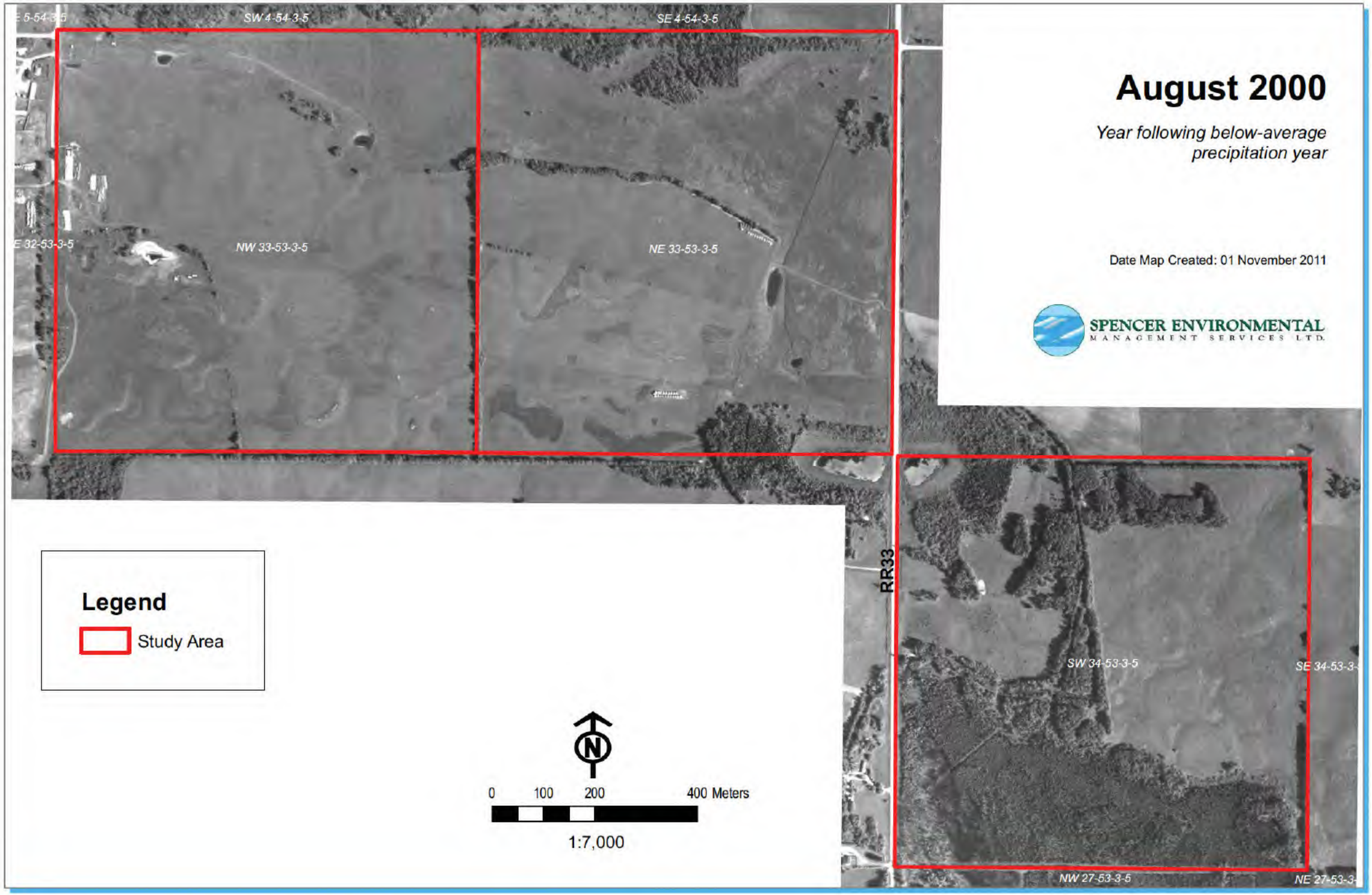
SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.

August 2000

Year following below-average precipitation year

Date Map Created: 01 November 2011

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.



Legend

Study Area

N

0 100 200 400 Meters

1:7,000

Year 2009

No precipitation data available

Date Map Created: 01 November 2011

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.

SW 4-54-3-5

SE 4-54-3-5

NW 33-53-3-5

RR33

SW 34-53-3-5

SE 34-53-3-

NW 27-53-3-5

NE 27-53-3-

Legend

Study Area

N

0 100 200 400 Meters

1:7,000

Appendix D: Wetland Community Site Notes for Select Sites (2010)

2010 Vegetation Survey Field Notes

Site #	Notes
10	Phalaris arundinacea, Taraxacum officinale and Trifolium hybridum; weedy; mowed
13	Phalaris arundinacea with Taraxacum officinale in slightly higher areas
14	Phalaris arundinacea with Taraxacum officinale in slightly higher areas; dotted with patches of Shallow Marsh
15	Phalaris arundinacea, Trifolium hybridum, Taraxacum officinale
21	Polygonum amphibium, Poa pratense, Taraxacum officinale, Trifolium pratense, Sonchus uliginosus and large areas of Phalaris arundinacea
48	Carex microptera, Trifolium hybridum, Phleum pratensis, Taraxacum officinale, Poa palustris and clumps of Phalaris arundinacea
49	Phalaris arundinacea, Bromus inermis, Trifolium hybridum, Taraxacum officinale
50	Medicago sativa, Bromus inermis, Phalaris arundinacea, Poa palustris, Carex canescens(?)
51	Phalaris arundinacea with Cirsium arvense in slightly raised areas
113	weedy old pasture with damaged Populus balsamifera over Bromus inermis, Urtica dioica, Agropyron repens and Phalaris arundinacea, plus scattered Salix bebbiana

Appendix E: Plant Species Inventory (2011)

	Scientific Name (ACIMS)	Common Name \ Site#	001a	001b	004	005	006	007	008	009	011	012	016	018	019	020	022	023	024	025	025	027	029	030	032	032	032	032	033	034	035	036	037	039	040	041	042	043	044	045	100	101	102	103	104	# of Sites
	TREES																																													
1 Tree	*Betula neoalaskana*	Alaska birch												A		O										O	R								O	R	D	R	R				D	O	11
1 Tree	*Larix laricina*	tamarack	R		D									D					O	O	D														D			D					O	9
1 Tree	*Picea glauca*	white spruce														R				O		D	O	O														D				R		7
1 Tree	*Picea mariana*	black spruce			O																D		O												D			D				D		6
1 Tree	*Pinus contorta*	lodgepole pine																																	R										1
1 Tree	*Populus balsamifera*	balsam poplar	R				D	D					O						O			D	A			R	D			O					D									11
1 Tree	*Populus tremuloides*	aspen					D	D	A				O									A	D												D									7
	SHRUBS																																												
2 SHRB	*Larix laricina*	tamarack																																			R							F	2
2 SHRB	*Oxycoccus microcarpus*	small bog cranberry																																										O	1
2 SHRB	*Rosa woodsii*	common wild rose																																						R						1
2 Shrub	*Alnus incana ssp. tenuifolia*	river alder																		O						A	O																	3
2 Shrub	*Amelanchier alnifolia*	saskatoon						A								O							O				R																	4
2 Shrub	*Betula neoalaskana*	Alaska birch		R	O				D							O			O	D				A												D	O		O			D	11
2 Shrub	*Betula pumila*	dwarf birch														D			O					O												O							O	5
2 Shrub	*Cornus stolonifera*	red-osier dogwood							R							O				O			O												O		R	F/A	O					8
2 Shrub	*Corylus cornuta*	beaked hazelnut						D															O																					2
2 Shrub	*Ledum groenlandicum*	common Labrador tea																			F														R	F/D	D	R	F				F/D	D	8
2 Shrub	*Lonicera dioica*	twining honeysuckle		O																			O												F			O						5
2 Shrub	*Lonicera involucrata*	bracted honeysuckle														F/A					O		O			F	D	A							D	O/A	O/A	F/D	O						11
2 Shrub	*Picea glauca*	white spruce														R							F/D												R							O		4
2 Shrub	*Picea mariana*	black spruce																																			O	R					F	3
2 Shrub	*Populus balsamifera*	balsam poplar																					F			O	O	O		O		F					O						7
2 Shrub	*Populus tremuloides*	aspen										R				R							D				R	O				R			A		R					R		9
2 Shrub	*Ribes americanum*	wild black currant								O											F	O	R			O		O		O							R		O				9
2 Shrub	*Ribes glandulosum*	skunk currant																		A						A																	2
2 Shrub	*Ribes oxyacanthoides*	northern gooseberry	R		O		O		O							O				A		O	F/A			F	A	D		O					O		F	O				R		16
2 Shrub	*Ribes triste*	wild red currant						F	O							R				O			O				O								O		R							8
2 Shrub	*Rosa acicularis*	prickly rose						D															F/A			R	O								F	O	R		R					8
2 Shrub	*Rubus idaeus*	wild red raspberry						O	D				O			F/D				D	O		O	O/A		D	F	O								O		O/A	O		O		R		16
2 Shrub	*Salix bebbiana*	beaked willow	R	R								R	O			D	O		O														R	D	R		R	O		O		O		14
2 Shrub	*Salix discolor*	pussy willow	R	R					O				O	O		D			D	D			D	O		D	O	O									R	F/A		O				16
2 Shrub	*Salix lucida*	shining willow														O																	R											2
2 Shrub	*Salix maccalliana*	velvet-fruited willow																																O											1
2 Shrub	*Salix myrtillifolia*	myrtle-leaved willow																																		O									1
2 Shrub	*Salix pedicellaris*	bog willow																	O/A																										1
2 Shrub	*Salix petiolaris*	basket willow											O			D			O/A	O				O					O	R		R	R	O			O/A		O			O		13
2 Shrub	*Salix planifolia*	flat-leaved willow				O							O			D									O								R				R		O		F/D		9
2 Shrub	*Salix pseudomonticola*	false mountain willow																																		O									1
2 Shrub	*Salix pyrifolia*	balsam willow											O						O															O			O		O		O		7
2 Shrub	*Salix sp.*	willow														D	O																	D							O		4
2 Shrub	*Sambucus racemosa*	red elderberry												O/A							R																							2
2 Shrub	*Shepherdia canadensis*	Canada buffaloberry																					O												O									2
2 Shrub	*Symphoricarpos albus*	snowberry																					O/A				O								F									3
2 Shrub	*Vaccinium myrtilloides*	common blueberry																																		O								R	2
2 Shrub	*Vaccinium vitis-idaea*	bog cranberry																																		F/A	F		O				O	F	5
2 Shrub	*Viburnum edule*	low-bush cranberry																					O												O									2
	FORBS																																												
3 Forb	*Achillea millefolium*	common yarrow			R			R					F				R						O						R	R			R		O		O	R		O		R		13
3 FORB	*Achillea sibirica*	many-flowered yarrow																																				R					R		2
3 Forb	*Actaea rubra*	red and white baneberry					O																O				O								O									4
3 Forb	*Adoxa moschatellina*	moschatel			F				O/A							F/D				O/A	D					O																	6
3 Forb	*Alisma plantago-aquatica*	broad-leaved water-plantain								R															R																			2
3 FORB	*Anemone cylindrica*	long-fruited anemone																					O																					1
3 FORB	*Antennaria rosea*	rosy everlasting																																						R						1
3 Forb	*Aralia nudicaulis*	wild sarsaparilla						O															O												D			R						4
3 Forb	*Arnica chamissonis*	leafy arnica						D																					O				R		F	O					F			6
3 Forb	*Aster ciliolatus*	Lindley's aster		O												O							F/A															R		O				5
3 Forb	*Aster modestus*	large northern aster																																							R				1
3 Forb	*Aster puniceus*	purple-stemmed aster												O		O			O	O									O	R		F/A	O				O		O			O	11
3 Forb	*Aster sp.*	aster		O												O								F														O		R				5
3 Forb	*Axyris amaranthoides*	Russian pigweed	F	F		O								R																														4
3 Forb	*Calla palustris*	water arum													D	F		F	O															F											5
3 Forb	*Callitriche verna*	vernal water-starwort								F/D	O																	R					O/A							F/A				5
3 Forb	*Caltha natans*	floating marsh-marigold																					D																					1
3 Forb	*Caltha palustris*	marsh-marigold							R				O	F/A		F			O		O								O/A		A		O	F				D	F/A	R					13
3 Forb	*Cardamine pensylvanica*	bitter cress	R	O	F									R														R		R				F						R				8
3 Forb	*Cerastium vulgatum*	common mouse-ear chickweed		O										R																									R					3
3 Forb	*Chenopodium album*	lamb's-quarters				O											O																											2
3 Forb	*Chrysosplenium iowense*	golden saxifrage																		R	R																							2
3 Forb	*Cicuta maculata*	water-hemlock																															F	O				O		O	R			5
3 Forb	*Circaea alpina*	small enchanter's nightshade			O																O					O										R								4
3 Forb	*Cirsium arvense*	creeping thistle	A	D		F/A	A		O	O				D								O	R	A	O		F/A	R	O/A	O	O	O	O					D	O					20

	Scientific Name (ACIMS)	Common Name \ Site#	001a	001b	004	005	006	007	008	009	011	012	016	018	019	020	022	023	024	025	025	027	029	030	032	032	032	032	033	034	035	036	037	039	040	041	042	043	044	045	100	101	102	103	104	# of Sites
	Scientific Name (ACIMS)	**Common Name \ Site#**	**001a**	**001b**	**004**	**005**	**006**	**007**	**008**	**009**	**011**	**012**	**016**	**018**	**019**	**020**	**022**	**023**	**024**	**025**	**025**	**027**	**029**	**030**	**032**	**032**	**032**	**032**	**033**	**034**	**035**	**036**	**037**	**039**	**040**	**041**	**042**	**043**	**044**	**045**	**100**	**101**	**102**	**103**	**104**	**# of Sites**
3 FORB	*Coeloglossum viride*	bracted bog orchid																					R																							1
3 FORB	*Corallorhiza maculata*	spotted coralroot																																			O								R	2
3 Forb	*Cornus canadensis*	bunchberry						O															F/A												O	O/A			R					R	6
3 Forb	*Descurainia sophia*	flixweed	O	O																																										2
3 Forb	*Disporum trachycarpum*	fairybells																					O												0										2
3 Forb	*Epilobium angustifolium*	common fireweed						A				O/D											O													O		R	R					O	7
3 Forb	*Epilobium palustre*	marsh willowherb																R																												1
3 Forb	*Erigeron philadelphicus*	Philadelphia fleabane		R																													R				R								3
3 Forb	*Erysimum cheiranthoides*	wormseed mustard																												O															1
3 Forb	*Eurybia conspicua*	showy aster																					O												F										2
3 Forb	*Fragaria virginiana*	wild strawberry	R	R				O					F/D	O		O							F/A			R									F/A		R	O	R	O				R	14
3 Forb	*Galeopsis tetrahit*	hemp-nettle			D	A			O/A	O			O/D	F/D			F/A			D		A				A						A	O				R		O					14
3 Forb	*Galium boreale*	northern bedstraw						D					O/A										F										R		F									R		6
3 FORB	*Galium labradoricum*	Labrador bedstraw											O	O																								F		R				R		5
3 Forb	*Galium trifidum*	small bedstraw																F	O													O	R					R	R						6
3 Forb	*Galium triflorum*	sweet-scented bedstraw			O											O					O		O				O								O			O					R		8
3 Forb	*Geum aleppicum*	yellow avens	O											O		O			O	O			O	O		F	F	O		O	F	O		O				O		O	O		O		18
3 Forb	*Geum macrophyllum*	large-leaved yellow avens												R																																1
3 Forb	*Gnaphalium uliginosum*	low cudweed								O																																			1
3 Forb	*Heracleum lanatum*	cow parsnip							D							F							O					F	R				R		O			O						8
3 Forb	*Hieracium aurantiacum*	orange hawkweed										O		O															R														F/A		4
3 Forb	*Hieracium umbellatum*	narrow-leaved hawkweed										O											O																						2
3 Forb	*Impatiens noli-tangere*	western jewelweed			O?A																																								1
3 Forb	*Impatiens sp.*	jewelweed							D					F/D		F/D				D	D					F/A	F/A																			7
3 Forb	*Kochia scoparia*	summer-cypress	R																																											1
3 Forb	*Lathyrus ochroleucus*	cream-colored vetchling						F															O												O										3
3 Forb	*Lemna minor*	common duckweed																							D																					1
3 Forb	*Linnaea borealis*	twinflower																					O												O	O/A	O/D	R	F/D						6
3 Forb	*Lycopus uniflorus*	northern water-horehound										O/D		O		O			R																			R		F						6
3 Forb	*Lysimachia thyrsiflora*	tufted loosestrife										O	O	O		O			R													O					O	R	O				O		10
3 Forb	*Maianthemum canadense*	wild lily-of-the-valley						F								O							O													O										4
3 Forb	*Mentha arvensis*	wild mint							O	O						F		O	O	O			O			O	O					F/A	F	R			O		O	A					15
3 FORB	*Menyanthes trifoliata*	buck-bean														O/A																														1
3 Forb	*Mertensia paniculata*	tall lungwort						F	O											O			O			R									O										6
3 Forb	*Mitella nuda*	bishop's-cap												O/A		O/A				O/D						R	O									O	O		R	F/A						9
3 FORB	*Moehringia lateriflora*	blunt-leaved sandwort																					O																						1
3 FORB	*Orthilia secunda*	one-sided wintergreen																																										R		1
3 Forb	*Osmorhiza depauperata*	spreading sweet cicely																			R		R				F																		3
3 Forb	*Petasites frigidus var. palmatus*	palmate-leaved coltsfoot						O																											O		O/A			O			O		5
3 Forb	*Petasites frigidus var. sagittatus*	arrow-leaved coltsfoot																		O				F/A					O/A			F/A	O			O	R	O	R	F		O		11
3 Forb	*Petasites frigidus var. x vitifolius*	vine-leaved coltsfoot	R											O									R/A												O										4
3 Forb	*Plantago major*	common plantain		O								O		F																			R						R				R		6
3 Forb	*Platanthera hyperborea*	northern green bog orchid																															R				O	R							3
3 Forb	*Polygonum amphibium*	water smartweed											F	O	O															D									D			A			6
3 Forb	*Polygonum lapathifolium*	pale persicaria								R																																			1
3 FORB	*Potentilla anserina*	silverweed																														O													1
3 Forb	*Potentilla norvegica*	rough cinquefoil		O																O												O						R				R		5
3 Forb	*Potentilla palustris*	marsh cinquefoil												O		F			F														R					O	R	R					7
3 Forb	*Pyrola asarifolia*	common pink wintergreen														R							F													F						R			4
3 Forb	*Ranunculus abortivus*	small-flowered buttercup			O																																R			O	R				4
3 Forb	*Ranunculus acris*	tall buttercup		F									D	O																															3
3 Forb	*Ranunculus macounii*	Macoun's buttercup								R															O				O			O	R								O		R		7
3 Forb	*Rubus arcticus*	dwarf raspberry	R	O								O/A	F/D	F/A		F			O	O				O										O		O/A	O/A	O	R	F/A			O		16
3 Forb	*Rubus chamaemorus*	cloudberry																																		F/A	D						O	D	4
3 Forb	*Rubus pubescens*	dewberry						O								O							R											O/A			O							5
3 Forb	*Rumex crispus*	curled dock																R	O													R							R		O			5
3 Forb	*Rumex occidentalis*	western dock														O													O	O		O					R						5
3 Forb	*Rumex sp.*	dock																	O																										1
3 Forb	*Rumex triangulivalvis*	narrow-leaved dock																											O												O				2
3 Forb	*Scutellaria galericulata*	marsh skullcap								O						O		O		O							O		R				F	O	R			O		O	O				12
3 FORB	*Senecio pauperculus*	balsam groundsel											O																															R		2
3 FORB	*Silene pratensis*	white cockle							O					R								F	R	O																					5
3 Forb	*Sium suave*	water parsnip								O						R		O	O													O/F	O	O											7
3 Forb	*Smilacina trifolia*	three-leaved Solomon's-seal													F					R																D	F		O				R/A	F	7
3 Forb	*Solidago canadensis*	Canada goldenrod											O																			R					O	R							4
3 Forb	*Sonchus uliginosus*	smooth perennial sow-thistle	O											F/A																									A			O			4
3 Forb	*Stachys palustris*	marsh hedge-nettle										R	O			O												O	R																5
3 Forb	*Stellaria longifolia*	long-leaved chickweed										O		O		O													R									R	O	R			O		8
3 Forb	*Stellaria media*	common chickweed	F	O										F/D														R																	4
3 Forb	*Taraxacum officinale*	common dandelion	A	A		O	D	O		O		R	F/D	F/A		O	D		O	F		A	D	A	F/A	R	O	F	F/A			O			O			R	A		F/A			26
3 Forb	*Trifolium hybridum*	alsike clover		O								O		F/A									D												O										4
3 Forb	*Trifolium pratense*	red clover								O			F/D										O		O	O									F/A					R	R				8
3 Forb	*Urtica dioica*	common nettle	O		D				D							O	D			D	O	A			O	D	D	D			O	O	O					O						16
3 Forb	*Vicia americana*	wild vetch						O						F/A		O							F				O		R				R		O										8
3 Forb	*Viola canadensis*	western Canada violet																		O/A	A		O																						3
3 FORB	*Viola palustris*	marsh violet														O/A																							R	R	R					4
3 Forb	*Viola renifolia*	kidney-leaved violet														O																			O	O		R							4

	Scientific Name (ACIMS)	Common Name \ Site#	001a	001b	004	005	006	007	008	009	011	012	016	018	019	020	022	023	024	025	025	027	029	030	032	032	032	032	033	034	035	036	037	039	040	041	042	043	044	045	100	101	102	103	104	# of Sites
3.3Pter	**PTERIDOPHYTES**																																													
4 Pter	*Dryopteris carthusiana*	narrow spinulose shield fern			O															O	O					O															R				5
4 Pter	*Equisetum arvense*	common horsetail							R				O			F				O						O		O						O	O			R		O			O		11
4 Pter	*Equisetum fluviatile*	swamp horsetail													O	F			F/D															O				F/A		O			O		7
4 PTER	*Equisetum palustre*	marsh horsetail																																			O								1
4 Pter	*Equisetum pratense*	meadow horsetail							R											F							O				O		O	R	O							R		8
4 Pter	*Equisetum sylvaticum*	woodland horsetail																																		R	R					O	O	4
4.4 GRAM	**GRAMINOIDS**																																												
5 Gram	*Alopecurus aequalis*	short-awned foxtail																							A																				1
5 Gram	*Alopecurus pratensis*	meadow foxtail		D		O/A				O																																			3
5 Gram	*Beckmannia syzigachne*	slough grass																							O				O/A													A				3
5 Gram	*Bromus inermis ssp. inermis*	smooth brome						D	D		O/D						D						F		O/A	O/A	F	F/D					R						O					11
5 Gram	*Calamagrostis canadensis*	bluejoint						D		R		O/D				F/D			F/A					O		O/A	F/A				D	F/D	D	D	O	R	F/D	D	F	O/D	D	O	O	D		22
5 Gram	*Carex aquatilis*	water sedge		F/A								O/D	O		F/D	O		D	F/D										F							O	F/A			F	D			O	13
5 Gram	*Carex atherodes*	awned sedge								D																			F/A	D	D	D	D										A			7
5 Gram	*Carex bebbii*	Bebb's sedge										R	R																					R											3
5 Gram	*Carex brunnescens*	brownish sedge																																		O		O	O						O	4
5 Gram	*Carex canescens*	hoary sedge																																			O		O					O	R	4
5 GRAM	*Carex capillaris*	hair-like sedge																																			R									1
5 Gram	*Carex deweyana*	Dewey's sedge																								O									R	O									3
5 Gram	*Carex disperma*	two-seeded sedge																																			F		O					O		3
5 GRAM	*Carex interior*	inland sedge																																			F		O							2
5 GRAM	*Carex leptalea*	bristle-stalked sedge																																					O							1
5 GRAM	*Carex loliacea*	rye-grass sedge																																										R		1
5 Gram	*Carex microptera*	small-winged sedge																																								R	R				2
5 GRAM	*Carex peckii*	Peck's sedge					O																																							1
5 Gram	*Carex stipata*	awl-fruited sedge																															R													1
5 Gram	*Carex trisperma*	three-seeded sedge																																		F		O						F	3
5 Gram	*Carex utriculata*	small bottle sedge								D					O/D	A		D	D					F/A					F					O				F		F	F	O	D			13
5 GRAM	*Carex vaginata*	sheathed sedge																																				O	O	O/A							3
5 Gram	*Cinna latifolia*	drooping wood-reed																			F/A																									1
5 Gram	*Eleocharis palustris*	creeping spike-rush																															R													1
5 Gram	*Elytrigia repens var. repens*	quack grass		O/D						D	O/A															O/D		O/D													F/D	D	O/A			8
5 Gram	*Eriophorum vaginatum*	sheathed cotton grass																																		R	F							O	3
5 Gram	*Festuca rubra*	red fescue										**O**	O	O									**O**						**R**									F				R		7
5 Gram	*Festuca* sp.	fescue species																																							O						1
5 Gram	*Glyceria borealis*	northern manna grass																							D			D					R/D												3
5 Gram	*Glyceria grandis*	common tall manna grass																							D				D			F	F/A	O							R	D	O/A			8
5 GRAM	*Glyceria pulchella*	graceful manna grass																										O																		1
5 GRAM	*Glyceria striata*	fowl manna grass												O																													O	O		R		4
5 Gram	*Hordeum jubatum*	foxtail barley																															R													1
5 Gram	*Leymus innovatus*	hairy wild rye																					O																							1
5 Gram	*Phalaris arundinacea*	reed canary grass	D	O/A	F/A	O/A				O/D	D	D	O	O/D	O/A		R			O									O/D	D	D		O							F/D					17
5 Gram	*Phleum pratense*	timothy			D							O/A	D												O	O	R		F				R						O	O	O				11
5 GRAM	*Poa compressa*	Canada bluegrass												O																																1
5 Gram	*Poa palustris*	fowl bluegrass								F/D	F	A		D					O	F					A	F/A		O	D	D	F	D	D					F	R	D	D	A	D	A		21
5 Gram	*Poa pratensis*	Kentucky bluegrass	D	D		D	D			F/D				D			A					D	D	D		F/A	F/A	O	A	O			O/A		O					F	F/A	F/A	O/A			21
5 Gram	*Schizachne purpurascens*	purple oat grass																					F																							1
5 Gram	*Scirpus microcarpus*	small-fruited bulrush		O						R																							R					R						4
5 Gram	*Typha latifolia*	common cattail													D			D																												2
5.5 Bryo	**BRYOPHYTES**																																													
6 Bryo	*Aulacomnium palustre*	tufted moss																																			O/A							O	2
6 Bryo	*Hylocomium splendens*	stair-step moss																																		O			A						2
6 Bryo	*Pleurozium schreberi*	Schreber's feathermoss																																		D			D						2
6 Bryo	*Polytrichum piliferum*	hairmoss																																			F/A									1
6 Bryo	*Sphagnum spp.*	sphagnum																																		O	D							F/D	3
6.6 Lich	**LICHENS**																																												
7 Lich	*Cladina mitis*	reindeer lichen																																		F/A									1
7 Lich	*Cladina rangiferina*	reindeer lichen																																		O									1
7 Lich	*Cladina stellaris*	reindeer lichen																																		O									1
7 Lich	*Cladonia spp.*	cladonia																																		O									1
	# of Species	**207**	**24**	**28**	**18**	**11**	**10**	**25**	**22**	**24**	**7**	**22**	**31**	**41**	**10**	**56**	**12**	**12**	**30**	**35**	**20**	**13**	**62**	**18**	**16**	**35**	**32**	**26**	**29**	**20**	**11**	**25**	**42**	**22**	**49**	**36**	**46**	**56**	**37**	**55**	**23**	**17**	**12**	**49**	**27**	
	192 species found in wetlands																																												
		SITE NUMBER	001a	001b	004	005	006	007	008	009	011	012	016	018	019	020	022	023	024	025	025	027	029	030	032	032	032	032	033	034	035	036	037	039	040	041	042	043	044	045	100	101	102	103	104	totals
		TOTAL SPECIES RICHNESS	24	28	18	11	10	25	22	24	7	22	31	41	10	56	12	12	30	35	20	13	62	18	16	35	32	26	29	20	11	25	42	22	49	36	46	56	37	55	23	17	12	49	27	**1196**
		TOTAL NON-NATIVE SPECIES	7	11	2	6	2	2	4	7	2	5	5	13	0	1	4	1	2	2	0	4	6	3	5	6	4	5	4	1	1	3	6	0	2	0	0	1	1	9	3	4	2	3	0	**149**
		TOTAL NATIVE SPECIES	17	17	16	5	8	23	18	17	5	17	26	28	10	55	8	11	28	33	20	9	56	15	11	29	28	21	25	19	10	22	36	22	47	36	46	55	36	46	20	13	10	46	27	**1047**
		% NON NATIVE SPECIES	29%	39%	11%	55%	20%	8%	18%	29%	29%	23%	16%	32%	0%	2%	33%	8%	7%	6%	0%	31%	10%	17%	31%	17%	13%	19%	14%	5%	9%	12%	14%	0%	4%	0%	0%	2%	3%	16%	13%	24%	17%	6%	0%	**12%**

Appendix F: Alberta Beach Granular Pre-Disturbance Soil Characterization (Navus, 2011)

ALBERTA BEACH GRANULAR
PRE-DISTURBANCE SOIL CHARACTERIZATION
N½ 33-053-03 W5M AND SW¼ 34-053-03 W5M

Prepared For:

Spencer Environmental Management Services Ltd
Suite 801, Capital Place
9707-110 Street,
Edmonton, Alberta
T5K 2L9

Prepared By:

Navus Environmental Inc.
Suite 207, 8711 – 50th Street
Edmonton, Alberta
T6B 1E7

June 2011

Alberta Beach Granular Pre-Disturbance Soil Characterization

N½ 33-053-03 W5M And SW¼ 34-053-03 W5M

Prepared For:

Spencer Environmental Management Services Ltd
Suite 801, Capital Place
9707-110 Street,
Edmonton, Alberta
T5K 2L9

Prepared By:

Navus Environmental Inc.
Suite 207, 8711 – 50th Street
Edmonton, Alberta
T6B 1E7

This information redacted as per Protection of Privacy Act (POPA)

FOR O. Stephen Abioye, M.Sc., A.I.T.
Project Coordinator

June 27, 2011
Date

This information redacted as per Protection of Privacy Act (POPA)

June 27, 2011
Date

Project Manager, Report Review

TABLE OF CONTENTS

1.0 INTRODUCTION ---- **1**

1.1 Objectives ---- *1*

2.0 BACKGROUND INFORMATION ---- **1**

2.1 Geological Characteristics ---- *1*

2.2 Topography and Soils ---- *2*

2.3 Vegetation ---- *2*

3.0 ASSESSMENT PROTOCOL ---- **3**

3.1 Methods of Soil Assessment ---- *3*

4.0 RESULTS ---- **4**

4.1 Landscape ---- *4*

4.2 Soil Assessment ---- *4*

5.0 CONCLUSIONS ---- **5**

6.0 REFERENCES ---- **7**

7.0 LIMITATIONS ---- **8**

LIST OF FIGURES

Figure 1. Test Pit Locations

LIST OF TABLES

Table 1. Soil Characterization

LIST OF APPENDICES

Appendix A. Site Photographs

1.0 INTRODUCTION

Spencer Environmental Management Services Limited retained Navus Environmental Inc. (Navus) to complete a pre-disturbance soil survey at N½ 33-053-03 W5M and SW¼ 34-053-03 W5M; the site of a proposed granular extraction project. It is located approximately 6 km south of Alberta Beach and Val Quentin, Alberta within Lac Ste. Anne County. The soil survey work was completed between May 31, 2011 and June 1, 2011 by Stephen Abioye and Kevin Renkema. This document provides a description of the site, methods used and results of the soil assessment.

1.1 Objectives

The objectives of the assessment are presented as follows:

- Assess topsoil and subsoil (B-horizon) depth, texture, color, consistency and structure in both forested and cultivated areas
- Prepare a report

2.0 BACKGROUND INFORMATION

The *Natural Regions and Subregions of Alberta* map indicates the site is located in the Dry Mixedwood Subregion of the Boreal Forest Natural Region. July is generally the warmest month with a mean temperature of 15.9 °C and January is generally the coldest month with a mean temperature of -16.8 °C. Maximum precipitation occurs in July with a total mean annual precipitation of 461 mm. Land use in the region is predominantly forestry and oil and gas, coal mining, recreation, grazing and agriculture (Natural Regions Committee, 2006).

2.1 Geological Characteristics

The Dry Mixedwood Natural Subregion comprises two distinct geological areas, mainly the undulating plains and hummocky uplands in central Alberta, and the level to gently rolling plains of the northern Peace River and Vermilion Lowlands. The bedrock formations in these two distinct areas include upper cretaceous sandstone, shale and siltstone formations. Surficial materials are moderately fine textured, moderately calcareous glacial till in central Alberta. Glaciofluvial sands and organic deposits (10%) with minor inclusions of glaciolacustrine materials also persist. Comparatively, the Peace River and Vermilion

Lowlands are predominatly comprised of textured glaciolacustrine and "lacustro-till" materials with glaciofluvial and eolian sands (15%). Organic deposits (10%) and small portions of glacial till are also present (Natural Regions Committee, 2006).

Wyatt et al. (1930) classified surficial deposits in Lac Ste. Anne County as residual deposits (formed by erosion processes of the underlying strata), unsorted glacial moraine (common in the northeast corner of the county), resorted glacial drift (deposited along old glacial drainage courses) and transported deposits (by running water and wind). Beneath the surficial materials lies the Lower Scollard Formation, which has a maximum thickness of 35 m. Underlying the Lower Scollard Formation is the Upper, Middle and Lower Horseshoe Canyon Formation, which has a maximum thickness of 350 m. The Bearpaw Formation underlies the Horseshoe Canyon Formation, and the Oldman Formation is found beneath the Bearpaw Formation (The Groundwater Centre, 2008).

2.2 Topography and Soils

In general, the topography of Lac Ste. Anne County is uneven and ranges from level, to undulating and rolling. Considerable portions of the area are occupied by lakes. Wyatt et al. (1930) reported an east-west trend in the drainage system, suggesting that the Chip Lake, Isle Lake and Lake St. Anne could have at one time, occurred as a long, narrow, continuous body of water. Although, wetlands are very numerous in the area, the natural drainage was considered good (Wyatt et al., 1930).

Four soil series are found on the assessed site (*Alberta Soil Information Viewer*, Government of Alberta, 2007), these soils are dominantly Dark Gray Luvisol (Uncas and Keephills soil series), Orthic Gray Luvisols (Hoadley soil series), and Organic soils (Golden spike soil series). The soils materials were believed to have developed mainly from Glaciofluvial, fluvial and lacustrine parent materials.

2.3 Vegetation

Lac Ste. Anne County is predominately cultivated with land used for annual crops, forages or tame pasture. Pockets of aspen forests with understory's consisting of low bush cranberry,

prickly rose, Canada buffaloberry are common throughout the county as well as fens vegetated with black spruce and tamarack. Aspen forests typically are found on fine textured Gray and Dark Gray Luvisols while black spruce and tamarack are found on organic soils (Willoughby et al., 2004).

3.0 ASSESSMENT PROTOCOL

Navus completed the field assessment between May 31st, 2011 and June 1st, 2011. Weather conditions were good with no frost and no snow on the ground. The site was used for tame pasture, annual crops (seeded just prior to the assessment) or was forested. Travel via an all terrain vehicle (ATV) left no ruts in the fields.

3.1 Methods of Soil Assessment

The site consisted of three quarter sections (64 ha each). Sampling was done along east-west transects in each quarter section. Topsoil assessment points were placed at 100 m intervals along each transect, and transects were spaced 100 m apart. Sixty four points per quarter section were assessed; a survey intensity level of 1 per ha (Figure 1). Subsoil assessment points were taken at approximately 200 m intervals or at every other topsoil assessment point; a survey intensity level of 1 per 2 ha. A Garmin GPSMAP® 60Cx was used to orientate transects and to determine assessment point location.

A shovel was used to dig pits for topsoil assessment points. Topsoil pits were dug to a minimum of 15 cm below the depth of the topsoil. A 2" hand-auger was used to assess the subsoil (B-horizon). Soil brought up by the hand-auger was used to assess the subsoil characteristics. Subsoil was characterized to the depth of the B-horizon or to a maximum depth of 1.2 m (maximum depth of the hand-auger). Subsoil was assessed for upland landscapes containing mineral topsoil. Detailed subsoil characteristics were assessed underneath organic soils only when the organic soil depth was shallow. The majority of organic soil depths were augered to a depth < 120 cm; however, few assessment points were hand augered past 120 cm to determine the maximum depth of organic soil in the area.

The Canadian System of Soil Classification (Soil Classification Working Group, 1998) was employed to characterize and document the topsoil and subsoil (B horizon) depth, texture, consistency, structure, moisture and color at each sample point. The Munsell ® Soil Color Charts were used to describe soil colour. Landscape characteristics including slope expression, percent slope, surface stoniness and land use were recorded at all sample locations. The soil profile and landscape was photographed at select assessment points. Photographs have been included in Appendix A.

4.0 RESULTS

4.1 Landscape

The site was dominantly used for pasture and annual crops with forested areas typically along the perimeter of each quarter section. The site was predominately level (0.5 to 2% slope) but undulating areas that had very gentle slopes (2 to 5%) were common. Surface stoniness ranged from nonstony in areas with organic soil to very stony in the cultivated and pasture areas. No evidence of erosion (rills or gullies) was noted at any of the assessment points. Ponding was observed in low areas with organic soils.

4.2 Soil Assessment

One hundred and fifteen sample locations contained mineral topsoil. Topsoil (mineral soil) was dominantly loam textured, friable, granular, moist with depths ranging from 10 to 50 cm with a mean of 22.5 cm (Table 1). The dominant color for mineral topsoil was very dark brown (10YR 2/2). Topsoil depths were generally deeper in low lying areas, near fence lines and edges of the forested areas. Shallower topsoil depths were observed on hill tops and on the sides of hills. One quarter section was not significantly different from another. The average volume of topsoil is 258,750 m^3.

Seventy five sample locations had organic soil. Organic soils were found in relatively level areas that were forested (black spruce, tamarack) or used for pasture. The depth of organic soil varied from 30 cm to 200 cm. Twenty one sample points had depths recorded to only 120 cm, at these locations that actual depth would vary between 120 cm and 200 cm. The average organic soil depth is 102 cm using 120 cm as the total depth for assessment points with depth

ranges recorded as 0-120+. The average volume of organic soil is approximately 765,000 m^3.

Subsoil (B-horizon) was dominantly clay loam textured, subangular blocky, friable, moist with depths ranging from 10 to 110 cm with a mean of 60.9 cm (Table 1). The dominant color for the subsoil ranged between light brownish gray to dark grayish brown (10 YR 6/2 to 10YR 4/2). The average volume of subsoil on upland landscapes is approximately 700,360 m^3.

5.0 CONCLUSIONS

For effective soil salvage in this area, all topsoil must be salvaged for the purpose of post-disturbance reconstruction and reclamation. Stripping of topsoil and stockpiling will likely be required. An average of 22.5 cm of topsoil will need to be stripped from areas where surface soil exists. In the isolated areas where organic soil is present, greater stripping depths will be required (50 cm+). Topsoil depths on the hilltops and side slopes are shallower versus the lower areas; therefore, stripping soil on hilltops and side slopes requires more attention. Care should be taken not to mix the upper subsoil (clay loam) with the topsoil during stripping. Topsoil stripping should not occur when the soil is either extremely dry or very moist or saturated.

Subsoil (B-horizon) will need to be stripped from areas where it is present. Areas with deep organic soils (120+ cm) may not have a B-horizon that is suitable for reclamation. Subsoil will need to be salvaged at an average depth of 54 cm. B-horizon can be distinguished by from the C-horizon by the presence of carbonates in the C-horizon and a slight colour change (C-horizon is lighter brown and/or gray than the B-horizon).

Topsoil, organic soil and subsoil should be stockpiled in regions where water saturation will likely not occur. Saturated conditions could degrade soil quality through increased anaerobic soil conditions and through loss of soil structure. The three different reclamation materials (topsoil, organic soil and subsoil) should be segregated for future use. Locations of stockpiles should be documented for future purposes. Additionally, to prevent loss of soil quantity and

quality, stockpiles should be revegetated. Species selected should be based on the climatic conditions of the region and soil physical properties noted. The species should be competitive enough to prevent encroachment of potential weeds. If certain species of an area want to be conserved for future revegtetation (i.e. upland forest topsoil) then topsoil from those areas should be handled separately with additional care.

6.0 REFERENCES

Alberta Municipal Affairs, 2009. Government of Alberta. 2009 Official Population List, Alberta. 2 pp.

Government of Alberta. January, 2007. *Alberta Soils Information Viewer*. <http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag10372>. Accessed on 29 November 2010.

Hydrogeological Consultants 1999. Lac Ste. Anne County. Parts of the North Saskatchewan and Athabasca Basins. Parts of Tp 053, R 01 to 09, W5M. Regional Groundwater Assessment. Prepared for Lac Ste. Anne County

Macyk, T.M., L.K. Brocke, J. Fujikawa, J.C. Hermans and D. McCoy. 1987. Soil Quality Criteria Relative to Disturbance and Reclamation. Conservation and Development Branch, Alberta Agriculture. Edmonton, Alberta. 56 pp.

Natural Regions Committee 2006. Natural Regions and Subregions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852.

Soil Classification Working Group. 1998. The Canadian System of Soil Classification. NRC Research Press. Ottawa, Ontario. 187 pp.

The Groundwater Centre. Accessed June 2011. http://www.tgwc.com/ (c) MOW-TECH LTD.

Willoughby, M.G., C. Stone, C. Hincz, D. Moisey, G. Ehlert, and D. Lawrence. 2004. Guide To Range Plant Community Types and Carrying Capacity for the Dry and Central Mixedwood Subregions in Alberta: Fourth Approximation. Alberta Sustainable Resource Development, Public Lands and Forests Division.

Wyatt, F.A., J.D. Newton and T.H. Mather, 1930. Soil Survey of St. Anne Sheet. University of Alberta Bulletin No. 20. April, 1930.

7.0 LIMITATIONS

This report has been prepared for the sole benefit of Spencer Environmental Management Services Ltd. This document may not be used by any other person or entity, with the exception of Alberta Environment and Alberta Sustainable Resource Development, without the express written consent of Navus Environmental Inc. (Navus) and Spencer Environmental Management Services Ltd. Any use of this report by a third party, or any reliance on decisions made based on it, or damages suffered as a result of the use of this report are the sole responsibility of the user.

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted scientific practices current at the time the work was performed. The conclusions and recommendations presented represent the best judgement of Navus based on the data obtained during the assessment. Due to the nature of the assessment and the data available, Navus cannot warrant against undiscovered environmental liabilities. Conclusions and recommendations presented in this report should not be considered legal advice.

N

Legend

- Test Pit Location

0 0.1 0.2 0.5km

Scale 1 : 15 000

N1/2 Sec. 33 and SW Sec 34 Twp 05 Rg 03 W5M

navus ENVIRONMENTAL **Test Pit Locations**

DRAWN:	APPROVED:	DATE:	FIGURE:
AD	SA	JUN 7/11	1
FILE: 33and34-053-03 W5M.dwg			

NOTE:
Testhole locations surveyed by Navus (GPS).

Table 1. Pre-Disturbance Soil Characterization
Spencer Environmental Management Services Ltd.
Assessment Date: May 31 - June 1, 2011

Assessment Point	Quarter Section	UTM NAD83			Topsoil Characteristics						Subsoil Characteristics						Landscape Characteristics				Comments
		Easting	Northing	Zone	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Surface Stoniness	Slope Expression	Slope (%)	Land Use	Additional Soil Information
001	NW33-053-03 W5M	672310	5945316	11	0-15	Loam	Friable	Granular	Moist	10YR 2/2	15-100	Clay Loam	Firm	SBK*	Moist	10YR 4/4	S1 - S2	Slightly Undulating	0-0.5	Pasture	
002	NW33-053-03 W5M	672411	5945319	11	0-20	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S1 - S2	Slightly Undulating	0-0.5	Pasture	
003	NW33-053-03 W5M	672511	5954320	11	0-20	Loam	Friable	Granular	Moist	10YR 2/2	20-70	Clay Loam	Friable	SBK	Moist	10YR 4/2	S2 - S3	Slightly Undulating	0-0.5	Pasture	
004	NW33-053-03 W5M	672611	5945316	11	0-120+	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S2 - S3	Level	0-0.5	Pasture	10 cm Ap on the surface
005	NW33-053-03 W5M	672711	5945318	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	Moist	10YR 6/4	S1 - S2	Level	0-0.5	Pasture	
006	NW33-053-03 W5M	672811	5945319	11	0-120+	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0 -S1	Level	0-0.5	Pasture	
007	NW33-053-03 W5M	672910	5945321	11	0-120+	Organic Soil		-	Moist	10YR 2/2		-	-	-	Moist	10YR 6/4	S0 -S1	Level	0-0.5	Pasture	
008	NW33-053-03 W5M	673012	5945318	11	0-120+	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0 -S1	Level	0-0.5	Pasture	
009	NW33-053-03 W5M	672313	5945220	11	0-25	Loam	Friable	Granular	Moist	10YR 2/2	-	-	Friable	SBK	Moist	-	S0 -S1	Slightly Undulating	0.5-2	Annual Crop	
010	NW33-053-03 W5M	672413	5945220	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 2/2	25-60	Clay Loam	Friable	SBK	Moist	10YR 6/2	S2 - S3	Slightly Undulating	0.5-2	Annual Crop	
011	NW33-053-03 W5M	672513	5945220	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S2 - S3	Undulating	0.5-2	Annual Crop	
012	NW33-053-03 W5M	672613	5945220	11	0-35	Silty Loam	Friable	Granular	Moist	10YR 3/3	35-65	Clay Loam	Friable	SBK	Moist	10YR 6/1	S0	Undulating	0.5-2	Annual Crop	Lower slope, mottled subsoil
013	NW33-053-03 W5M	672713	5945221	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S2 - S3	Undulating	0.5-2	Annual Crop	
014	NW33-053-03 W5M	672813	5945221	11	0-40	Organic Soil		-	Moist	10YR 3/3	40-105	Clay Loam	Firm	SBK	Moist	10YR 7/1	S2 - S3	Undulating	0.5-2	Pasture	
015	NW33-053-03 W5M	672913	5945221	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
016	NW33-053-03 W5M	676012	5945220	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
017	NW33-053-03 W5M	673032	5945122	11	0-110	Organic Soil		-	Moist	10YR 4/3	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
018	NW33-053-03 W5M	672927	5945119	11	0-40	Organic Soil		-	Moist	10YR 3/1	40-100	Clay Loam	Friable	SBK	Moist	10YR 5/4	S0-S1	Slightly Undulating	0-0.5	Pasture	
019	NW33-053-03 W5M	672825	5945119	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S1	Undulating	0-0.5	Pasture	
020	NW33-053-03 W5M	672732	5945124	11	0-23	Loam	Friable	Granular	Moist	10YR 6/2	23-90	Clay Loam	Friable	SBK	Moist	10YR 3/2	S3	Undulating	0.5-2	Annual Crop	Coarse fragments and mottles
021	NW33-053-03 W5M	672624	5945121	11	0-17	Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S3	Undulating	0.5-2	Annual Crop	
022	NW33-053-03 W5M	672534	5945123	11	0-20	Loam	Friable	Granular	Moist	10YR 3/2	20-100	Clay Loam	Firm	SBK	Moist	10YR 3/3	S3-S4	Undulating	0.5-2	Annual Crop	
023	NW33-053-03 W5M	672431	5945123	11	0-120+	Organic Soil		-	Moist	10YR 3/2	-	-	-	-	-	-	S0	Level	0-0.5	Annual Crop	
024	NW33-053-03 W5M	672332	5945116	11	0-20	Loam	Friable	Granular	Moist	10YR 3/2	20-110	Clay Loam	Firm	SBK	Moist	10YR 4/2	S3	Undulating	0.5-2	Farmyard	
025	NW33-053-03 W5M	673014	5945020	11	0-20	Loam	Friable	Granular	Moist	10YR 6/2	20-40	Clay	Firm	SBK	Moist	10YR 4/1	S3-S4	Undulating	0.5-2	Farmyard	Mottled Subsoil
026	NW33-053-03 W5M	672914	5945020	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 4/3	-	-	-	-	-	-	S3-S4	Undulating	0.5-2	Annual Crop	
027	NW33-053-03 W5M	672814	59450202	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 3/3	15-50	Clay	Friable	SBK	Moist	10YR 6/1	S3-S4	Undulating	0.5-2	Annual Crop	Lower slope; mottled subsoil
028	NW33-053-03 W5M	672613	5945020	11	0-20	Clay Loam	Friable	Granular	Moist	10YR 4/3	-	-	-	-	-	-	S3	Undulating	0.5-2	Annual Crop	
029	NW33-053-03 W5M	672613	5945023	11	0-25	Loam	Friable	Granular	Moist	10YR 3/3	25-80	Clay	Firm	SBK	Moist	10YR 5/4	S3	Undulating	0.5-2	Annual Crop	
030	NW33-053-03 W5M	672531	5945020	11	0-20	Loam	Friable	Granular	Moist	-	-	-	-	-	-	-	S3-S4	Undulating	0-0.5	Annual Crop	
031	NW33-053-03 W5M	672428	5945023	11	0-17	Loam	Friable	Granular	Moist	-	17-110	Clay	Firm	SBK	Moist	-	S3-S4	Undulating	0-0.5	Annual Crop	
032	NW33-053-03 W5M	672330	5945021	11	0-12	Clay Loam	Friable	Granular	Moist	-	-	-	-	-	-	-	S3-S4	Undulating	0-0.5	Annual Crop	20% Coarse fragments in subsoil
033	NW33-053-03 W5M	672383	5944918	11	0-30	Silty Loam	Friable	Granular	Moist	10YR 2/1	30-90	Silty Loam	Friable	SBK	Moist	10YR 7/1	S3	Undulating	0.5-2	Pasture	
034	NW33-053-03 W5M	672483	5944918	11	-	Slough	-	-	Wet	-	-	-	-	-	-	-	-	-	-	-	
035	NW33-053-03 W5M	672584	5944919	11	0-22	Loam	Friable	Granular	Moist	10YR 3/2	22-100	Clay Loam	Friable	SBK	Moist	10YR 4/2	S3	Undulating	0.5-2	Annual Crop	
036	NW33-053-03 W5M	672679	5944922	11	0-23	Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S3	Undulating	0.5-2	Annual Crop	
037	NW33-053-03 W5M	672782	5944919	11	0-21	Silty Loam	Friable	Granular	Moist	10YR 3/2	21-90	SCL	Firm	SBK	Moist	10YR 5/4	S3	Undulating	0.5-2	Annual Crop	Mottled Subsoil
038	NW33-053-03 W5M	672882	5944923	11	0-30	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2-S3	Undulating	0.5-2	Annual Crop	
039	NW33-053-03 W5M	672987	5944922	11	0-40	Loam	Friable	Granular	Moist	10YR 2/1	40-120	SCL	Friable	SBK	Moist	10YR 5/4	S3	Undulating	0.5-2	Annual Crop	Mottled Subsoil
040	NW33-053-03 W5M	673053	5944917	11	0-20	Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Annual Crop	
041	NW33-053-03 W5M	672347	5944820	11	0-45	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
042	NW33-053-03 W5M	672447	5944820	11	0-130+	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
043	NW33-053-03 W5M	672548	5944820	11	0-70	Organic Soil		-	V.Wet	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
044	NW33-053-03 W5M	672647	5944821	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 6/2	20-55	Silty Loam	Friable	SBK	Moist	10YR 7/1	S0	Slightly Undulating	0.5-2	Pasture	
045	NW33-053-03 W5M	672847	5944820	11	0-15	Silty Loam	Friable	Granular	Dry	10YR 6/4	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
046	NW33-053-03 W5M	672847	5944820	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 6/2	15-50	Sandy Clay	Friable	SBK	Moist	10YR 6/4	S0	Slightly Undulating	0.5-2	Pasture	
047	NW33-053-03 W5M	672947	5944820	11	0-20	Silty Loam	Firm	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
048	NW33-053-03 W5M	673047	5944820	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 6/2	15-40	Silty Loam	Friable	SBK	Moist	10YR 6/4	S0	Slightly Undulating	0.5-2	Pasture	
049	NW33-053-03 W5M	673060	5944716	11	0-30	Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	
050	NW33-053-03 W5M	672965	5944716	11	0-15	Loam	Friable	Granular	Moist	10YR 3/1	15-50	Silty Loam	Friable	SBK	Moist	10YR 4/2	S2	Undulating	0.5-2	Pasture	
051	NW33-053-03 W5M	672855	5944719	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
052	NW33-053-03 W5M	672764	5944720	11	0-20	Loam	Friable	Granular	Moist	10YR 2/2	20-100	Clay Loam	Friable	SBK	Moist	10YR 4/2	S2	Undulating	0.5-2	Pasture	
053	NW33-053-03 W5M	672660	5944718	11	0-15	Loam	Friable	Granular	Dry	10YR 3/3	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	
054	NW33-053-03 W5M	672560	5944727	11	0-20	Sandy Loam	Friable	Granular	Moist	10YR 2/2	20-110	Clay Loam	Friable	SBK	Moist	10YR 6/2	S2	Undulating	0.5-2	Pasture	
055	NW33-053-03 W5M	672562	5944721	11	0-30	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S2	Slightly Undulating	0.5-2	Pasture	
056	NW33-053-03 W5M	672364	5944724	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
057	NW33-053-03 W5M	673047	5944620	11	0-25	Silty Loam	Friable	Platy	Moist	10YR 6/2	25-45	Clay	Friable	Platy	Moist	10YR 6/2	S0	Undulating	0.5-2	Pasture	
058	NW33-053-03 W5M	672947	5944621	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
059	NW33-053-03 W5M	672847	5944621	11	0-30	Silty Loam	Friable	Granular	Moist	10YR 6/2	30-80	Clay	Firm	SBK	Moist	10YR 6/2	S0	Undulating	0.5-2	Pasture	
060	NW33-053-03 W5M	672748	5944620	11	0-100	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
061	NW33-053-03 W5M	672647	5944620	11	0-30	Silty Loam	Friable	Granular	Moist	10YR 2/2	30-70	Clay Loam	Friable	SBK	Moist	10YR 6/2	S0	Slightly Undulating	0.5-2	Pasture	
062	NW33-053-03 W5M	672547	5944619	11	0-20	Sandy Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
063	NW33-053-03 W5M	672449	5944620	11	0-15	Loam	Friable	Granular	Moist	10YR 3/3	15-70	Clay Loam	Friable	SBK	Moist	10YR 5/4	S0	Slightly Undulating	0.5-2	Pasture	
064	NW33-053-03 W5M	672347	5944620	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	

**SBK=Subangular blocky*

Table 1 (Continued). Pre-Disturbance Soil Characterization
Spencer Environmental Management Services Ltd.
Assessment Date: May 31 - June 1, 2011

Assessment Point	Quarter Section	UTM NAD83			Topsoil Characteristics						Subsoil Characteristics						Landscape Characteristics				Comments
		Easting	Northing	Zone	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Surface Stoniness	Slope Expression	Slope (%)	Land Use	Additional Soil Information
065	NE33-053-03 W5M	673087	5945355	11	0-130	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	Moist	-	S0	Level	0-0.5	Pasture	
066	NE33-053-03 W5M	673187	5945348	11	0-80	Organic Soil		-	Wet	10YR 3/3	-	Sandy Loam	Friable	SBK*	Moist	10YR 6/2	S0	Level	0-0.5	Pasture	
067	NE33-053-03 W5M	673287	5945358	11	0-15	Silty Loam	Friable	Granular	Wet	10YR 3/3	15-65	Silty Clay	Friable	SBK	Moist	10YR 6/2	S0	Level	0-0.5	Pasture	
068	NE33-053-03 W5M	673387	5945318	11	0-15	Loam	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
069	NE33-053-03 W5M	673487	5945352	11	0-100	Organic Soil		-	Wet	10YR 3/3	-	Clay Loam	Friable	SBK	Moist	10YR 6/2	S0	Level	0-0.5	Pasture	
070	NE33-053-03 W5M	673587	5945359	11	0-120	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
071	NE33-053-03 W5M	673687	5945379	11	0-110	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
072	NE33-053-03 W5M	673787	5945380	11	0-80	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
073	NE33-053-03 W5M	673091	5945254	11	0-30	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
074	NE33-053-03 W5M	673192	5945251	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
075	NE33-053-03 W5M	673293	5945251	11	0-30	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
076	NE33-053-03 W5M	673390	5945253	11	0-110	Organic Soil		-	Moist	10YR 2/2	-	Silty Clay	Friable	SBK	Moist	10YR 7/1	S0	Level	0-0.5	Pasture	
077	NE33-053-03 W5M	673490	5945249	11	0-35	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
078	NE33-053-03 W5M	673592	5945250	11	0-80	Organic Soil		-	Moist	10YR 2/2	-	SiCL	Friable	SBK	Moist	10YR 6/4	S0	Slightly Undulating	0-0.5	Pasture	
079	NE33-053-03 W5M	673690	5945248	11	0-30	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
080	NE33-053-03 W5M	673803	5945256	11	0-35	Loam	Friable	Granular	Moist	10YR 2/2	35-100	Clay Loam	Firm	SBK	Moist	10YR 5/2	S3	Undulating	0.5-2	Pasture	
081	NE33-053-03 W5M	673878	5945150	11	0-30	Loam	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
082	NE33-053-03 W5M	673778	5945149	11	0-30	Loam	Friable	Granular	Moist	10YR 3/3	30-75	Silty Loam	Friable	SBK	Moist	10YR 5/1	S0	Slightly Undulating	0-0.5	Pasture	
083	NE33-053-03 W5M	673678	5945154	11	0-110	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
084	NE33-053-03 W5M	673578	5945153	11	0-10	Loam	Friable	Granular	Moist	10YR 7/1	10-30	Sandy Loam	Friable	SBK	Moist	10YR 6/4	S0	Slightly Undulating	0-0.5	Pasture	
085	NE33-053-03 W5M	673478	5945164	11	0-130	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
086	NE33-053-03 W5M	673378	5945151	11	0-100	Organic Soil		-	Moist	10YR 2/2	-	Loam	Friable	SBK	Wet	10YR 3/2	S0	Slightly Undulating	0-0.5	Pasture	
087	NE33-053-03 W5M	673278	5945156	11	0-100	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
088	NE33-053-03 W5M	673178	5945158	11	0-100	Organic Soil		-	Moist	10YR 2/2	-	Silty Loam	Firm	SBK	Wet	10YR 7/1	S0	Slightly Undulating	0-0.5	Pasture	
089	NE33-053-03 W5M	673885	5945056	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
090	NE33-053-03 W5M	673785	5945060	11	0-30	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	20% Coarse fragments in Ae
091	NE33-053-03 W5M	673680	5945057	11	0-90	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
092	NE33-053-03 W5M	673583	5945060	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	20% Coarse fragments in Ae
093	NE33-053-03 W5M	673482	5945061	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 2/2	25-110	Clay Loam	Firm	SBK	Moist	10YR 4/1	S3	Undulating	0.5-2	Annual Crop	
094	NE33-053-03 W5M	673385	5945056	11	0-50	Silty Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Annual Crop	
095	NE33-053-03 W5M	673281	5945057	11	0-25	Silty Loam	Friable	Platy	Moist	10YR 2/2	25-110	Clay Loam	Firm	SBK	Moist	10YR 3/3	S2	Undulating	0.5-2	Annual Crop	
096	NE33-053-03 W5M	673180	5945053	11	0-35	Silty Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S1	Undulating	0.5-2	Annual Crop	
097	NE33-053-03 W5M	673137	5944952	11	0-50	Organic Soil		-	Moist	10YR 2/2	50-100	Silty Loam	Friable	SBK	Moist	10YR 6/2	S0	Undulating	0.5-2	Pasture	Water table close to surface
098	NE33-053-03 W5M	673237	5944942	11	0-10	Loamy Sand			Moist	10YR 7/1	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
099	NE33-053-03 W5M	673337	5944924	11	0-35	Silty Loam	Friable	Granular	Moist	10YR 7/1	35-100	Silty Clay	Friable	SBK	Moist	10YR 7/2	S0	Slightly Undulating	0.5-2	Pasture	
100	NE33-053-03 W5M	673437	5944904	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
101	NE33-053-03 W5M	673537	5944951	11	0-20	Silty Clay	Friable	Granular	Moist	10YR 6/2	20-60	Silty Clay	Friable	SBK	Moist	10YR 7/1	S0	Slightly Undulating	0.5-2	Annual Crop	
102	NE33-053-03 W5M	673637	5944955	11	0-15	Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Annual Crop	
103	NE33-053-03 W5M	673737	5944955	11	0-15	Loam	Friable	Granular	Moist	10YR 6/2	15-50	Silty Loam	Friable	SBK	Moist	10YR 7/1	S0	Slightly Undulating	0.5-2	Pasture	20% Coarse fragments in subsoil
104	NE33-053-03 W5M	673837	5944955	11	0-20	Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
105	NE33-053-03 W5M	673123	5944855	11	0-20	Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	
106	NE33-053-03 W5M	673226	5944856	11	0-35	Organic Soil		-	Moist	10YR 2/2	35-120	SCL	Firm	SBK	Moist	10YR 5/2	S2	Undulating	0.5-2	Pasture	
107	NE33-053-03 W5M	673325	5944853	11	0-25	SiL-Loam	Friable	Granular	Moist	10YR 4/2	-	-	-	-	-	-	S1-S2	Undulating	0.5-2	Pasture	
108	NE33-053-03 W5M	673429	5944855	11	0-25	Sandy Loam	Friable	Granular	Moist	10YR 6/2	25-120	Clay Loam	Firm	SBK	Moist	10YR 4/2	S1-S2	Undulating	0.5-2	Pasture	
109	NE33-053-03 W5M	673528	5944855	11	0-30	Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S1-S2	Undulating	0.5-2	Pasture	
110	NE33-053-03 W5M	673627	5944855	11	0-30	Loam	Friable	Granular	Moist	10YR 3/3	30-120	Clay Loam	Firm		Moist	10YR 3/3	S1-S2	Slightly Undulating	0.5-2	Pasture	
111	NE33-053-03 W5M	673732	5944852	11	0-35	Loam	Friable	SBK	Moist	10YR 6/8	-	-	-	-	-	-	S1-S2	Slightly Undulating	0.5-2	Pasture	
112	NE33-053-03 W5M	673833	5944852	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 3/2	25-100	Clay Loam	Firm	SBK	Moist	10YR 4/2	S1-S2	Slightly Undulating	0.5-2	Pasture	
113	NE33-053-03 W5M	673887	5944770	11	0-13	Silty Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
114	NE33-053-03 W5M	673787	5944770	11	0-25	Loam	Friable	Granular	Moist	10YR 3/2	25-100	Silty Clay	Firm	SBK	Moist	10YR 5/2	S0	Slightly Undulating	0-0.5	Pasture	
115	NE33-053-03 W5M	673687	5944770	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
116	NE33-053-03 W5M	673587	5944772	11	0-130	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
117	NE33-053-03 W5M	673487	5944768	11	0-50	Loam	Friable	Granular	Moist	10YR 3/2	50-100	Silty Clay	Firm	SBK	Moist	10YR 6/2	S0	Slightly Undulating	0.5-2	Pasture	
118	NE33-053-03 W5M	673388	5944771	11	0-20	Loam	Friable	Granular	Moist	10YR 3/2	20-100	Silty Clay	Firm	SBK	Moist	10YR 6/2	S0	Slightly Undulating	0.5-2	Pasture	20% Coarse fragments in subsoil
119	NE33-053-03 W5M	673287	5944772	11	0-15	Loam	Friable	Granular	Moist	10YR 3/1	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	Upper slope position
120	NE33-053-03 W5M	673187	5944746	11	0-25	Loam	Friable	Granular	Moist	10YR 2/2	25-100	Clay Loam	Firm	SBK	Moist	10YR 3/2	S1-S2	Undulating	0.5-2	Pasture	Upper slope position
121	NE33-053-03 W5M	673884	5944659	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
122	NE33-053-03 W5M	673782	5944660	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
123	NE33-053-03 W5M	673683	5944655	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
124	NE33-053-03 W5M	673579	5944650	11	0-80	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
125	NE33-053-03 W5M	673487	5944652	11	0-16	Loam	Friable	Granular	Moist	10YR 2/2	16-100	Clay Loam	Firm	SBK	Moist	10YR 4/2	S3	Undulating	0.5-2	Annual Crop	
126	NE33-053-03 W5M	673381	5944651	11	0-30	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Annual Crop	Lower slope position
127	NE33-053-03 W5M	673281	5944648	11	0-25	Loam	Friable	Granular	Moist	10YR 2/2	25-80	Clay Loam	Friable	SBK	Moist	10YR 4/1	S0	Undulating	0.5-2	Annual Crop	Lower slope position
128	NE33-053-03 W5M	673187	5944636	11	0-35	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Undulating	0.5-2	Annual Crop	Lower slope position

**SBK=Subangular blocky*

Table 1 (Continued). Pre-Disturbance Soil Characterization
Spencer Environmental Management Services Ltd.
Assessment Date: May 31 - June 1, 2011

Assessment Point	Quarter Section	UTM NAD83			Topsoil Characteristics						Subsoil Characteristics						Landscape Characteristics				Comments
		Easting	Northing	Zone	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Surface Stoniness	Slope Expression	Slope (%)	Land Use	Additional Soil Information
129	SW34-053-03 W5M	674946	5944565	11	-	Slough	-	-	Wet	-	-	-	-	-	-	-	-	-	-	-	
130	SW34-053-03 W5M	674046	5944570	11	0-130	Organic Soil		-	Wet	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
131	SW34-053-03 W5M	674145	5944563	11	0-120	Organic Soil		-	Moist	10YR 5/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
132	SW34-053-03 W5M	674245	5944555	11	0-30	Loam	Friable	SBK	Moist	10YR 5/1	-	-	-	-	-	-	S1	Undulating	0.5-2	Pasture	
133	SW34-053-03 W5M	674358	5944562	11	0-100	Organic Soil		-	Wet	10YR 5/3		-	-	-	-	-	S0	Undulating	0-0.5	Pasture	
134	SW34-053-03 W5M	674445	5944558	11	0-30	Loam	Friable	Granular	Moist	10YR 5/3	-	-	-	-	-	-	S1	Undulating	0-0.5	Pasture	
135	SW34-053-03 W5M	674546	5944562	11	0-30	Sandy Loam	Friable	Granular	Moist	10YR 5/3	30-80	Silty Loam	Firm	SBK*	Moist	10YR 4/2	S3-S4	Undulating	0.5-2	Pasture	
136	SW34-053-03 W5M	674660	5944566	11	0-30	Loam	Friable	Granular	Moist	10YR 2/2	30-80	Silty Loam	Friable	SBK	Moist	10YR 3/3	S3-S4	Undulating	0.5-2	Pasture	
137	SW34-053-03 W5M	673956	5944465	11	0-120+	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
138	SW34-053-03 W5M	674056	5944482	11	0-130+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
139	SW34-053-03 W5M	674156	5944470	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
140	SW34-053-03 W5M	674258	5944464	11	0-15	Loam	Friable	Granular	Moist	10YR 3/3	15-50	Sandy Loam	Firm	SBK	Moist	10YR 6/2	S2	Slightly Undulating	0.5-2	Forest	
141	SW34-053-03 W5M	674356	5944464	11	0-20	Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S2-S3	Slightly Undulating	0.5-2	Pasture	
142	SW34-053-03 W5M	674456	5944464	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S2-S3	Slightly Undulating	0.5-2	Pasture	
143	SW34-053-03 W5M	674557	5944469	11	0-20	Silty Clay	Firm	Granular	Moist	10YR 6/2	20-80	Silty Clay Loam	Firm	SBK	Moist	10YR 5/6	S0	Slightly Undulating	0.5-2	Pasture	
144	SW34-053-03 W5M	674656	5944466	11	0-20	Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
145	SW34-053-03 W5M	674688	5944364	11	0-20	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	
146	SW34-053-03 W5M	674583	5944360	11	0-15	Loam	Friable	Granular	Moist	10YR 2/2	15-70	Loamy Sand	Friable	SBK	Moist	10YR 6/2	S2	Undulating	2-5	Pasture	
147	SW34-053-03 W5M	674480	5944355	11	0-30	Silty Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	2-5	Pasture	
148	SW34-053-03 W5M	674382	5944358	11	0-10	Loam	Friable	Granular	Moist	10YR 2/2	10-120	Sandy Clay Loam	Friable	SBK	Moist	10YR 5/3	S2	Undulating	0.5-2	Pasture	
149	SW34-053-03 W5M	674280	5944355	11	0-15	Loam	Friable	Granular	Moist	10YR 5/3	-	-	-	-	-	-	S2	Slightly Undulating	0.5-2	Pasture	
150	SW34-053-03 W5M	674183	5944354	11	0-23	Silty Loam	Friable	Granular	Moist	10YR 4/1	23-110	Loam	Friable	SBK	Moist	10YR 5/2	S1-S2	Slightly Undulating	0.5-2	Pasture	
151	SW34-053-03 W5M	674084	5944366	11	0-25	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S0-S1	Slightly Undulating	0.5-2	Pasture	
152	SW34-053-03 W5M	673980	5944361	11	0-20	Clay Loam	Firm	SBK	Moist	10YR 3/2	20-80	Clay Loam	Firm	SBK	Moist	10YR 4/2	S1-S2	Undulating	0.5-2	Pasture	
153	SW34-053-03 W5M	674654	5944265	11	0-120+	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
154	SW34-053-03 W5M	674554	5944264	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
155	SW34-053-03 W5M	674454	5944265	11	0-15	Loam	Friable	Granular	Moist	10YR 6/2	15-70	Clay Loam	Firm	SBK	Moist	10YR 7/1	S0	Slightly Undulating	0.5-2	Pasture	
156	SW34-053-03 W5M	674354	5944265	11	0-20	Loamy Sand	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
157	SW34-053-03 W5M	674254	5944265	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 7/1	15-70	Sandy Clay Loam	Friable	SBK	Moist	10YR 6/6	S0	Slightly Undulating	0.5-2	Pasture	Carbonates and gravels in subsoil
158	SW34-053-03 W5M	674154	5944367	11	0-40	Silty Clay	Firm	Granular	Moist	10YR 7/1	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
159	SW34-053-03 W5M	674056	5944267	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 4/2	15-100	Clay Loam	Firm	SBK	Moist	10YR 7/1	S0	Undulating	0.5-2	Pasture	
160	SW34-053-03 W5M	673966	5944252	11	0-120+	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
161	SW34-053-03 W5M	673972	5944155	11	0-15	Loam	Friable	Granular	Moist	10YR 5/3	15-80	Clay Loam	Friable	SBK	Moist	10YR 5/3	S0-S1	Level	0-0.5	Forest	Disturbed soil
162	SW34-053-03 W5M	674064	5944161	11	0-100	Organic Soil		-	Moist	10YR 5/2	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
163	SW34-053-03 W5M	674150	5944168	11	0-25	Clay Loam	Friable	SBK	Moist	10YR 2/1	25-100	Clay Loam	Friable	SBK	Moist	10YR 3/3	S0-S1	Level	0-0.5	Forest	
164	SW34-053-03 W5M	674257	5944153	11	0-30	Clay Loam	Friable	Granular	Moist	10YR 4/2	30-120	Sandy Clay Loam	Firm	SBK	Moist	10YR 4/4	S1-S2	Slightly Undulating	0.5-2	Forest	
165	SW34-053-03 W5M	674372	5944155	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 2/2	25-100	Clay Loam	Firm	SBK	Moist	10YR 4/2	S2	Undulating	0.5-2	Pasture	
166	SW34-053-03 W5M	674460	5944160	11	0-15	Sandy Loam	Friable	Granular	Moist	10YR 5/3	-	-	-	-	-	-	S1-S2	Undulating	0.5-2	Pasture	
167	SW34-053-03 W5M	674580	5944161	11	0-25	Clay Loam	Friable	Granular	Moist	10YR 5/3	25-90	Clay Loam	Firm	SBK	Moist	10YR 4/2	S1-S2	Undulating	0.5-2	Pasture	
168	SW34-053-03 W5M	674668	5944154	11	0-18	Loam	Friable	Granular	Moist	10YR 5/3	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	
169	SW34-053-03 W5M	673979	5944052	11	0-100	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
170	SW34-053-03 W5M	674081	5944053	11	0-130	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
171	SW34-053-03 W5M	674179	5944055	11	0-130	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
172	SW34-053-03 W5M	674279	5944053	11	0-30	Loam	Friable	Granular	Wet	10YR 3/3	30-95	Loamy Sand	Friable	SBK	Moist	10YR 5/4	S0	Level	0-0.5	Forest	
173	SW34-053-03 W5M	674377	5944052	11	0-85	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
174	SW34-053-03 W5M	674479	5944052	11	0-20	Sandy Loam	Friable	Granular	Moist	10YR 5/3	20-95	Sandy Clay	Firm	SBK	Moist	10YR 5/2	S0	Slightly Undulating	0.5-2	Pasture	
175	SW34-053-03 W5M	674579	5944052	11	0-15	Loam	Friable	Granular	Moist	10YR 5/2	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
176	SW34-053-03 W5M	674679	5944052	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 5/2	25-35	Clay	Firm	SBK	Moist	10YR 5/2	S0	Undulating	0.5-2	Pasture	Admixing caused by ploughing
177	SW34-053-03 W5M	674700	5943952	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Forest	
178	SW34-053-03 W5M	674600	5943953	11	0-120+	Organic Soil		-	Moist	10YR 5/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
179	SW34-053-03 W5M	674501	5943952	11	0-120+	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
180	SW34-053-03 W5M	674400	5943955	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
181	SW34-053-03 W5M	674300	5943957	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
182	SW34-053-03 W5M	674200	5943953	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
183	SW34-053-03 W5M	674100	5943954	11	0-100	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
184	SW34-053-03 W5M	674000	5943953	11	0-200	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
185	SW34-053-03 W5M	674745	5943850	11	0-100	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S1-S2	Slightly Undulating	0.5-2	Forest	
186	SW34-053-03 W5M	674654	5943850	11	0-22	Silty Loam	Friable	Granular	Wet	10YR 2/1	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Forest	
187	SW34-053-03 W5M	674554	5943859	11	0-100	Organic Soil		-	Wet	10YR 2/2	-	Silty Loam	Friable	SBK	Wet	10YR 5/2	S0	Hummocky	0-0.5	Forest	
188	SW34-053-03 W5M	674457	5943856	11	0-80	Organic Soil		-	Wet	10YR 2/2	-	Silty Loam	Friable	SBK	Wet	10YR 5/2	S0	Hummocky	0-0.5	Forest	
189	SW34-053-03 W5M	674352	5943847	11	0-120+	Organic Soil		-	Wet	10YR 2/2	-	-	-	-	-	-	S0	Hummocky	0-0.5	Forest	
190	SW34-053-03 W5M	674256	5943854	11	0-120+	Organic Soil		-	Wet	10YR 2/2	-	-	-	-	-	-	S0	Hummocky	0-0.5	Forest	
191	SW34-053-03 W5M	674154	5943855	11	0-120+	Organic Soil		-	Wet	10YR 2/2	-	-	-	-	-	-	S0	Hummocky	0-0.5	Forest	
192	SW34-053-03 W5M	674044	5943849	11	0-120+	Organic Soil		-	Wet	10YR 2/2	-	-	-	-	-	-	S0	Hummocky	0-0.5	Forest	

*SBK=Subangular blocky

Photo 1. Viewing southeast from Pit 1 (NW-33-053-03 W5M).

Photo 2. Viewing southwest from Pit 8 (NW-33-053-03 W5M).

Photo 3. Viewing east from Pit 31 (NW-33-053-03 W5M).

Photo 4. Viewing north from Pit 31 (NW-33-053-03 W5M).

Photo 5. Viewing west from Pit 31 (NW-33-053-03 W5M).

Photo 6. Viewing south from Pit 31 (NW-33-053-03 W5M).

Photo 7. Viewing northwest from Pit 49 (NW-33-053-03 W5M).

Photo 8. Viewing northeast from Pit 64 (NW-33-053-03 W5M).

Photo 9. Viewing southwest from Pit 72 (NE-33-053-03 W5M).

Photo 10. Viewing east from Pit 93 (NE-33-053-03 W5M).

Photo 11. Viewing north from Pit 93 (NE-33-053-03 W5M).

Photo 12. Viewing west from Pit 93 (NE-33-053-03 W5M).

Photo 13. Viewing south from Pit 93 (NE-33-053-03 W5M).

Photo 14. Viewing northwest from Pit 121 (NE-33-053-03 W5M).

Photo 15. Viewing east from Pit 167 (SW-34-053-03 W5M).

Photo 16. Viewing north from Pit 167 (SW-34-053-03 W5M).

Photo 17. Viewing west from Pit 167 (SW-34-053-03 W5M).

Photo 18. Viewing south from Pit 167 (SW-34-053-03 W5M).

Photo 19. Viewing soil profile at Pit 93 (annual crop).

Photo 20. Viewing soil profile at pit 110 (pasture).

Photo 21. Viewing soil profile at Pit 167 (pasture).

Photo 22. Viewing soil profile at pit 186 (forested).

Appendix G: Special Status Wildlife Species with the Potential to Occur in the Study Area

Special Status Wildlife Species with the Potential to Occur in the Study Area

Common Name	Scientific Name	Provincial Status (General Status of AB Wild Species)	Wildlife Act Designation and New Species Assessed by ESCC (see Comments)	COSEWIC Designation	SARA Designation
Golden-winged Warbler	*Vermivora chrysoptera*	Accidental/Vagrant		Threatened	
Peregrine Falcon	*Falco peregrinus anatum*	At Risk	Threatened	Special Concern	Schedule 1 (Threatened)
Red Knot	*Calidris canutus*	May Be At Risk		Endangered	
Canadian Toad	*Bufo hemiophrys*	May Be At Risk	Data Deficient	Not at Risk	
Baird's Sparrow	*Ammodramus bairdii*	May Be At Risk		Not at Risk	
Long-tailed Weasel	*Mustela frenata*	May Be At Risk		Not at Risk	
Short-eared Owl	*Asio flammeus*	May Be At Risk		Special Concern	Schedule 3 (Special Concern)
Olive-sided Flycatcher	*Contopus cooperi*	Secure		Threatened	Schedule 1 (Threatened)
Forster's Tern	*Sterna forsteri*	Sensitive		Data Deficient	
Barn Swallow	*Hirundo rustica*	Sensitive		HP Candidate	
Wandering Garter Snake	*Thamnophis elegans*	Sensitive	LP Candidate	LP Candidate (SSC)	
Red-sided Garter Snake	*Thamnophis sirtalis*	Sensitive	LP Candidate	LP Candidate (SSC)	
Plains Garter Snake	*Thamnophis radix*	Sensitive	MP Candidate	MP Candidate (SSC)	
Grasshopper Sparrow	*Ammodramus savannarum*	Sensitive		MP Candidate (SSC)	
Bald Eagle	*Haliaeetus leucocephalus*	Sensitive		Not at Risk	
Northern Harrier	*Circus cyaneus*	Sensitive		Not at Risk	
Prairie Falcon	*Falco mexicanus*	Sensitive	Special Concern	Not at Risk	
Caspian Tern	*Sterna caspia*	Sensitive		Not at Risk	
Black Tern	*Chlidonias niger*	Sensitive		Not at Risk	
Northern Hawk Owl	*Surnia ulula*	Sensitive		Not at Risk	
Great Grey Owl	*Strix nebulosa*	Sensitive		Not at Risk	
Sedge Wren	*Cistothorus platensis*	Sensitive		Not at Risk	
American Badger	*Taxidea taxus taxus*	Sensitive	Data Deficient	Not at Risk	
Canada Lynx	*Lynx canadensis*	Sensitive		Not at Risk	
Northern Goshawk	*Accipiter gentilis atricapillus*	Sensitive		Not at Risk	
Western Toad	*Anaxyrus boreas*	Sensitive		Special Concern	Schedule 1 (Special Concern)
Rusty Blackbird	*Euphagus carolinus*	Sensitive		Special Concern	Schedule 1 (Threatened)
Sprague's Pipit	*Anthus spragueii*	Sensitive	Special Concern	Threatened	Schedule 1 (Threatened)
Canada Warbler	*Wilsonia canadensis*	Sensitive		Threatened	Schedule 1 (Threatened)
Bobolink	*Dolichonyx oryzivorus*	Sensitive		Threatened	see Comments
Common Nighthawk	*Chordeiles minor*	Sensitive		Threatened	Schedule 1 (Threatened)
Loggerhead Shrike	*Lanius ludovicianus excubitoride*	Sensitive	Special Concern	Threatened	Schedule 1 (Threatened)
Yellow Rail	*Coturnicops noveboracensis*	Undetermined		Special Concern	Schedule 1 (Special Concern)

Appendix G

Traffic Impact Assessment (December 2010)
Prepared by EBA Engineering Consultants Ltd.

1531486 Alberta Ltd.
c/o G & J Parking Lot Maintenance LP

ISSUED FOR USE

TRAFFIC IMPACT ASSESSMENT
GRAVEL PIT OPERATION
RANGE ROAD 33
PARKLAND COUNTY AND LAC STE. ANNE COUNTY

E32101266.001

December 2010

EBA Engineering Consultants Ltd.
p. 780.451.2121 • f. 780.454.5688
14940 - 123 Avenue • Edmonton, Alberta T5V 1B4 • CANADA

PAGE

1.0 INTRODUCTION 1

2.0 OBJECTIVE 1

3.0 METHODOLOGY 1

3.1 Task 1 – Project initiation Meeting, Data Compilation and Site Investigation 1

3.2 Task 2 – Analysis 2

3.3 Task 3 – Preparation of Report 2

4.0 EXISTING CONDITIONS 2

4.1 Site Location and Accesses 2

4.2 Gravel Pit Operation 3

4.3 Adjacent Roadway Network 4

4.3.1 Range Road 33 4

4.3.2 Intersection of Highway 16:12 and Range Road 33 4

4.4 Traffic Data 6

4.4.1 Available Data on Highway 16:12 6

4.4.2 Available Data on Range Road 33, South of Highway 633 6

4.4.3 Traffic Data at the Intersection of Highway 16 and Range Road 33 7

4.5 Safety Performance 7

5.0 DEVELOPMENT TRAFFIC 7

5.1 Traffic From Gravel Pit Operation 7

5.2 Traffic Distribution and Assignment 8

6.0 TRAFFIC IMPACTS 8

6.1 Projected Volumes 9

6.2 Local Road Standards – Highway Geometric Design Guide 9

6.3 Local Road Standards – Lac Ste. Anne County and Parkland County 9

6.4 Intersection analysis – Highway Geometric Design Guide 10

6.4.1 Intersection of Highway 16 and Range Road 33 10

6.4.2 Median Width of Highway 16 12

6.5 Intersection analysis – Highway Capacity Manual 12

6.5.1 Intersection Analysis – Background Conditions 12

6.5.2 Intersection Analysis – Combined Traffic Conditions 14

7.0 SUMMARY AND CONCLUSIONS 14

7.1 Background Conditions 14

7.2 Traffic Impacts 15
7.3 Required Improvements 15
8.0 CLOSURE 17

FIGURES

Figure 1 Location Plan
Figure 2 Air Photo
Figure 3 Figure: 2012 Background Traffic
Figure 4 Figure: 2032 Background Traffic
Figure 5 Figure: 2012 Background Traffic + Traffic from Gravel Pit Operation by 1531486 Alberta Ltd.
Figure 6 Figure: 2032 Background Traffic + Traffic from Gravel Pit Operation by 1531486 Alberta Ltd.
Figure 7 Figure: 2012 Background Traffic + Traffic from Gravel Pit Operation by Inland
Figure 8 Figure: 2032 Background Traffic + Traffic from Gravel Pit Operation by Inland
Figure 9 Figure: 2012 Background Traffic + Traffic from Gravel Pit Operations by 1531486 Alberta Ltd. and Inland
Figure 10 Figure: 2032 Background Traffic + Traffic from Gravel Pit Operations by 1531486 Alberta Ltd. and Inland

PHOTOGRAPHS

Site Photos

APPENDICES

Appendix A Intersection Plans
Appendix B Traffic Data
Appendix C Collision Data
Appendix D Intersection Analysis – Highway Geometric Design Guide
Appendix E Intersection Analysis – Synchro

1.0 INTRODUCTION

This report addresses the impact of the traffic generated from the proposed gravel pit operation along Range Road 33 on six quarter sections of land by 1531486 Alberta Ltd. close to the boundary of Parkland County and Lac Ste. Anne County. This report also considers the cumulative impact from an adjacent development by Inland Aggregates (Inland) on the adjacent roadway network.

This report identifies any existing deficiencies in the transportation infrastructure prior to commencement of gravel operations based on the traffic, geometric and collision data from available published sources, and visual observations and measurements during a site investigation. It examines issues, site access, possible impacts and expected changes in traffic volumes and composition, traffic conflicts, traffic behaviour (volume and capacity) due to the proposed gravel pit operation by 1531486 Alberta Ltd.

This report presents the impacts and improvements required to the adjacent road network due to the introduction of the proposed development by 1531486 Alberta Ltd. It also considers the cumulative impacts on the road network by the proposed development from Inland; however, details of Inland's operation are included in a separate traffic impact assessment. This report identifies recommendations and associated costs to implement them specific to the development proposed by 1531486 Alberta Ltd. while considering the adjacent proposed development by Inland.

2.0 OBJECTIVE

The main objectives of this study are to:

- identify deficiencies in the existing transportation infrastructure in the immediate vicinity of the site;
- identify the areas of traffic impact and expected changes in traffic volumes, composition and type within the study area;
- volume and capacity analysis at the intersection of Range Road 33 and Highway 16 adjacent to the proposed development; and
- provide recommendations and improvement options to address identified deficiencies.

3.0 METHODOLOGY

The assessment was undertaken through the completion of three tasks.

3.1 TASK 1 – PROJECT INITIATION MEETING, DATA COMPILATION AND SITE INVESTIGATION

This task included confirmation of the details of gravel pit operations which comprised of the duration of gravel pit operations, estimated tonnage per year, peak production year, typical payload per truck, seasonal variations in production quantities, hours of pit

operations, number of part-time/full-time employees located at the pit, and the destination market for the gravel. A project start up meeting was arranged by teleconference with 1531486 Alberta Ltd. representatives to confirm the proposed gravel pit operations.

This task involved compiling available traffic, geometric and collision information from known and reliable sources. Traffic data was available at the intersection of Highway 16 and Range Road 32 and at the intersection of Highway 16 and Range Road 35 from Alberta Transportation (AT). However, traffic data was not available along Range Road 33 or at the intersection of Highway 16 and Range Road 33 from AT, Parkland County or Lac Ste. Anne County. A traffic count was completed at the intersection of Highway 16 and Range Road 33 as a part of this study. The available traffic volumes and those obtained from the traffic count at the intersection of Highway 16 and Range Road 33 were used to perform volume and capacity analysis.

This task also included travel to the site, visual observations and minor on-site measurements.

3.2 TASK 2 – ANALYSIS

This task included establishing and analyzing the background traffic (volume and composition) on the existing surrounding network with respect to safety performance, traffic control, geometry and operation. The impacts of existing traffic volumes, additional traffic volume from the proposed gravel operation, and projected 20-year traffic growth on the surrounding network especially at the intersection of Highway 16 and Range Road 33 was analyzed following the intersection analysis procedures contained in AT's Highway Geometric Design Guide (1999). Detailed volume and capacity analysis using the Highway Capacity Manual (HCM 2000) was included in this work using the Synchro 7 analysis software. Improvements required to the roadway network due to existing traffic volumes, additional traffic from the proposed development, and projected traffic growth were determined in this task with a cost estimate of any required improvements.

3.3 TASK 3 – PREPARATION OF REPORT

This task included the documentation of the above tasks and presentation of a summary of the impacts and recommended improvements. The report also presents when the improvements are required, the cost associated with each recommended improvement and the party responsible to implement any improvements required.

4.0 EXISTING CONDITIONS

4.1 SITE LOCATION AND ACCESSES

1531486 Alberta Ltd. is planning to commence gravel pit operations in parcels of land on the six quarter sections listed below:

- NW28 53-3-W5;
- SE32 53-3-W5;
- NE32 53-3-W5;
- NW33 53-3-W5;
- NE33 53-3-W5; and
- SW34 53-3-W5.

Figure 1 shows the location plan of the proposed development. These six quarter sections are located close to the boundary of Parkland County and Lac Ste. Anne County. Figure 2 shows the six quarters sections proposed for the gravel pit operation by 1531486 Alberta Ltd. as well as the location of the proposed gravel pit operation by Inland in the adjacent area.

An access to the quarter section (SW34 53-3-W5) on the east side of Range Road 33 will be provided along the quarter line between NW34 and SW34. Site access to the remaining quarter sections will be provided from NE33 53-3-W5 with an internal road connecting the other quarter sections on the west side of Range Road 33. The destination market of the load from the gravel pit operation is Edmonton. It is anticipated that traffic from the proposed gravel pit will travel to Range Road 33 through the access roads and then travel along Range Road 33 in the southbound direction towards Highway 16. The traffic then will travel east along Highway 16 towards Edmonton.

4.2 GRAVEL PIT OPERATION

1531486 Alberta Ltd. is planning to commence gravel pit operations as early as 2011. The gravel operation could continue for as long as 20 years. The gravel pit is expected to operate 8 months per year for crushing, washing and over burden removal operations. The gravel produced in these 8 months will be stockpiled at the pit site and will be hauled to the market area during the 10 months of hauling operation, March to December. It is anticipated that the hauling operation from the gravel pit will operate 24 days per month.

The anticipated production from this gravel pit operation is 300,000 tonnes per year. It is anticipated that the month of peak production would be October with the production of approximately 56,000 tonnes of gravel. A total of 16 people will be employed for stripping, crushing, washing, scaling, hauling and overburden removal operations in different periods of the year. Approximately 5 to 7 people will be present at the site at a time during the peak month of production. During this peak month, 13 B-train trucks will be operating to haul approximately 67 loads per day. This hauling operation will run 10 hours from 7.00 a.m. in the morning to 5.00 p.m. in the evening every haul day.

4.3 ADJACENT ROADWAY NETWORK

The existing roadway system in the vicinity of the proposed gravel pit operation includes Range Road 33 and the intersection of Highway 16 and Range Road 33. The location of the proposed development and adjacent road network is shown on Figure 1 and Figure 2. The existing conditions of major roads and intersections that may be impacted by the proposed development are discussed below.

4.3.1 Range Road 33

Range Road 33 is a local county road that provides access to the Village of Alberta Beach, north of the proposed gravel pits. In the vicinity of the proposed development, Range Road 33 is also known as Alberta Beach Road. Range Road 33, north of Highway 16 is a two-lane paved county road. The posted speed limit of this section of roadway is 80 km/hr.

Existing gravel pit operations (by BURNCO) are located on both sides of Range Road 33 north of Highway 16. It is understood that as part of the permitting process to allow these pits to operate, improvement of Range Road 33 was completed. This included widening the road as specified by the local county. The existing operations along Range Road 33 extend from Highway 16 for approximately 2.5 km to the north.

The pavement width of Range Road 33 between Highway 16 and 2.7 km north of Highway 16 is approximately 9.2 m, which includes 3.6 m lanes and 1.0 m shoulders. The pavement width narrows to 7.0 m outside of the recently widened section and it continues to narrow travelling north. Near the accesses to the proposed development, the width of the pavement is approximately 5.2 m.

Two accesses will be provided off Range Road 33 for the gravel pit operation by 1531486 Alberta Ltd. These accesses are planned near the quarter section line approximately 5.66 km north of the Highway 16 intersection. One access will be provided to the east and another access will be provided to the west. No sight distance issues were observed at the location of the proposed accesses on Range Road 33.

Range Road 33 immediately south of Highway 16 is a 6.5 m wide gravel road.

4.3.2 Intersection of Highway 16:12 and Range Road 33

Highway 16 is a divided multilane highway in the AT Class 1A service category. Highway 16 intersects Range Road 33 at an angle of approximately 90 degrees and forms a four legged intersection. Highway 16 forms the east and west legs and Range Road 33 forms the north and south legs of this intersection. The intersection of Highway 16 and Range Road 33 is located at the tangent section of Highway 16:12 and Range Road 33. This intersection is located at a crest curve on Highway 16:12. No sight distance issues were observed at this intersection during the site investigation. The intersection sight distance at this intersection in the eastbound and westbound direction is greater than 500 m.

The intersection of Highway 16 and Range Road 33 is stop controlled on the north and south legs.

The following table (Table 1) presents the existing treatment at this intersection.

TABLE 1: INTERSECTION TREATMENT AT HIGHWAY 16 AND RANGE ROAD 33

Intersection Approach	Westbound	Eastbound	Northbound	Southbound
Through Lanes	Two 3.7 m lanes with a 2.4 m to 2.6 m wide outside shoulder and a 1.2 m to 1.6 m inside shoulder outside the intersection treatment.	Two 3.7 m lanes with a 2.7 m wide outside shoulder and a 0.6 m to 0.8 m inside shoulder outside the intersection treatment.	A 3.6 m lane with a 1 m wide shoulder.	A 6.5 m wide gravel road.
Right Turn Lane	A 107 m long, 3.4 m wide right turn lane with a 2.2 m wide shoulder for westbound to northbound traffic.	None	None	None
Right Turn Taper	A 118 m long, 35:1 taper.	None	None	None
Left Turn Lane	A 56 m long, 3.9 m wide left turn lane with a 1.5 m to 1.6 m wide shoulder for westbound to southbound traffic.	A 58 m long, 3.8 m wide left turn lane with a 0.8 m to 0.6 m wide shoulder for eastbound to northbound traffic.	None	None
Left Turn Taper	A 100 m, 25:1 taper.	An 87 m, 23:1 taper.	None	None
Right Turn Acceleration Lane	An 80 m long, 2.5 m wide acceleration lane with a 0.3 m wide shoulder for southbound to westbound traffic.	None	None	None
Return Taper	A 127 m, 50:1 return taper for southbound to westbound traffic.	None	None	None

The intersection treatment along westbound Highway 16 is similar to AT's typical major road intersection on a four-lane divided highway with minor deviations in taper rates and lengths. The treatment along the eastbound lanes appears similar to AT's typical minor road intersection on a four-lane divided highway except the existing left turn lane eastbound to northbound and minor deviations in taper rates and lengths. AT's typical minor road intersection treatment on a four-lane divided highway does not include a left turn lane. Plans showing these intersection treatments (major and minor road treatments) are included in Appendix A.

Range Road 33 forms the north and south legs of this intersection. No turning lanes or tapers are provided on the north and south legs.

4.4 TRAFFIC DATA

Traffic data is available from AT on Highway 16:12 and at the intersection of Highway 633 and Range Road 33 located 3.3 km north of the proposed development. Traffic data along Range Road 33 and at the intersection of Highway 16 and Range Road 33 was not available from AT, Lac Ste. Anne County or Parkland County. A traffic count was conducted at the intersection of Highway 16 and Range Road 33 on September 8, 2010 as a part of this study. The traffic data available from AT and obtained from the traffic count are presented in the following sections.

4.4.1 Available Data on Highway 16:12

Historical traffic data for Highway 16:12 are available from AT at the following locations and is included in Appendix B:

- east of Range Road 34 (approximately 1.6 km west of Range Road 33); and
- west of Range Road 32 (approximately 1.6 km east of Range Road 33).

This data is presented as the average annual daily traffic (AADT). This data is generally collected over a 12 hour period from 7 a.m. to 7 p.m. and then factored to consider a 24 hour period. Traffic growth rates along Highway 16:12 were calculated from available historical traffic volume data. This data and calculated growth rates are included in Appendix B. Calculated growth rates along Highway 16 near Range Road 33 vary from 0.49% to 1.71% per year.

The existing AADT (2009) along Highway 16 varies from 12,160 vehicles per day (vpd) to 12,280 vpd with truck traffic accounting for 19.0% of this volume (13.2% tractor-trailer units).

4.4.2 Available Data on Range Road 33, South of Highway 633

Traffic data along Range Road 33, south of Highway 633:02 are available from AT and are included in Appendix B.

This traffic data is available from the turning movement summary data at the Highway 633 and Range Road 33 intersection and is presented as AADT. Traffic growth rate along Range Road 33 south of Highway 633 was calculated from available historical traffic volume data. This data and calculated growth rates are included in Appendix B. The data at this location has only been collected since 2008, with little or no growth observed in volumes over this short period.

The existing AADT (2009) along Range Road 33 south of Highway 633 is 380 vpd with truck traffic accounting for 4.7% of this volume (0.5% tractor-trailer units).

The existing traffic volume on Range Road 33 south of Highway 633 is more representative of the traffic volume on Range Road 33 adjacent to the proposed development as this

volume does not account for the traffic from the existing developments north of the Highway 16 intersection.

4.4.3 Traffic Data at the Intersection of Highway 16 and Range Road 33

Traffic data at the intersection of Highway 16 and Range Road 33 was collected from the traffic count undertaken on September 8, 2010 (Wednesday). The detailed traffic count worksheets are included in Appendix B.

This traffic data at this intersection is presented as vehicles per hour (vph). This data was collected over the morning peak period from 7 a.m. to 9 a.m. and the evening peak period from 3 p.m. to 6 p.m.

The average hourly volume along Highway 16 east of Range Road 33 is 840 vph and west of Range Road 33 is 820 vph. The average hourly volume for tractor-trailers on Highway 16 east of Range Road 33 is 135 vph (16% of all vehicles) and west of Range Road 33 is 125 vph (16% of all vehicles).

The average hourly volume along Range Road 33 north of Highway 16 is 55 vph and south of Highway 16 is 3 vph. The average hourly volume for tractor-trailers on Range Road 33 north of Highway 16 is 12 vph (22% of all vehicles). No tractor-trailer was observed on Range Road 33 south of Highway 16 during traffic count period.

4.5 SAFETY PERFORMANCE

Collision data at this intersection was obtained from AT for the past five years (2004 to 2008). The collision data shows that only four collisions were reported at this intersection in the past five years (2004 to 2008). All of these collisions were animal collisions. No injuries or fatalities resulted from these collisions. All of these animal collisions occurred at night. No trends were observed with respect to collisions that might raise safety concerns at this intersection. Collision data is included in Appendix C.

No safety issues were observed at the intersection of Highway 16 and Range Road 33 during the site investigation. Although the intersection of Highway 16 and Range Road 33 is located at a crest curve on Highway 16:12, no sight distance issues were observed at this intersection during the site investigation.

Overall, there are no safety concerns at this intersection as demonstrated by the available collision data.

5.0 DEVELOPMENT TRAFFIC

5.1 TRAFFIC FROM GRAVEL PIT OPERATION

During the peak month of production, the hauling operation will run 10 hours from 7 a.m. in the morning to 5 p.m. in the evening every haul day. It is anticipated that about five to seven employees employed for scaling and loading at the pit site will travel to the gravel pit

site in their own vehicles and park their vehicles in the gravel pit site for the whole day. These employees will then leave the pit site at the end of the day in their personal vehicles. The trucks will travel to the pit site every morning to start hauling. The hauling operation will result in 67 trips inbound and 67 trips outbound by 13 B-train trucks.

5.2 TRAFFIC DISTRIBUTION AND ASSIGNMENT

The distribution and assignment of additional traffic that will be generated by the proposed gravel pit operation was completed based on the information provided by 1531486 Alberta Ltd. For the traffic distribution and assignment, traffic from the gravel pit in a typical day of the peak months of production was considered.

Considering the 67 inbound and 67 outbound trips that will be generated everyday from the gravel pit operation and personal vehicles of the employees based at the pit site, it was estimated that there will be additional 150 vpd on Range Road 33 during peak months of production. To consider the critical case scenario at the intersection of Highway 16 and Range Road 33, it was anticipated that truck traffic from the gravel pit site will travel on to Range Road 33 through access roads and 100% of the truck traffic will travel south towards the Highway 16 intersection. It was also anticipated that 100% of the southbound truck traffic will turn on to eastbound at Highway 16 intersection and travel towards the market area in Edmonton. Empty trucks from the market area in Edmonton will travel westbound along Highway 16, turn north onto Range Road 33 at the Highway 16 intersection and travel northbound towards the gravel pit. It was estimated that in the peak hour, an additional 14 trucks to the background traffic will be traveling through the Highway 16 intersection. Seven empty trucks will turn right from westbound to northbound and seven loaded trucks will turn left from southbound to eastbound. This additional traffic volume generated from the gravel pit operation by 1531486 Alberta Ltd. was combined with the existing, projected and anticipated additional traffic from Inland at this intersection. These volumes were used to perform detailed volume and capacity analysis at this intersection.

Analysis for two horizon years has been considered for this study. Although the proposed development may commence as early as 2011, horizon years for 2012 and 2032 have been considered for this study to coincide with the proposed development by Inland, which will likely begin after the operation by 1531486 Alberta Ltd. Due to the low growth rates on the adjacent network, traffic volumes in 2011 and 2012 are very similar and it is expected that any impacts to the network in 2012 will be present in 2011. The distribution of traffic in 2012 and 2032 for different traffic volume scenarios are presented on Figure 3 to Figure 10.

6.0 TRAFFIC IMPACTS

Traffic volume on Range Road 33 adjacent to the proposed development by 1531486 Alberta Ltd. was assessed for local road standards of the counties and for the local road standards contained in AT's Highway Geometric Design Guide (1999). Intersection analysis was completed at the intersection of Highway 16 and Range Road 33 following the procedures contained in AT's Highway Geometric Design Guide (1999) and other

guidelines from TAC, as required. Detailed analysis using the Highway Capacity Manual (HCM 2000) methodology was included in this work using the Synchro 7 analysis software.

6.1 PROJECTED VOLUMES

The traffic volume on Range Road 33 south of Highway 633 was used to project the background traffic volume for the base year 2012 and for the horizon year 2032 on Range Road 33 adjacent to the proposed development by 1531486 Alberta Ltd. Table 2 below presents different traffic scenarios on Range Road 33 adjacent and south of the proposed development.

TABLE 2: PROJECTED TRAFFIC VOLUME ON RANGE ROAD 33 ADJACENT TO PROPOSED DEVELOPMENT

Traffic Scenario	Year	Projected Traffic Volume (vpd)
Background Traffic	2012	390
	2032	470
Background Traffic + Traffic from Gravel Pit Operation by 1531486 Alberta Ltd.	2012	540
	2032	645
Background Traffic + Traffic from Gravel Pit Operation by Inland	2012	505
	2032	605
Background Traffic + Combined Traffic from Gravel Pit Operations by 1531486 Alberta Ltd. and Inland	2012	655
	2032	785

6.2 LOCAL ROAD STANDARDS – HIGHWAY GEOMETRIC DESIGN GUIDE

According to *Chapter H. Local Roads* of AT's Highway Geometric Design Guide (1999), local roads with AADT ranging from 200 vpd to 1,500 vpd should have a 9.0 m gravel road with allowance for future paving. The traffic volumes presented in Table 2 falls within this volume range. The width of Range Road 33 varies from 5.2 m to 9.2 m north of Highway 16. Range Road 33 adjacent to the proposed development should have a minimum 9.0 m wide gravel roadway with future paving allowance presently following these guidelines.

6.3 LOCAL ROAD STANDARDS – LAC STE. ANNE COUNTY AND PARKLAND COUNTY

The width of Range Road 33 varies from 5.2 m to 7.0 m adjacent to the proposed development, north of the widened section of road immediately north of Highway 16. Lac Ste. Anne County does not define certain threshold requirements in terms of traffic volumes or percentage of truck traffic present to determine when widening of a pavement surface should occur. However, they do specify that a minimum pavement width of 8.0 m is required to permit hauling operations along local county roads. The existing width is less than the local road standard specified by Lac Ste. Anne County.

Parkland County defines Range Road 33 north of Highway 16 as an industrial collector road. According to the local road standards for Parkland County, this classification of road requires a 9.0 m pavement width to permit hauling. The existing pavement width of 7.0 m

within the county is below this minimum requirement. Similar to Lac Ste. Anne County, Parkland County does not define other threshold requirements along this road other than the need to provide a wider surface in order to allow hauling to occur.

6.4 INTERSECTION ANALYSIS – HIGHWAY GEOMETRIC DESIGN GUIDE

The intersection of Highway 16 and Range Road 33 was analyzed according to AT's Highway Geometric Design Guide and are presented in the following sections.

The lane configuration of the study intersection is presented in Table 3.

TABLE 3: INTERSECTION LANING AND CONFIGURATION

E-W	N-S	Eastbound			Westbound			Northbound			Southbound			Signal?
		L	T	R	L	T	R	L	T	R	L	T	R	
Highway 16	Range Road 33	1	2	<	1	2	1	>	1	<	>	1	<	N

Note: > or < means no dedicated left or right turn lane but shares with the adjacent through lane, L means left turn, T means through, R means right turn

6.4.1 Intersection of Highway 16 and Range Road 33

The existing intersection treatment at Highway 16 and Range Road 33 is similar to AT's typical major road intersection along the westbound lanes. The existing intersection treatment along the eastbound lanes appears similar to AT's typical minor road intersection except the addition of the left turn lane (eastbound to northbound). Deficiencies in the current treatment are related to taper rates and lengths.

The warrants for right turn and left turn lanes at this intersection were checked following the procedure contained in AT's Highway Geometric Design Guide. A right turn lane with allowance for deceleration is warranted when the right turn volume is greater than 360 vpd for the movement in question. A left turn lane is warranted when the left turn volume for the movement in question and the opposing through volume fall in the warranted zone in Figure D-8.6c of AT's Highway Geometric Design Guide. This figure is included in Appendix D.

The following table (Table 4) illustrates left turn and right turn warrants under different traffic scenarios as well as the existing treatment at the intersection of Highway 16 and Range Road 33.

TABLE 4: EXISTING INTERSECTION TREATMENTS AND WARRANTS

Intersection Approach	Traffic Scenario	Year	Warrant Check	Warranted ?	Standard Treatment (if Warranted)	Existing Treatment
Highway 16 Westbound	Background Traffic	2012	Right Turn Lane	No	140 m, 40:1 Taper and 100 m Right Turn Parallel Deceleration Lane	A 118 m, 35:1 Taper and a 107 m Right Turn Parallel Deceleration Lane
		2032		No		
	Background Traffic + Traffic from Gravel Pit Operation by 1531486 Alberta Ltd.	2012		No		
		2032		Yes		
	Background Traffic + Traffic from Gravel Pit Operation by Inland	2012		No		
		2032		Yes		
	Background Traffic + Combined Traffic from Gravel Pit Operations by 1531486 Alberta Ltd. and Inland	2012		No		
		2032		Yes		
	Background Traffic	2012	Left Turn Lane	No	-	A 100 m, 25:1 Taper and a 56 m Left Turn Parallel Deceleration Lane
		2032		No		
	Background Traffic + Traffic from Gravel Pit Operation by 1531486 Alberta Ltd.	2012		No		
		2032		No		
	Background Traffic + Traffic from Gravel Pit Operation by Inland	2012		No		
		2032		No		
	Background Traffic + Combined Traffic from Gravel Pit Operations by 1531486 Alberta Ltd. and Inland	2012		No		
		2032		No		
Highway 16 Eastbound	Background Traffic	2012	Right Turn Lane	No	-	No Existing Right Turn Lane Treatment
		2032		No		
	Background Traffic + Traffic from Gravel Pit Operation by 1531486 Alberta Ltd.	2012		No		
		2032		No		
	Background Traffic + Traffic from Gravel Pit Operation by Inland	2012		No		
		2032		No		
	Background Traffic + Combined Traffic from Gravel Pit Operations by 1531486 Alberta Ltd. and Inland	2012		No		
		2032		No		
	Background Traffic	2012	Left Turn Lane	No	-	An 87 m, 23:1 Taper and a 58 m Left Turn Parallel Deceleration Lane
		2032		No		
	Background Traffic + Traffic from Gravel Pit Operation by 1531486 Alberta Ltd.	2012		No		
		2032		No		
	Background Traffic + Traffic from Gravel Pit Operation by Inland	2012		No		
		2032		No		
	Background Traffic + Combined Traffic from Gravel Pit Operations by 1531486 Alberta Ltd. and Inland	2012		No		
		2032		No		

The warrants presented in Table 4 above are based on the turning volumes at the intersection. The table shows that a right turning parallel deceleration lane on the westbound approach is not warranted for 2012 background traffic or for 2032 future

background traffic. This right turning parallel deceleration lane on the westbound approach is not expected to be warranted for 2012 combined traffic from the gravel pit operations by 1531486 Alberta Ltd. and Inland together with the background traffic. However, this lane is expected to be warranted for 2032 traffic from either of the gravel pit operations combined with the background traffic independently as well as for 2032 traffic from both gravel pit operations combined with the background traffic. According to AT's Highway Geometric Design Guide (1999) the standard treatment for right turning parallel deceleration lane on westbound approach of Highway 16 would be a 140 m long 40:1 taper with a 100 m right turn parallel deceleration lane. The existing treatment for right turning vehicles on westbound approach has a 118 m, 35:1 taper with a 107 m long right turn parallel deceleration lane.

There is an existing 80 m long, 2.5 m wide acceleration lane with a 0.3 m wide shoulder for southbound to westbound traffic. There is also an existing 127 m long, 50:1 return taper for southbound to westbound traffic. According to AT's Highway Geometric Design Guide (1999) the standard acceleration lane for southbound to westbound traffic of Highway 16 would be a 3.5 m wide acceleration lane with 1.5 m shoulder.

The left turn lane on the westbound approach or right turn lane and left turn lane on the eastbound approach was not warranted for any of the possible traffic scenarios considered in this study.

6.4.2 Median Width of Highway 16

Highway 16 is designated as a future freeway or expressway. This designation requires that a median width of 22.6 m to 30.6 m be provided to accommodate turning movements at existing intersections. Median width is defined as the distance between the edges of the driving lanes in opposing directions (i.e., yellow line to yellow line). At the intersection of Highway 16 and Range Road 33, the existing median width is 30.8 m. Hauling operations will utilize a B-train configuration (WB-23) with a length of 25.0 m. The existing median width is considered to be adequate to accommodate B-trains turning at this intersection.

6.5 INTERSECTION ANALYSIS – HIGHWAY CAPACITY MANUAL

6.5.1 Intersection Analysis – Background Conditions

The operation of the two study intersections was analyzed using the HCM operational methodology. For unsignalized intersections, the operational analysis methodology gives three indicators for the overall performance of an intersection and for the individual turning movements. The first is the volume to capacity ratio (v/c) where the volume is the number of vehicles wishing to make a certain movement, and capacity is the maximum number of vehicles that can be accommodated in an hour. The capacity takes into account the number of lanes available for the movement, conflicting traffic, and the intersection layout. The higher the v/c ratio, the more congested the intersection becomes. A v/c ratio of greater than 1.0 indicates that more vehicles wish to make a given movement than are able to due

to the limited capacity. In theory, a v/c ratio in excess of 1.0 cannot be recorded with existing traffic. The second measure, the average delay per vehicle, is based on the volume and the capacity. The third measure is the Level of Service which is established from the average delay. The larger the average delay, the worse the Level of Service.

While the HCM methods provide an overall Level of Service and delay for an unsignalized intersection, it is commonly left turning movements from minor roads at such intersections, which are the primary focus of interest. With only low turning volumes from the minor road and high through volumes on the main road, delays to turning vehicles can become excessive. As delays increase, turning vehicles will attempt to turn across unacceptable gaps, which can present safety concerns. Table 5 shows the relationship between level of service and delay.

TABLE 5: LEVEL OF SERVICE VS. DELAY

LoS	Delays	Unsignalized Intersection Control Delay/Vehicle (s)
A	Little or no delay	≤ 10.0
B	Short traffic delays	> 10 and ≤ 15
C	Average traffic delays	> 15 and ≤ 25
D	Long traffic delays	> 25 and ≤ 35
E	Very long traffic delays	> 35 and ≤ 50
F	Failure	> 50

The determination of whether intersection improvements should be considered at an unsignalized intersection is typically a function of the Level of Service for the minor street movements. Where a minor street turn operates at Level of Service E or F, intersection improvements are typically considered.

Table 6 presents a summary of the existing and future intersection performance under background conditions.

TABLE 6: BACKGROUND INTERSECTION PERFORMANCE

Intersection	2012 (Background)		2032 (Background)	
	LoS	Delay (seconds)	LoS	Delay (seconds)
Highway 16/Range Road 33				
a.m. peak hour	B	11.7	B	13.6
p.m. peak hour	B	12.4	B	14.6

Note: LoS and Delay for the critical approach

The intersection of Highway 16 and Range Road 33 with the background traffic is predicted to operate at a Level of Service B with average delays of less than 15 seconds per vehicle on the minor legs at 2012 and 2032 year horizons. The critical movement at this intersection is for southbound to eastbound traffic turning left.

6.5.2 Intersection Analysis – Combined Traffic Conditions

The intersection of Highway 16 and Range Road 33 was re-analyzed under different traffic condition scenarios with the traffic generated by the gravel pit operations by 1531486 Alberta Ltd. and Inland. A summary of the intersection performance under the combined traffic condition is provided in Table 7.

TABLE 7: INTERSECTION PERFORMANCE- DIFFERENT TRAFFIC CONDITION SCENARIO HIGHWAY 16/RANGE ROAD 33

Intersection/Traffic Condition Scenario	Year 2012		Year 2032	
	LoS	Delay (seconds)	LoS	Delay (seconds)
Background Traffic + Traffic from Gravel Pit Operation by 1531486 Alberta Ltd.				
a.m. peak hour	B	11.8	B	14.0
p.m. peak hour	B	12.7	C	15.2
Background Traffic + Traffic from Gravel Pit Operation by Inland				
a.m. peak hour	B	12.0	B	13.9
p.m. peak hour	B	12.7	C	15.1
Background Traffic + Combined Traffic from Gravel Pit Operation by 1531486 Alberta Ltd. and Inland				
a.m. peak hour	B	12.0	B	14.3
p.m. peak hour	B	13.0	C	15.6

Note: LoS and Delay for the critical approach

The results presented above from the detailed volume and capacity analysis at the intersection of Highway 16 and Range Road 33 shows that this intersection will perform satisfactorily in 2012 with a Level of Service B and an average approach delay less than 15 seconds per vehicle on minor legs even with the addition of traffic from the gravel pit operations by 1531486 Alberta Ltd. and Inland. However, this intersection will deteriorate to a Level of Service of C in the 2032 horizon year with an average approach delay just over 15 seconds per vehicle on minor legs with the addition of traffic from the gravel pit operations by 1531486 Alberta Ltd. and Inland. The critical movement at this intersection is the left turn movement of southbound traffic turning left on to eastbound Highway 16.

Details of the intersection analyses are provided in Appendix E.

7.0 SUMMARY AND CONCLUSIONS

7.1 BACKGROUND CONDITIONS

- The proposed gravel pit sites of 1531486 Alberta Ltd. and Inland are located east and west of Range Road 33 near the boundary of Parkland County and Lac Ste. Anne County. The proposed gravel pit sites will be accessed through site accesses off Range Road 33 and truck traffic will haul the gravel through the intersection of Highway 16 and Range Road 33 towards the market area in Edmonton.

- The width of Range Road 33 varies from 5.2 m to 7.0 m from 2.7 km north of Highway 16 to further north. The width of Range Road 33 adjacent to the proposed development is not adequate for the existing traffic.
- Traffic volumes for detailed volume and capacity analysis at the intersection of Highway 16 and Range Road 33 were obtained from the traffic count at this intersection.
- The intersection of Highway 16 and Range Road 33 with the background traffic is predicted to operate at a Level of Service of B on the stop controlled southbound approach in 2012 and in the 2032 horizon year.

7.2 TRAFFIC IMPACTS

- On the westbound approach at the intersection of Highway 16 and Range Road 33, the right turn parallel deceleration lane is warranted for 2032 traffic from either of the gravel pit operations by 1531486 Alberta Ltd. and Inland combined with the background traffic independently as well as for 2032 traffic from both gravel pit operations combined with the background traffic. The existing right turn parallel deceleration lane tapers are below the requirements for this warranted treatment according to AT's Highway Geometric Design Guide (1999).
- After commencement of the gravel pit operations, the critical movement at the intersection of Highway 16 and Range Road 33 is predicted to operate at a Level of Service B on the southbound approach in 2012. This considers additional traffic from both 1531486 Alberta Ltd. and Inland developments combined with the background traffic.
- The operation of this intersection is predicted to deteriorate to a Level of Service C with an average approach delays over 15 seconds per vehicle on the southbound approach of the intersection in the 2032 horizon year with the addition of traffic from the gravel pit operation by 1531486 Alberta Ltd. or from the gravel pit operation by Inland independently or with the additional traffic from both the developments combined with the background traffic. This slight increase in delay is attributed to the additional southbound traffic from the gravel pit operations accessing the intersection to turn left on to eastbound direction and the higher volumes on Highway 16 reducing the number of gaps available in the traffic flow.

7.3 REQUIRED IMPROVEMENTS

- It is recommended that the right turn and left turn parallel lanes and tapers on the eastbound and westbound approaches on Highway 16 at the intersection with Range Road 33 be repainted to meet appropriate AT guidelines. This could be achieved within the existing pavement width and could be completed during AT's regular maintenance program.

- In order to permit hauling operations along Range Road 33 within Lac Ste. Anne County, Range Road 33 is required to meet a minimum width of 8.0 m. As the existing width is below this requirement, this road should be widened. The length of Range Road 33 that falls within Lac Ste. Anne County's jurisdiction is approximately 800 m. The estimated cost of this improvement is $320,000. Confirmation of which party(ies) is responsible to fund this improvement should be determined through discussion with Lac Ste. Anne County.
- Parkland County requires a minimum width of 9.0 m along local roads to permit hauling operations. As the existing width is below this requirement, this road should be widened. The total length of Range Road 33 falling with Parkland County's jurisdiction is 2.1 km. Approximately 900 m of this 2.1 km will be used by both 1531486 Alberta Ltd. and Inland, with the remaining 1.2 km used only by 1531486 Alberta Ltd. The estimated cost of improving this 2.1 km section of Range Road 33 is $840,000. Confirmation of which party(ies) is responsible to fund this improvement should be determined through discussion with Parkland County.

8.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

Sincerely,
EBA Engineering Consultants Ltd.

This information redacted as per Protection of Privacy Act (POPA)

This information redacted as per Protection of Privacy Act (POPA)

Upal Barua, M.Sc., E.I.T.
Transportation Engineer
Highways Practice
Direct Line: 403.203.3305 x818
ubarua@eba.ca

Paul H.A. Steel, M.Eng., P.Eng.
Transportation Engineer
Highways Practice
Direct Line: 403.723.6881
psteel@eba.ca

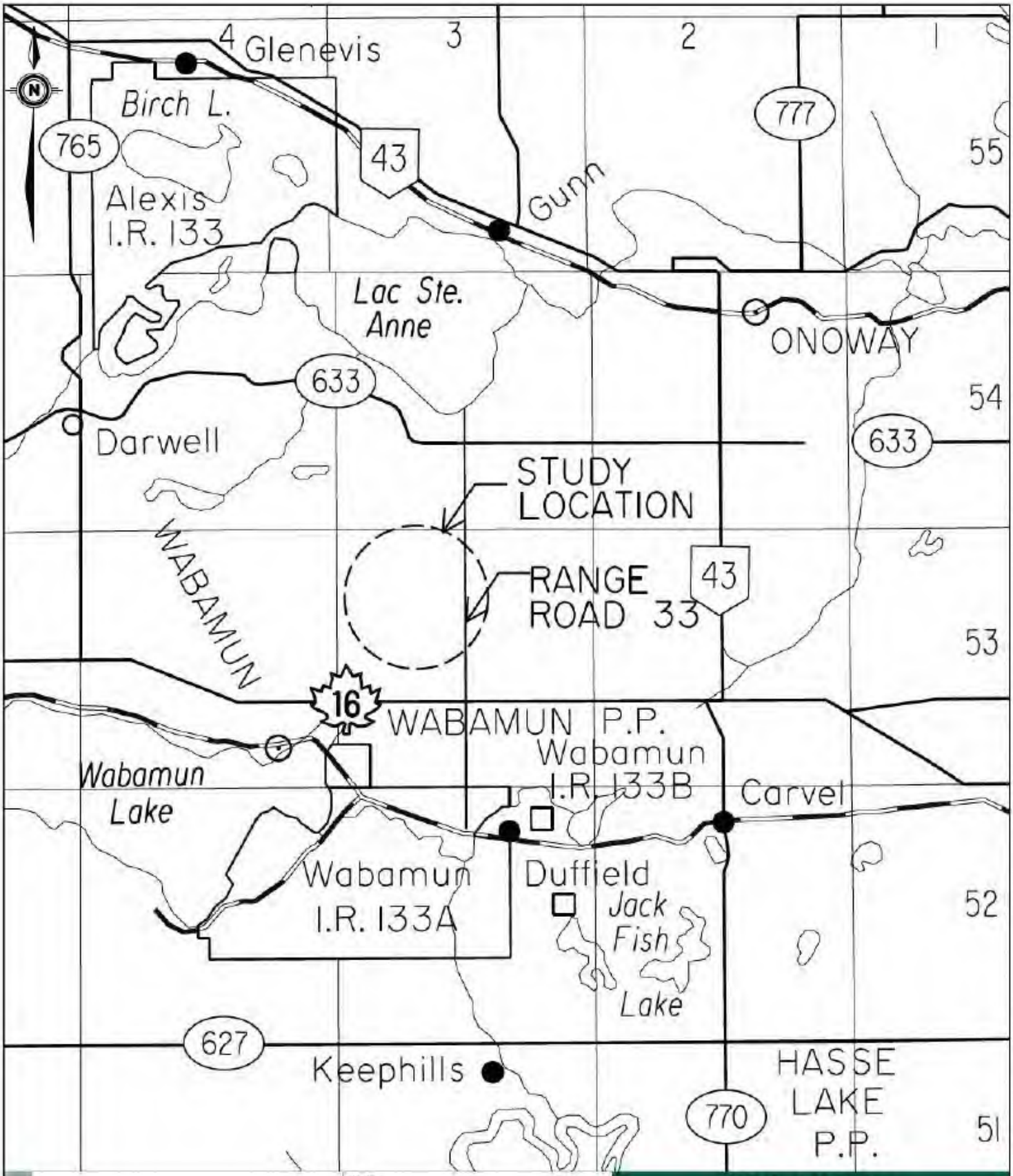
This information redacted as per Protection of Privacy Act (POPA)

PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature This information redacted as per Protection of Privacy Act (POPA)
Date Dec 22, 2010
PERMIT NUMBER: P245
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Reviewed by:
Gerard Kennedy, P.Eng.
Project Director
Highways Practice
Direct Line: 780.451.2130 x620
gkennedy@eba.ca

/bvb

FIGURES



NOTES

N.T.S.

CLIENT

1531486 ALBERTA LTD.

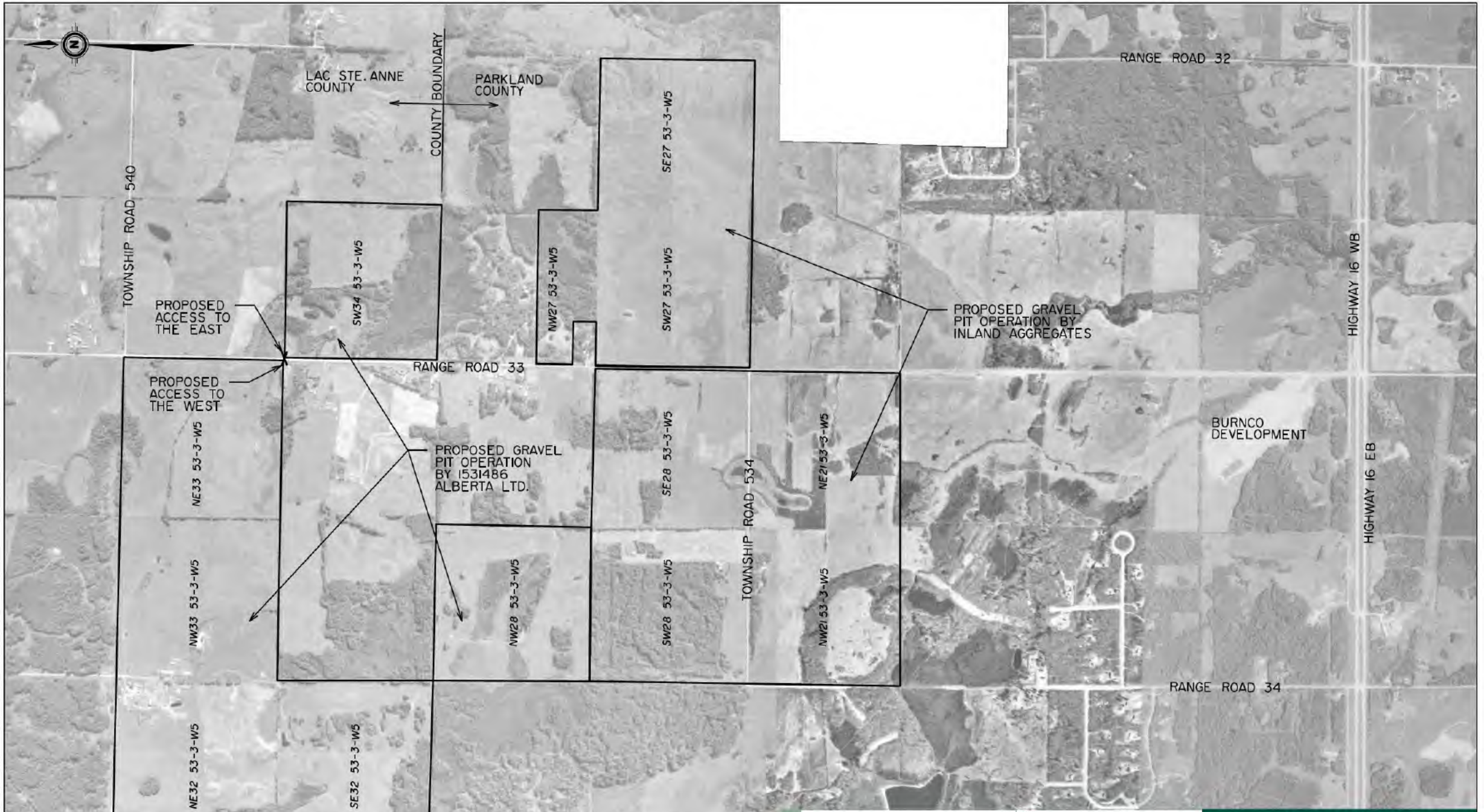
EBA Engineering Consultants Ltd.

1531486 ALBERTA LTD.
TRAFFIC IMPACT ASSESSMENT

LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
E32101266.001	IB	UB	
OFFICE: EBA-RIVERBEND	DATE: OCTOBER 2010		

FIGURE 1



NOTES

N.T.S.

CLIENT

1531486 ALBERTA LTD.

1531486 ALBERTA LTD.
TRAFFIC IMPACT ASSESMENT

AIR PHOTO

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
E32101266.001	IB	UB	
OFFICE: EBA-RIVERBEND	DATE: OCTOBER 2010		

FIGURE 2

LEGEND

000 - AM PEAK HOUR VOLUME
(000) - PM PEAK HOUR VOLUME

N.T.S.

CLIENT

1531486 ALBERTA LTD.

1531486 ALBERTA LTD.
TRAFFIC IMPACT ASSESMENT

2012 BACKGROUND TRAFFIC

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
E32101266.001	IB	UB	
OFFICE: EBA-RIVERBEND	DATE: OCTOBER 2010		

FIGURE 3

LEGEND

000 - AM PEAK HOUR VOLUME
(000) - PM PEAK HOUR VOLUME

N.T.S.

CLIENT

1531486 ALBERTA LTD.

1531486 ALBERTA LTD.
TRAFFIC IMPACT ASSESMENT

2032 BACKGROUND TRAFFIC

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
E32101266.001	IB	UB	
OFFICE: EBA-RIVERBEND	DATE: OCTOBER 2010		

FIGURE 4

LEGEND

000 - AM PEAK HOUR VOLUME
(000) - PM PEAK HOUR VOLUME

N.T.S.

CLIENT

1531486 ALBERTA LTD.

1531486 ALBERTA LTD.
TRAFFIC IMPACT ASSESMENT

2012 BACKGROUND TRAFFIC & TRAFFIC FROM GRAVEL PIT OPERATION BY 1531486 ALBERTA LTD.

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
E32101266.001	IB	UB	
OFFICE: EBA-RIVERBEND	DATE: OCTOBER 2010		

FIGURE 5

LEGEND

000 - AM PEAK HOUR VOLUME
(000) - PM PEAK HOUR VOLUME

N.T.S.

CLIENT

1531486 ALBERTA LTD.

1531486 ALBERTA LTD.
TRAFFIC IMPACT ASSESMENT

2032 BACKGROUND TRAFFIC & TRAFFIC FROM GRAVEL PIT OPERATION BY 1531486 ALBERTA LTD.

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
E32101266.001	IB	UB	
OFFICE: EBA-RIVERBEND	DATE: OCTOBER 2010		

FIGURE 6

LEGEND

000 - AM PEAK HOUR VOLUME
(000) - PM PEAK HOUR VOLUME

N.T.S.

CLIENT

1531486 ALBERTA LTD.

1531486 ALBERTA LTD.
TRAFFIC IMPACT ASSESMENT

2012 BACKGROUND TRAFFIC & TRAFFIC FROM GRAVEL PIT OPERATION BY INLAND

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
E32101266.001	IB	UB	
OFFICE: EBA-RIVERBEND	DATE: OCTOBER 2010		

FIGURE 7

LEGEND

000 - AM PEAK HOUR VOLUME
(000) - PM PEAK HOUR VOLUME

N.T.S.

CLIENT

1531486 ALBERTA LTD.

1531486 ALBERTA LTD.
TRAFFIC IMPACT ASSESMENT

2032 BACKGROUND TRAFFIC & TRAFFIC FROM GRAVEL PIT OPERATION BY INLAND

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
E32101266.001	IB	UB	
OFFICE: EBA-RIVERBEND	DATE: OCTOBER 2010		

FIGURE 8

LEGEND

000 - AM PEAK HOUR VOLUME
(000) - PM PEAK HOUR VOLUME

N.T.S.

CLIENT

1531486 ALBERTA LTD.

1531486 ALBERTA LTD.
TRAFFIC IMPACT ASSESMENT

2012 BACKGROUND TRAFFIC & TRAFFIC FROM GRAVEL PIT OPERATIONS BY 1531486 ALBERTA LTD. AND INLAND

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
E32101266.001	IB	UB	
OFFICE: EBA-RIVERBEND	DATE: OCTOBER 2010		

FIGURE 9

LEGEND

000 - AM PEAK HOUR VOLUME
(000) - PM PEAK HOUR VOLUME

N.T.S.

CLIENT

1531486 ALBERTA LTD.

1531486 ALBERTA LTD.
TRAFFIC IMPACT ASSESMENT

2032 BACKGROUND TRAFFIC & TRAFFIC FROM GRAVEL PIT OPERATIONS BY 1531486 ALBERTA LTD. AND INLAND

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
E32101266.001	IB	UB	
OFFICE: EBA-RIVERBEND	DATE: OCTOBER 2010		

FIGURE 10

PHOTOGRAPHS

Photo 1
Looking west along Highway 16 at westbound intersection with Range Road 33 from adjacent crossover.

Photo 2
Looking west along Highway 16 at eastbound intersection with Range Road 33 from adjacent crossover.

Photo 3
Looking east along Highway 16 at westbound to northbound right turn lane.

Photo 4
Looking east along Highway 16 – no eastbound outside lane treatment.

Photo 5
Truck turning and accelerating along eastbound Highway 16 from southbound Range Road 33.

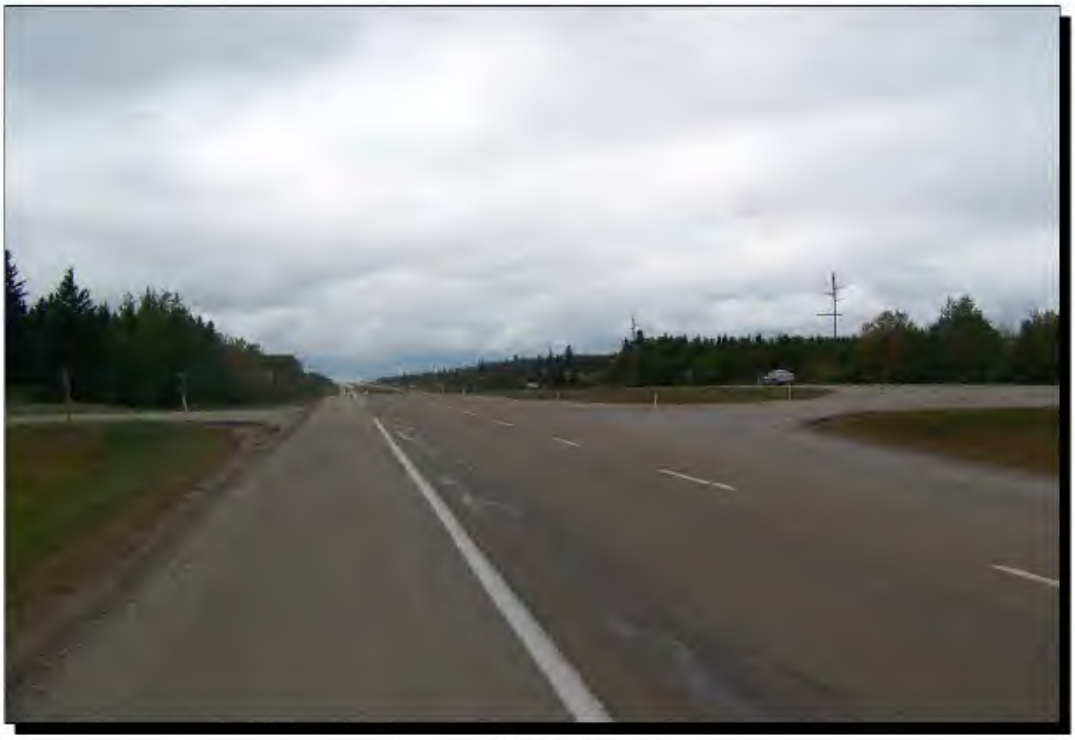


Photo 6
Looking west along Highway 16 – no eastbound outside lane treatment.

Photo 7
Looking west along Highway 16 at westbound to southbound left turn lane.

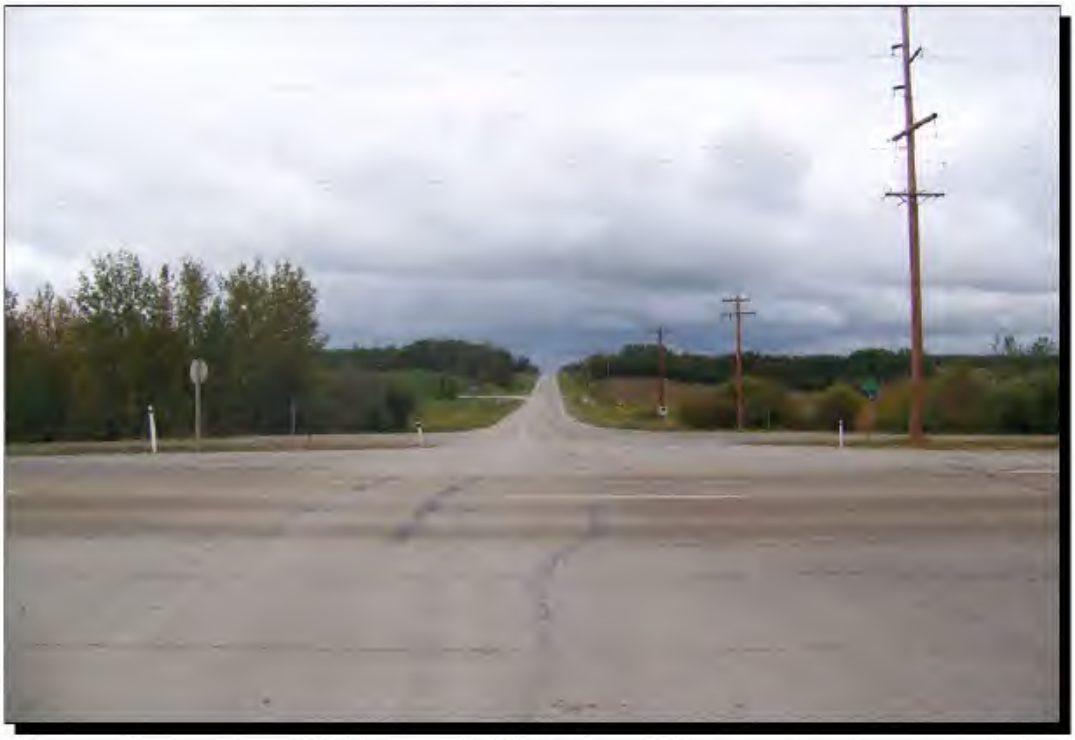


Photo 8
Looking north along Range Road 33 from median area.

Photo 9
Looking south along Range Road 33 from median area.

Photo 10
Looking west along Highway 16 at southbound to westbound merge lane.

Photo 11
Looking east along Highway 16 from southbound to westbound merge lane.

Photo 12
Looking east along Highway 16 from westbound to southbound left turn lane.

Photo 13
Looking east along Highway 16 at eastbound to northbound left turn lane.

Photo 14
Looking west along Highway 16 from eastbound to northbound left turn lane.

Photo 15
Looking north along Range Road 33 at change in pavement width, approximately 2.66 km north of Highway 16.

Photo 16
Looking south along Range Road 33 at change in pavement width, approximately 2.66 km north of Highway 16. Shows access to BURNCO pit.

Photo 17
Looking north along Range Road 33 at Township Road 534 intersection, approximately 3.26 km north of Highway 16.

Photo 18
Looking south along Range Road 33 at Township Road 534 intersection, approximately 3.26 km north of Highway 16. Shows BURNCO pit on the east side of Range Road 33.

Photo 19
Looking west along Township Road 534 at Range Road 33 intersection,
approximately 3.26 km north of Highway 16.

Photo 20
Looking north along Range Rd 33 from possible access location for Inland development,
approximately 3.66 km north of Highway 16.

Photo 21
Looking south along Range Road 33 from possible access location for Inland development, approximately 3.66 km north of Highway 16.

Photo 22
Possible access on the east side of Range Road 33 for Inland development, approximately 3.66 km north of Highway 16.

Photo 23
Ditch profile adjacent to possible access on the east side of Range Road 33 for Inland development, approximately 3.66 km north of Highway 16.

Photo 24
Pavement deterioration along Range Road 33, approximately 6.00 km north of Highway 16.

Photo 25
Looking south along Range Road 33 from Township Road 540 intersection, approximately 6.52 km north of Highway 16.

Photo 26
Looking south along Range Road 33, approximately 30 m north of Highway 16.

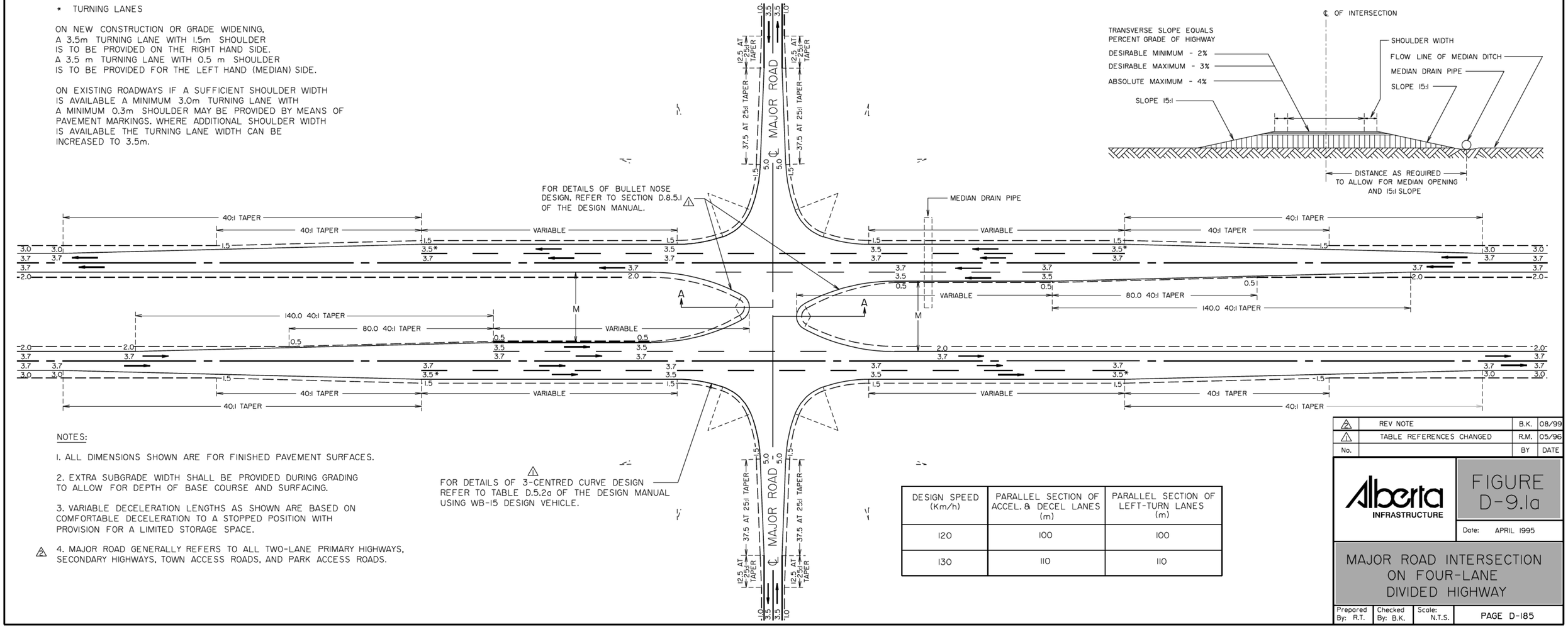
APPENDIX A

APPENDIX A INTERSECTION PLANS

* TURNING LANES

ON NEW CONSTRUCTION OR GRADE WIDENING,
A 3.5m TURNING LANE WITH 1.5m SHOULDER
IS TO BE PROVIDED ON THE RIGHT HAND SIDE.
A 3.5 m TURNING LANE WITH 0.5 m SHOULDER
IS TO BE PROVIDED FOR THE LEFT HAND (MEDIAN) SIDE.

ON EXISTING ROADWAYS IF A SUFFICIENT SHOULDER WIDTH
IS AVAILABLE A MINIMUM 3.0m TURNING LANE WITH
A MINIMUM 0.3m SHOULDER MAY BE PROVIDED BY MEANS OF
PAVEMENT MARKINGS. WHERE ADDITIONAL SHOULDER WIDTH
IS AVAILABLE THE TURNING LANE WIDTH CAN BE
INCREASED TO 3.5m.



SECTION A-A

NOTES:

1. ALL DIMENSIONS SHOWN ARE FOR FINISHED PAVEMENT SURFACES.

2. EXTRA SUBGRADE WIDTH SHALL BE PROVIDED DURING GRADING TO ALLOW FOR DEPTH OF BASE COURSE AND SURFACING.

3. VARIABLE DECELERATION LENGTHS AS SHOWN ARE BASED ON COMFORTABLE DECELERATION TO A STOPPED POSITION WITH PROVISION FOR A LIMITED STORAGE SPACE.

△2 4. MAJOR ROAD GENERALLY REFERS TO ALL TWO-LANE PRIMARY HIGHWAYS, SECONDARY HIGHWAYS, TOWN ACCESS ROADS, AND PARK ACCESS ROADS.

△1 FOR DETAILS OF 3-CENTRED CURVE DESIGN REFER TO TABLE D.5.2a OF THE DESIGN MANUAL USING WB-15 DESIGN VEHICLE.

DESIGN SPEED (Km/h)	PARALLEL SECTION OF ACCEL. & DECEL LANES (m)	PARALLEL SECTION OF LEFT-TURN LANES (m)
120	100	100
130	110	110

No.		BY	DATE
△2	REV NOTE	B.K.	08/99
△1	TABLE REFERENCES CHANGED	R.M.	05/96

Alberta INFRASTRUCTURE

FIGURE D-9.1a

Date: APRIL 1995

MAJOR ROAD INTERSECTION ON FOUR-LANE DIVIDED HIGHWAY

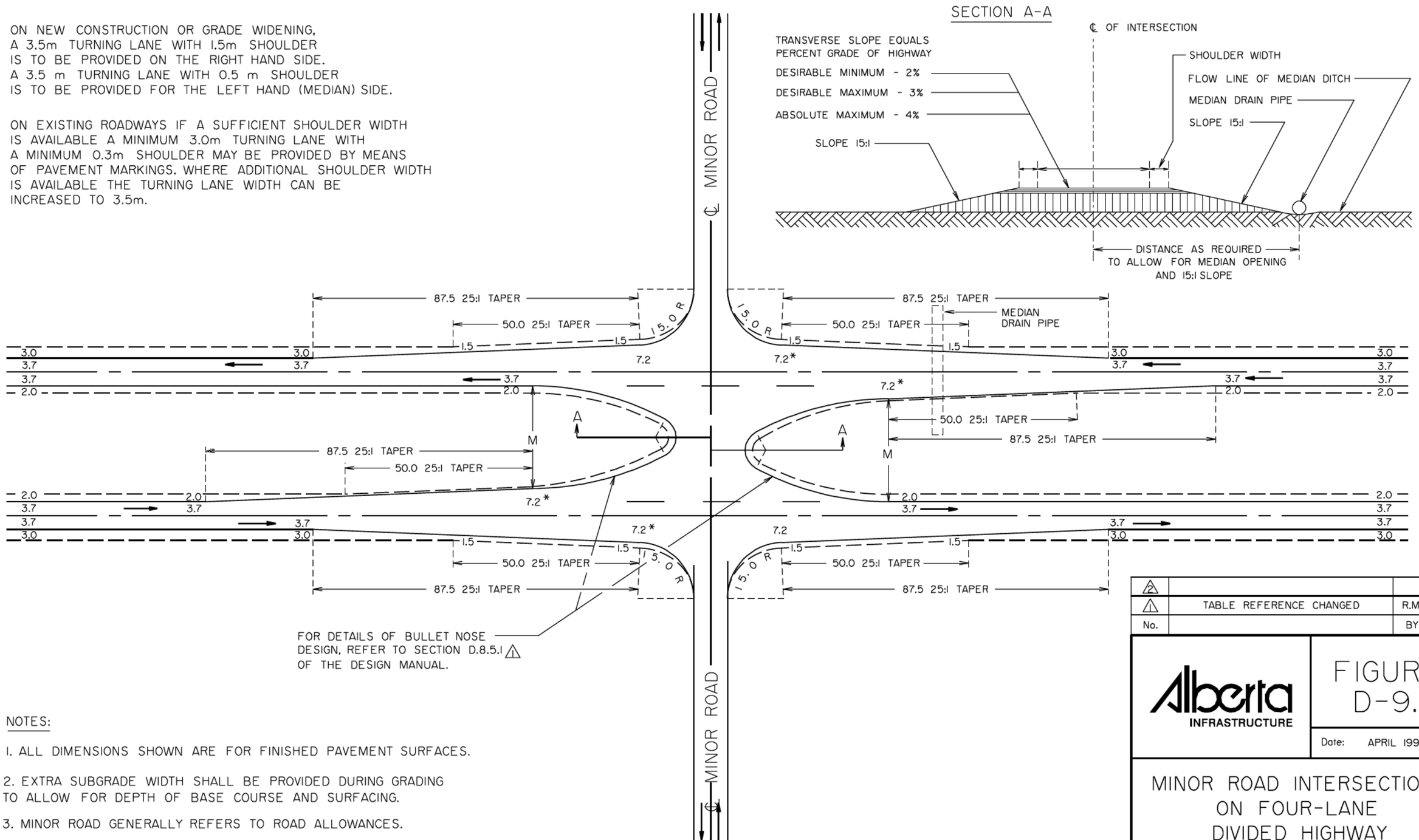
Prepared By: R.T.	Checked By: B.K.	Scale: N.T.S.	PAGE D-185

Graphics File: debd9la.man

* TURNING LANES:

ON NEW CONSTRUCTION OR GRADE WIDENING,
A 3.5m TURNING LANE WITH 1.5m SHOULDER
IS TO BE PROVIDED ON THE RIGHT HAND SIDE.
A 3.5 m TURNING LANE WITH 0.5 m SHOULDER
IS TO BE PROVIDED FOR THE LEFT HAND (MEDIAN) SIDE.

ON EXISTING ROADWAYS IF A SUFFICIENT SHOULDER WIDTH
IS AVAILABLE A MINIMUM 3.0m TURNING LANE WITH
A MINIMUM 0.3m SHOULDER MAY BE PROVIDED BY MEANS
OF PAVEMENT MARKINGS. WHERE ADDITIONAL SHOULDER WIDTH
IS AVAILABLE THE TURNING LANE WIDTH CAN BE
INCREASED TO 3.5m.



NOTES:

1. ALL DIMENSIONS SHOWN ARE FOR FINISHED PAVEMENT SURFACES.

2. EXTRA SUBGRADE WIDTH SHALL BE PROVIDED DURING GRADING TO ALLOW FOR DEPTH OF BASE COURSE AND SURFACING.

3. MINOR ROAD GENERALLY REFERS TO ROAD ALLOWANCES.

No.		BY	DATE
⚠2			
⚠1	TABLE REFERENCE CHANGED	R.M.	05/96

Alberta INFRASTRUCTURE

FIGURE D-9.1b

Date: APRIL 1995

MINOR ROAD INTERSECTION ON FOUR-LANE DIVIDED HIGHWAY

Prepared By: R.T.	Checked By: B.K.	Scale: N.T.S.	PAGE D-187

Graphics File: debd91b.man

APPENDIX B

APPENDIX B TRAFFIC DATA

Vehicle Turning Movement Survey
With Classification

Major Route: Route 16
Minor Route: Range Road 33
Municipality: Parkland County
Filename: 1-Route16@RangeRoad33-Sep8.xls
Location #: 1

Date: September 8, 2010
Day-of-week: Wednesday

East/West Route: Route 16
Intersection Type: Four approach intersection
Signalized?: No
Weather: Rain & Wet

Vehicle Classifications: Regular Vehicles
Heavy Trucks
Bicycles

This data is for All Vehicles Combined

Shift	Start	Duration	End
AM	7:00	2.00	9:00
PM	15:00	3.00	18:00
	Total	5.00	

Note: duration: decimal hours
start time: 24 hr clock (15 min increments)

Notes: North Approach - southbound vehicles approaching intersection from the north
15x4 - 15 min volume (from maximum 15 minute period of movement/approach in peak hour period [*]) x 4
Pedestrians - N indicates pedestrians crossing north approach (east/west)

Comments: Six leg intersection as eastbound and westbound travel lanes of Highway 16 are separated. Parkland School Division 70 - Wabamun School (K-9) fall classes started Aug 31, 2010.

Survey Data

Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for All Vehicles Combined

Time	Range Road 33				Range Road 33				Route 16				Route 16							Pedestrians			
Period	NORTH Approach				SOUTH Approach				WEST Approach				EAST Approach				Total Volume		Peak				
Begins	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	15-min	Hour		N	S	W	E
7:00	11	0	6	**17**	0	0	0	**0**	2	81	0	**83**	0	93	3	**96**	196		*	0	0	0	0
7:15	5	0	2	**7**	0	0	0	**0**	2	100	0	**102**	0	109	1	**110**	219		+	0	0	0	0
7:30	7	0	2	**9**	0	0	0	**0**	1	99	0	**100**	0	93	3	**96**	205		*	0	0	0	0
7:45	7	1	2	**10**	0	0	0	**0**	2	86	0	**88**	1	68	1	**70**	168	788	*	0	0	0	0
8:00	2	1	2	**5**	0	0	2	**2**	1	85	0	**86**	0	77	4	**81**	174	766		0	0	0	0
8:15	6	0	2	**8**	0	0	0	**0**	0	78	0	**78**	0	92	6	**98**	184	731		0	0	0	0
8:30	7	0	0	**7**	0	0	1	**1**	3	77	0	**80**	0	71	4	**75**	163	689		0	0	0	0
8:45	3	0	1	**4**	0	0	0	**0**	0	71	0	**71**	0	97	1	**98**	173	694		0	0	0	0
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
Total	48	2	17	**67**	0	0	3	**3**	11	677	0	**688**	1	700	23	**724**	1482			0	0	0	0

n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
Total	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0			0	0	0	0

15:00	5	0	0	**5**	0	0	0	**0**	1	112	0	**113**	0	92	6	**98**	216			0	0	0	0
15:15	5	0	0	**5**	0	0	0	**0**	0	108	0	**108**	0	99	5	**104**	217			0	0	0	0
15:30	2	1	1	**4**	0	1	0	**1**	5	94	0	**99**	1	102	5	**108**	212			0	0	0	0
15:45	4	0	1	**5**	0	0	0	**0**	4	114	0	**118**	0	107	5	**112**	235	880		0	0	0	0
16:00	4	0	2	**6**	0	0	0	**0**	2	133	0	**135**	1	102	3	**106**	247	911	*	0	0	0	0
16:15	2	0	0	**2**	0	0	0	**0**	5	128	0	**133**	0	105	3	**108**	243	937	*	0	0	0	0
16:30	2	0	1	**3**	0	0	1	**1**	6	125	0	**131**	0	119	4	**123**	258	983	+	0	0	0	0
16:45	3	0	0	**3**	0	0	0	**0**	6	124	0	**130**	0	107	13	**120**	253	1001	*	0	0	0	0
17:00	2	0	3	**5**	0	0	0	**0**	7	123	0	**130**	0	99	4	**103**	238	992		0	0	0	0
17:15	3	0	2	**5**	0	0	0	**0**	1	124	0	**125**	0	110	6	**116**	246	995		0	0	0	0
17:30	6	0	1	**7**	0	0	1	**1**	5	98	0	**103**	2	94	6	**102**	213	950		0	0	0	0
17:45	2	0	3	**5**	0	0	0	**0**	4	104	0	**108**	0	110	16	**126**	239	936		0	0	0	0
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
Total	40	1	14	**55**	0	1	2	**3**	46	1387	0	**1433**	4	1246	76	**1326**	2817			0	0	0	0

AM Peak Period

Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for All Vehicles Combined

Time Period	Range Road 33 NORTH Approach				Range Road 33 SOUTH Approach				Route 16 WEST Approach				Route 16 EAST Approach				Total Volume		Peak	Pedestrians				Conflict	
Begins	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	15-min	Hour		N	S	W	E	15 min	Hr
07:00	11	0	6	17	0	0	0	0	2	81	0	83	0	93	3	96	196		*	0	0	0	0	109	
07:15	5	0	2	7	0	0	0	0	2	100	0	102	0	109	1	110	219		+	0	0	0	0	117	
07:30	7	0	2	9	0	0	0	0	1	99	0	100	0	93	3	96	205		*	0	0	0	0	106	
07:45	7	1	2	10	0	0	0	0	2	86	0	88	1	68	1	70	168	788	*	0	0	0	0	94	426
08:00	2	1	2	5	0	0	2	2	1	85	0	86	0	77	4	81	174	766		0	0	0	0	89	406
08:15	6	0	2	8	0	0	0	0	0	78	0	78	0	92	6	98	184	731		0	0	0	0	104	393
08:30	7	0	0	7	0	0	1	1	3	77	0	80	0	71	4	75	163	689		0	0	0	0	86	373
08:45	3	0	1	4	0	0	0	0	0	71	0	71	0	97	1	98	173	694		0	0	0	0	101	380
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
Total	48	2	17	67	0	0	3	3	11	677	0	688	1	700	23	724	1482			0	0	0	0		785
Avg Hr	24	1	9	34	0	0	2	2	6	339	0	344	1	350	12	362	741			0	0	0	0		n/a

Peak hour of the intersection

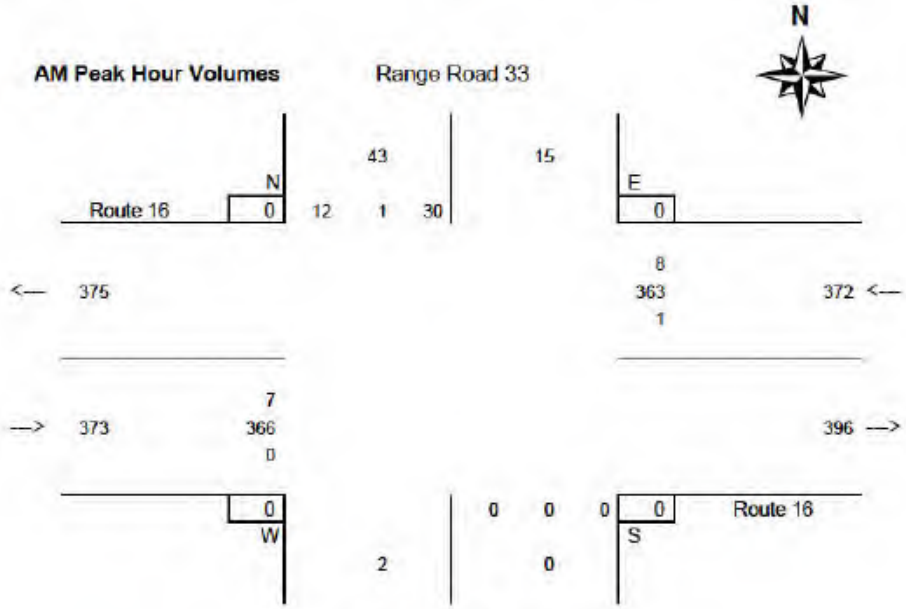
Pk Hr	30	1	12	43	0	0	0	0	7	366	0	373	1	363	8	372	788	*		0	0	0	0		408
15x4	44	4	24	68	0	0	0	0	8	400	0	408	4	436	12	440	876	+		0	0	0	0		500
PHF	0.68	0.25	0.50	0.63	n/a	n/a	n/a	n/a	0.88	0.92	n/a	0.91	0.25	0.83	0.67	0.85	0.90			n/a	n/a	n/a	n/a		0.82

Peak hour of conflicting volumes for the intersection

Pk Hr	30	1	12	43	0	0	0	0	7	366	0	373	1	363	8	372	788	*		0	0	0	0		408
15x4	44	4	24	68	0	0	0	0	8	400	0	408	4	436	12	440	876	+		0	0	0	0		500
PHF	0.68	0.25	0.50	0.63	n/a	n/a	n/a	n/a	0.88	0.92	n/a	0.91	0.25	0.83	0.67	0.85	0.90			n/a	n/a	n/a	n/a		0.82

** Calculated peak hour occurs during the first or last hour of shift and therefore may be invalid. **

AM Peak Hour Volumes



PM Peak Period

Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for All Vehicles Combined

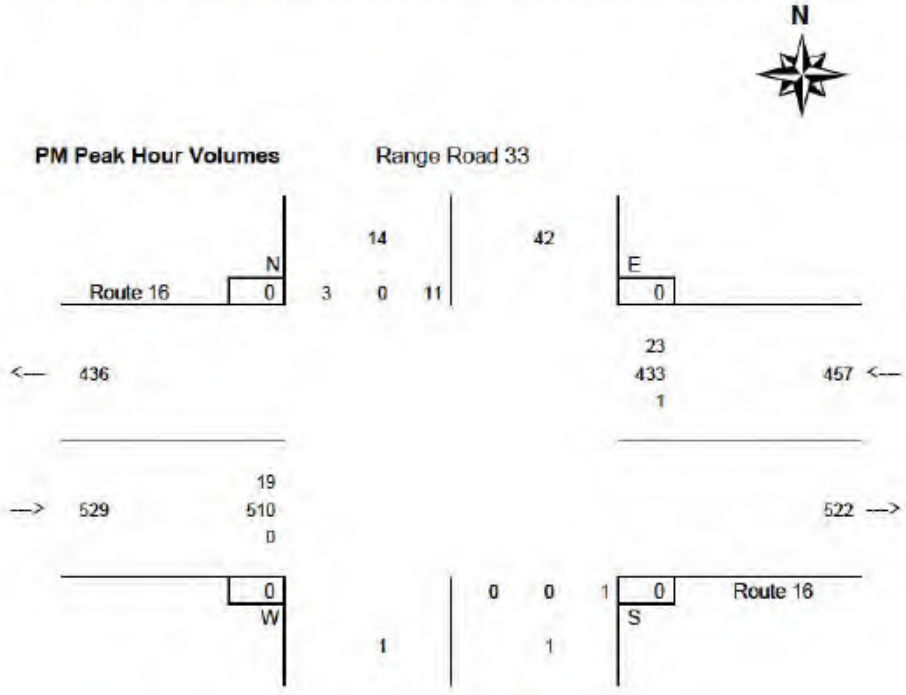
Time Period	Range Road 33 NORTH Approach				Range Road 33 SOUTH Approach				Route 16 WEST Approach				Route 16 EAST Approach				Total Volume			Pedestrians				Conflict	
Begins	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	15-min	Hour		N	S	W	E	15 min	Hr
15:00	5	0	0	5	0	0	0	0	1	112	0	113	0	92	6	98	216			0	0	0	0	117	
15:15	5	0	0	5	0	0	0	0	0	108	0	108	0	99	5	104	217			0	0	0	0	113	
15:30	2	1	1	4	0	1	0	1	5	94	0	99	1	102	5	108	212			0	0	0	0	115	
15:45	4	0	1	5	0	0	0	0	4	114	0	118	0	107	5	112	235	880		0	0	0	0	120	465
16:00	4	0	2	6	0	0	0	0	2	133	0	135	1	102	3	106	247	911	*	0	0	0	0	138	486
16:15	2	0	0	2	0	0	0	0	5	128	0	133	0	105	3	108	243	937	*	0	0	0	0	130	503
16:30	2	0	1	3	0	0	1	1	6	125	0	131	0	119	4	123	258	983	+	0	0	0	0	132	520
16:45	3	0	0	3	0	0	0	0	6	124	0	130	0	107	13	120	253	1001	*	0	0	0	0	129	529
17:00	2	0	3	5	0	0	0	0	7	123	0	130	0	99	4	103	238	992		0	0	0	0	126	517
17:15	3	0	2	5	0	0	0	0	1	124	0	125	0	110	6	116	246	995		0	0	0	0	127	514
17:30	6	0	1	7	0	0	1	1	5	98	0	103	2	94	6	102	213	950		0	0	0	0	112	494
17:45	2	0	3	5	0	0	0	0	4	104	0	108	0	110	16	126	239	936		0	0	0	0	133	498
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
Total	40	1	14	55	0	1	2	3	46	1387	0	1433	4	1246	76	1326	2817			0	0	0	0		1434
Avg Hr	13	0	5	18	0	0	1	1	15	462	0	478	1	415	25	442	939			0	0	0	0		n/a

Peak hour of the intersection

Pk Hr	11	0	3	14	0	0	1	1	19	510	0	529	1	433	23	457	1001	*		0	0	0	0		523
15x4	16	0	8	24	0	0	4	4	24	532	0	540	4	476	52	492	1032	+		0	0	0	0		572
PHF	0.69	n/a	0.38	0.58	n/a	n/a	0.25	0.25	0.79	0.96	n/a	0.98	0.25	0.91	0.44	0.93	0.97			n/a	n/a	n/a	n/a		0.91

Peak hour of conflicting volumes for the intersection

Pk Hr	11	0	3	14	0	0	1	1	19	510	0	529	1	433	23	457	1001	*		0	0	0	0		523
15x4	16	0	8	24	0	0	4	4	24	532	0	540	4	476	52	492	1032	+		0	0	0	0		572
PHF	0.69	n/a	0.38	0.58	n/a	n/a	0.25	0.25	0.79	0.96	n/a	0.98	0.25	0.91	0.44	0.93	0.97			n/a	n/a	n/a	n/a		0.91



Average Hour

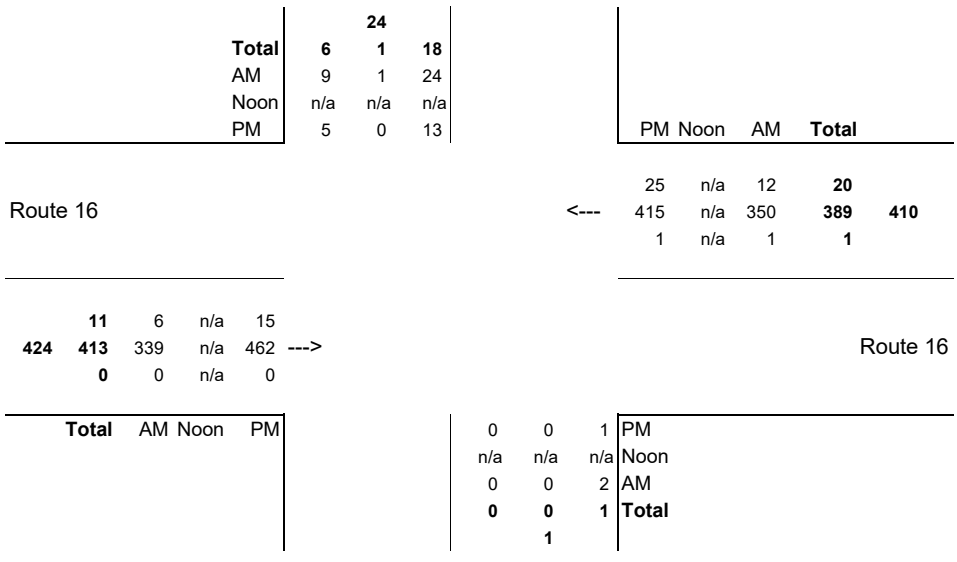
Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for All Vehicles Combined

	Range Road 33 NORTH Approach				Range Road 33 SOUTH Approach				Route 16 WEST Approach				Route 16 EAST Approach				Total	Pedestrians			
	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Volume	N	S	W	E
Survey																					
Total	88	3	31	**122**	0	1	5	**6**	57	2064	0	**2121**	5	1946	99	**2050**	4299	0	0	0	0
Hours	5	5	5	**5**	5	5	5	**5**	5	5	5	**5**	5	5	5	**5**	5	5	5	5	5
Avg Hr	18	1	6	**24**	0	0	1	**1**	11	413	0	**424**	1	389	20	**410**	860	0	0	0	0
AM Period																					
Total	48	2	17	**67**	0	0	3	**3**	11	677	0	**688**	1	700	23	**724**	1482	0	0	0	0
Hours	2	2	2	**2**	2	2	2	**2**	2	2	2	**2**	2	2	2	**2**	2	2	2	2	2
Avg Hr	24	1	9	**34**	0	0	2	**2**	6	339	0	**344**	1	350	12	**362**	741	0	0	0	0
Noon Period																					
Total	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0
Hours	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0
Avg Hr	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	n/a	n/a
PM Period																					
Total	40	1	14	**55**	0	1	2	**3**	46	1387	0	**1433**	4	1246	76	**1326**	2817	0	0	0	0
Hours	3	3	3	**3**	3	3	3	**3**	3	3	3	**3**	3	3	3	**3**	3	3	3	3	3
Avg Hr	13	0	5	**18**	0	0	1	**1**	15	462	0	**478**	1	415	25	**442**	939	0	0	0	0

Average Hour Volumes

Range Road 33



Range Road 33

Vehicle Turning Movement Survey
With Classification

Major Route: Route 16
Minor Route: Range Road 33
Municipality: Parkland County
Filename: 1-Route16@RangeRoad33-Sep8.xls
Location #: 1

Date: September 8, 2010
Day-of-week: Wednesday

East/West Route: Route 16
Intersection Type: Four approach intersection
Signalized?: No
Weather: Rain & Wet

Vehicle Classifications: Regular Vehicles
Heavy Trucks
Bicycles

This data is for Regular Vehicles

Shift	Start	Duration	End
AM	7:00	2.00	9:00
PM	15:00	3.00	18:00
	Total	5.00	

Note: duration: decimal hours
start time: 24 hr clock (15 min increments)

Notes: North Approach - southbound vehicles approaching intersection from the north
15x4 - 15 min volume (from maximum 15 minute period of movement/approach in peak hour period [*]) x 4
Pedestrians - N indicates pedestrians crossing north approach (east/west)

Comments: Six leg intersection as eastbound and westbound travel lanes of Highway 16 are separated. Parkland School Division 70 - Wabamun School (K-9) fall classes started Aug 31, 2010.

Survey Data

Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for Regular Vehicles

Time	Range Road 33				Range Road 33				Route 16				Route 16							Pedestrians			
Period	NORTH Approach				SOUTH Approach				WEST Approach				EAST Approach				Total Volume		Peak				
Begins	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	15-min	Hour		N	S	W	E
7:00	4	0	4	**8**	0	0	0	**0**	2	75	0	**77**	0	78	1	**79**	164		*	0	0	0	0
7:15	3	0	2	**5**	0	0	0	**0**	2	90	0	**92**	0	90	1	**91**	188		+	0	0	0	0
7:30	3	0	2	**5**	0	0	0	**0**	1	71	0	**72**	0	79	0	**79**	156		*	0	0	0	0
7:45	4	1	2	**7**	0	0	0	**0**	1	61	0	**62**	1	55	1	**57**	126	634	*	0	0	0	0
8:00	2	0	2	**4**	0	0	1	**1**	1	68	0	**69**	0	68	0	**68**	142	612		0	0	0	0
8:15	3	0	2	**5**	0	0	0	**0**	0	58	0	**58**	0	73	4	**77**	140	564		0	0	0	0
8:30	4	0	0	**4**	0	0	1	**1**	3	62	0	**65**	0	54	2	**56**	126	534		0	0	0	0
8:45	2	0	1	**3**	0	0	0	**0**	0	50	0	**50**	0	80	1	**81**	134	542		0	0	0	0
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
Total	25	1	15	**41**	0	0	2	**2**	10	535	0	**545**	1	577	10	**588**	1176			0	0	0	0

n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
Total	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0			0	0	0	0

15:00	2	0	0	**2**	0	0	0	**0**	1	84	0	**85**	0	85	4	**89**	176			0	0	0	0
15:15	2	0	0	**2**	0	0	0	**0**	0	92	0	**92**	0	79	4	**83**	177			0	0	0	0
15:30	2	1	1	**4**	0	0	0	**0**	5	74	0	**79**	0	94	5	**99**	182			0	0	0	0
15:45	3	0	0	**3**	0	0	0	**0**	3	101	0	**104**	0	96	4	**100**	207	742		0	0	0	0
16:00	3	0	2	**5**	0	0	0	**0**	2	113	0	**115**	1	83	2	**86**	206	772		0	0	0	0
16:15	1	0	0	**1**	0	0	0	**0**	5	104	0	**109**	0	93	2	**95**	205	800		0	0	0	0
16:30	2	0	1	**3**	0	0	1	**1**	6	105	0	**111**	0	105	4	**109**	224	842	+	0	0	0	0
16:45	2	0	0	**2**	0	0	0	**0**	5	113	0	**118**	0	90	13	**103**	223	858	*	0	0	0	0
17:00	2	0	3	**5**	0	0	0	**0**	7	109	0	**116**	0	90	4	**94**	215	867	*	0	0	0	0
17:15	3	0	2	**5**	0	0	0	**0**	0	112	0	**112**	0	101	6	**107**	224	886	*	0	0	0	0
17:30	6	0	1	**7**	0	0	1	**1**	5	86	0	**91**	2	86	5	**93**	192	854		0	0	0	0
17:45	2	0	3	**5**	0	0	0	**0**	4	88	0	**92**	0	104	16	**120**	217	848		0	0	0	0
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
Total	30	1	13	**44**	0	0	2	**2**	43	1181	0	**1224**	3	1106	69	**1178**	2448			0	0	0	0

AM Peak Period

Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for Regular Vehicles

Time Period	Range Road 33 NORTH Approach				Range Road 33 SOUTH Approach				Route 16 WEST Approach				Route 16 EAST Approach				Total Volume		Peak	Pedestrians				Conflict	
Begins	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	15-min	Hour		N	S	W	E	15 min	Hr
07:00	4	0	4	8	0	0	0	0	2	75	0	77	0	78	1	79	164		*	0	0	0	0	85	
07:15	3	0	2	5	0	0	0	0	2	90	0	92	0	90	1	91	188		+	0	0	0	0	96	
07:30	3	0	2	5	0	0	0	0	1	71	0	72	0	79	0	79	156		*	0	0	0	0	83	
07:45	4	1	2	7	0	0	0	0	1	61	0	62	1	55	1	57	126	634	*	0	0	0	0	66	330
08:00	2	0	2	4	0	0	1	1	1	68	0	69	0	68	0	68	142	612		0	0	0	0	72	317
08:15	3	0	2	5	0	0	0	0	0	58	0	58	0	73	4	77	140	564		0	0	0	0	80	301
08:30	4	0	0	4	0	0	1	1	3	62	0	65	0	54	2	56	126	534		0	0	0	0	67	285
08:45	2	0	1	3	0	0	0	0	0	50	0	50	0	80	1	81	134	542		0	0	0	0	83	302
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
Total	25	1	15	41	0	0	2	2	10	535	0	545	1	577	10	588	1176			0	0	0	0		624
Avg Hr	13	1	8	21	0	0	1	1	5	268	0	273	1	289	5	294	588			0	0	0	0		n/a

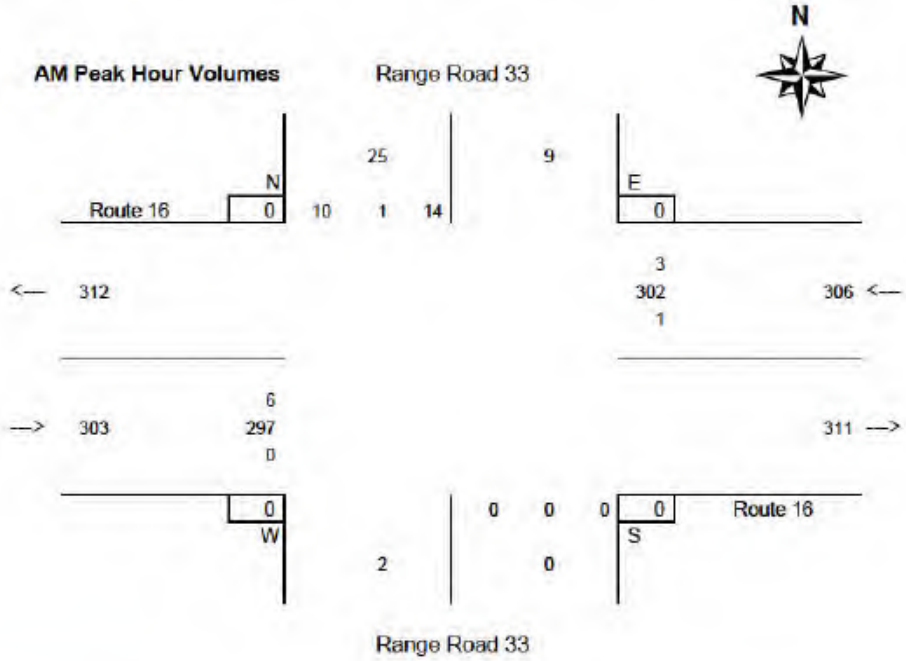
Peak hour of the intersection

Pk Hr	14	1	10	25	0	0	0	0	6	297	0	303	1	302	3	306	634	*		0	0	0	0		325
15x4	16	4	16	32	0	0	0	0	8	360	0	368	4	360	4	364	752	+		0	0	0	0		392
PHF	0.88	0.25	0.63	0.78	n/a	n/a	n/a	n/a	0.75	0.83	n/a	0.82	0.25	0.84	0.75	0.84	0.84			n/a	n/a	n/a	n/a		0.83

Peak hour of conflicting volumes for the intersection

Pk Hr	14	1	10	25	0	0	0	0	6	297	0	303	1	302	3	306	634	*		0	0	0	0		325
15x4	16	4	16	32	0	0	0	0	8	360	0	368	4	360	4	364	752	+		0	0	0	0		392
PHF	0.88	0.25	0.63	0.78	n/a	n/a	n/a	n/a	0.75	0.83	n/a	0.82	0.25	0.84	0.75	0.84	0.84			n/a	n/a	n/a	n/a		0.83

** Calculated peak hour occurs during the first or last hour of shift and therefore may be invalid. **



PM Peak Period

Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for Regular Vehicles

Time Period	Range Road 33 NORTH Approach				Range Road 33 SOUTH Approach				Route 16 WEST Approach				Route 16 EAST Approach				Total Volume			Pedestrians				Conflict	
Begins	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	15-min	Hour		N	S	W	E	15 min	Hr
15:00	2	0	0	2	0	0	0	0	1	84	0	85	0	85	4	89	176			0	0	0	0	92	
15:15	2	0	0	2	0	0	0	0	0	92	0	92	0	79	4	83	177			0	0	0	0	94	
15:30	2	1	1	4	0	0	0	0	5	74	0	79	0	94	5	99	182			0	0	0	0	106	
15:45	3	0	0	3	0	0	0	0	3	101	0	104	0	96	4	100	207	742		0	0	0	0	106	398
16:00	3	0	2	5	0	0	0	0	2	113	0	115	1	83	2	86	206	772		0	0	0	0	117	423
16:15	1	0	0	1	0	0	0	0	5	104	0	109	0	93	2	95	205	800		0	0	0	0	105	434
16:30	2	0	1	3	0	0	1	1	6	105	0	111	0	105	4	109	224	842	+	0	0	0	0	118	446
16:45	2	0	0	2	0	0	0	0	5	113	0	118	0	90	13	103	223	858	*	0	0	0	0	115	455
17:00	2	0	3	5	0	0	0	0	7	109	0	116	0	90	4	94	215	867	*	0	0	0	0	112	450
17:15	3	0	2	5	0	0	0	0	0	112	0	112	0	101	6	107	224	886	*	0	0	0	0	115	460
17:30	6	0	1	7	0	0	1	1	5	86	0	91	2	86	5	93	192	854		0	0	0	0	103	445
17:45	2	0	3	5	0	0	0	0	4	88	0	92	0	104	16	120	217	848		0	0	0	0	127	457
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
Total	30	1	13	44	0	0	2	2	43	1181	0	1224	3	1106	69	1178	2448			0	0	0	0		1250
Avg Hr	10	0	4	15	0	0	1	1	14	394	0	408	1	369	23	393	816			0	0	0	0		n/a

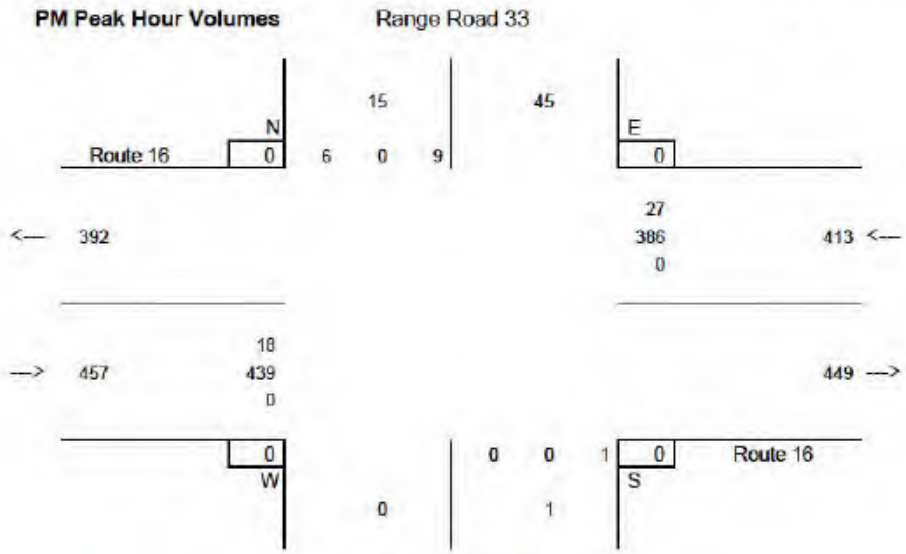
Peak hour of the intersection

Pk Hr	9	0	6	15	0	0	1	1	18	439	0	457	0	386	27	413	886	*		0	0	0	0	449	
15x4	12	0	12	20	0	0	4	4	28	452	0	472	0	420	52	436	896	+		0	0	0	0	516	
PHF	0.75	n/a	0.50	0.75	n/a	n/a	0.25	0.25	0.64	0.97	n/a	0.97	n/a	0.92	0.52	0.95	0.99			n/a	n/a	n/a	n/a	0.87	

Peak hour of conflicting volumes for the intersection

Pk Hr	9	0	6	15	0	0	1	1	18	439	0	457	0	386	27	413	886	*		0	0	0	0	449	
15x4	12	0	12	20	0	0	4	4	28	452	0	472	0	420	52	436	896	+		0	0	0	0	516	
PHF	0.75	n/a	0.50	0.75	n/a	n/a	0.25	0.25	0.64	0.97	n/a	0.97	n/a	0.92	0.52	0.95	0.99			n/a	n/a	n/a	n/a	0.87	

PM Peak Hour Volumes



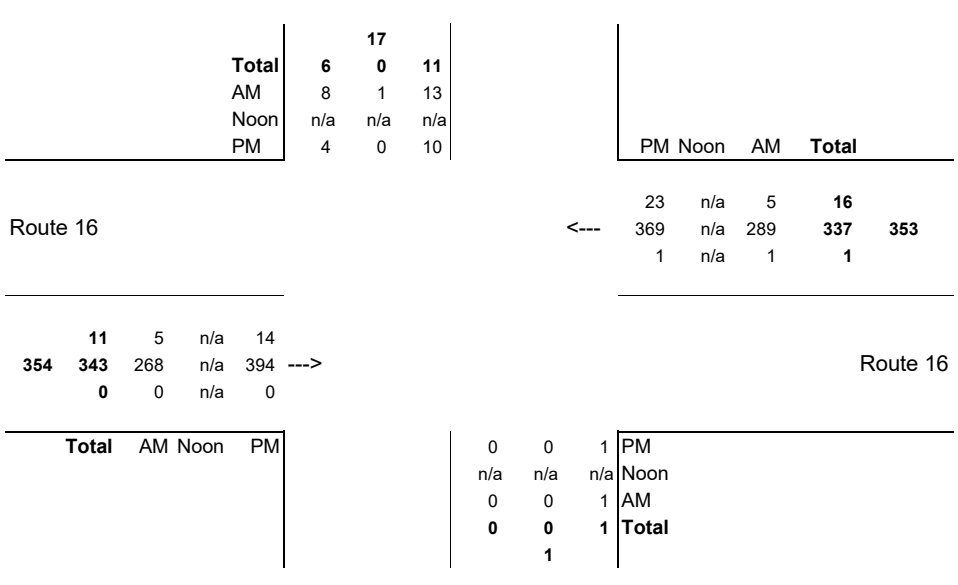
Average Hour

Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for Regular Vehicles

	Range Road 33 NORTH Approach				Range Road 33 SOUTH Approach				Route 16 WEST Approach				Route 16 EAST Approach				Total	Pedestrians			
	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Volume	N	S	W	E
Survey																					
Total	55	2	28	**85**	0	0	4	**4**	53	1716	0	**1769**	4	1683	79	**1766**	3624	0	0	0	0
Hours	5	5	5	**5**	5	5	5	**5**	5	5	5	**5**	5	5	5	**5**	5	5	5	5	5
Avg Hr	11	0	6	**17**	0	0	1	**1**	11	343	0	**354**	1	337	16	**353**	725	0	0	0	0
AM Period																					
Total	25	1	15	**41**	0	0	2	**2**	10	535	0	**545**	1	577	10	**588**	1176	0	0	0	0
Hours	2	2	2	**2**	2	2	2	**2**	2	2	2	**2**	2	2	2	**2**	2	2	2	2	2
Avg Hr	13	1	8	**21**	0	0	1	**1**	5	268	0	**273**	1	289	5	**294**	588	0	0	0	0
Noon Period																					
Total	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0
Hours	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0
Avg Hr	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	n/a	n/a
PM Period																					
Total	30	1	13	**44**	0	0	2	**2**	43	1181	0	**1224**	3	1106	69	**1178**	2448	0	0	0	0
Hours	3	3	3	**3**	3	3	3	**3**	3	3	3	**3**	3	3	3	**3**	3	3	3	3	3
Avg Hr	10	0	4	**15**	0	0	1	**1**	14	394	0	**408**	1	369	23	**393**	816	0	0	0	0

Average Hour Volumes



Vehicle Turning Movement Survey
With Classification

Major Route: Route 16
Minor Route: Range Road 33
Municipality: Parkland County
Filename: 1-Route16@RangeRoad33-Sep8.xls
Location #: 1

Date: September 8, 2010
Day-of-week: Wednesday

East/West Route: Route 16
Intersection Type: Four approach intersection
Signalized?: No
Weather: Rain & Wet

Vehicle Classifications: Regular Vehicles
Heavy Trucks
Bicycles

This data is for Heavy Trucks

Shift	Start	Duration	End
AM	7:00	2.00	9:00
PM	15:00	3.00	18:00
	Total	5.00	

Note: duration: decimal hours
start time: 24 hr clock (15 min increments)

Notes: North Approach - southbound vehicles approaching intersection from the north
15x4 - 15 min volume (from maximum 15 minute period of movement/approach in peak hour period [*]) x 4
Pedestrians - N indicates pedestrians crossing north approach (east/west)

Comments: Six leg intersection as eastbound and westbound travel lanes of Highway 16 are separated. Parkland School Division 70 - Wabamun School (K-9) fall classes started Aug 31, 2010.

Survey Data

Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for Heavy Trucks

Time	Range Road 33				Range Road 33				Route 16				Route 16							Pedestrians			
Period	NORTH Approach				SOUTH Approach				WEST Approach				EAST Approach				Total Volume		Peak				
Begins	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	15-min	Hour		N	S	W	E
7:00	7	0	2	**9**	0	0	0	**0**	0	6	0	**6**	0	15	2	**17**	32			0	0	0	0
7:15	2	0	0	**2**	0	0	0	**0**	0	10	0	**10**	0	19	0	**19**	31			0	0	0	0
7:30	4	0	0	**4**	0	0	0	**0**	0	28	0	**28**	0	14	3	**17**	49		+	0	0	0	0
7:45	3	0	0	**3**	0	0	0	**0**	1	25	0	**26**	0	13	0	**13**	42	154	*	0	0	0	0
8:00	0	1	0	**1**	0	0	1	**1**	0	17	0	**17**	0	9	4	**13**	32	154	*	0	0	0	0
8:15	3	0	0	**3**	0	0	0	**0**	0	20	0	**20**	0	19	2	**21**	44	167	*	0	0	0	0
8:30	3	0	0	**3**	0	0	0	**0**	0	15	0	**15**	0	17	2	**19**	37	155		0	0	0	0
8:45	1	0	0	**1**	0	0	0	**0**	0	21	0	**21**	0	17	0	**17**	39	152		0	0	0	0
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
Total	23	1	2	**26**	0	0	1	**1**	1	142	0	**143**	0	123	13	**136**	306			0	0	0	0

n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
Total	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0			0	0	0	0

15:00	3	0	0	**3**	0	0	0	**0**	0	28	0	**28**	0	7	2	**9**	40			0	0	0	0
15:15	3	0	0	**3**	0	0	0	**0**	0	16	0	**16**	0	20	1	**21**	40			0	0	0	0
15:30	0	0	0	**0**	0	1	0	**1**	0	20	0	**20**	1	8	0	**9**	30			0	0	0	0
15:45	1	0	1	**2**	0	0	0	**0**	1	13	0	**14**	0	11	1	**12**	28	138		0	0	0	0
16:00	1	0	0	**1**	0	0	0	**0**	0	20	0	**20**	0	19	1	**20**	41	139	+	0	0	0	0
16:15	1	0	0	**1**	0	0	0	**0**	0	24	0	**24**	0	12	1	**13**	38	137	*	0	0	0	0
16:30	0	0	0	**0**	0	0	0	**0**	0	20	0	**20**	0	14	0	**14**	34	141	*	0	0	0	0
16:45	1	0	0	**1**	0	0	0	**0**	1	11	0	**12**	0	17	0	**17**	30	143	*	0	0	0	0
17:00	0	0	0	**0**	0	0	0	**0**	0	14	0	**14**	0	9	0	**9**	23	125		0	0	0	0
17:15	0	0	0	**0**	0	0	0	**0**	1	12	0	**13**	0	9	0	**9**	22	109		0	0	0	0
17:30	0	0	0	**0**	0	0	0	**0**	0	12	0	**12**	0	8	1	**9**	21	96		0	0	0	0
17:45	0	0	0	**0**	0	0	0	**0**	0	16	0	**16**	0	6	0	**6**	22	88		0	0	0	0
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
n/a																							
Total	10	0	1	**11**	0	1	0	**1**	3	206	0	**209**	1	140	7	**148**	369			0	0	0	0

AM Peak Period

Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for Heavy Trucks

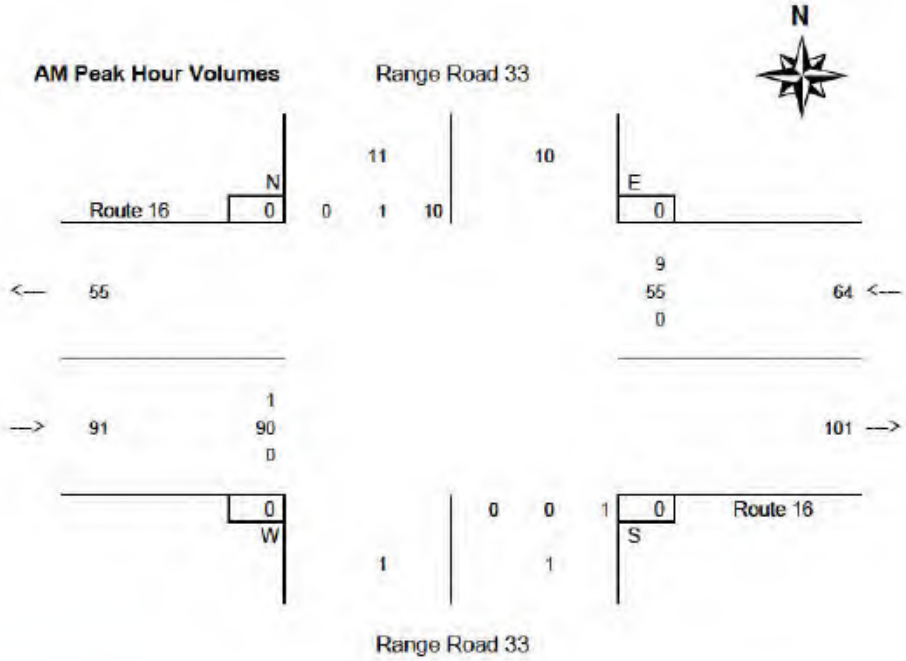
Time Period	Range Road 33 NORTH Approach				Range Road 33 SOUTH Approach				Route 16 WEST Approach				Route 16 EAST Approach				Total Volume		Peak	Pedestrians				Conflict	
Begins	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	15-min	Hour		N	S	W	E	15 min	Hr
07:00	7	0	2	9	0	0	0	0	0	6	0	6	0	15	2	17	32			0	0	0	0	24	
07:15	2	0	0	2	0	0	0	0	0	10	0	10	0	19	0	19	31			0	0	0	0	21	
07:30	4	0	0	4	0	0	0	0	0	28	0	28	0	14	3	17	49		+	0	0	0	0	32	
07:45	3	0	0	3	0	0	0	0	1	25	0	26	0	13	0	13	42	154	*	0	0	0	0	28	105
08:00	0	1	0	1	0	0	1	1	0	17	0	17	0	9	4	13	32	154	*	0	0	0	0	18	99
08:15	3	0	0	3	0	0	0	0	0	20	0	20	0	19	2	21	44	167	*	0	0	0	0	24	102
08:30	3	0	0	3	0	0	0	0	0	15	0	15	0	17	2	19	37	155		0	0	0	0	22	92
08:45	1	0	0	1	0	0	0	0	0	21	0	21	0	17	0	17	39	152		0	0	0	0	22	86
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
Total	23	1	2	26	0	0	1	1	1	142	0	143	0	123	13	136	306			0	0	0	0		166
Avg Hr	12	1	1	13	0	0	1	1	1	71	0	72	0	62	7	68	153			0	0	0	0		n/a

Peak hour of the intersection

Pk Hr	10	1	0	11	0	0	1	1	1	90	0	91	0	55	9	64	167	*		0	0	0	0		101
15x4	16	4	0	16	0	0	4	4	4	112	0	112	0	76	16	84	196	+		0	0	0	0		132
PHF	0.63	0.25	n/a	0.69	n/a	n/a	0.25	0.25	0.25	0.80	n/a	0.81	n/a	0.72	0.56	0.76	0.85			n/a	n/a	n/a	n/a		0.77

Peak hour of conflicting volumes for the intersection

Pk Hr	16	0	2	18	0	0	0	0	1	69	0	70	0	61	5	66	154	*		0	0	0	0		85
15x4	28	0	8	36	0	0	0	0	4	112	0	112	0	76	12	76	196	+		0	0	0	0		140
PHF	0.57	n/a	0.25	0.50	n/a	n/a	n/a	n/a	0.25	0.62	n/a	0.63	n/a	0.80	0.42	0.87	0.79			n/a	n/a	n/a	n/a		0.61



PM Peak Period

Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for Heavy Trucks

Time	Range Road 33				Range Road 33				Route 16				Route 16							Pedestrians				Conflict	
Period	NORTH Approach				SOUTH Approach				WEST Approach				EAST Approach				Total Volume								
Begins	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	15-min	Hour		N	S	W	E	15 min	Hr
15:00	3	0	0	3	0	0	0	0	0	28	0	28	0	7	2	9	40			0	0	0	0	31	
15:15	3	0	0	3	0	0	0	0	0	16	0	16	0	20	1	21	40			0	0	0	0	24	
15:30	0	0	0	0	0	1	0	1	0	20	0	20	1	8	0	9	30			0	0	0	0	22	
15:45	1	0	1	2	0	0	0	0	1	13	0	14	0	11	1	12	28	138		0	0	0	0	14	91
16:00	1	0	0	1	0	0	0	0	0	20	0	20	0	19	1	20	41	139	+	0	0	0	0	21	81
16:15	1	0	0	1	0	0	0	0	0	24	0	24	0	12	1	13	38	137	*	0	0	0	0	25	82
16:30	0	0	0	0	0	0	0	0	0	20	0	20	0	14	0	14	34	141	*	0	0	0	0	20	80
16:45	1	0	0	1	0	0	0	0	1	11	0	12	0	17	0	17	30	143	*	0	0	0	0	19	85
17:00	0	0	0	0	0	0	0	0	0	14	0	14	0	9	0	9	23	125		0	0	0	0	14	78
17:15	0	0	0	0	0	0	0	0	1	12	0	13	0	9	0	9	22	109		0	0	0	0	12	65
17:30	0	0	0	0	0	0	0	0	0	12	0	12	0	8	1	9	21	96		0	0	0	0	12	57
17:45	0	0	0	0	0	0	0	0	0	16	0	16	0	6	0	6	22	88		0	0	0	0	16	54
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
n/a																									
Total	10	0	1	11	0	1	0	1	3	206	0	209	1	140	7	148	369			0	0	0	0		218
Avg Hr	3	0	0	4	0	0	0	0	1	69	0	70	0	47	2	49	123			0	0	0	0		n/a

Peak hour of the intersection

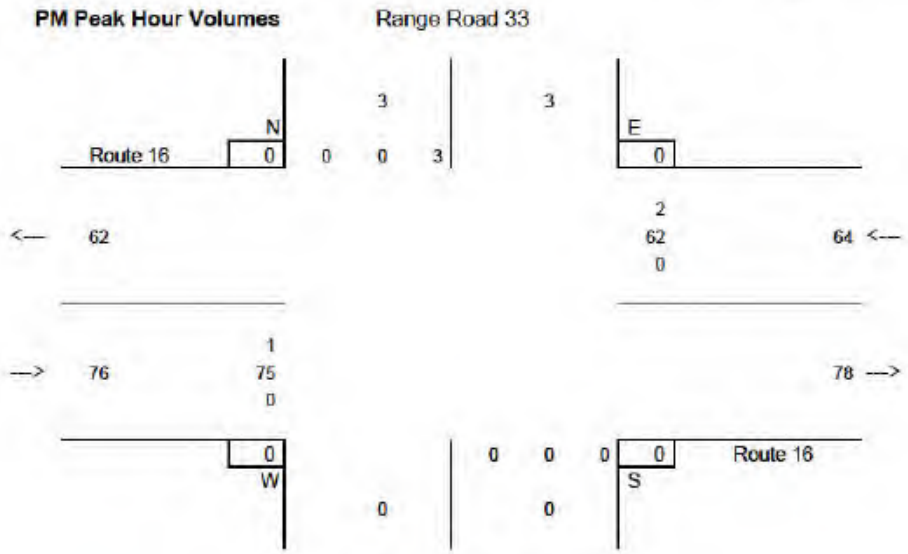
Pk Hr	3	0	0	3	0	0	0	0	1	75	0	76	0	62	2	64	143	*		0	0	0	0		78
15x4	4	0	0	4	0	0	0	0	4	96	0	96	0	76	4	80	164	+		0	0	0	0		100
PHF	0.75	n/a	n/a	0.75	n/a	n/a	n/a	n/a	0.25	0.78	n/a	0.79	n/a	0.82	0.50	0.80	0.87			n/a	n/a	n/a	n/a		0.78

Peak hour of conflicting volumes for the intersection

Pk Hr	7	0	1	8	0	1	0	1	1	77	0	78	1	46	4	51	138	*		0	0	0	0		86
15x4	12	0	4	12	0	4	0	4	4	112	0	112	4	80	8	84	160	+		0	0	0	0		132
PHF	0.58	n/a	0.25	0.67	n/a	0.25	n/a	0.25	0.25	0.69	n/a	0.70	0.25	0.58	0.50	0.61	0.86			n/a	n/a	n/a	n/a		0.65

N

PM Peak Hour Volumes



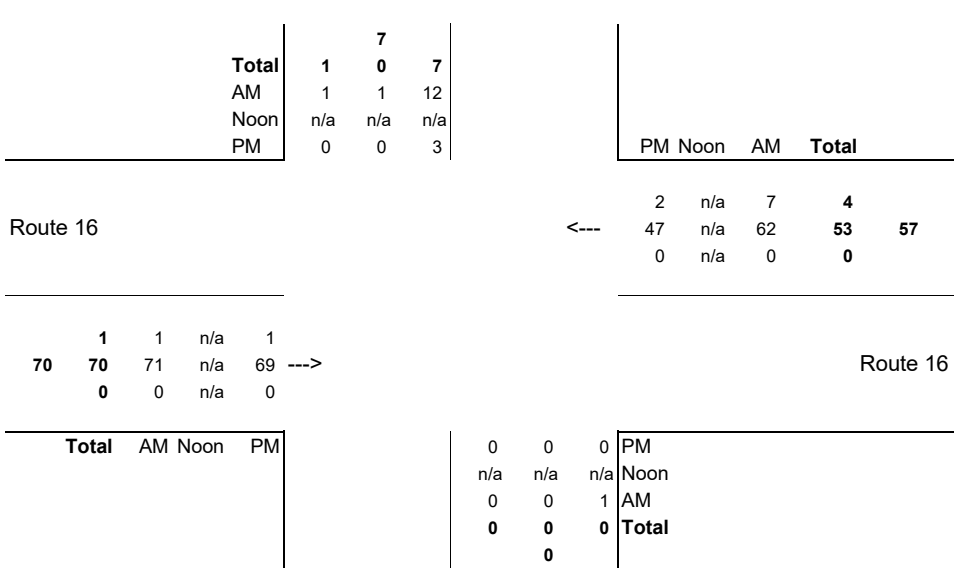
Average Hour

Location: Route 16 @ Range Road 33
Date: Wednesday, September 8, 2010

This data is for Heavy Trucks

	Range Road 33 NORTH Approach				Range Road 33 SOUTH Approach				Route 16 WEST Approach				Route 16 EAST Approach				Total	Pedestrians			
	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Left	Thru	Right	Total	Volume	N	S	W	E
Survey																					
Total	33	1	3	**37**	0	1	1	**2**	4	348	0	**352**	1	263	20	**284**	675	0	0	0	0
Hours	5	5	5	**5**	5	5	5	**5**	5	5	5	**5**	5	5	5	**5**	5	5	5	5	5
Avg Hr	7	0	1	**7**	0	0	0	**0**	1	70	0	**70**	0	53	4	**57**	135	0	0	0	0
AM Period																					
Total	23	1	2	**26**	0	0	1	**1**	1	142	0	**143**	0	123	13	**136**	306	0	0	0	0
Hours	2	2	2	**2**	2	2	2	**2**	2	2	2	**2**	2	2	2	**2**	2	2	2	2	2
Avg Hr	12	1	1	**13**	0	0	1	**1**	1	71	0	**72**	0	62	7	**68**	153	0	0	0	0
Noon Period																					
Total	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0
Hours	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0
Avg Hr	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	n/a	n/a
PM Period																					
Total	10	0	1	**11**	0	1	0	**1**	3	206	0	**209**	1	140	7	**148**	369	0	0	0	0
Hours	3	3	3	**3**	3	3	3	**3**	3	3	3	**3**	3	3	3	**3**	3	3	3	3	3
Avg Hr	3	0	0	**4**	0	0	0	**0**	1	69	0	**70**	0	47	2	**49**	123	0	0	0	0

Average Hour Volumes



ALBERTA HIGHWAYS 1 TO 986
TRAFFIC VOLUME HISTORY 2000 - 2009

Alberta Transportation
Program Management Branch
Network Planning and Performance

Produced: 26-Feb-2010 By CornerStone Solutions Inc.

Hwy	CS	TCS	Muni	From	2000 AADT	2001 AADT	2002 AADT	2003 AADT	2004 AADT	2005 AADT	2006 AADT	2007 AADT	2008 AADT	2009 AADT	2009 ASDT
16	12	16	Park	E OF 765 E OF FALLIS	7950	8220	8370	8120	8410	8870	9360	9490	8900	8770	10480
16	12	16	Park	W OF WABAMUN ACC 11-53-4-515000100	8240	8540	8600	8580	8880	9380	9920	10060		9050	10820
16	12	16	Park	E OF WABAMUN ACC 11-53-4-515000100	9910	10280	10260	10040	10400	10880	11500	11800		11000	13150
16	12	16	Park	W OF WABAMUN LAKE PP ACC	9860	10230	10240	10060	10420	10900	11520	11820	11270	11000	13150
16	12	20	Park	E OF WABAMUN LAKE PP ACC	10290	10670	10980	10780	11170	11610	12180	12580	12060	12160	14650
16	12	20	Park	W OF RGE RD 32 10-53-3-500000000							12100	12480	12160	12280	14800
16	12	20	Park	E OF RGE RD 32 10-53-3-500000000							12980	13440	13120	13260	15980
16	12	20	Park	W OF PARKLAND DR 12-53-3-513000000							13010	13470	13120	13260	15980
16	12	20	Park	E OF PARKLAND DR 12-53-3-513000000							12960	13420	13070	13220	15930
16	12	20	Park	W OF MESO RD 12-53-3-500000000	10860	11310	11490	11280	11680	12100	12960	13420	13070	13220	15930
16	12	20	Park	E OF MESO RD 12-53-3-500000000	11260	11740	12010	11800	12230	12600	13390	13930	13640	14010	16880
16	12	20	Park	1.0 KM W OF 16 & 43 CARVEL CORNER	11860	12350	12550	12280	12690	13060	13530	14080	13880	14060	16980
16	12	20	Park	W OF 770 W OF MANLY CORNER	11850	12350	12460	12230	12670	13050	13570	14090	13920	14090	16980
16	12	24	Park	E OF 770 W OF MANLY CORNER	12800	13370	13490	13270	13760	14180	14740	15310	15120	15320	18460
16	12	24	Park	W OF 43 AT MANLY CORNER	12850	13400	13490	13270	13760	14180	14740	15310	15120	15320	18460
16	14	4	Park	E OF 43 AT MANLY CORNER	20740	21760	22060	21990	22760	23470	24810	26100	25650	25880	29110
16	14	4	Park	W OF 16A NW OF BEACH CORNER	20740	21800	22020	21950	22630	23540	24810	26100	25650	25880	29110
16	14	8	Park	E OF 16A NW OF BEACH CORNER	11900	12630	12760	12790	14160	14920	16680	18140	18080	18800	21510
16	14	8	Park	W OF LAKE EDEN RD 12-53-2-500000150	11900	12650	12760	12790	14160	14920	16680	18140	18080	18800	21520
16	14	8	Park	E OF LAKE EDEN RD 12-53-2-500000150	12830	13550	14290	14280	15630	16390	18760	20360	20480	21300	24380
16	14	8	Park	W OF BEACH CORNER RD 7-53-1-500000075	12830	13800	14290	14280	15630	16390	18760	20360	20480	21300	24380
16	14	8	Park	E OF BEACH CORNER RD 7-53-1-500000075	13400	14600	15340	15260	16590	17340	19670	21320	21380	22260	25470
16	14	8	Park	W OF HUBBLES LAKE RD 17-53-1-500001550	13400	14740	15340	15260	16590	17340	19670	21320	21380	22260	25470
16	14	8	Park	E OF HUBBLES LAKE RD 17-53-1-500001550	14180	15400	16090	15980	17280	18020	20320	22010	21730	22630	25900
16	14	8	Park	W OF ALAN BEACH RD 16-53-1-500001480	14180	15400	16090	15980	17280	18020	20320	22010	21730	22630	25900
16	14	8	Park	E OF ALAN BEACH RD 16-53-1-500001480	14960	15920	16630	16530	17680	18410	20850	22600	22210	23130	26470
16	14	8	Park	W OF ROSENTHAL RD 10-53-1-500000075	14960	15950	16930	16530	17680	18410	20850	22600	22210	23130	26470
16	14	8	Park	E OF ROSENTHAL RD 10-53-1-500000075	15110	16240	16730	16620	17560	18250	20600	22330	22420	23340	26710
16	14	8	Park	2.1 KM W OF 16 & 779 STONY PLAIN	15110	16240	16880	16850	17620	18250	20830	22350	22400	23370	26710
16	14	8	Park	W OF 779 N OF STONY PLAIN	15330	16240	16730	16620	17560	18250	20600	22330	22420	23340	26710
16	14	12	Park	E OF 779 N OF STONY PLAIN	18870	20610	21240	20300	21440	22360	25020	27130	27470	27910	31940
16	14	12	Park	W OF CAMPSITE RD 8-53-27-400000120	19200	20620	21250	20310	21440	22360	25020	27130	27470	27910	31940
16	14	12	Park	E OF CAMPSITE RD 8-53-27-400000120	20490	21500	22150	21190	22350	23660	26230	28430	28810	29860	34170
16	14	16	Park	W OF CENTURY RD 10-53-27-400000000	20850	21240	23450	23370	24650	26000	28510	28430	28810	29860	34170
16	14	16	Park	E OF CENTURY RD 10-53-27-400000000	23500	23930	24720	25680	27100	28590	31350	33990	34430	35270	40360
16	14	16	Park	W OF PIONEER RD 14-53-27-400001550	23500	23900	24720	25680	27100	28590	31350	33990	34430	35270	40360
16	14	16	Park	E OF PIONEER RD 14-53-27-400001550	23500	23900	24680	25640	27060	28550	31370	34010	34450	35290	40390
16	14	16	Park	W OF ATIM RD 13-53-27-400001500	23500	23900	24680	25640	27060	28550	31370	34010	34450	35290	40390
16	14	16	Park	E OF ATIM RD 13-53-27-400001500	23500	23950	24720	25660	27060	28550	31490	34150	34590	35430	40550
16	14	16	Park	W OF 44 W OF EDMONTON	23500	23960	24720	25660	27060	28550	31490	34150	34590	35430	40550
16	14	20	Park	E OF 44 W OF EDMONTON	25490	26610	27570	27110	28520	30080	32670	35540	36240	36670	40130

ALBERTA HIGHWAYS 1 TO 986
TRAFFIC VOLUME, VEHICLE CLASSIFICATION, TRAVEL and ESAL STATISTICS REPORT
2009

Alberta Transportation
Planning Branch
Strategic and Network Planning

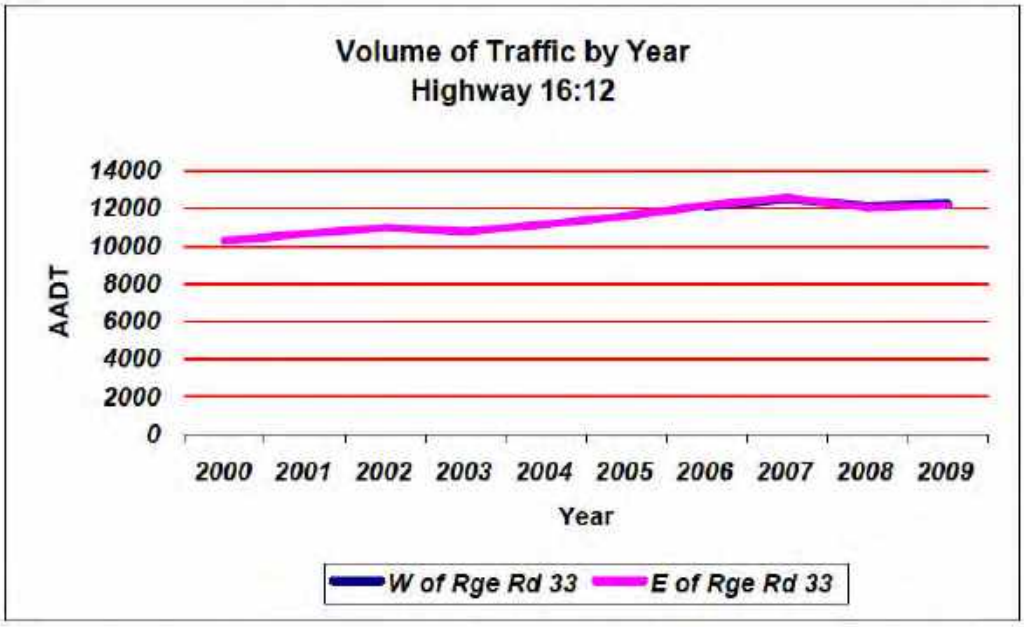
Produced: 09-Mar-2010 By CornerStone Solutions Inc

Hwy	CS	TCS	Muni	From	To	From Km	To Km	Length in Km	Volume AADT	Volume ASDT	Classifications %PV	%RV	%BU	%SU	%TT	%CM	Travel MVKM Annual	Travel MVKM Summer	ESAL / Day / Dir SU	ESAL / Day / Dir TC	ESAL / Day / Dir Total
15	8	20	Lamo	E OF 834 W OF CHIPMAN	N OF 16 & 855 S OF MUNDARE	19.980	47.121	27.141	1230	1370	78.0	2.3	0.2	7.5	12.0	19.7	12.2	5.7	40.6	153.0	193.6
15	8			E OF 45 S OF BRUDERHEIM	N OF 16 & 855 S OF MUNDARE			47.121	1970	2226	81.4	2.4	0.4	5.3	10.5	15.2	33.9	16.0	46.0	214.4	260.4
15				EDMONTON E.C.L.	N OF 16 & 855 S OF MUNDARE			66.197	4114	4649	84.8	2.1	0.4	4.3	8.4	13.1	99.4	47.1	77.9	358.2	436.1
16	2	4	Yelw	JASPER PARK BOUNDARY	W OF 40 S OF ENTRANCE WJ	0.000	19.400	19.400	3940	5380	75.6	7.9	0.5	2.3	13.7	16.5	27.9	16.0	38.9	559.5	598.4
16	2	8	Yelw	E OF 40 SE OF ENTRANCE WJ	W OF 40 SW OF HINTON W.C.L. EJ	19.400	21.370	1.970	5880	7010	76.7	7.1	0.7	3.7	11.8	16.2	4.2	2.1	95.6	716.7	812.2
16	2	12	Yelw	E OF 40 SW OF HINTON W.C.L. EJ	HINTON E.C.L.	21.370	31.030	9.660	8670	10380	83.0	3.8	0.4	3.6	9.2	13.2	30.6	15.3	137.5	826.6	964.3
16	2	16	Yelw	HINTON E.C.L.	WEST OF OBED	31.030	53.073	22.043	5410	6470	70.2	1.9	0.6	4.8	22.5	27.9	43.5	21.8	114.4	1261.7	1376.1
16	2			JASPER PARK BOUNDARY	WEST OF OBED			53.073	5483	6603	75.8	4.2	0.5	3.8	15.9	20.2	106.2	55.2	91.8	903.6	995.4
16	4	4	Yelw	WEST OF OBED	W OF 47 W OF EDSON	0.000	49.551	49.551	5770	6910	70.6	6.3	0.3	5.0	17.8	23.1	104.4	52.4	127.1	1064.5	1191.6
16	4			WEST OF OBED	W OF 47 W OF EDSON			49.551	5770	6910	70.6	6.3	0.3	5.0	17.8	23.1	104.4	52.4	127.1	1064.5	1191.6
16	5	4	Yelw	E OF 47 W OF EDSON	EDSON W.C.L.	0.000	8.140	8.140	8450	9710	74.9	9.6	0.5	5.7	16.2	22.5	25.1	12.1	212.2	1418.9	1631.1
16	5	8	Yelw	EDSON W.C.L.	EDSON E.C.L.	8.140	11.660	3.520	18380	21120	83.7	1.6	0.5	4.9	9.3	14.7	23.6	11.4	396.7	1771.7	2168.4
16	5	8	Yelw	EDSON E.C.L.	W OF 32 S OF PEERS	11.660	42.291	30.631	8130	9460	72.8	4.9	0.4	6.1	15.8	22.3	90.9	44.3	218.5	1331.4	1549.9
16	5			E OF 47 W OF EDSON	W OF 32 S OF PEERS			42.291	9045	10479	75.0	5.9	0.5	5.8	14.8	21.1	139.6	67.8	231.1	1387.5	1618.6
16	8	4	Yelw	E OF 32 SE OF PEERS	W OF 751 SW OF NOJACK	0.000	25.320	25.320	6050	7230	86.6	6.2	0.4	5.3	19.5	25.2	55.9	26.0	141.2	1222.8	1364.0
16	8	8	Yelw	E OF 751 SW OF NOJACK	W 753 E OF CHIP LAKE	25.320	36.924	11.604	5510	6590	89.5	6.9	0.2	4.4	19.1	23.7	23.3	11.7	109.8	1090.8	1197.6
16	8			E OF 32 SE OF PEERS	W 753 E OF CHIP LAKE			36.924	5860	7029	88.9	6.4	0.3	5.0	19.4	24.7	79.2	38.7	129.5	1182.4	1311.9
16	10	4	Yelw	E OF 753 E OF CHIP LAKE	W OF 16A W OF STYAL	0.000	19.040	19.040	5840	6980	89.3	4.6	0.4	5.8	19.7	25.9	40.6	20.3	149.2	1192.5	1341.7
16	10	8	Yelw	E OF 16A W OF STYAL	W OF 22 SE OF ENTWISTLE EJ	19.040	29.643	10.603	7330	8790	72.2	4.2	0.5	5.7	17.4	23.6	25.4	14.2	184.0	1322.0	1506.0
16	10			E OF 753 E OF CHIP LAKE	W OF 22 SE OF ENTWISTLE EJ			29.643	6373	7617	79.4	4.6	0.4	5.8	18.8	25.0	69.0	34.5	162.8	1241.9	1404.7
16	12	4	Park	E OF 22 SE OF ENTWISTLE EJ	W OF 757 S OF MAGNOLIA	0.000	8.560	8.560	7520	8930	73.5	3.2	0.5	6.3	16.5	23.3	23.5	11.8	209.7	1286.1	1494.8
16	12	8	Park	E OF 757 S OF MAGNOLIA	W OF 31 E OF GAINFORD	8.560	18.950	8.390	7490	8950	73.1	5.0	0.4	5.8	15.9	21.9	22.9	11.5	184.8	1234.4	1419.2
16	12	12	Park	E OF 31 E OF GAINFORD	W OF 765 E OF FALLS	18.950	28.700	9.750	8340	9970	74.9	5.5	0.4	4.5	14.7	19.6	29.7	14.9	165.3	1270.7	1436.0
16	12	16	Park	E OF 765 E OF FALLS	W OF RGE RD 35 N OF KAPASIWIN	28.700	38.450	11.750	9770	11680	77.4	5.1	0.4	3.5	13.6	17.5	41.9	21.0	150.8	1377.2	1527.8
16	12	20	Park	E OF RGE RD 35 N OF KAPASIWIN	W OF 770 W OF MANLY CORNER	38.450	51.280	12.830	13130	15820	79.2	3.2	0.4	4.0	13.2	17.6	61.5	31.1	231.4	1796.4	2027.8
16	12	24	Park	E OF 770 W OF MANLY CORNER	W OF 43 AT MANLY CORNER	51.280	51.548	0.268	15420	18460	81.4	3.3	0.7	3.7	10.7	15.1	1.5	0.8	249.7	1690.1	1948.8
16	12			E OF 22 SE OF ENTWISTLE EJ	W OF 43 AT MANLY CORNER			51.548	9620	11531	78.6	4.2	0.4	4.5	14.3	19.2	161.0	90.9	190.7	1425.9	1616.6
16	14	4	Park	E OF 43 AT MANLY CORNER	W OF 16A NW OF BEACH CORNER	0.000	4.220	4.220	25860	29110	82.8	2.5	0.5	3.8	10.3	14.7	39.9	18.8	433.2	2762.9	3196.1
16	14	8	Park	E OF 16A NW OF BEACH CORNER	W OF 779 N OF STONY PLAIN	4.220	14.800	10.580	22450	25690	78.5	3.7	0.3	4.1	15.4	19.8	85.1	40.8	405.5	3583.5	3989.0
16	14	12	Park	E OF 779 N OF STONY PLAIN	W OF RGE RD 273 N OF SPRUCE GROVE	14.800	20.680	6.080	28520	32640	80.9	1.0	0.4	4.3	13.4	18.1	63.3	30.4	540.2	3961.2	4501.4
16	14	16	Park	E OF RGE RD 273 N OF SPRUCE GROVE	W OF 44 W OF EDMONTON	20.680	27.370	6.690	33120	37900	85.0	1.9	0.2	3.0	9.3	13.1	80.9	38.8	525.2	3192.6	3717.8
16	14	20	Park	E OF 44 W OF EDMONTON	W OF 60 W OF EDMONTON	27.370	30.435	3.065	35670	40130	82.4	1.4	0.3	4.0	11.3	16.2	41.0	18.8	743.0	4295.0	5038.0
16	14			E OF 43 AT MANLY CORNER	W OF 60 W OF EDMONTON			30.435	27916	31691	81.3	2.2	0.3	4.0	12.2	16.5	310.1	147.6	491.9	3530.1	4022.0
16	16	4	Park	E OF 60 W OF EDMONTON	W OF 216 W OF EDMONTON	0.000	7.490	7.490	41300	45190	80.8	1.6	0.3	6.4	10.9	17.6	112.9	51.6	1164.3	4666.0	5830.3
16	16			E OF 60 W OF EDMONTON	W OF 216 W OF EDMONTON			7.490	41300	45190	80.8	1.6	0.3	6.4	10.9	17.6	112.9	51.6	1164.3	4666.0	5830.3
16	18	8	Strc	EDMONTON E.C.L.	W OF 21 N OF BREMNER	0.000	7.354	7.354	44020	47970	86.5	1.0	0.6	5.1	6.8	12.5	118.2	54.0	988.9	3102.6	4091.5
16	18			EDMONTON E.C.L.	W OF 21 N OF BREMNER			7.354	44020	47970	86.5	1.0	0.6	5.1	6.8	12.5	118.2	54.0	988.9	3102.6	4091.5
16	20	4	Strc	E OF 21 E OF BREMNER	W OF 824 E OF QUEENSDALE PLACE	0.000	6.506	6.506	17270	19370	86.1	1.9	0.8	3.3	7.9	12.0	41.0	19.5	251.0	1414.1	1665.1
16	20	8	Strc	E OF 824 E OF QUEENSDALE PLACE	W OF 830 W OF ELK ISLAND PARK	6.506	11.430	4.924	15750	17650	85.1	3.3	0.9	3.1	7.6	11.6	28.3	13.3	215.1	1240.7	1455.8
16	20	12	Strc	E OF 830 W OF ELK ISLAND PARK	W OF ELK ISLAND PARK ACCESS	11.430	26.967	15.537	11200	12560	81.8	3.5	0.5	3.4	10.8	14.7	83.5	39.9	167.7	1253.8	1421.5
16	20			E OF 21 E OF BREMNER	W OF ELK ISLAND PARK ACCESS			26.967	13495	15132	83.8	3.0	0.7	3.3	9.2	13.2	132.8	62.4	199.2	1288.9	1488.1

EBA Project No. E32101266
Highway 16:12
Intersection at Highway 16:12 and Range Road 33

Traffic Data Summary for Highway 16:12

	AADT									
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Location	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
W of Rge Rd 33							12100	12480	12160	12280
E of Rge Rd 33	10290	10670	10980	10780	11170	11610	12180	12580	12060	12160



Average Rate of Growth per Year:

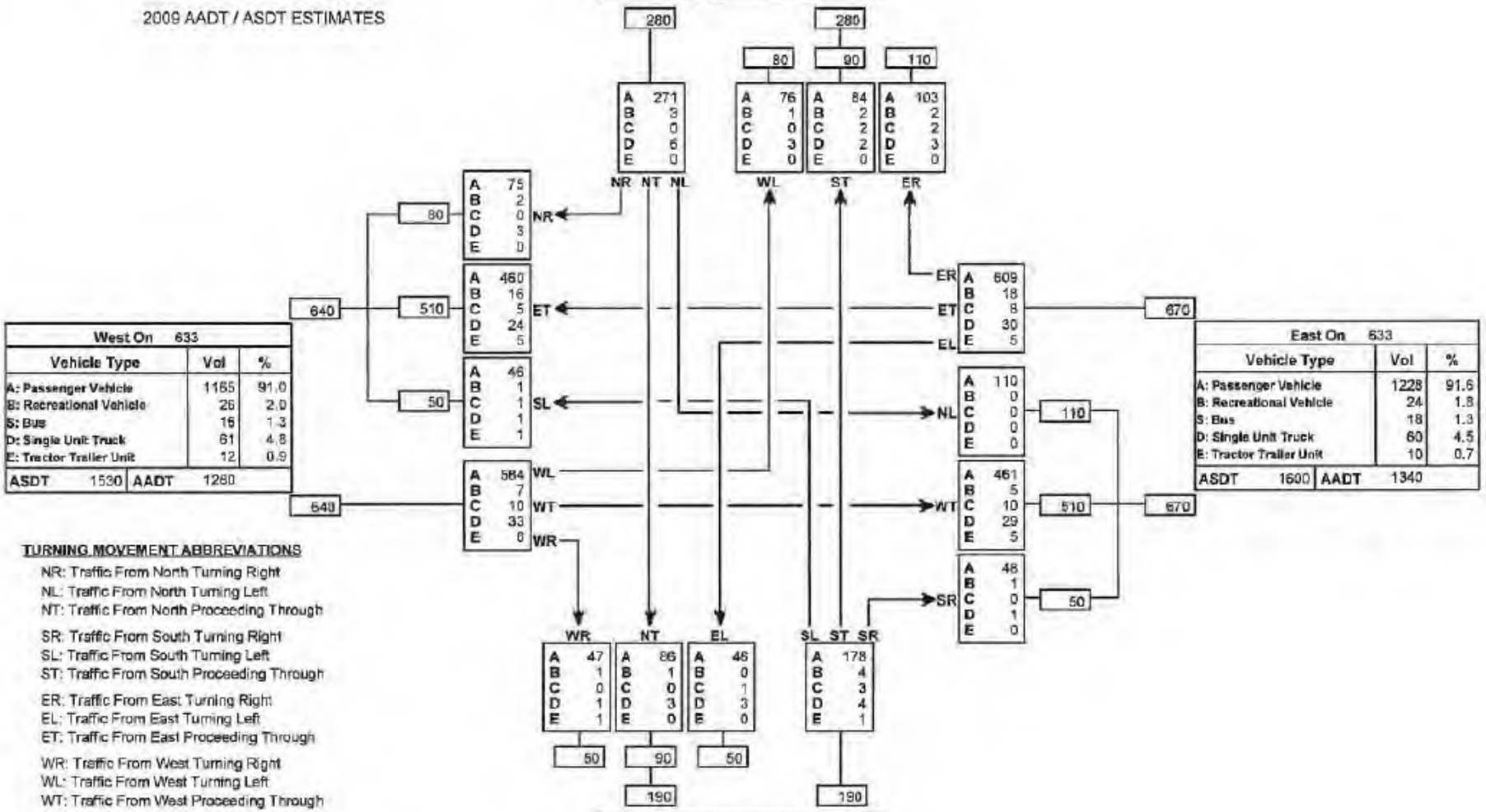
W of Rge Rd 33	0.49%
E of Rge Rd 33	1.71%

Turning Movement Summary Diagram

Reference No.: 70000394

Intersection of:
633 & RGE RD 33 9-54-3-500000000

2009 AADT / ASDT ESTIMATES



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Average Annual Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of May 1 to September 30 (153 days)

Turning Movement Summary Diagram

Reference No.: 70000394

Intersection of:
633 & RGE RD 33 9-54-3-500000000

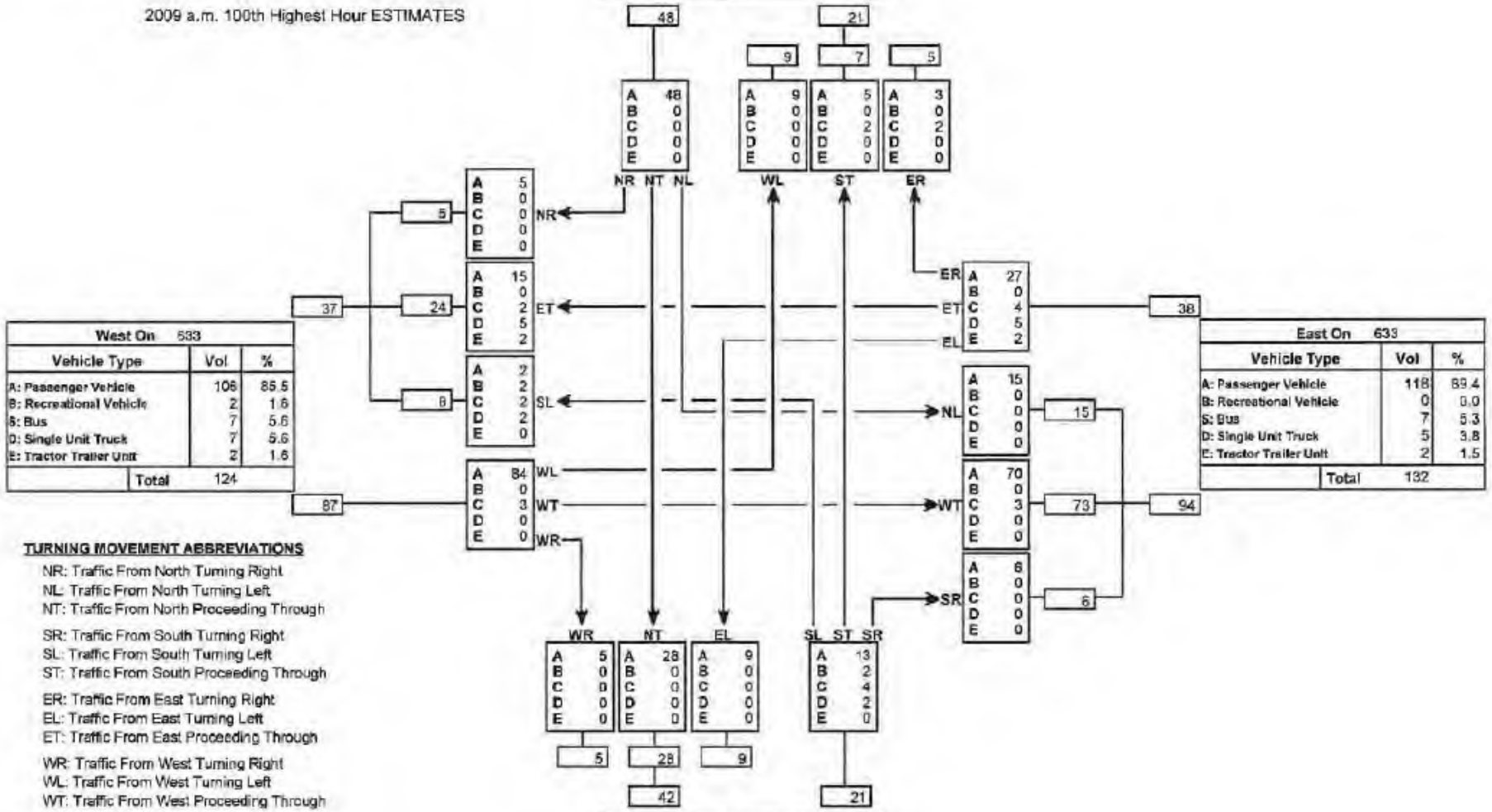
2009 a.m. 100th Highest Hour ESTIMATES

North On Rge Rd 33		
Vehicle Type	Vol	%
A: Passenger Vehicle	65	94.2
B: Recreational Vehicle	0	0.0
S: Bus	4	5.8
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	69	

West On 633		
Vehicle Type	Vol	%
A: Passenger Vehicle	106	85.5
B: Recreational Vehicle	2	1.6
S: Bus	7	5.6
D: Single Unit Truck	7	5.6
E: Tractor Trailer Unit	2	1.6
Total	124	

East On 633		
Vehicle Type	Vol	%
A: Passenger Vehicle	118	89.4
B: Recreational Vehicle	0	0.0
S: Bus	7	5.3
D: Single Unit Truck	5	3.8
E: Tractor Trailer Unit	2	1.5
Total	132	

South On Rge Rd 33		
Vehicle Type	Vol	%
A: Passenger Vehicle	55	87.3
B: Recreational Vehicle	2	3.2
S: Bus	4	6.3
D: Single Unit Truck	2	3.2
E: Tractor Trailer Unit	0	0.0
Total	63	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

Turning Movement Summary Diagram

Reference No.: 70000394

Intersection of:
633 & RGE RD 33 9-54-3-500000000

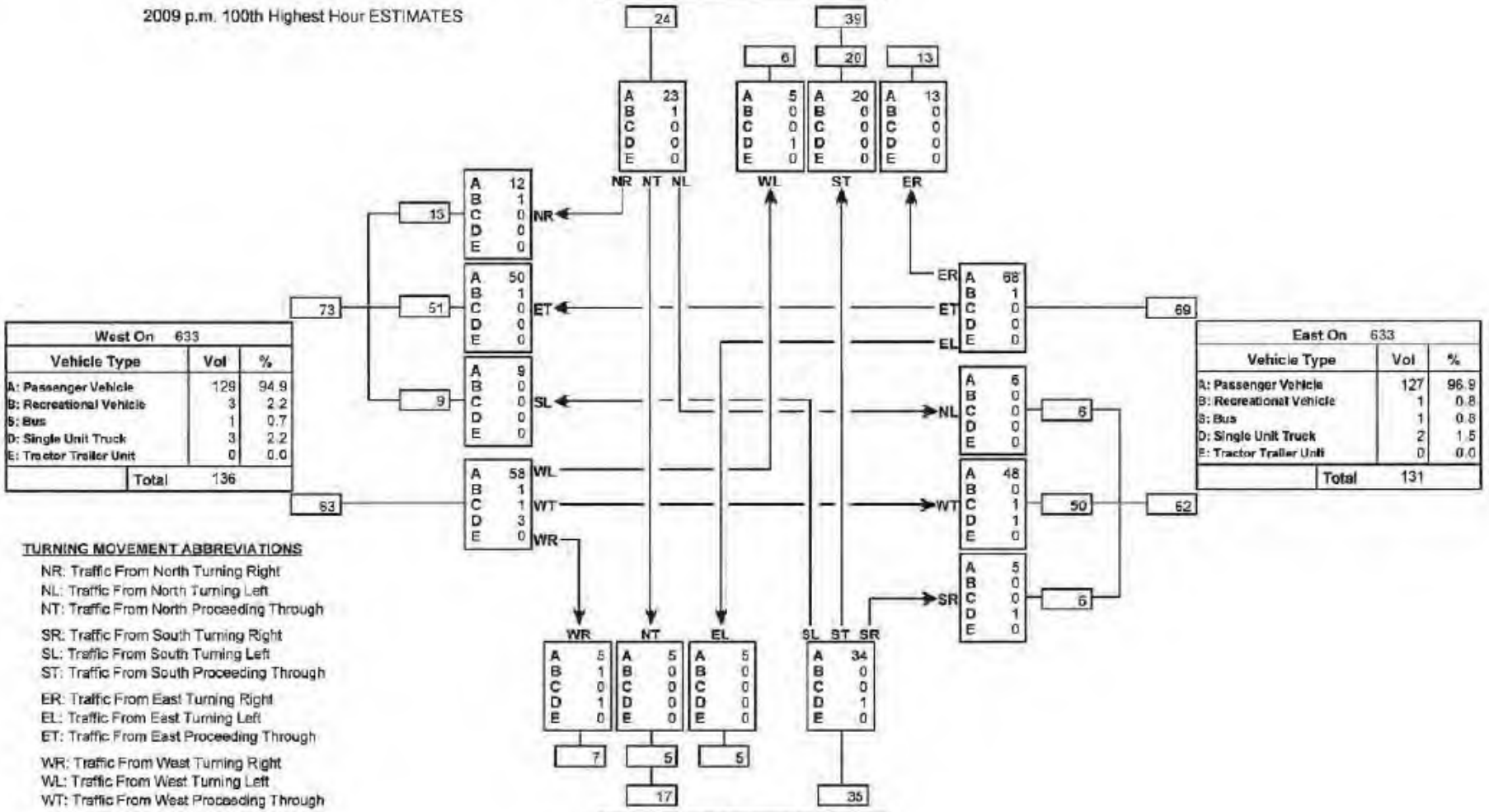
2009 p.m. 100th Highest Hour ESTIMATES

North On Rge Rd 33		
Vehicle Type	Vol	%
A: Passenger Vehicle	81	96.8
B: Recreational Vehicle	1	1.6
S: Bus	0	0.0
D: Single Unit Truck	1	1.6
E: Tractor Trailer Unit	0	0.0
Total	83	

West On 633		
Vehicle Type	Vol	%
A: Passenger Vehicle	129	94.9
B: Recreational Vehicle	3	2.2
S: Bus	1	0.7
D: Single Unit Truck	3	2.2
E: Tractor Trailer Unit	0	0.0
Total	136	

East On 633		
Vehicle Type	Vol	%
A: Passenger Vehicle	127	96.9
B: Recreational Vehicle	1	0.8
S: Bus	1	0.8
D: Single Unit Truck	2	1.5
E: Tractor Trailer Unit	0	0.0
Total	131	

South On Rge Rd 33		
Vehicle Type	Vol	%
A: Passenger Vehicle	49	94.2
B: Recreational Vehicle	1	1.9
S: Bus	0	0.0
D: Single Unit Truck	2	3.8
E: Tractor Trailer Unit	0	0.0
Total	52	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

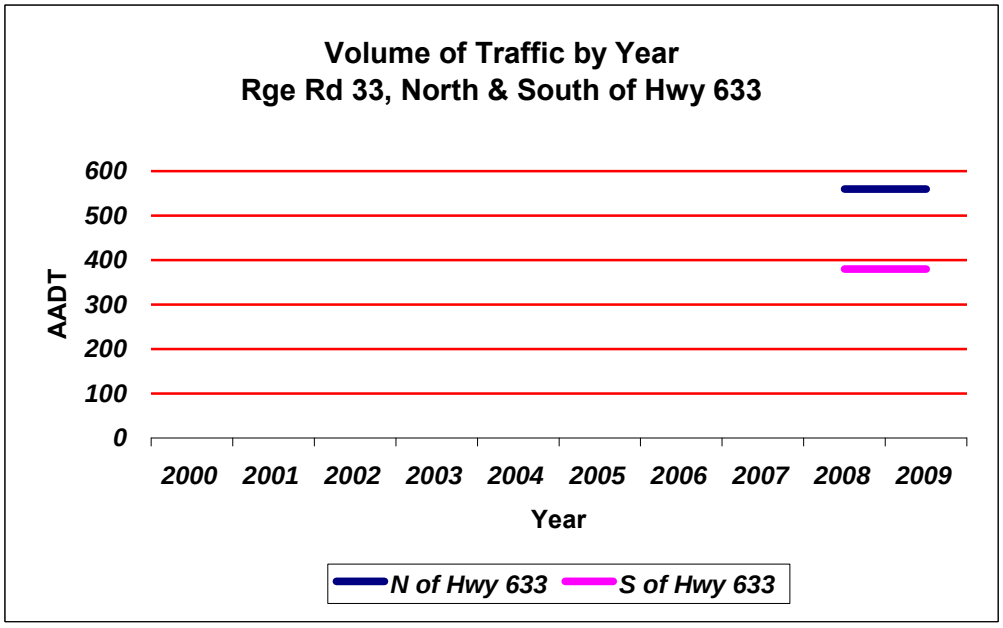
ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

EBA Project No. E32101266
Highway 633:02 and Range Road 33
Intersection at Highway 633 and Range Road 33

Traffic Data Summary for Range Road 33

	AADT									
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Location	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
N of Hwy 633									560	560
S of Hwy 633									380	380



Average Rate of Growth per Year:

N of Hwy 633	0.00%
S of Hwy 633	0.00%

APPENDIX C

APPENDIX C COLLISION DATA

							At Int.		At Int.	Not			Not at int.,	Special	**Occurrence**			Veh 1	Veh 2					Mjr.			Env.	Surf.	Total	Total	
Year	Case	Obj.	Police	In/	Place	On	With	On	With	At Int.		Km	Reference	Reference Location		Hour	Col.	Pri.	Dir. Of	Dir. Of	Veh 1	Veh 2	Col.	Hwy	Ctrl.	Safety	Km					Decription
	Number	No.	Service	Near	Name	Hwy	Hwy	Street	Street	Dist.	Dir.	/m	Point Description	Description	Date	24 hd.	Sev.	Event	Travel	Travel	Mnvr	Mnvr	Type	No.	Sctn.	Sctn.	Post	Cond.	Cond.	Injuries	Fatalities	
2005	1640774		1467	2	STONY PL	16			RR 33						2/25/2005	23.45	3	1	7		47		94	16	12	40	41.77	1	1	0	0	V1 WB STRUCK DEER.
2005	1687757		1467	2	WABAMUN	16								EAST OF ALBERTA BEACH ROAD(RR # 33)	11/11/2005	18.3	3	1	7		47		94	16	12	40	41.87	1	1	0	0	V1 WB, DEER STRUCK V1.
2008	Z539854		1467	2	WABAMUN	16			RR 33						1/1/2008	22.45	3	1	3		47		94	16	12	40	41.82			0	0	VEH EB, MOOSE RAN INTO VEH.
2008	1991119		EPS	1	STONY PL	16			RGE RD 33					APPROX 40KM W	7/16/2008	21	3	1	3		47		94	16	12	40	41.41	1	1	0	0	V1 EB, STRUCK SB DEER.

ALBERTA COLLISION REPORT FORM - TSS284/TSS284A
CODE DEFINITIONS

(Please note that throughout the code 97 identifies missing information)

OCCURRENCE MONTH

01 = January
02 = February
03 = March
04 = April
05 = May
06 = June
07 = July
08 = August
09 = September
10 = October
11 = November
12 = December

OCCURRENCE TIME

24 hr clock

COLLISION SEVERITY

01 = Fatal
02 = Injury
03 = Property Damage

PRIMARY EVENT

01 = Struck Object
02 = Off Road Left
03 = Right Angle
04 = Passing - Left Turn
05 = Left Turn - Across Path
06 = Sideswipe
07 = Other
08 = Rear End
09 = Off Road Right
10 = Head On
11 = Passing Right Turn
12 = Sideswipe - Same Direction
13 = Backing

VEHICLE DIRECTION OF TRAVEL

01 = Northbound
02 = Northeastbound
03 = Eastbound
04 = Southeastbound
05 = Southbound
06 = Southwestbound
07 = Westbound
08 = Northwestbound
09 = Unknown

VEHICLE MANEUVER

01= Post-Collision Maneuver
05 = Parked
10 = Passing Maneuver
15 = Being Passed
20 = Merging
22 = Diverging
24 = Avoiding A Vehicle
26 = Avoiding Other Objects
28 = Other Lane - Changing Maneuver
30 = Backing
32 = Making A U-Turn
34 = Making A Left Turn
36 = Making A right Turn
45 = Stopped/Stopping in Traffic
47 = Moving Ahead
48 = Unusual Maneuver
49 = Unknown
51 = Post-Collision Maneuver
55 = Parked
60 = Passing Maneuver
65 = Being Passed
70 = Merging
72 = Diverging
74 = Avoiding A Vehicle
76 = Avoiding Other Objects
78 = Other Lane - Changing Maneuver
80 = Backing
82 = Making A U-Turn
84 = Making A Left Turn
86 = Making A Right Turn
95 = Stopping/Stopped In Traffic
97 = Moving Ahead
98 = Unusual Maneuver

99 = Unknown

COLLISION TYPE

Angle
- 01 = left turn across path
- 02 = passing on left turn
- 08 = all others

Head-on
- 11 = cross through median
- 12 = wrong way on one-way
- 18 = all others

Rear-end
- 21 = parked vehicle
- 28 = all others

Sideswipe
- 31 = cross through median
- 32 = wrong way on one-way
- 33 = parked vehicle
- 34 = opposite direction sideswipe
- 36 = same direction sideswipe
- 38 = all others

Run-off-road-only
- 41 = left/median side
- 42 = 'T' intersection
- 48 = all others

Run-off-road and overturn
- 51 = left/median side
- 52 = 'T' Intersection
- 58 = all others

Run-off-road and strike fixed object
- 61 = left/median side
- 62 = 'T' intersection
- 68 = all others

Run-off-road and strike fixed object and overturn
- 71 = left/median side
- 72 = 'T' intersection
- 78 = all others

Miscellaneous
- 90 = pedestrian
- 91 = over turn on roadway
- 92 = strike fixed object while traveling on roadway
- 93 = strike non-fixed object on roadway (include trains)
- 94 = strike animal
- 97 = multi-vehicle collision off roadway

98 = others
99 = unknown

ENVIRONMENTAL CONDITION

01 = Clear
02 = Raining
03 = Hail/Sleet
04 = Snow
05 = Fog/Smog/Smoke/Dust
06 = High Wind
97 = Blank
98 = Other
99 = Unknown

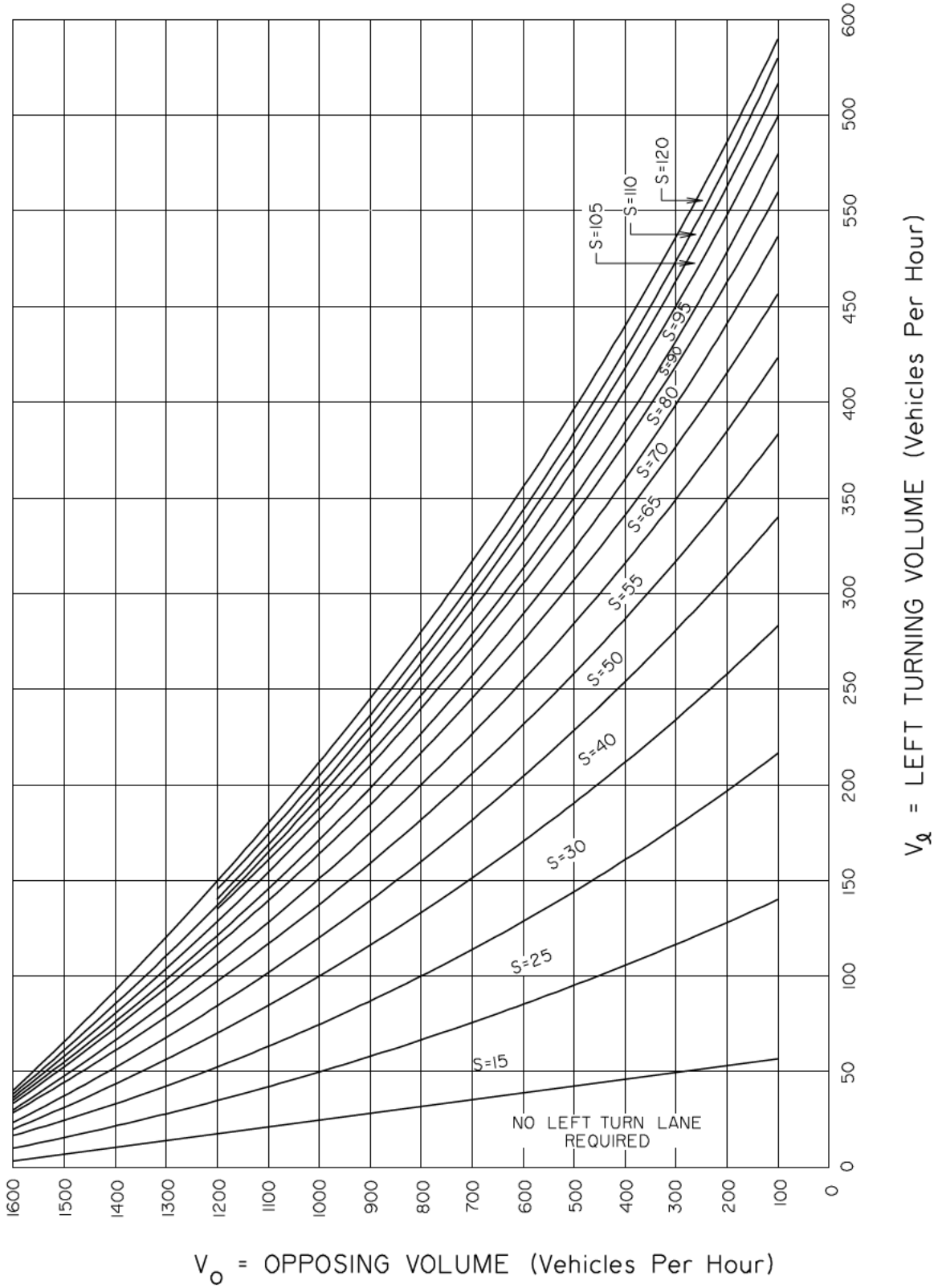
SURFACE CONDITION

01 = Dry
02 = Wet
03 = Slush/Snow/Ice
04 = Loose Surface Material
05 = Muddy
97 = Blank
98 = Other
99 = Unknown

APPENDIX D

APPENDIX D INTERSECTION ANALYSIS – HIGHWAY GEOMETRIC DESIGN GUIDE

FIGURE D-8.6c WARRANTS FOR LEFT TURN LANES AND STORAGE REQUIREMENTS FOR FOUR-LANE DIVIDED HIGHWAYS



GRAPHICS FILE: DEI:[200.221]debxd86.man

APPENDIX E

APPENDIX E INTERSECTION ANALYSIS – SYNCHRO

TABLE E1: UNSIGNALIZED INTERSECTION PERFORMANCE – HIGHWAY 16 / RANGE ROAD 33														
		Eastbound			Westbound			Northbound			Southbound			Capacity Utilization
		L	T	R	L	T	R	L	T	R	L	T	R	
2012 AM														
Background	LoS	A	A	A	A	A	A	A	A	A	B	B	B	20.4%
	v/c	0.01	0.16	0.08	0.01	0.12	0.01	0.01	0.01	0.01	0.08	0.08	0.08	
	Delay (s)	8.2	0.0	0.0	8.1	0.0	0.0	0.0	0.0	0.0	11.7	11.7	11.7	
	Queue (m)	0.2	0	0	0	0	0	0	0	0	2	2	2	
2012 PM														
Background	LoS	A	A	A	A	A	A	B	B	B	B	B	B	29.9%
	v/c	0.02	0.22	0.11	0.01	0.14	0.02	0.01	0.01	0.01	0.03	0.03	0.03	
	Delay (s)	8.5	0.0	0.0	8.6	0.0	0.0	10.0	10.0	10.0	12.4	12.4	12.4	
	Queue (m)	0.5	0	0	0	0	0	0	0	0	0.7	0.7	0.7	
2032 AM														
Background	LoS	A	A	A	A	A	A	A	A	A	B	B	B	24.8%
	v/c	0.01	0.17	0.09	0.01	0.17	0.01	0.01	0.01	0.01	0.14	0.14	0.14	
	Delay (s)	8.7	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	13.6	13.6	13.6	
	Queue (m)	0.2	0	0	0	0	0	0	0	0	3.6	3.6	3.6	
2032 PM														
Background	LoS	A	A	A	A	A	A	B	B	B	B	B	B	31.9%
	v/c	0.03	0.24	0.12	0.01	0.20	0.02	0.01	0.01	0.01	0.05	0.05	0.05	
	Delay (s)	9.2	0.0	0.0	8.8	0.0	0.0	10.2	10.2	10.2	14.6	14.6	14.6	
	Queue (m)	0.6	0	0	0	0	0	0	0	0	1.3	1.3	1.3	

Notes: LoS – Level of Service; v/c – volume to capacity ratio; Delay – control delay is the average delay per vehicle (in sec) due to the traffic control; Queue – 95th percentile maximum queue length

TABLE E1: UNSIGNALIZED INTERSECTION PERFORMANCE – HIGHWAY 16 / RANGE ROAD 33														
		Eastbound			Westbound			Northbound			Southbound			Capacity Utilization
		L	T	R	L	T	R	L	T	R	L	T	R	
2012 AM														
Development Traffic from 1531486 Alberta Ltd.	LoS	A	A	A	A	A	A	A	A	A	B	B	B	20.4%
	v/c	0.01	0.16	0.08	0.01	0.12	0.01	0.01	0.01	0.01	0.10	0.10	0.10	
	Delay (s)	8.2	0.0	0.0	8.1	0.0	0.0	0.0	0.0	0.0	11.8	11.8	11.8	
	Queue (m)	0.2	0	0	0	0	0	0	0	0	2.4	2.4	2.4	
2012 PM														
Development Traffic from 1531486 Alberta Ltd.	LoS	A	A	A	A	A	A	B	B	B	B	B	B	30.3%
	v/c	0.02	0.22	0.11	0.01	0.14	0.02	0.01	0.01	0.01	0.05	0.05	0.05	
	Delay (s)	8.5	0.0	0.0	8.6	0.0	0.0	10.0	10.0	10.0	12.7	12.7	12.7	
	Queue (m)	0.5	0	0	0	0	0	0	0	0	1.1	1.1	1.1	
2032 AM														
Development Traffic from 1531486 Alberta Ltd.	LoS	A	A	A	A	A	A	A	A	A	B	B	B	25.3%
	v/c	0.01	0.17	0.09	0.01	0.17	0.01	0.01	0.01	0.01	0.16	0.16	0.16	
	Delay (s)	8.7	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	14.0	14.0	14.0	
	Queue (m)	0.2	0	0	0	0	0	0	0	0	4.4	4.4	4.4	
2032 PM														
Development Traffic from 1531486 Alberta Ltd.	LoS	A	A	A	A	A	A	B	B	B	C	C	C	32.5%
	v/c	0.03	0.24	0.12	0.01	0.20	0.03	0.01	0.01	0.01	0.08	0.08	0.08	
	Delay (s)	9.3	0.0	0.0	8.8	0.0	0.0	10.2	10.2	10.2	15.2	15.2	15.2	
	Queue (m)	0.6	0	0	0	0	0	0	0	0	2.1	2.1	2.1	

Notes: LoS – Level of Service; v/c – volume to capacity ratio; Delay – control delay is the average delay per vehicle (in sec) due to the traffic control; Queue – 95th percentile maximum queue length

TABLE E1: UNSIGNALIZED INTERSECTION PERFORMANCE – HIGHWAY 16 / RANGE ROAD 33														
		Eastbound			Westbound			Northbound			Southbound			Capacity Utilization
		L	T	R	L	T	R	L	T	R	L	T	R	
2012 AM														
Development Traffic from Inland	LoS	A	A	A	A	A	A	A	A	A	B	B	B	20.4%
	v/c	0.01	0.16	0.08	0.01	0.12	0.01	0.01	0.01	0.01	0.09	0.09	0.09	
	Delay (s)	8.2	0.0	0.0	8.1	0.0	0.0	0.0	0.0	0.0	12.0	12.0	12.0	
	Queue (m)	0.2	0	0	0	0	0	0	0	0	2.3	2.3	2.3	
2012 PM														
Development Traffic from Inland	LoS	A	A	A	A	A	A	B	B	B	B	B	B	30.2%
	v/c	0.02	0.22	0.11	0.01	0.14	0.02	0.01	0.01	0.01	0.04	0.04	0.04	
	Delay (s)	8.5	0.0	0.0	8.6	0.0	0.0	10.0	10.0	10.0	12.7	12.7	12.7	
	Queue (m)	0.5	0	0	0	0	0	0	0	0	1.5	1.5	1.5	
2032 AM														
Development Traffic from Inland	LoS	A	A	A	A	A	A	A	A	A	B	B	B	25.2%
	v/c	0.01	0.17	0.09	0.01	0.17	0.01	0.01	0.01	0.01	0.16	0.16	0.16	
	Delay (s)	8.7	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	13.9	13.9	13.9	
	Queue (m)	0.2	0	0	0	0	0	0	0	0	4.2	4.2	4.2	
2032 PM														
Development Traffic from Inland	LoS	A	A	A	A	A	A	B	B	B	C	C	C	32.4%
	v/c	0.03	0.24	0.12	0.01	0.20	0.03	0.01	0.01	0.01	0.08	0.08	0.08	
	Delay (s)	9.2	0.0	0.0	8.8	0.0	0.0	10.2	10.2	10.2	15.1	15.1	15.1	
	Queue (m)	0.6	0	0	0	0	0	0	0	0	1.9	1.9	1.9	

Notes: LoS – Level of Service; v/c – volume to capacity ratio; Delay – control delay is the average delay per vehicle (in sec) due to the traffic control; Queue – 95th percentile maximum queue length

TABLE E1: UNSIGNALIZED INTERSECTION PERFORMANCE – HIGHWAY 16 / RANGE ROAD 33														
		Eastbound			Westbound			Northbound			Southbound			Capacity Utilization
		L	T	R	L	T	R	L	T	R	L	T	R	
2012 AM														
Development	LoS	A	A	A	A	A	A	A	A	A	B	B	B	20.4%
Traffic from	v/c	0.01	0.16	0.08	0.01	0.12	0.01	0.01	0.01	0.01	0.11	0.11	0.11	
Both	Delay (s)	8.2	0.0	0.0	8.1	0.0	0.0	0.0	0.0	0.0	12.0	12.0	12.0	
Gravel Pit Dev.	Queue (m)	0.2	0	0	0	0	0	0	0	0	2.7	2.7	2.7	
2012 PM														
Development	LoS	A	A	A	A	A	A	B	B	B	B	B	B	30.6%
Traffic from	v/c	0.02	0.22	0.11	0.01	0.14	0.02	0.01	0.01	0.01	0.06	0.06	0.06	
Both	Delay (s)	8.5	0.0	0.0	8.5	0.0	0.0	10.0	10.0	10.0	13.0	13.0	13.0	
Gravel Pit Dev.	Queue (m)	0.5	0	0	0	0	0	0	0	0	1.5	1.5	1.5	
2032 AM														
Development	LoS	A	A	A	A	A	A	A	A	A	B	B	B	25.8%
Traffic from	v/c	0.01	0.17	0.09	0.01	0.17	0.02	0.01	0.01	0.01	0.18	0.18	0.18	
Both	Delay (s)	8.8	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	14.3	14.3	14.3	
Gravel Pit Dev.	Queue (m)	0.2	0	0	0	0	0	0	0	0	5.0	5.0	5.0	
2032 PM														
Development	LoS	A	A	A	A	A	A	B	B	B	C	C	C	32.9%
Traffic from	v/c	0.03	0.24	0.12	0.01	0.20	0.03	0.01	0.01	0.01	0.11	0.11	0.11	
Both	Delay (s)	9.3	0.0	0.0	8.8	0.0	0.0	10.2	10.2	10.2	15.6	15.6	15.6	
Gravel Pit Dev.	Queue (m)	0.6	0	0	0	0	0	0	0	0	2.8	2.8	2.8	

Notes: LoS – Level of Service; v/c – volume to capacity ratio; Delay – control delay is the average delay per vehicle (in sec) due to the traffic control; Queue – 95th percentile maximum queue length

Appendix H

Noise Impact Assessment (July 2011)

Prepared by Patching Associates Acoustical Engineering Ltd.

Noise Impact Assessment
Rojas Management Ltd.
Lac Ste Anne Gravel Pit
NE and NW quarters of 33-53-3 W5M

Prepared for:

Bob Sanderson
Rojas Management Ltd.

Prepared by:
Richard Patching, P.Eng.
Michel Freitas, P.M.

of

Patching Associates Acoustical Engineering Ltd.
Consultants in Acoustics, Noise Control and Vibration

July 29, 2011
PAAE File: 2011-3051

Executive Summary

Patching Associates Acoustical Engineering Ltd. was retained by Rojas Management Ltd. to evaluate and predict the noise level from the proposed Lac Ste Anne Gravel Pit to be located on the NE and NW quarters of 33-53-3 W5M.

The study was conducted in order to:

- Assess the sound data of typical equipment and operations that are proposed for the Gravel Pit,
- Predict the noise level from the most impacting proposed operation (top soil removal) from all blocks at the potentially most affected receiver locations.

The sound power levels emitted from the facility were determined through the use of theoretical calculations. These values were then used to model the installation and the surrounding area to determine the expected noise level at residences around the Pit. The modeling was performed using the CadnaA noise-modeling package.

The following table summarises the predicted noise levels at the most impacted residences (MIR) based on the top soil removal operation in the pit area for each block.

Summary of Predicted Noise Levels Generated by Activity

For the Proposed Lac Ste Anne Gravel Pit under downwind conditions

Scenarios	Most Impacted Residence Location	Predicted Noise Levels Day-Time (dBA)	Proposed Ambient Sound Levels (dBA)	Predicted Noise Levels Day-Time plus Proposed Ambient Sound Levels (dBA)
Block 01	West	**60.6**	35	60.6
Block 02	West	**66.6**	35	66.6
Block 03	West	**68.9**	35	68.9
Block 04	West	**64.6**	35	64.6
Block 05	West	**59.4**	35	59.4
Block 06	West	**57.6**	35	57.6
Block 07	Southeast	**59.9**	35	59.9
Block 08	Southeast	**62.2**	35	62.2
Block 09	Southeast	**64.7**	35	64.7
Block 10	Southeast	**66.5**	35	66.5
Block 11	Southeast	**66.6**	35	66.6
Block 12	Northeast	**59.8**	35	59.8
Block 13	Northeast	**58.8**	35	58.8
Block 14	Northeast	**62.2**	35	62.2
Block 15	Northeast	**59.9**	35	59.9
Block 16	Northeast	**57.5**	35	57.5
Block 17	Southeast	**56.8**	35	56.8
Block 18	Northeast	**57.9**	35	57.9
Block 19	Northeast	**56.1**	35	56.1
Block 20	Southeast	**56.1**	35	56.1
Block 21	Southeast	**55.3**	35	55.3
Block 22	Northeast	**54.5**	35	54.5
Block 23	West	**54.5**	35	54.5
Block 24	West	**54.7**	35	54.7
Block 25	West	**55.9**	35	55.9

Table of Contents

Introduction and Scope-of-Work	1
Project Study Area	1
Major Equipment	2
Method	2
Sound Power Level Calculations	3
Sound Propagation Calculations	4
Modeling Results	4
Source Order Ranking	31
Conclusion	56
Explanation of Technical Details Regarding Sound Level Measurement and Analysis	Appendix A

Introduction and Scope-of-Work

Patching Associates Acoustical Engineering Ltd. was retained by Rojas Management Ltd. to evaluate and predict the noise level from the proposed Lac Ste Anne Gravel Pit to be located on the NE and NW quarters of 33-53-3 W5M.

The study was conducted in order to:

- Assess the sound data of typical equipment and operations that are proposed for the Gravel Pit,
- Predict the noise level from the most impacting proposed operation (top soil removal) from all blocks at the potentially most affected receiver locations.

Project Study Area

The project study area is located in the Lac Ste Anne County, Alberta. The terrain cover around the facility is mainly rolling and grassed. Figure 1 presents an overview of the project study area.

Figure 1 – Study Area Map

Aerial Image Courtesy of Google Earth Pro, Version 5.0.11733.9347 Licensed to Patching Associates Acoustical Engineering

Major Equipment

Table 1 –Major Equipment Details

Equipment Category	Equipment Description
Crushing Equipment	• 1 - 750 kW diesel engine driving a generator • 1 Cat 980 loader or equivalent • 2 John Deere 6 cylinder diesel or equivalent driving de-watering pumps.
Washing Equipment (If Required)	• 1 Cat 980 loader or equivalent to load delivery trucks • 7 Volvo A40 trucks or equivalent • 1 Cat 980 loader or equivalent
Hauling Equipment	• 1 Cat 980 loader or equivalent to load delivery trucks
Overburden Removal	• 4 Cat 657 motor scrapers or equivalent • 3 Cat D8 dozer or equivalent • 4 Volvo A40 haul trucks or equivalent • 1 Cat 375 backhoe or equivalent

Method

The distances to the residences and facility physical layout information were obtained from satellite photos and drawings provided by Rojas Management Ltd. Sound power levels were determined for all of the major noise sources at the proposed facility. Sound propagation calculations were then undertaken to determine the sound pressure level that will exist at the most impacted residences around the facility for the most impacting scenarios (top soil removal at each block). All calculations were undertaken in octave bands.

The octave band sound power level for each source that will exist at the facility was obtained or calculated from manufacturer's data, acoustical reference literature or previous studies.

Noise Criteria

The County of Lac Ste Anne addresses noise in their Land Use Bylaw (16-08) and their Municipal development Plan (Bylaw 17-08). These do not state specific noise limits, but do require consideration of sound and presentation of maps of the predicted noise level, as well as limiting hours of operation. The regulations do allow activities associated with an approved development permit.

Sound Power Level Calculations

Octave band sound power levels were calculated for all of the major noise sources that will be present at the facility. These octave band sound power levels and the source of the data are presented in Table 3; these assume low-performance engine exhaust silencers.

Table 3 – Source Octave Band Sound Power Levels

Source Description	Data Source	Linear Octave Band Centre Frequency (dB, ref 1 pW)									Total (dBA)
		31.5	63	125	250	500	1k	2k	4k	8k	
Generator and Engine Casing	Theoretical Calculation	101	108	115	115	114	116	115	109	102	**120**
Tractor Scraper, Engine of Scraper Section	Theoretical Calculation	98	106	113	113	112	114	113	107	100	**118**
Tractor Scraper, Engine of Tractor Section	Theoretical Calculation	98	106	113	113	112	114	113	107	100	**118**
CAT D8 Dozer Engine	Theoretical Calculation	97	105	112	112	111	113	112	106	99	**118**
CAT 375 Backhoe Engine	Theoretical Calculation	96	104	111	111	110	112	111	105	98	**117**
Volvo A40 Truck Engine	Theoretical Calculation	96	104	111	111	110	112	111	105	98	**116**
Pump Driver Engine Casing	Theoretical Calculation	96	104	111	111	110	112	111	105	98	**116**
Cat 980 Loader Engine	Theoretical Calculation	95	103	110	110	109	111	110	104	97	**115**
Tractor Scraper, Scraper Engine Exhaust Silenced	Theoretical Calculation	140	136	124	107	107	105	107	98	90	**115**
Tractor Scraper, Tractor Engine Exhaust Silenced	Theoretical Calculation	140	136	124	107	107	105	107	98	90	**115**
Pump Driver, Engine Exhaust Silenced	Theoretical Calculation	138	134	122	105	105	103	105	96	88	**113**
Generator Driver, Engine Exhaust Silenced	Theoretical Calculation	136	132	120	103	103	101	103	94	86	**111**
CAT D8 Dozer, Engine Exhaust Silenced	Theoretical Calculation	134	130	118	101	101	99	101	92	84	**109**
CAT 375 Backhoe, Engine Exhaust Silenced	Theoretical Calculation	132	128	116	99	99	97	99	90	82	**107**
Volvo A40 Truck, Engine Exhaust Silenced	Theoretical Calculation	132	128	116	99	99	97	99	90	82	**107**
Generator Driver Engine Air Intake	Theoretical Calculation	105	98	96	96	97	100	101	100	92	**106**
Cat 980 Loader, Exhaust Silenced	Theoretical Calculation	131	127	115	98	98	96	98	89	81	**106**
Pump Cooler Inlet	Theoretical Calculation	86	96	101	103	99	99	98	97	88	**105**
Generator Cooler Inlet	Theoretical Calculation	96	104	105	107	99	98	95	89	80	**104**

Table 3 (Continued) – Source Octave Band Sound Power Levels

Source Description	Data Source	Linear Octave Band Centre Frequency (dB, ref 1 pW)									Total (dBA)
		31.5	63	125	250	500	1k	2k	4k	8k	
Generator Cooler Discharge	Theoretical Calculation	87	95	101	88	93	94	91	90	88	**99**

Sound Propagation Calculations

The sound propagation calculations were undertaken using the noise modeling software package CadnaA by Datakustik. CadnaA bases its calculation algorithms on ISO 9613 and the ground cover was modeled as mixed ground between the operations and residential areas, with consideration of some deciduous trees in the area. Octave-band sound power level information was used for the major noise sources for the proposed project. The frequency dependency of sound propagation calculations such as ground absorption, air absorption and elevation relative to the sound source, and barrier effects are considered in the model. The temperature modeled was 10° C as an average temperature over the 12-month period when outdoor activities are expected, and 80% relative humidity; the temperature and humidity values are conditions with a minimum value of air absorption, and so constitute a "worst case" condition. The CadnaA model calculates the contribution level of each noise source at each receiver location in octave bands as well as the overall dBA level.

Modeling Results

The objective of this study was to predict the noise level from the most impacting proposed operation scenarios at the most affected residences. The predictions based on the CadnaA model for this facility are summarized in Table 4.

Table 4 – Predicted Noise Levels Generated by Activity,

From the Proposed Lac Ste Anne Gravel Pit under downwind conditions

Scenarios	Most Impacted Residence Location	Predicted Noise Levels Day-Time (dBA)	Proposed Ambient Sound Levels (dBA)	Predicted Noise Levels Day-Time plus Proposed Ambient Sound Levels (dBA)
Block 01	West	**60.6**	35	60.6
Block 02	West	**66.6**	35	66.6
Block 03	West	**68.9**	35	68.9
Block 04	West	**64.6**	35	64.6
Block 05	West	**59.4**	35	59.4
Block 06	West	**57.6**	35	57.6
Block 07	Southeast	**59.9**	35	59.9
Block 08	Southeast	**62.2**	35	62.2
Block 09	Southeast	**64.7**	35	64.7
Block 10	Southeast	**66.5**	35	66.5
Block 11	Southeast	**66.6**	35	66.6
Block 12	Northeast	**59.8**	35	59.8
Block 13	Northeast	**58.8**	35	58.8

Table 4 (Continued) – Predicted Noise Levels Generated by Activity, From the Proposed Lac Ste Anne Gravel Pit under downwind conditions

Scenarios	Most Impacted Residence Location	Predicted Noise Levels Day-Time (dBA)	Proposed Ambient Sound Levels (dBA)	Predicted Noise Levels Day-Time plus Proposed Ambient Sound Levels (dBA)
Block 14	Northeast	**62.2**	35	62.2
Block 15	Northeast	**59.9**	35	59.9
Block 16	Northeast	**57.5**	35	57.5
Block 17	Southeast	**56.8**	35	56.8
Block 18	Northeast	**57.9**	35	57.9
Block 19	Northeast	**56.1**	35	56.1
Block 20	Southeast	**56.1**	35	56.1
Block 21	Southeast	**55.3**	35	55.3
Block 22	Northeast	**54.5**	35	54.5
Block 23	West	**54.5**	35	54.5
Block 24	West	**54.7**	35	54.7
Block 25	West	**55.9**	35	55.9

Figures 2 to 26 show the predicted sound levels for the area. The labelled sound levels are the predicted sound levels from only the facility (ambient sound level is not included). The scales on the figures are the Universal Transverse Mercator (UTM) coordinates in zone 11U.

Figure 2 – Predicted Facility Sound Contours (Not Including Ambient) from Block 1 Top Soil Removal

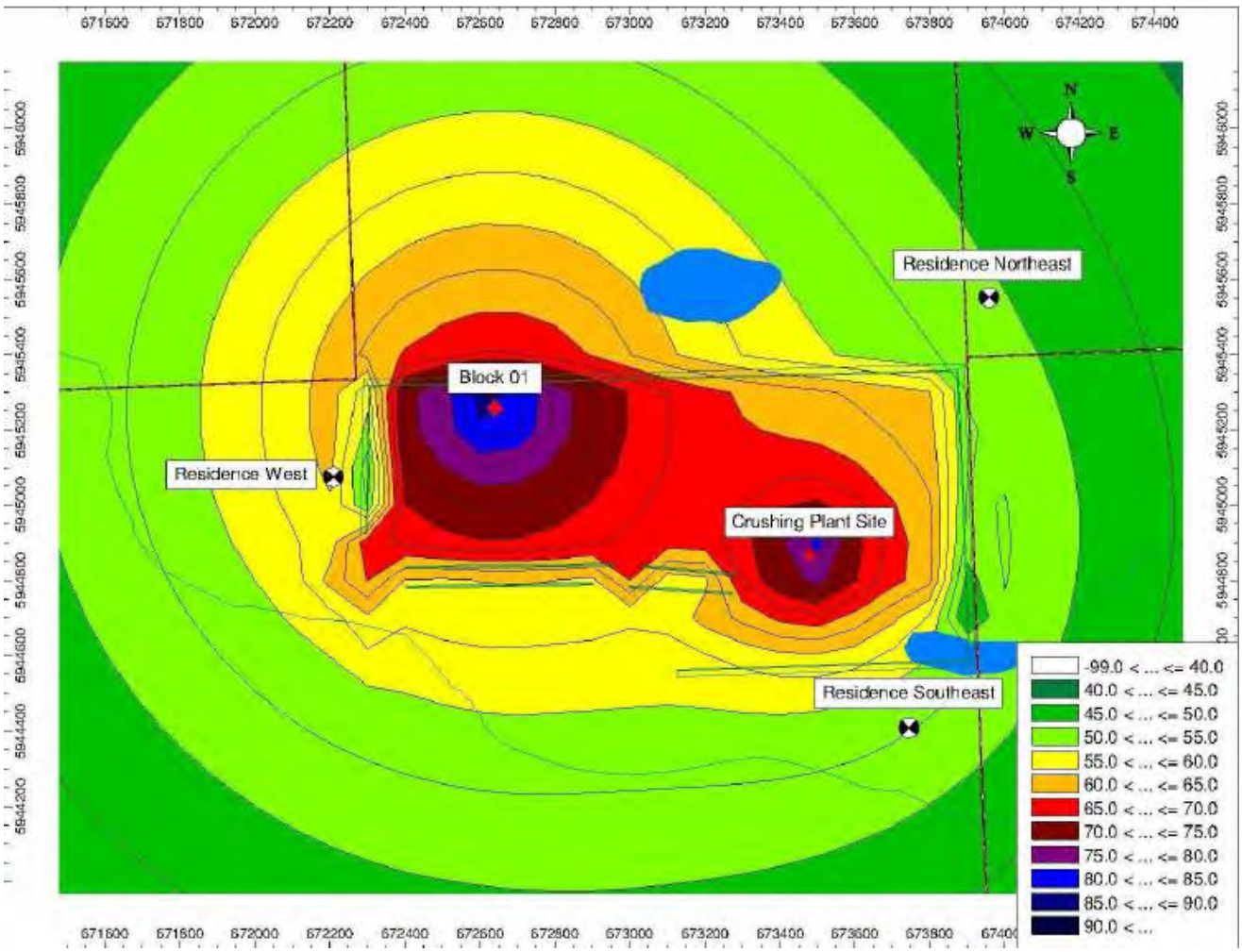


Figure 3 – Predicted Facility Sound Contours (Not Including Ambient) from Block 2 Top Soil Removal

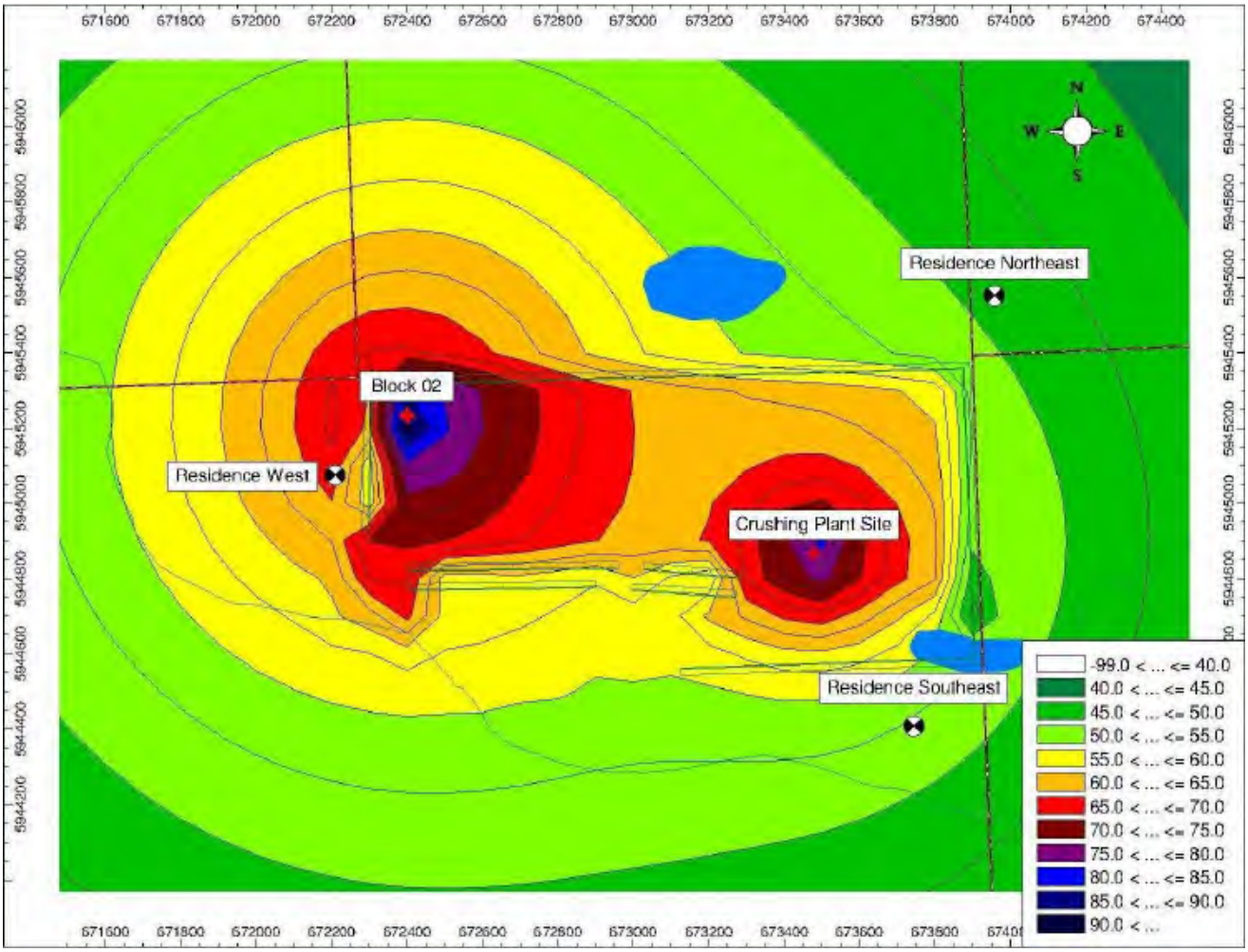


Figure 4 – Predicted Facility Sound Contours (Not Including Ambient) from Block 3 Top Soil Removal

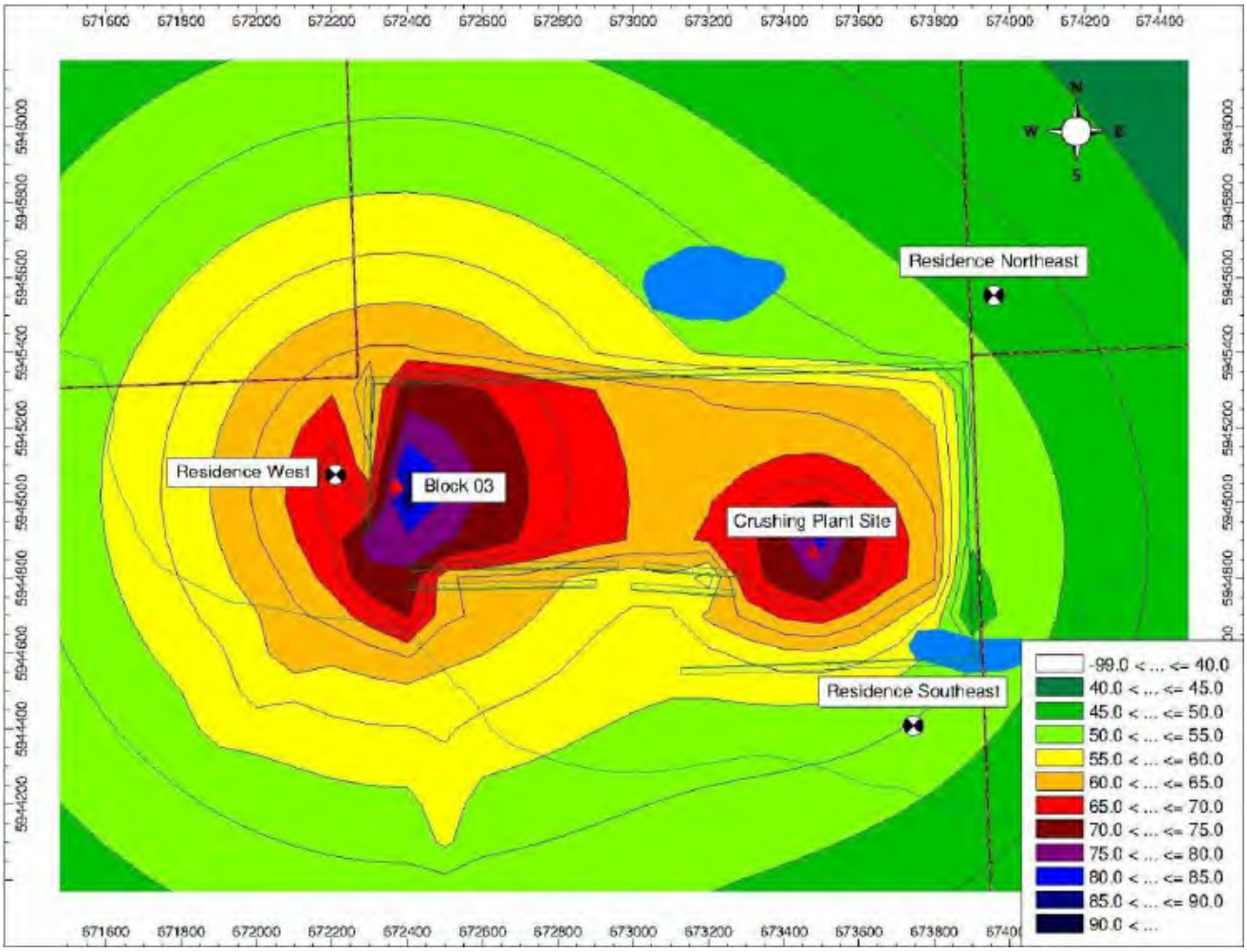


Figure 5 – Predicted Facility Sound Contours (Not Including Ambient) from Block 4 Top Soil Removal

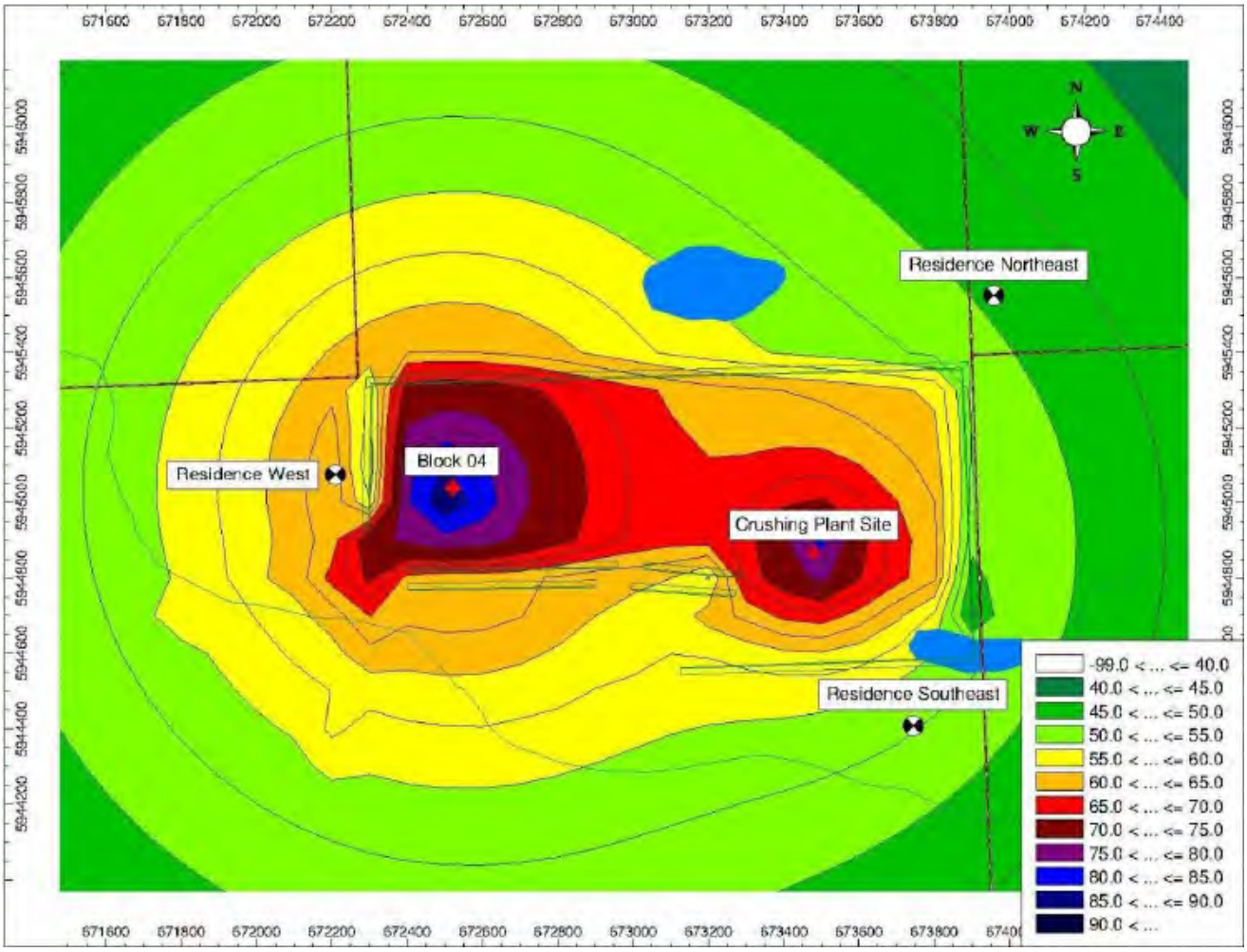


Figure 6 – Predicted Facility Sound Contours (Not Including Ambient) from Block 5 Top Soil Removal

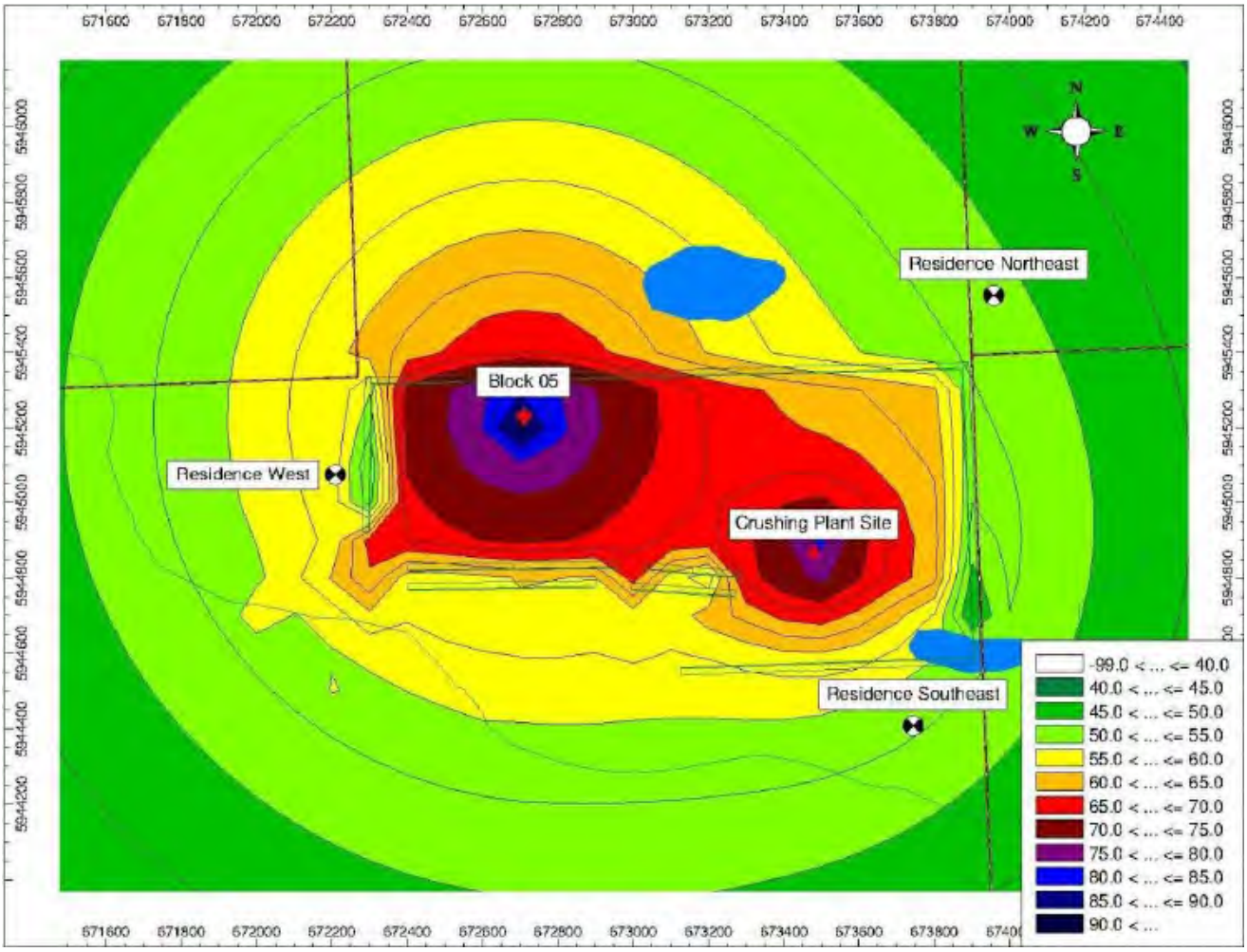


Figure 7 – Predicted Facility Sound Contours (Not Including Ambient) from Block 6 Top Soil Removal

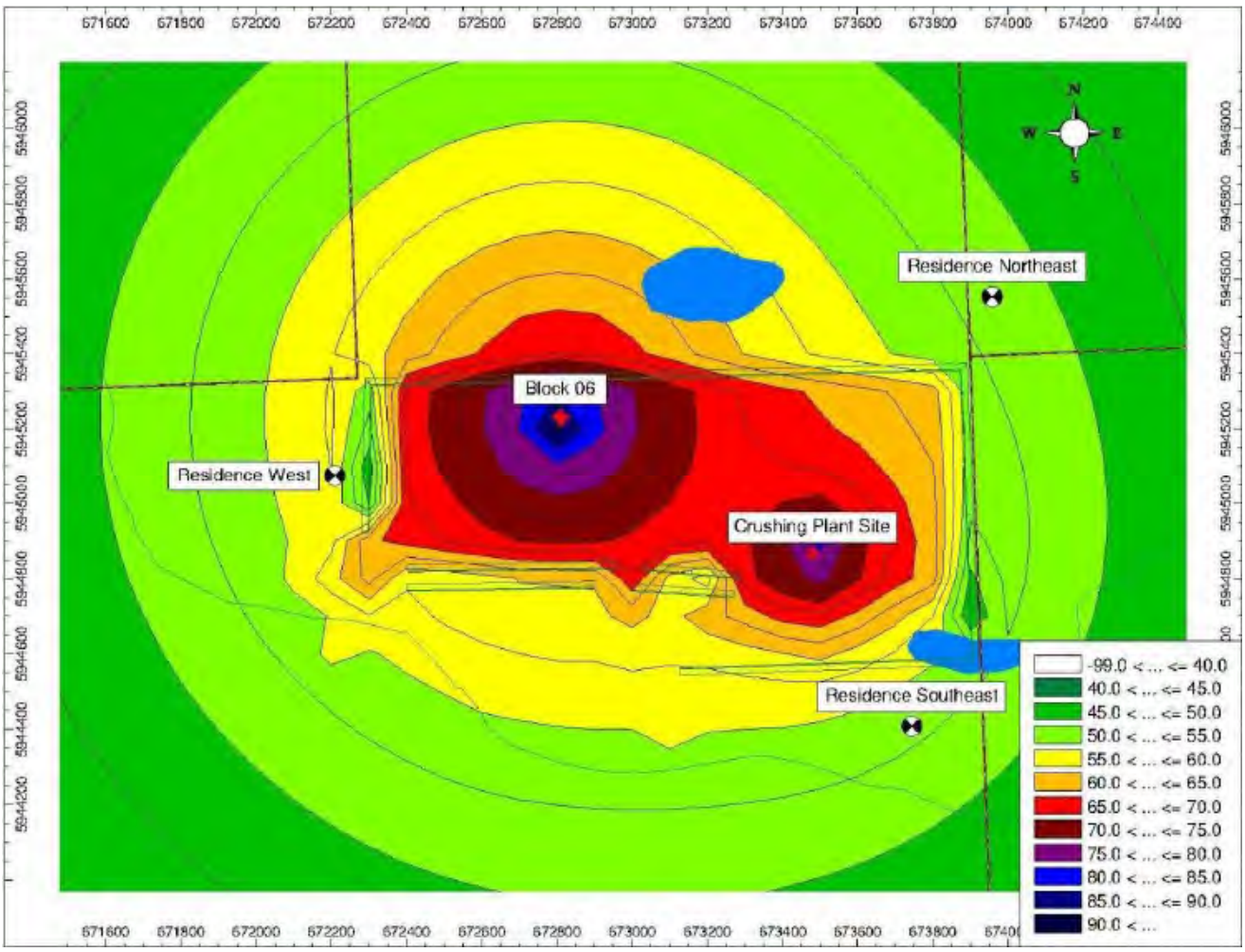


Figure 8 – Predicted Facility Sound Contours (Not Including Ambient) from Block 7 Top Soil Removal

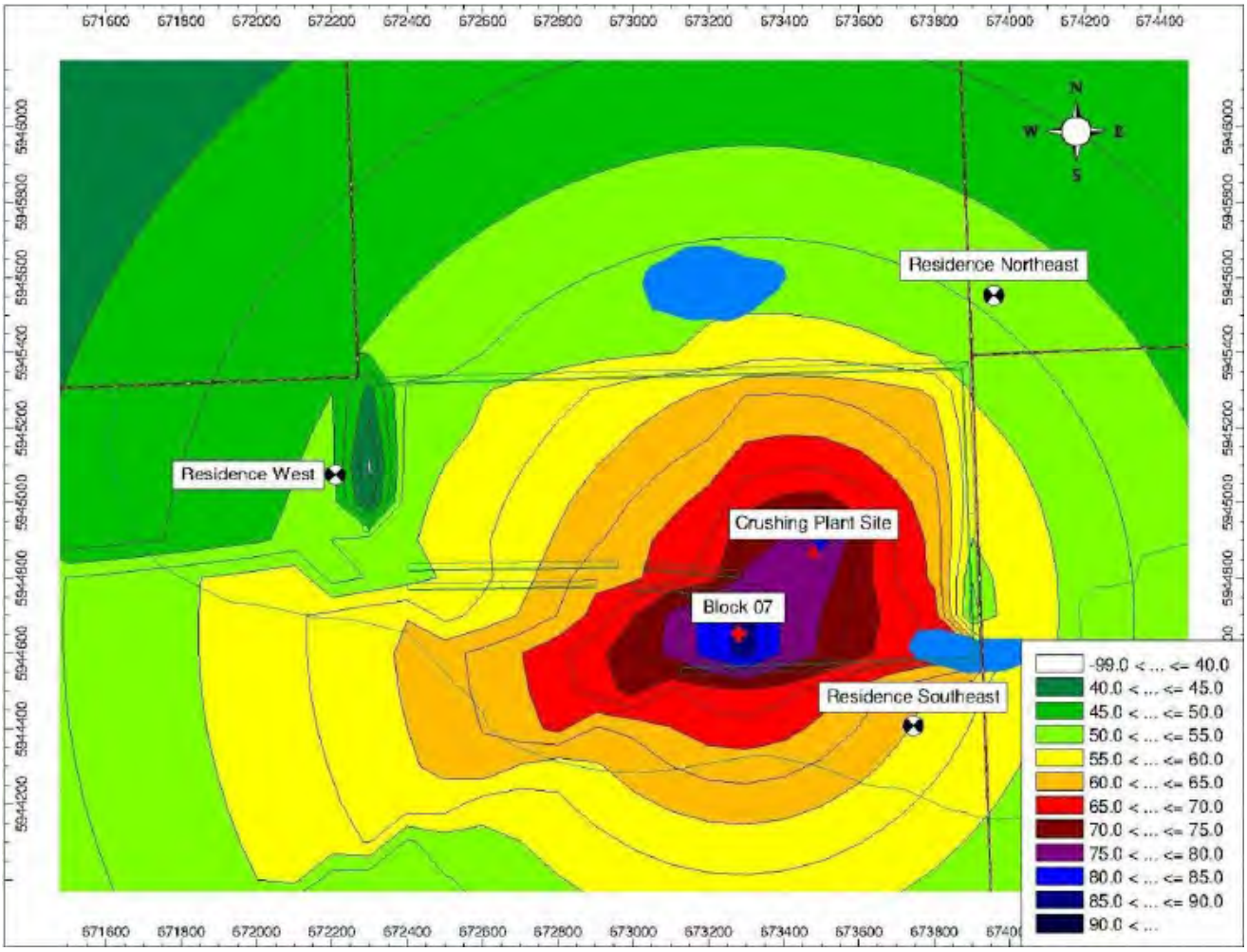


Figure 9 – Predicted Facility Sound Contours (Not Including Ambient) from Block 8 Top Soil Removal

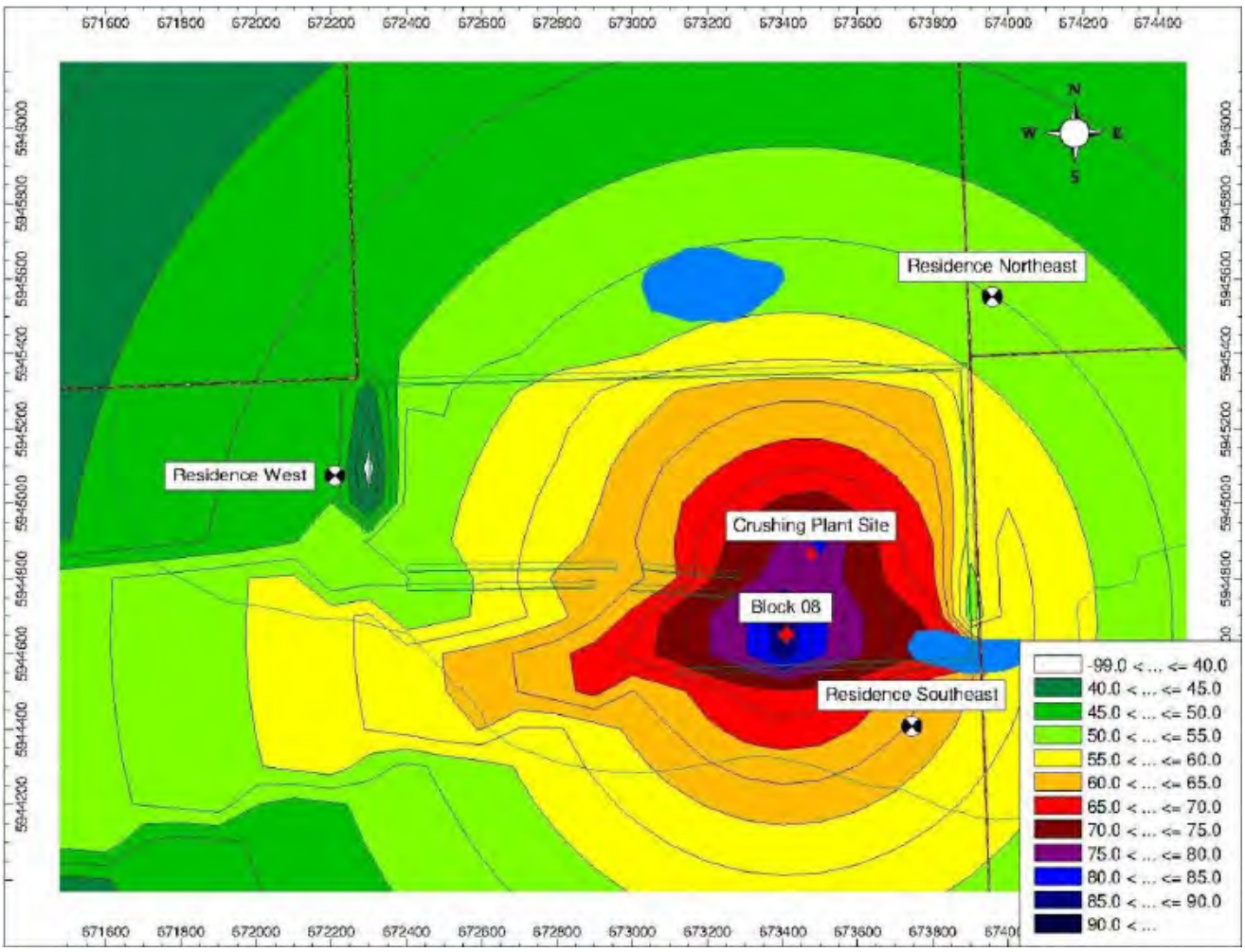


Figure 10 – Predicted Facility Sound Contours (Not Including Ambient) from Block 9 Top Soil Removal

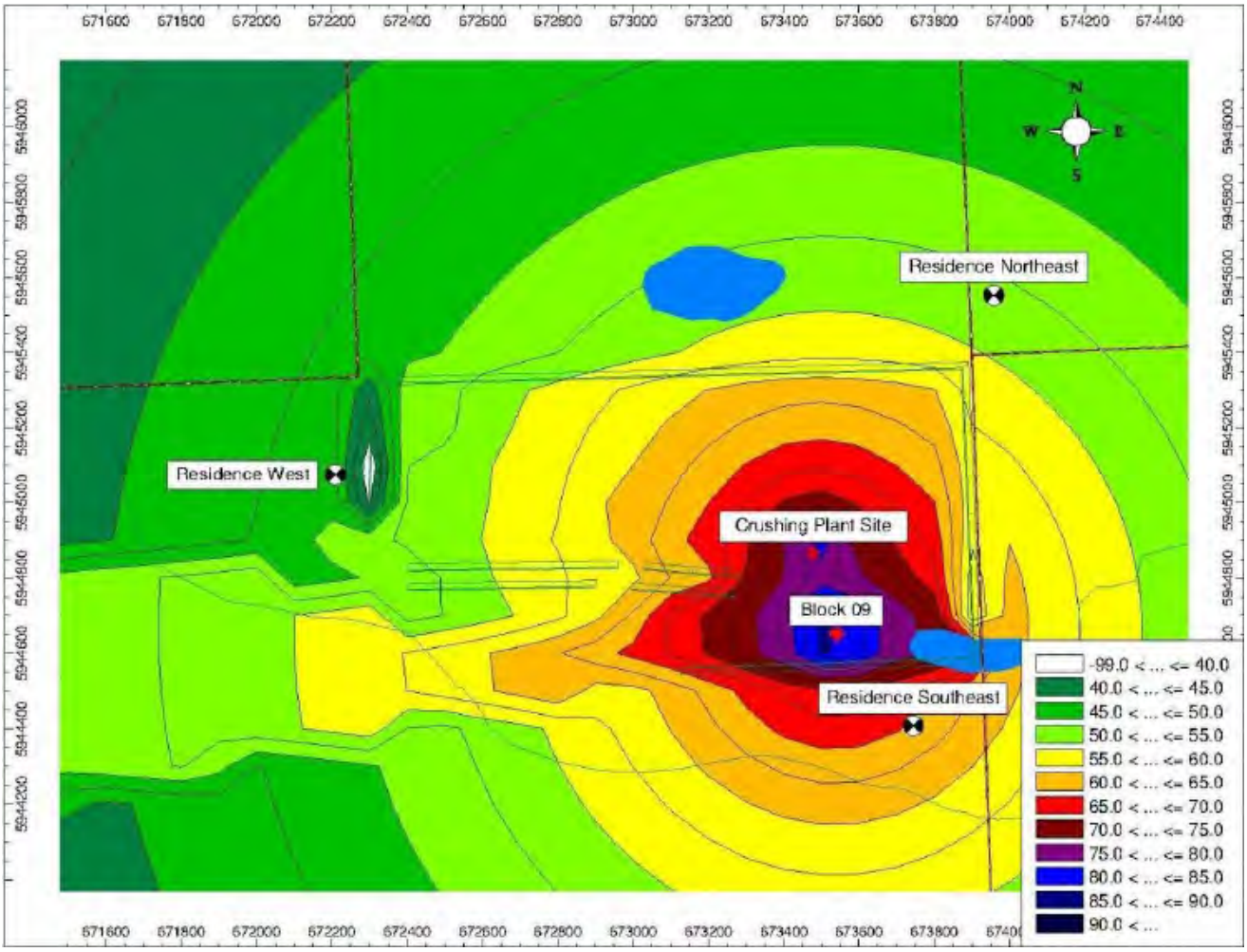


Figure 11 – Predicted Facility Sound Contours (Not Including Ambient) from Block 10 Top Soil Removal

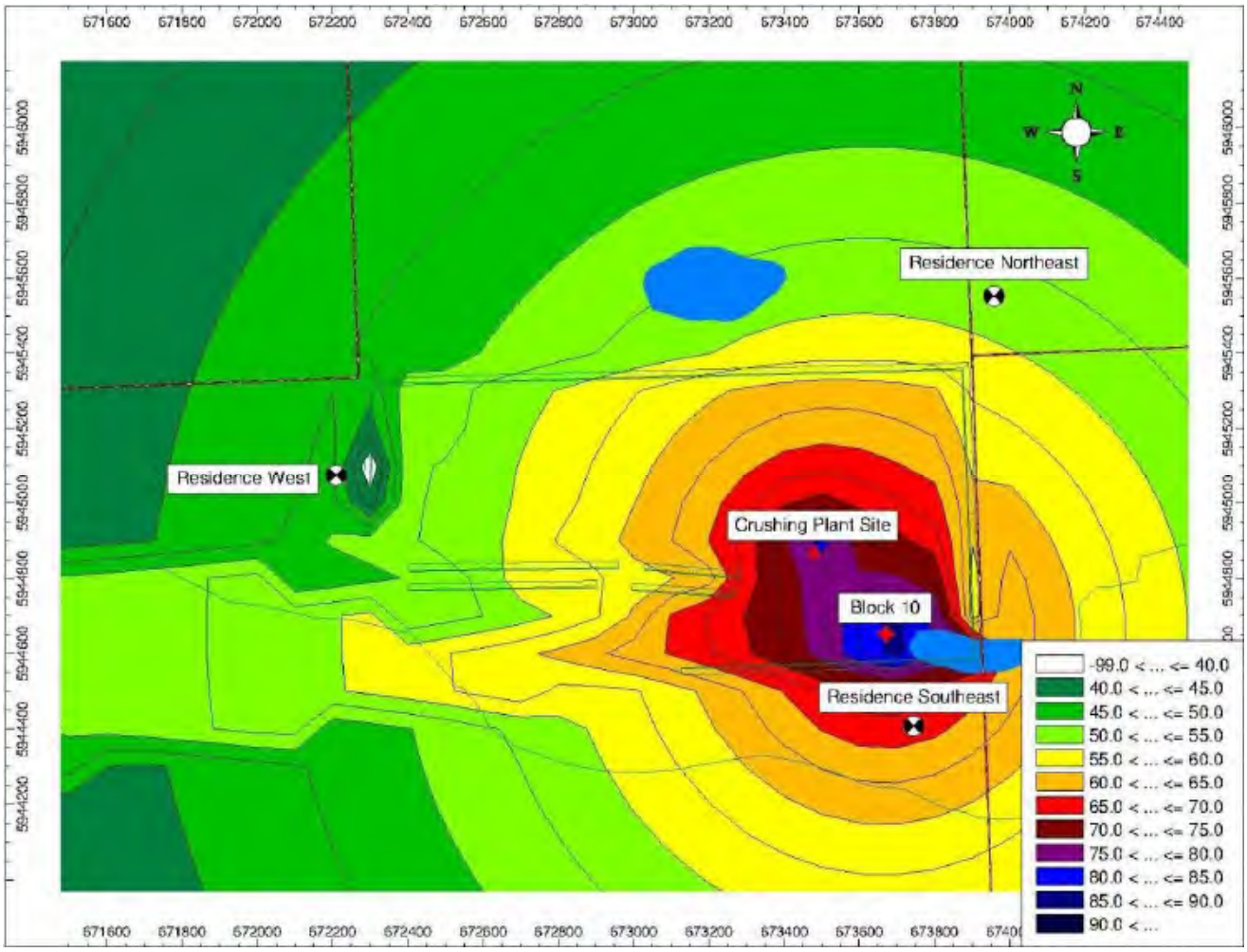


Figure 12 – Predicted Facility Sound Contours (Not Including Ambient) from Block 11 Top Soil Removal

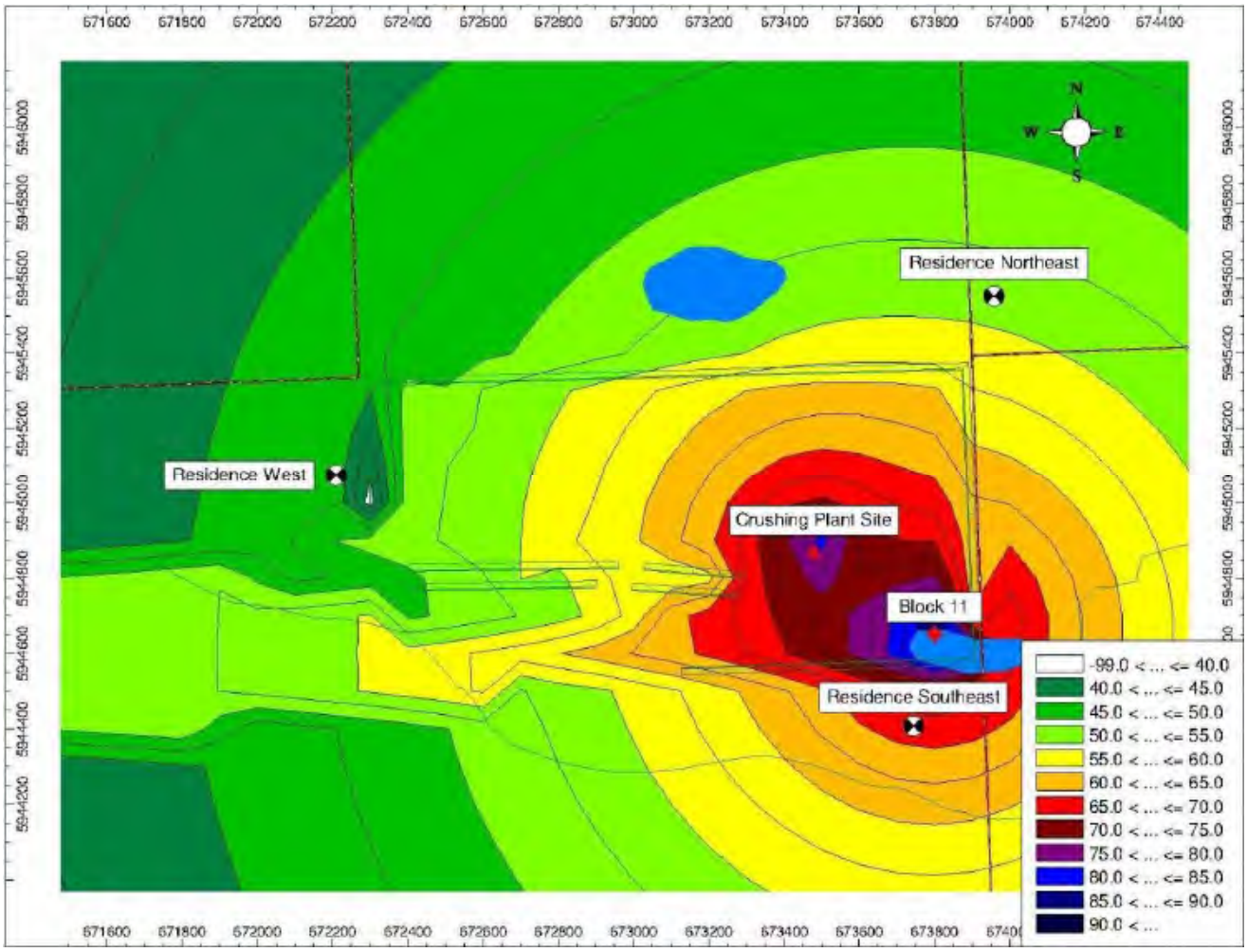


Figure 13 – Predicted Facility Sound Contours (Not Including Ambient) from Block 12 Top Soil Removal

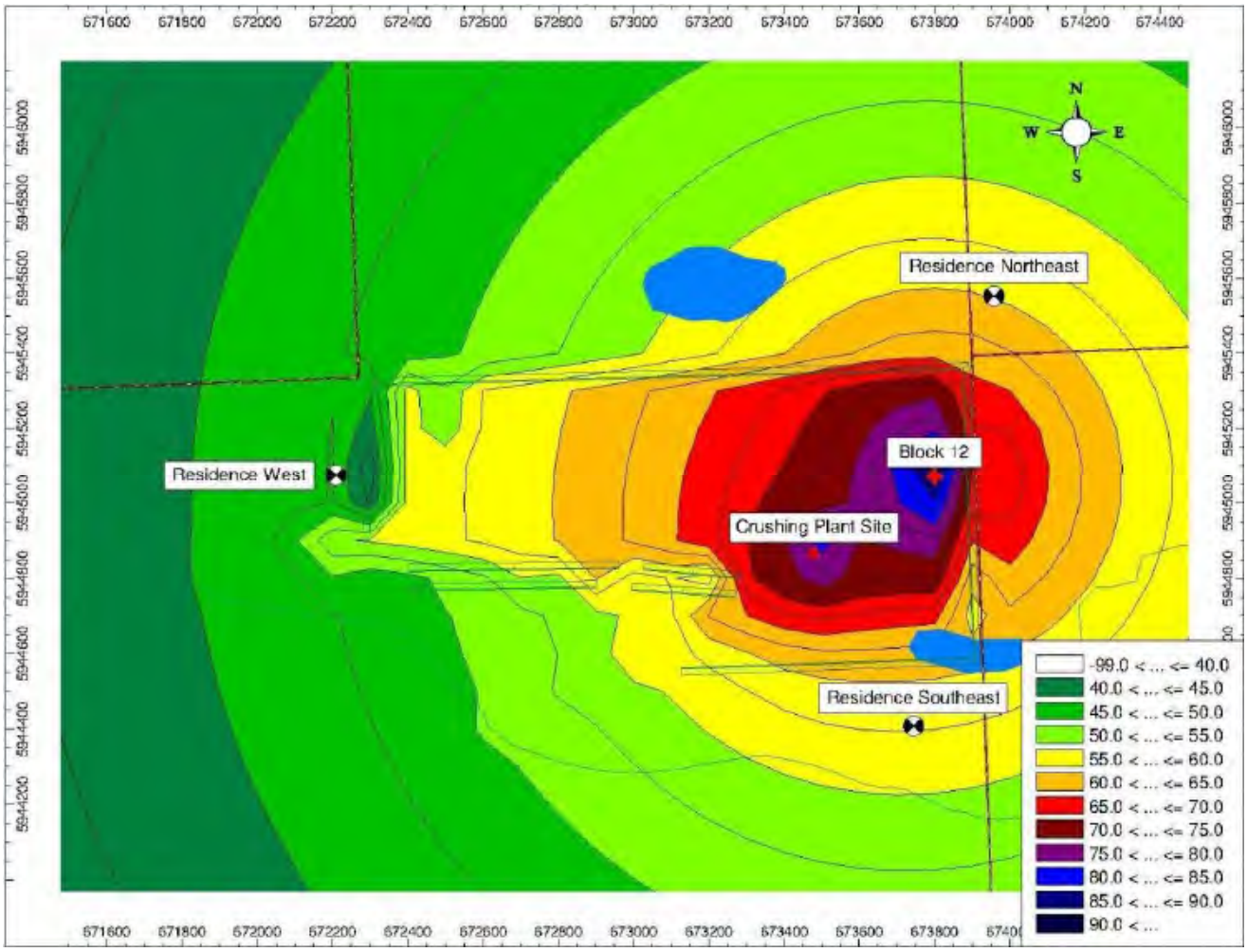


Figure 14 – Predicted Facility Sound Contours (Not Including Ambient) from Block 13 Top Soil Removal

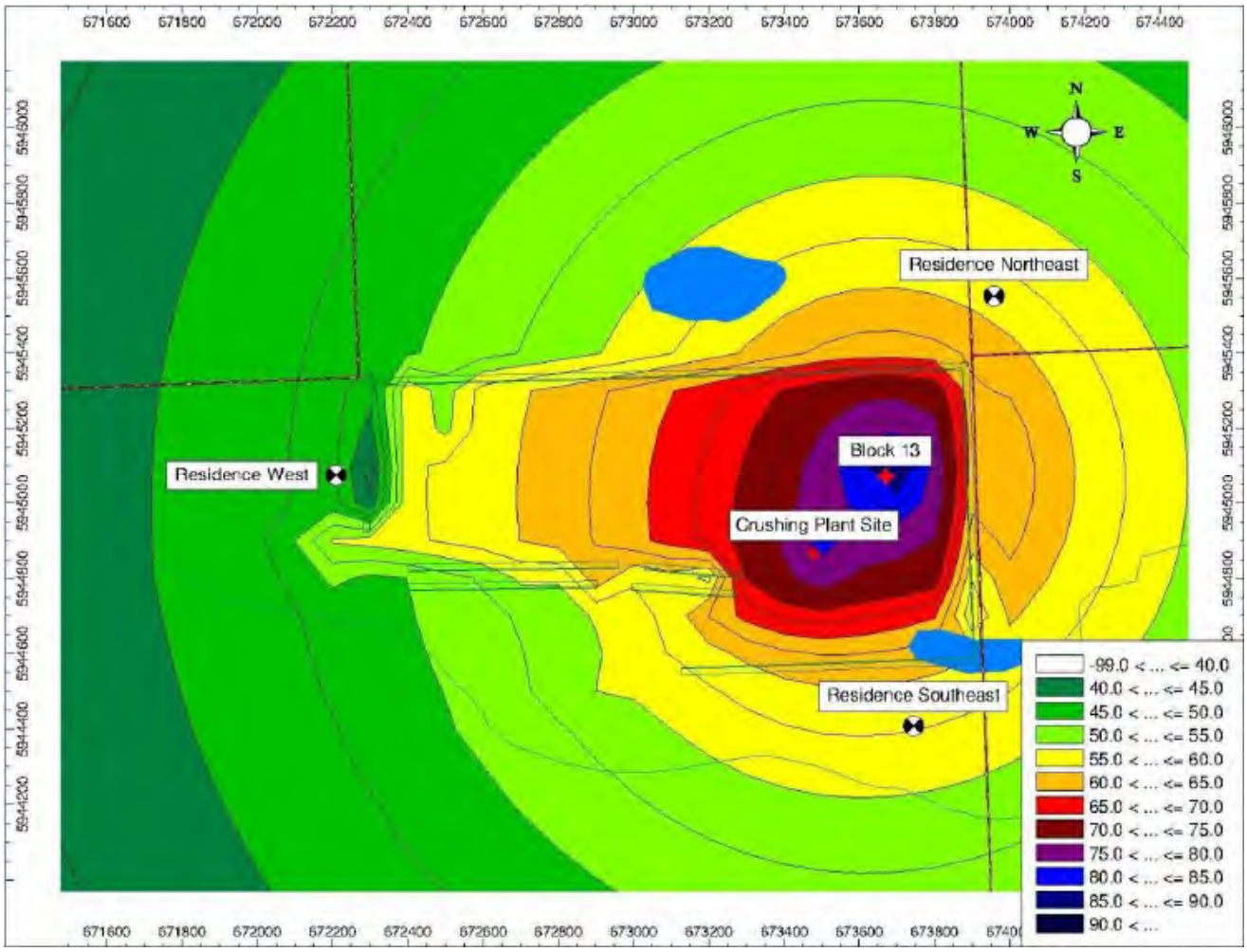


Figure 15 – Predicted Facility Sound Contours (Not Including Ambient) from Block 14 Top Soil Removal

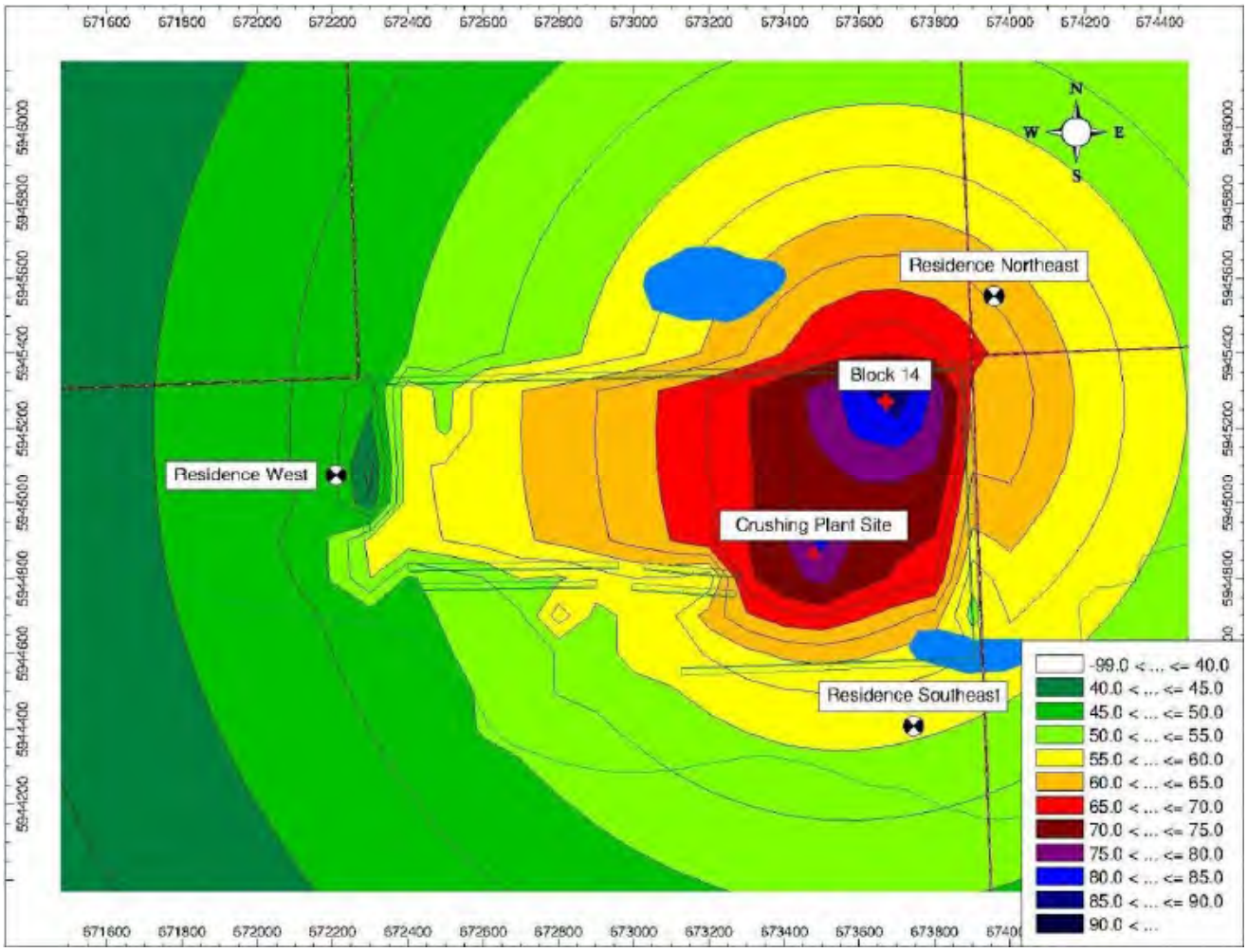


Figure 16 – Predicted Facility Sound Contours (Not Including Ambient) from Block 15 Top Soil Removal

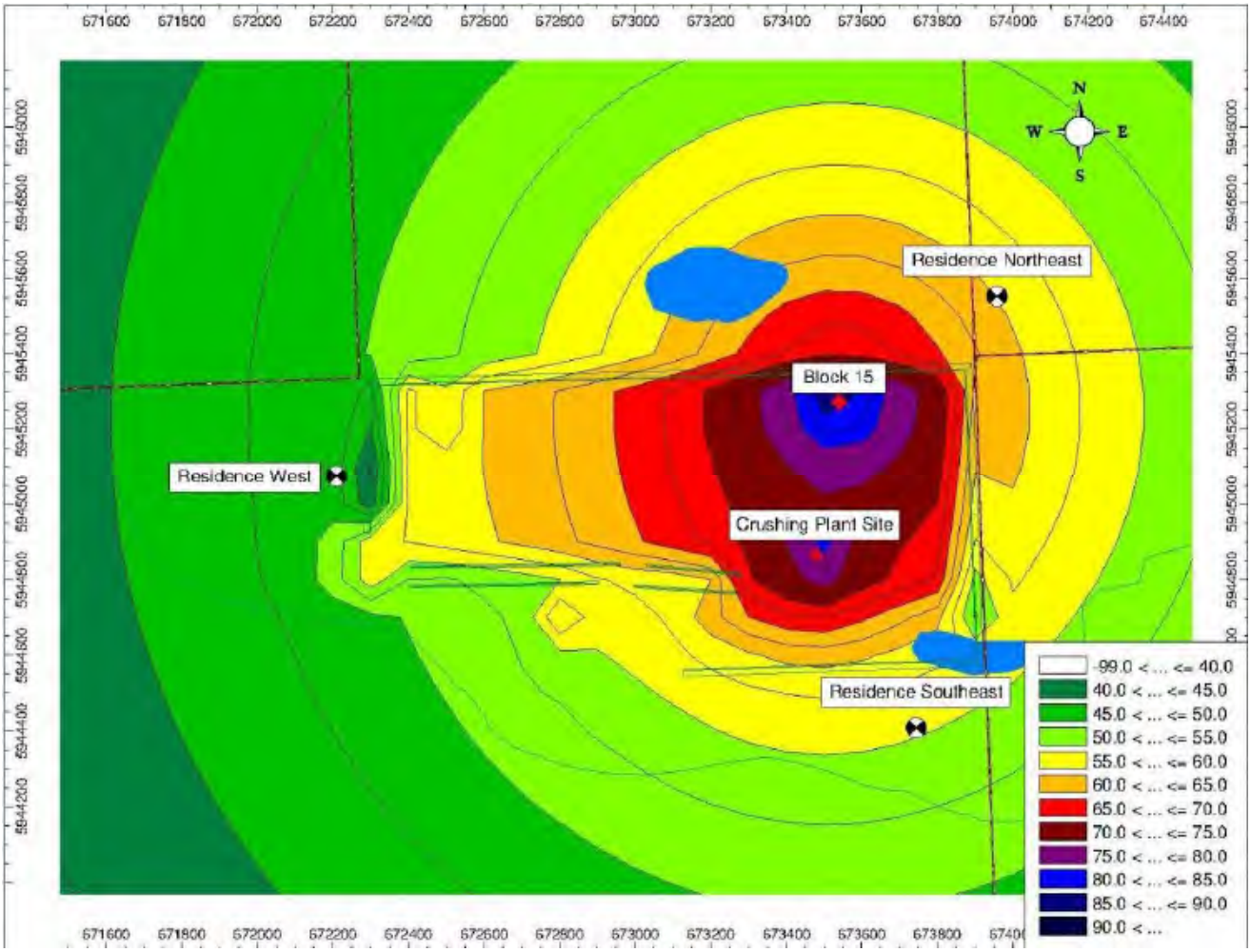


Figure 17 – Predicted Facility Sound Contours (Not Including Ambient) from Block 16 Top Soil Removal

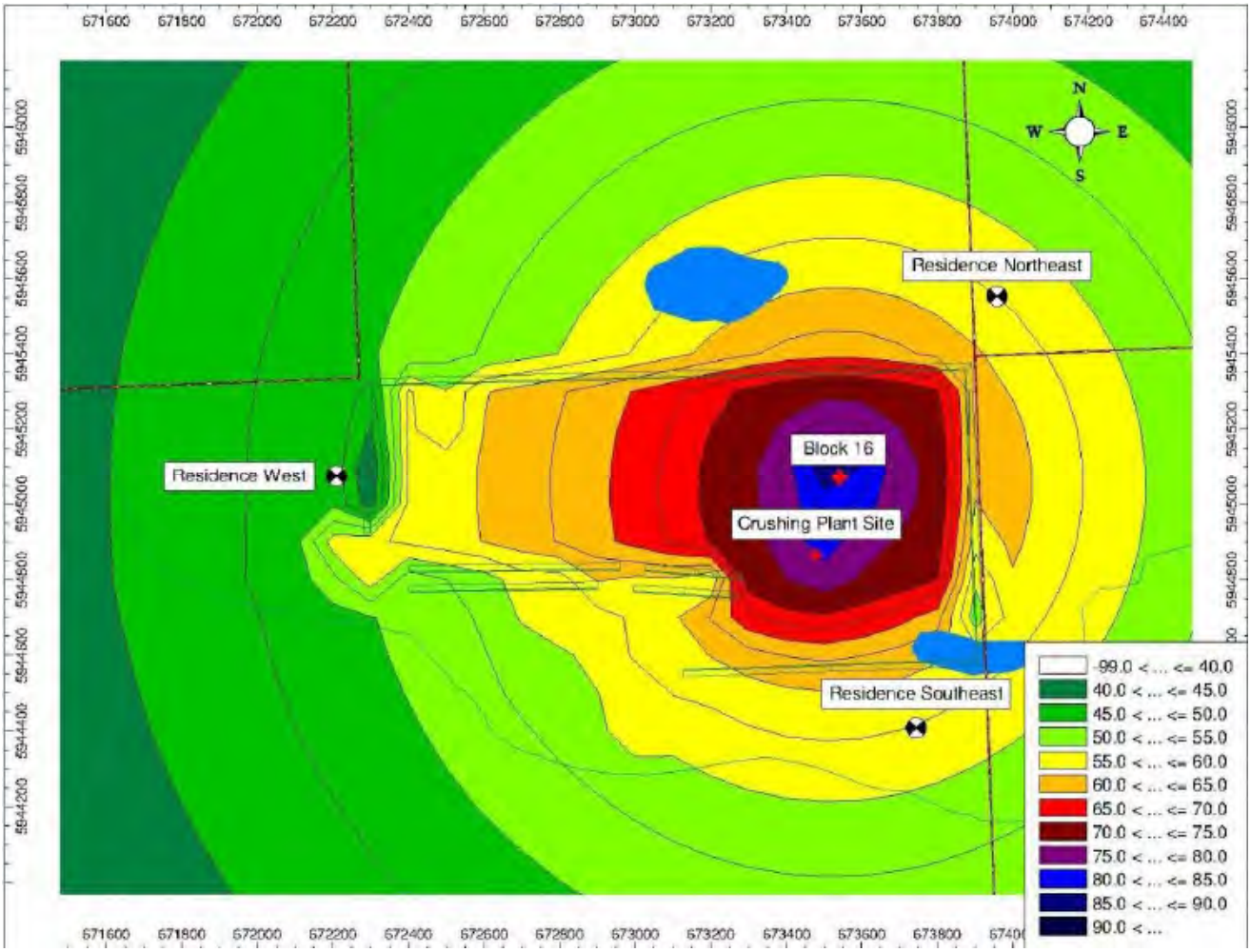


Figure 18 – Predicted Facility Sound Contours (Not Including Ambient) from Block 17 Top Soil Removal

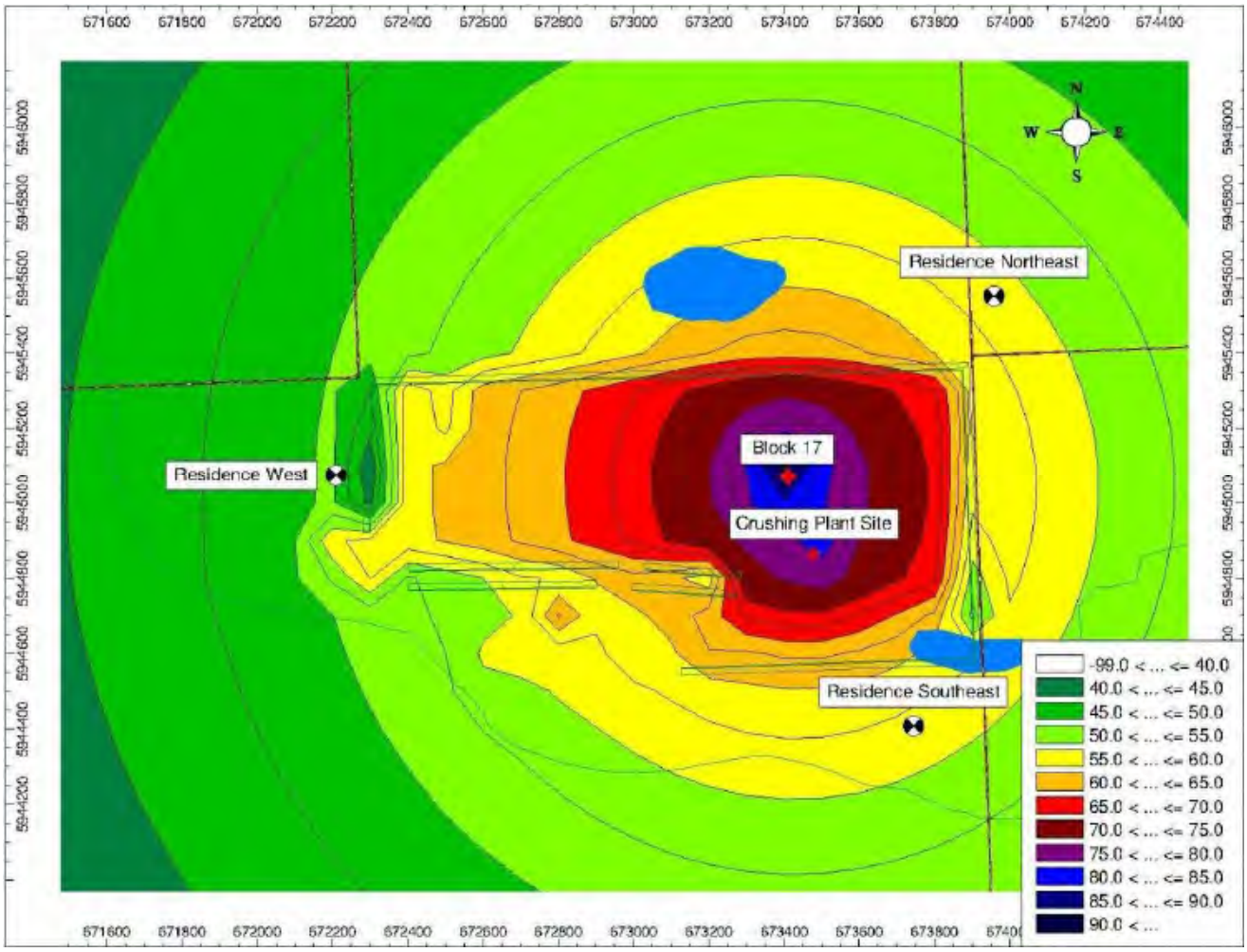


Figure 19 – Predicted Facility Sound Contours (Not Including Ambient) from Block 18 Top Soil Removal

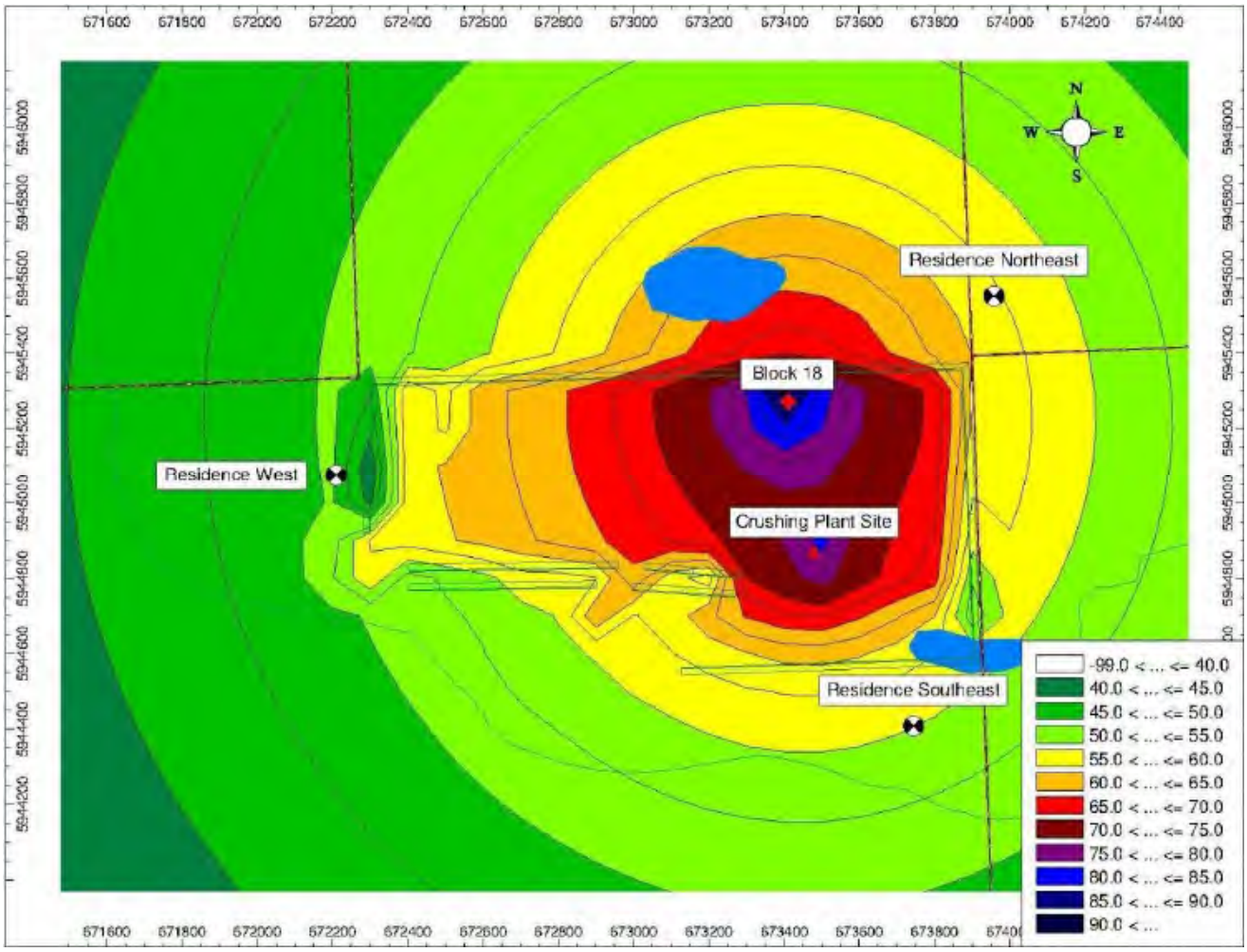


Figure 20 – Predicted Facility Sound Contours (Not Including Ambient) from Block 19 Top Soil Removal

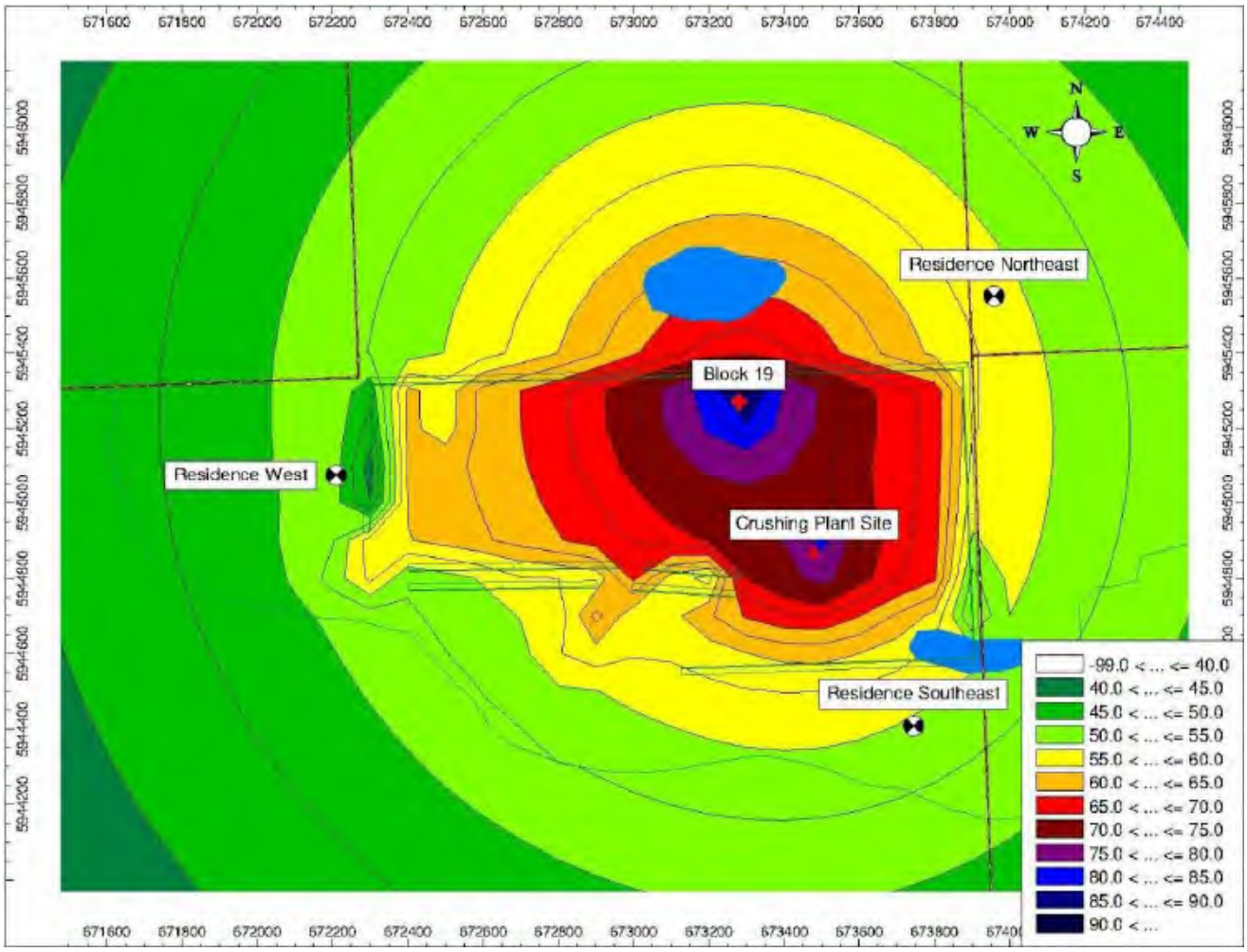


Figure 21 – Predicted Facility Sound Contours (Not Including Ambient) from Block 20 Top Soil Removal

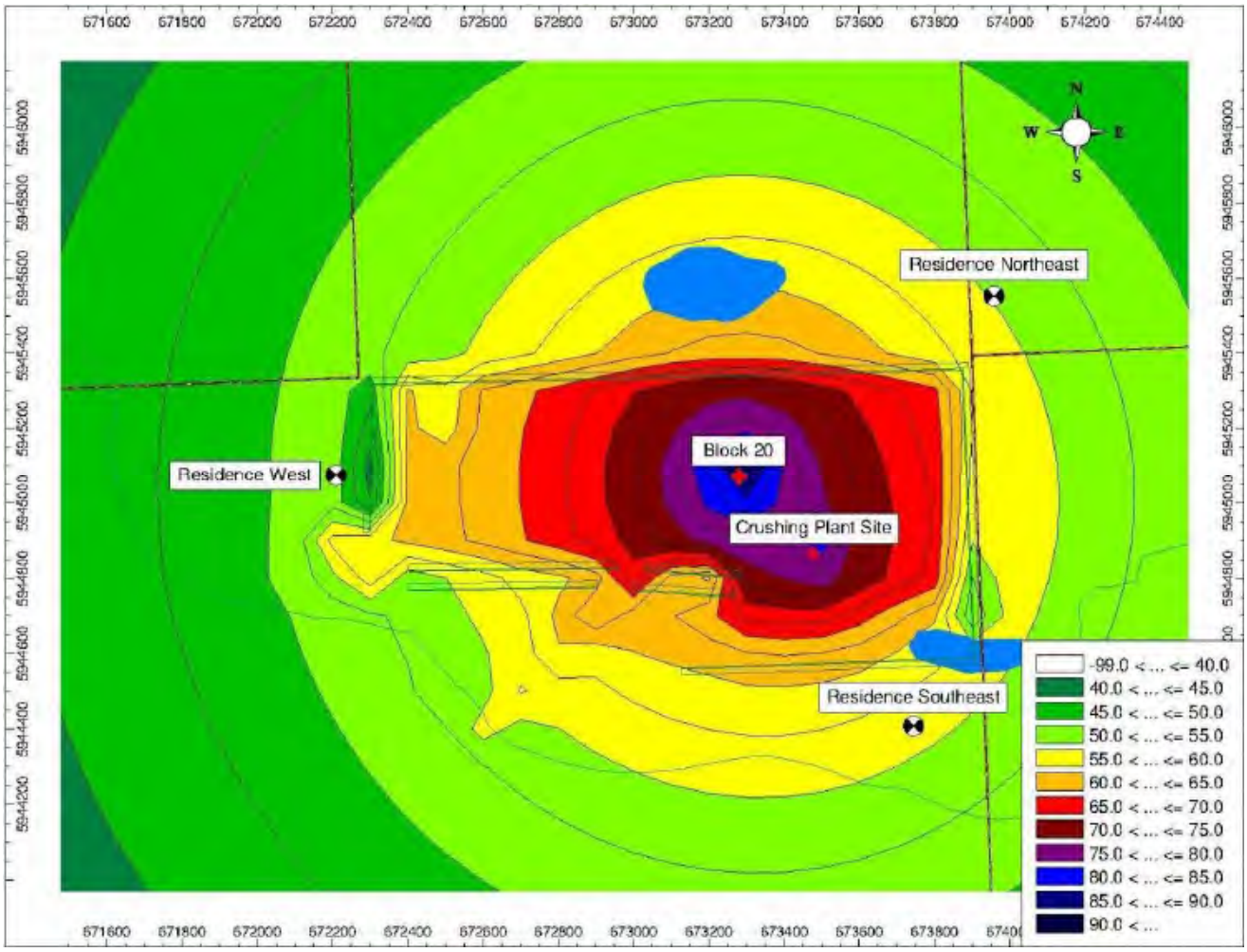


Figure 22 – Predicted Facility Sound Contours (Not Including Ambient) from Block 21 Top Soil Removal

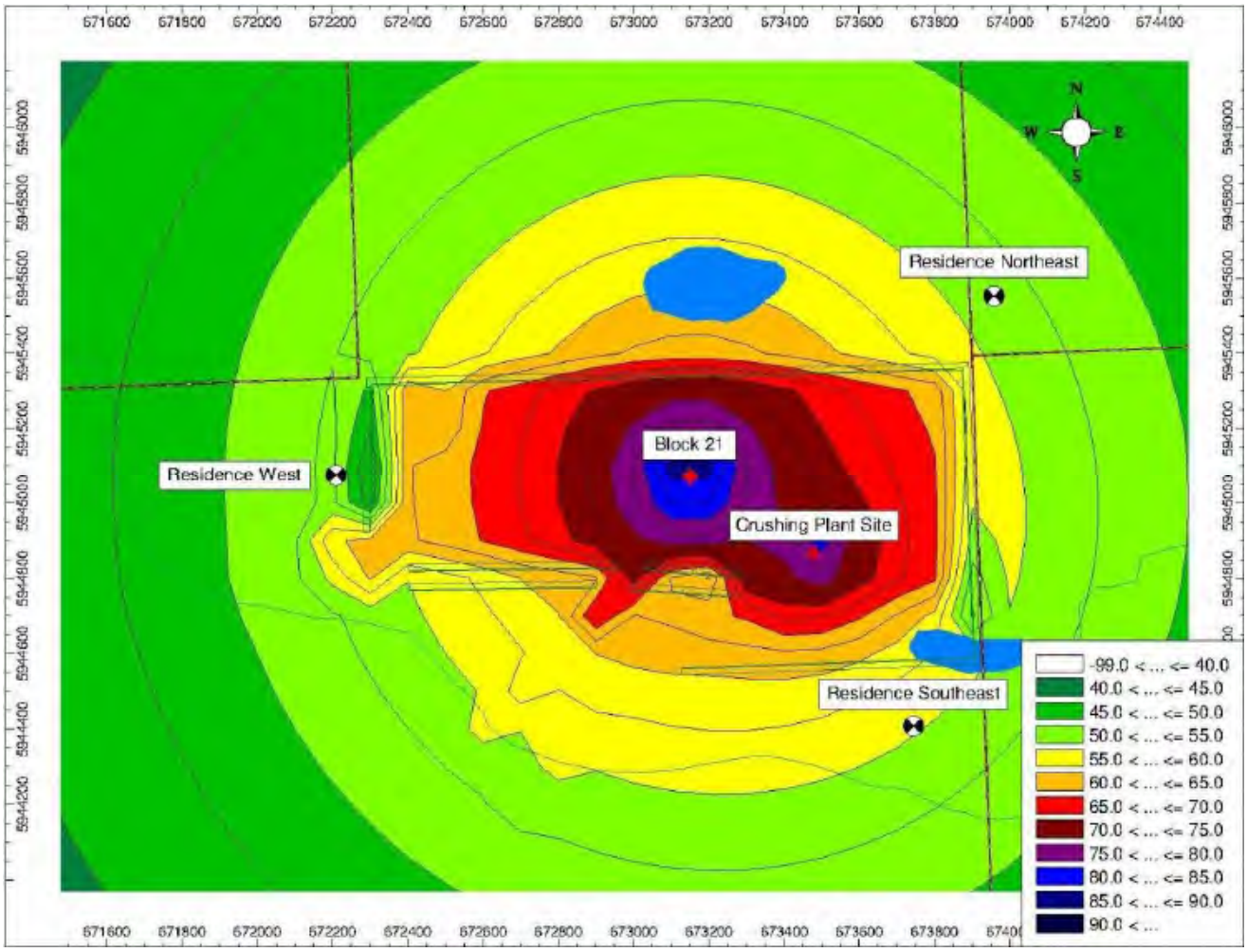


Figure 23 – Predicted Facility Sound Contours (Not Including Ambient) from Block 22 Top Soil Removal

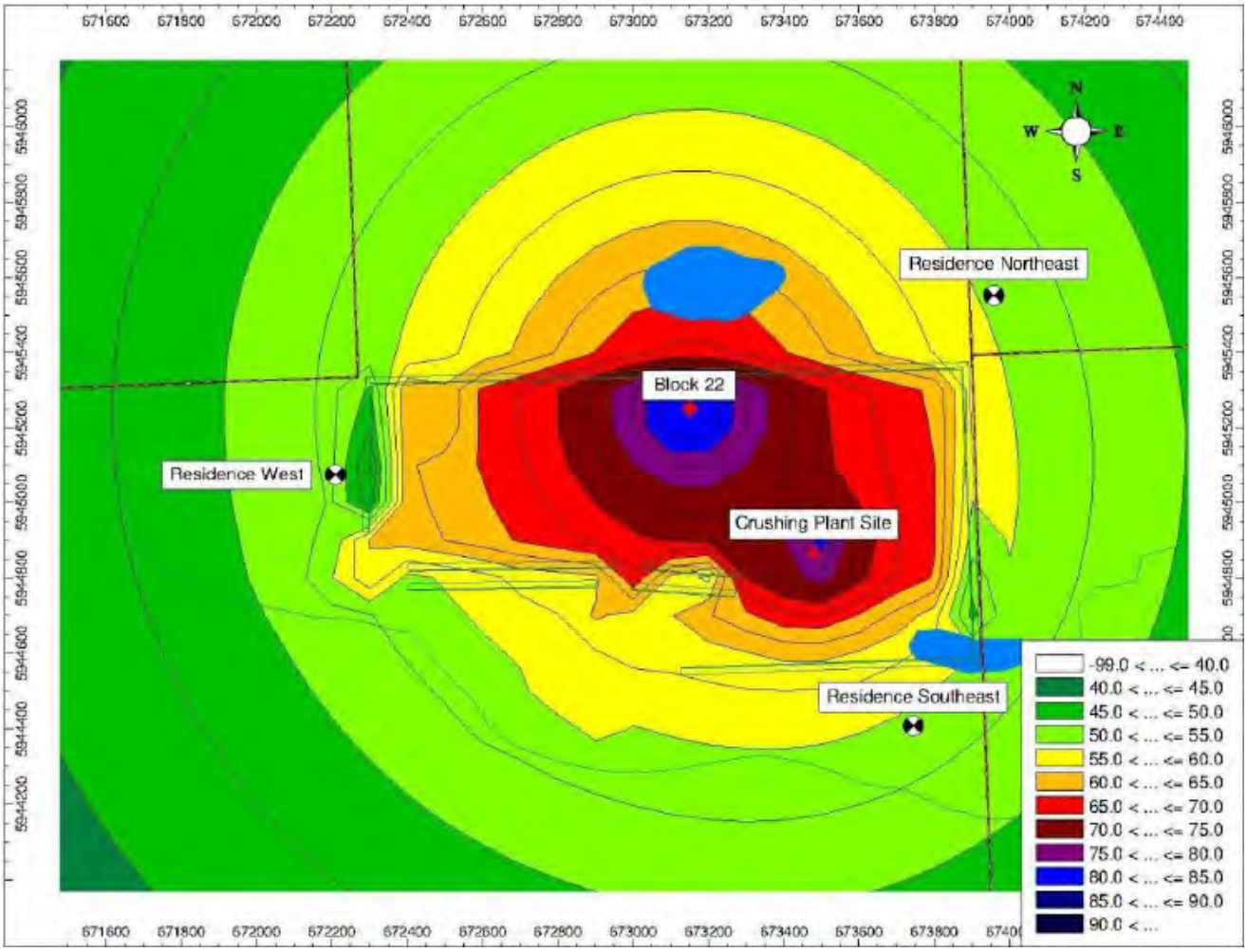


Figure 24 – Predicted Facility Sound Contours (Not Including Ambient) from Block 23 Top Soil Removal

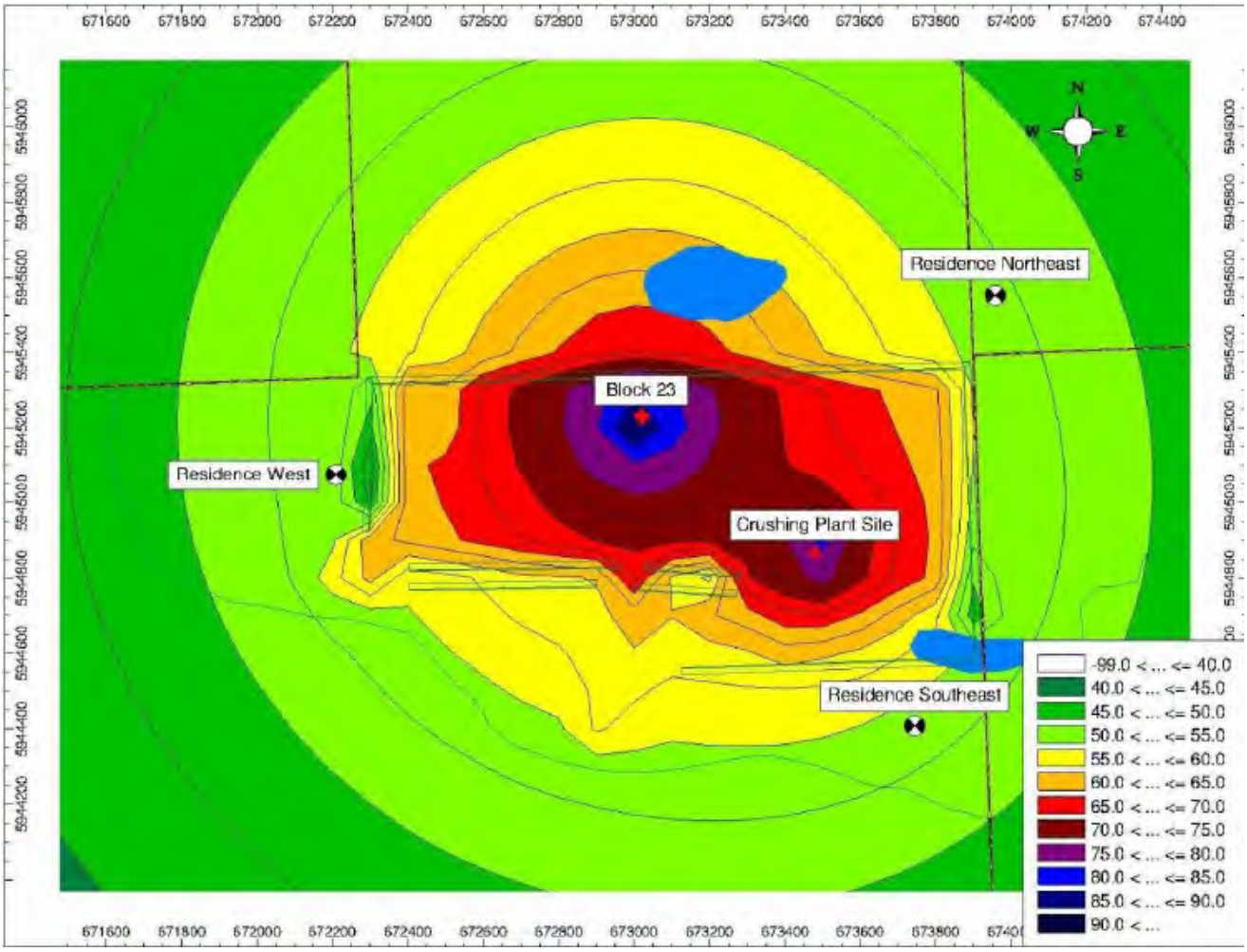


Figure 25 – Predicted Facility Sound Contours (Not Including Ambient) from Block 24 Top Soil Removal

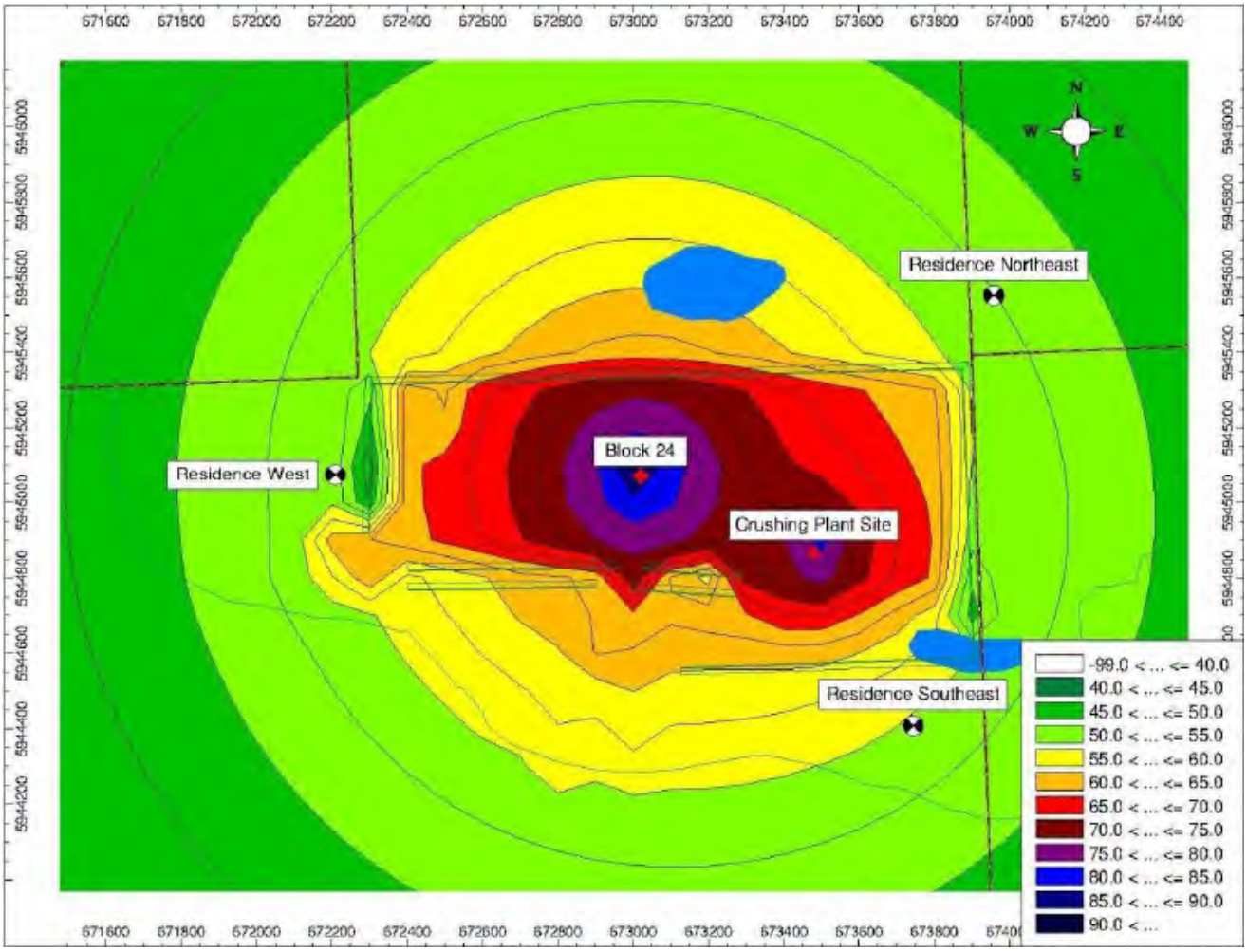
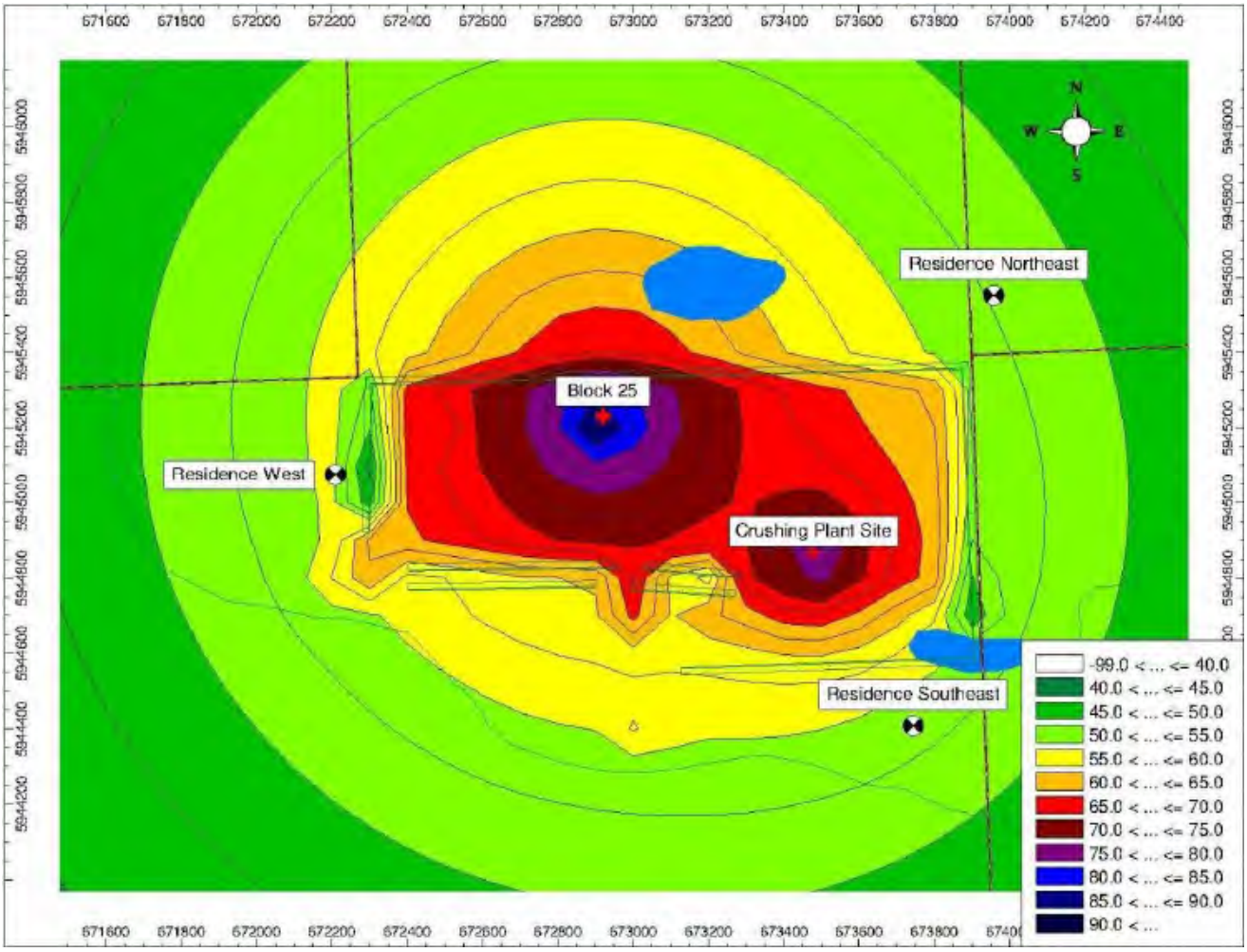


Figure 26 – Predicted Facility Sound Contours (Not Including Ambient) from Block 25 Top Soil Removal



Source Order Ranking

Based on the CadnaA model, the sound sources can be ranked by the sound levels at the receivers. The source order ranking is shown in Tables 5 to 29 at the most impacted residence for each Block scenario.

Table 5 – Source Order Ranking of Block1 at West Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 4	46
Tractor Scraper, Tractor Engine Unit 4	46
Tractor Scraper, Scraper Engine Unit 1	46
Tractor Scraper, Tractor Engine Unit 1	46
Tractor Scraper, Scraper Engine Unit 2	46
Tractor Scraper, Scraper Engine Unit 3	46
Tractor Scraper, Tractor Engine Unit 2	46
Tractor Scraper, Tractor Engine Unit 3	46
CAT D8 Dozer, Engine Unit 1	46
CAT D8 Dozer, Engine Unit 2	46
CAT D8 Dozer, Engine Unit 3	46
CAT 375 Backhoe Engine	45
Volvo A40 Truck Engine Unit 1	44
Volvo A40 Truck Engine Unit 2	44
Volvo A40 Truck Engine Unit 3	44
Volvo A40 Truck Engine Unit 4	44
Volvo A40 Truck Engine Unit 5	44
Volvo A40 Truck Engine Unit 6	44
Volvo A40 Truck Engine Unit 7	44
Volvo A40 Truck Engine Unit 8	44
Volvo A40 Truck Engine Unit 9	44
Volvo A40 Truck Engine Unit 10	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	44
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	44
Other sources added	54
Total Facility Sound Level	**60.6**
Average Ambient Level	35
Total Facility Plus Ambient	**60.6**

Table 6 – Source Order Ranking of Block2 at West Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 1	52
Tractor Scraper, Tractor Engine Unit 1	52
Tractor Scraper, Scraper Engine Unit 2	52
Tractor Scraper, Scraper Engine Unit 3	52
Tractor Scraper, Scraper Engine Unit 4	52
Tractor Scraper, Tractor Engine Unit 2	52
Tractor Scraper, Tractor Engine Unit 3	52
Tractor Scraper, Tractor Engine Unit 4	52
CAT D8 Dozer, Engine Unit 1	52
CAT D8 Dozer, Engine Unit 2	52
CAT D8 Dozer, Engine Unit 3	52
Volvo A40 Truck Engine Unit 7	51
CAT 375 Backhoe Engine	51
Volvo A40 Truck Engine Unit 2	51
Volvo A40 Truck Engine Unit 3	51
Volvo A40 Truck Engine Unit 4	51
Volvo A40 Truck Engine Unit 5	51
Volvo A40 Truck Engine Unit 6	51
Volvo A40 Truck Engine Unit 8	51
Volvo A40 Truck Engine Unit 9	51
Volvo A40 Truck Engine Unit 10	51
Volvo A40 Truck Engine Unit 11	51
Volvo A40 Truck Engine Unit 1	51
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	50
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	50
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	50
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	50
Other sources added	58
Total Facility Sound Level	**66.6**
Average Ambient Level	35
Total Facility Plus Ambient	**66.6**

Table 7 – Source Order Ranking of Block3 at West Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 1	54
Tractor Scraper, Tractor Engine Unit 1	54
CAT D8 Dozer Engine Unit 1	54
CAT D8 Dozer Engine Unit 2	54
CAT D8 Dozer Engine Unit 3	54
Tractor Scraper, Scraper Engine Unit 2	54
Tractor Scraper, Scraper Engine Unit 3	54
Tractor Scraper, Scraper Engine Unit 4	54
Tractor Scraper, Tractor Engine Unit 2	54
Tractor Scraper, Tractor Engine Unit 3	54
Tractor Scraper, Tractor Engine Unit 4	54
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	53
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	53
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	53
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	53
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	53
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	53
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	53
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	53
CAT 375 Backhoe Engine	53
Volvo A40 Truck Engine Unit 1	53
Volvo A40 Truck Engine Unit 2	53
Volvo A40 Truck Engine Unit 3	53
Volvo A40 Truck Engine Unit 4	53
Volvo A40 Truck Engine Unit 5	53
Volvo A40 Truck Engine Unit 6	53
Volvo A40 Truck Engine Unit 7	53
Volvo A40 Truck Engine Unit 8	53
Volvo A40 Truck Engine Unit 9	53
Volvo A40 Truck Engine Unit 10	53
Volvo A40 Truck Engine Unit 11	53
Other sources added	60
Total Facility Sound Level	**68.9**
Average Ambient Level	35
Total Facility Plus Ambient	**68.9**

Table 8 – Source Order Ranking of Block4 at West Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 1	50
Tractor Scraper, Tractor Engine Unit 1	50
Tractor Scraper, Scraper Engine Unit 2	50
Tractor Scraper, Scraper Engine Unit 3	50
Tractor Scraper, Scraper Engine Unit 4	50
Tractor Scraper, Tractor Engine Unit 2	50
Tractor Scraper, Tractor Engine Unit 3	50
Tractor Scraper, Tractor Engine Unit 4	50
CAT D8 Dozer Engine Unit 1	50
CAT D8 Dozer Engine Unit 2	50
CAT D8 Dozer Engine Unit 3	50
CAT 375 Backhoe Engine	49
Volvo A40 Truck Engine Unit 1	49
Volvo A40 Truck Engine Unit 2	49
Volvo A40 Truck Engine Unit 3	49
Volvo A40 Truck Engine Unit 4	49
Volvo A40 Truck Engine Unit 5	49
Volvo A40 Truck Engine Unit 6	49
Volvo A40 Truck Engine Unit 7	49
Volvo A40 Truck Engine Unit 8	49
Volvo A40 Truck Engine Unit 9	49
Volvo A40 Truck Engine Unit 10	49
Volvo A40 Truck Engine Unit 11	49
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	48
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	48
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	48
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	48
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	48
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	48
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	48
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	48
Other sources added	56
Total Facility Sound Level	**64.6**
Average Ambient Level	35
Total Facility Plus Ambient	**64.6**

Table 9 – Source Order Ranking of Block5 at West Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 1	45
Tractor Scraper, Tractor Engine Unit 1	45
Tractor Scraper, Scraper Engine Unit 2	45
Tractor Scraper, Scraper Engine Unit 3	45
Tractor Scraper, Scraper Engine Unit 4	45
Tractor Scraper, Tractor Engine Unit 2	45
Tractor Scraper, Tractor Engine Unit 3	45
Tractor Scraper, Tractor Engine Unit 4	45
CAT D8 Dozer Engine Unit 1	45
CAT D8 Dozer Engine Unit 2	45
CAT D8 Dozer Engine Unit 3	45
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	43
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	43
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	43
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	43
CAT 375 Backhoe Engine	43
Volvo A40 Truck Engine Unit 4	43
Volvo A40 Truck Engine Unit 5	43
Volvo A40 Truck Engine Unit 6	43
Volvo A40 Truck Engine Unit 7	43
Volvo A40 Truck Engine Unit 8	43
Volvo A40 Truck Engine Unit 1	43
Volvo A40 Truck Engine Unit 2	43
Volvo A40 Truck Engine Unit 3	43
Volvo A40 Truck Engine Unit 9	43
Volvo A40 Truck Engine Unit 10	43
Volvo A40 Truck Engine Unit 11	43
Other sources added	51
Total Facility Sound Level	**59.4**
Average Ambient Level	35
Total Facility Plus Ambient	**59.4**

Table 10 – Source Order Ranking of Block6 at West Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 1	43
Tractor Scraper, Tractor Engine Unit 1	43
Tractor Scraper, Scraper Engine Unit 2	43
Tractor Scraper, Scraper Engine Unit 3	43
Tractor Scraper, Scraper Engine Unit 4	43
Tractor Scraper, Tractor Engine Unit 2	43
Tractor Scraper, Tractor Engine Unit 3	43
Tractor Scraper, Tractor Engine Unit 4	43
CAT D8 Dozer Engine Unit 1	43
CAT D8 Dozer Engine Unit 2	43
CAT D8 Dozer Engine Unit 3	43
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	42
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	42
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	42
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	42
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	42
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	42
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	42
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	42
CAT 375 Backhoe Engine	41
Volvo A40 Truck Engine Unit 2	41
Volvo A40 Truck Engine Unit 3	41
Volvo A40 Truck Engine Unit 4	41
Volvo A40 Truck Engine Unit 5	41
Volvo A40 Truck Engine Unit 6	41
Volvo A40 Truck Engine Unit 7	41
Volvo A40 Truck Engine Unit 8	41
Volvo A40 Truck Engine Unit 1	41
Volvo A40 Truck Engine Unit 9	41
Volvo A40 Truck Engine Unit 10	41
Volvo A40 Truck Engine Unit 11	41
Other sources added	50
Total Facility Sound Level	**57.6**
Average Ambient Level	35
Total Facility Plus Ambient	**57.6**

Table 11 – Source Order Ranking of Block7 at Southeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Generator and Engine Casing	47
Tractor Scraper, Scraper Engine Unit 1	45
Tractor Scraper, Tractor Engine Unit 1	45
Tractor Scraper, Scraper Engine Unit 2	45
Tractor Scraper, Scraper Engine Unit 3	45
Tractor Scraper, Scraper Engine Unit 4	45
Tractor Scraper, Tractor Engine Unit 2	45
Tractor Scraper, Tractor Engine Unit 3	45
Tractor Scraper, Tractor Engine Unit 4	45
CAT D8 Dozer Engine Unit 3	45
CAT D8 Dozer Engine Unit 1	45
CAT D8 Dozer Engine Unit 2	45
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	43
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	43
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	43
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	43
Volvo A40 Truck Engine Unit 11	43
Volvo A40 Truck Engine Unit 3	43
Volvo A40 Truck Engine Unit 4	43
Volvo A40 Truck Engine Unit 5	43
Volvo A40 Truck Engine Unit 6	43
Volvo A40 Truck Engine Unit 7	43
Volvo A40 Truck Engine Unit 8	43
Volvo A40 Truck Engine Unit 9	43
Volvo A40 Truck Engine Unit 10	43
CAT 375 Backhoe Engine	43
Volvo A40 Truck Engine Unit 1	43
Other sources added	53
Total Facility Sound Level	**59.9**
Average Ambient Level	35
Total Facility Plus Ambient	**59.9**

Table 12 – Source Order Ranking of Block8 at Southeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 1	47
Tractor Scraper, Tractor Engine Unit 1	47
Tractor Scraper, Scraper Engine Unit 2	47
Tractor Scraper, Scraper Engine Unit 3	47
Tractor Scraper, Scraper Engine Unit 4	47
Tractor Scraper, Tractor Engine Unit 2	47
Tractor Scraper, Tractor Engine Unit 3	47
Tractor Scraper, Tractor Engine Unit 4	47
CAT D8 Dozer Engine Unit 1	47
CAT D8 Dozer Engine Unit 2	47
CAT D8 Dozer Engine Unit 3	47
Generator and Engine Casing	47
Volvo A40 Truck Engine Unit 10	46
Volvo A40 Truck Engine Unit 11	46
Volvo A40 Truck Engine Unit 5	46
Volvo A40 Truck Engine Unit 6	46
Volvo A40 Truck Engine Unit 7	46
Volvo A40 Truck Engine Unit 8	46
Volvo A40 Truck Engine Unit 9	46
CAT 375 Backhoe Engine	46
Volvo A40 Truck Engine Unit 1	46
Volvo A40 Truck Engine Unit 2	46
Volvo A40 Truck Engine Unit 3	46
Volvo A40 Truck Engine Unit 4	46
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	46
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	46
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	46
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	46
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	46
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	46
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	46
Other sources added	55
Total Facility Sound Level	**62.2**
Average Ambient Level	35
Total Facility Plus Ambient	**62.2**

Table 13 – Source Order Ranking of Block9 at Southeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 1	50
Tractor Scraper, Tractor Engine Unit 1	50
Tractor Scraper, Scraper Engine Unit 2	50
Tractor Scraper, Scraper Engine Unit 3	50
Tractor Scraper, Scraper Engine Unit 4	50
Tractor Scraper, Tractor Engine Unit 2	50
Tractor Scraper, Tractor Engine Unit 3	50
Tractor Scraper, Tractor Engine Unit 4	50
CAT D8 Dozer Engine Unit 1	50
CAT D8 Dozer Engine Unit 2	50
CAT D8 Dozer Engine Unit 3	50
Volvo A40 Truck Engine Unit 10	49
Volvo A40 Truck Engine Unit 11	49
Volvo A40 Truck Engine Unit 5	49
Volvo A40 Truck Engine Unit 6	49
Volvo A40 Truck Engine Unit 7	49
Volvo A40 Truck Engine Unit 8	49
Volvo A40 Truck Engine Unit 9	49
CAT 375 Backhoe Engine	49
Volvo A40 Truck Engine Unit 1	48
Volvo A40 Truck Engine Unit 2	48
Volvo A40 Truck Engine Unit 3	48
Volvo A40 Truck Engine Unit 4	48
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	48
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	48
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	48
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	48
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	48
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	48
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	48
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	48
Other sources added	57
Total Facility Sound Level	**64.7**
Average Ambient Level	35
Total Facility Plus Ambient	**64.7**

Table 14 – Source Order Ranking of Block10 at Southeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 3	52
Tractor Scraper, Scraper Engine Unit 4	52
Tractor Scraper, Tractor Engine Unit 3	52
Tractor Scraper, Tractor Engine Unit 4	52
Tractor Scraper, Scraper Engine Unit 1	52
Tractor Scraper, Tractor Engine Unit 1	52
Tractor Scraper, Scraper Engine Unit 2	52
Tractor Scraper, Tractor Engine Unit 2	52
CAT D8 Dozer Engine Unit 1	52
CAT D8 Dozer Engine Unit 2	52
CAT D8 Dozer Engine Unit 3	52
Volvo A40 Truck Engine Unit 8	50
Volvo A40 Truck Engine Unit 9	50
Volvo A40 Truck Engine Unit 10	50
Volvo A40 Truck Engine Unit 11	50
CAT 375 Backhoe Engine	50
Volvo A40 Truck Engine Unit 2	50
Volvo A40 Truck Engine Unit 3	50
Volvo A40 Truck Engine Unit 4	50
Volvo A40 Truck Engine Unit 5	50
Volvo A40 Truck Engine Unit 6	50
Volvo A40 Truck Engine Unit 7	50
Volvo A40 Truck Engine Unit 1	50
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	50
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	50
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	50
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	50
Other sources added	58
Total Facility Sound Level	**66.4**
Average Ambient Level	35
Total Facility Plus Ambient	**66.4**

Table 15 – Source Order Ranking of Block11 at Southeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 1	52
Tractor Scraper, Tractor Engine Unit 1	52
Tractor Scraper, Scraper Engine Unit 2	52
Tractor Scraper, Scraper Engine Unit 3	52
Tractor Scraper, Scraper Engine Unit 4	52
Tractor Scraper, Tractor Engine Unit 2	52
Tractor Scraper, Tractor Engine Unit 3	52
Tractor Scraper, Tractor Engine Unit 4	52
CAT D8 Dozer Engine Unit 3	52
CAT D8 Dozer Engine Unit 1	52
CAT D8 Dozer Engine Unit 2	52
Volvo A40 Truck Engine Unit 6	51
Volvo A40 Truck Engine Unit 7	51
Volvo A40 Truck Engine Unit 8	51
Volvo A40 Truck Engine Unit 9	51
CAT 375 Backhoe Engine	51
Volvo A40 Truck Engine Unit 1	50
Volvo A40 Truck Engine Unit 2	50
Volvo A40 Truck Engine Unit 3	50
Volvo A40 Truck Engine Unit 4	50
Volvo A40 Truck Engine Unit 5	50
Volvo A40 Truck Engine Unit 10	50
Volvo A40 Truck Engine Unit 11	50
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	50
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	50
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	50
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	50
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	50
Other sources added	58
Total Facility Sound Level	**66.6**
Average Ambient Level	35
Total Facility Plus Ambient	**66.6**

Table 16 – Source Order Ranking of Block12 at Northeast Residence with Downwind Condition

Source	Residence Levels (dBA)
CAT D8 Dozer Engine Unit 1	45
CAT D8 Dozer Engine Unit 2	45
Tractor Scraper, Scraper Engine Unit 1	45
Tractor Scraper, Tractor Engine Unit 1	45
Tractor Scraper, Scraper Engine Unit 2	45
Tractor Scraper, Scraper Engine Unit 3	45
Tractor Scraper, Scraper Engine Unit 4	45
Tractor Scraper, Tractor Engine Unit 2	45
Tractor Scraper, Tractor Engine Unit 3	45
Tractor Scraper, Tractor Engine Unit 4	45
CAT D8 Dozer Engine Unit 3	45
CAT 375 Backhoe Engine	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	44
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	44
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	44
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	44
Volvo A40 Truck Engine Unit 1	44
Volvo A40 Truck Engine Unit 2	44
Volvo A40 Truck Engine Unit 3	44
Volvo A40 Truck Engine Unit 4	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	44
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	44
Volvo A40 Truck Engine Unit 5	44
Volvo A40 Truck Engine Unit 6	44
Volvo A40 Truck Engine Unit 7	44
Volvo A40 Truck Engine Unit 8	44
Volvo A40 Truck Engine Unit 9	44
Volvo A40 Truck Engine Unit 10	44
Volvo A40 Truck Engine Unit 11	44
Other sources added	52
Total Facility Sound Level	**59.8**
Average Ambient Level	35
Total Facility Plus Ambient	**59.8**

Table 17 – Source Order Ranking of Block13 at Northeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 1	44
Tractor Scraper, Tractor Engine Unit 1	44
Tractor Scraper, Scraper Engine Unit 2	44
Tractor Scraper, Scraper Engine Unit 3	44
Tractor Scraper, Tractor Engine Unit 2	44
Tractor Scraper, Tractor Engine Unit 3	44
CAT D8 Dozer Engine Unit 1	44
CAT D8 Dozer Engine Unit 2	44
CAT D8 Dozer Engine Unit 3	44
Tractor Scraper, Scraper Engine Unit 4	44
Tractor Scraper, Tractor Engine Unit 4	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	43
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	43
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	43
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	43
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	43
CAT 375 Backhoe Engine	43
Volvo A40 Truck Engine Unit 1	43
Volvo A40 Truck Engine Unit 2	43
Volvo A40 Truck Engine Unit 3	42
Volvo A40 Truck Engine Unit 4	42
Volvo A40 Truck Engine Unit 5	42
Volvo A40 Truck Engine Unit 6	42
Volvo A40 Truck Engine Unit 7	42
Volvo A40 Truck Engine Unit 8	42
Volvo A40 Truck Engine Unit 9	42
Volvo A40 Truck Engine Unit 10	42
Volvo A40 Truck Engine Unit 11	42
Other sources added	51
Total Facility Sound Level	**58.8**
Average Ambient Level	35
Total Facility Plus Ambient	**58.8**

Table 18 – Source Order Ranking of Block14 at Northeast Residence with Downwind Condition

Source	Residence Levels (dBA)
CAT D8 Dozer Engine Unit 1	47
Tractor Scraper, Scraper Engine Unit 1	48
Tractor Scraper, Tractor Engine Unit 1	48
Tractor Scraper, Scraper Engine Unit 2	48
Tractor Scraper, Scraper Engine Unit 3	48
Tractor Scraper, Tractor Engine Unit 2	48
Tractor Scraper, Tractor Engine Unit 3	48
CAT D8 Dozer Engine Unit 2	47
CAT D8 Dozer Engine Unit 3	47
Tractor Scraper, Scraper Engine Unit 4	47
Tractor Scraper, Tractor Engine Unit 4	47
CAT 375 Backhoe Engine	46
Volvo A40 Truck Engine Unit 1	46
Volvo A40 Truck Engine Unit 2	46
Volvo A40 Truck Engine Unit 3	46
Volvo A40 Truck Engine Unit 4	46
Volvo A40 Truck Engine Unit 10	46
Volvo A40 Truck Engine Unit 11	46
Volvo A40 Truck Engine Unit 5	46
Volvo A40 Truck Engine Unit 6	46
Volvo A40 Truck Engine Unit 7	46
Volvo A40 Truck Engine Unit 8	46
Volvo A40 Truck Engine Unit 9	46
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	46
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	46
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	46
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	46
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	46
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	46
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	46
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	46
Other sources added	54
Total Facility Sound Level	**62.2**
Average Ambient Level	35
Total Facility Plus Ambient	**62.2**

Table 19 – Source Order Ranking of Block15 at Northeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 1	45
Tractor Scraper, Tractor Engine Unit 1	45
Tractor Scraper, Scraper Engine Unit 2	45
Tractor Scraper, Scraper Engine Unit 3	45
Tractor Scraper, Tractor Engine Unit 2	45
Tractor Scraper, Tractor Engine Unit 3	45
CAT D8 Dozer Engine Unit 1	45
CAT D8 Dozer Engine Unit 2	45
CAT D8 Dozer Engine Unit 3	45
Tractor Scraper, Scraper Engine Unit 4	45
Tractor Scraper, Tractor Engine Unit 4	45
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	44
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	44
Volvo A40 Truck Engine Unit 1	44
Volvo A40 Truck Engine Unit 11	44
CAT 375 Backhoe Engine	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	44
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	44
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	44
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	44
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	44
Volvo A40 Truck Engine Unit 2	44
Volvo A40 Truck Engine Unit 3	44
Volvo A40 Truck Engine Unit 4	44
Volvo A40 Truck Engine Unit 5	44
Volvo A40 Truck Engine Unit 6	44
Volvo A40 Truck Engine Unit 7	44
Volvo A40 Truck Engine Unit 8	44
Volvo A40 Truck Engine Unit 9	44
Volvo A40 Truck Engine Unit 10	44
Other sources added	52
Total Facility Sound Level	**59.9**
Average Ambient Level	35
Total Facility Plus Ambient	**59.9**

Table 20 – Source Order Ranking of Block16 at Northeast Residence with Downwind Condition

Source	Residence Levels (dBA)
CAT D8 Dozer Engine Unit 1	42
CAT D8 Dozer Engine Unit 2	42
CAT D8 Dozer Engine Unit 3	42
Tractor Scraper, Scraper Engine Unit 1	42
Tractor Scraper, Tractor Engine Unit 1	42
Tractor Scraper, Scraper Engine Unit 2	42
Tractor Scraper, Scraper Engine Unit 3	42
Tractor Scraper, Scraper Engine Unit 4	42
Tractor Scraper, Tractor Engine Unit 2	42
Tractor Scraper, Tractor Engine Unit 3	42
Tractor Scraper, Tractor Engine Unit 4	42
Generator and Engine Casing	42
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	41
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	41
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	41
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	41
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	41
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	41
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	41
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	41
CAT 375 Backhoe Engine	41
Volvo A40 Truck Engine Unit 1	41
Volvo A40 Truck Engine Unit 2	41
Volvo A40 Truck Engine Unit 3	41
Volvo A40 Truck Engine Unit 4	41
Volvo A40 Truck Engine Unit 5	41
Volvo A40 Truck Engine Unit 9	41
Volvo A40 Truck Engine Unit 10	41
Volvo A40 Truck Engine Unit 11	41
Volvo A40 Truck Engine Unit 6	41
Volvo A40 Truck Engine Unit 7	41
Other sources added	50
Total Facility Sound Level	**57.5**
Average Ambient Level	35
Total Facility Plus Ambient	**57.5**

Table 21 – Source Order Ranking of Block17 at Southeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Generator and Engine Casing	47
Pump Driver Engine Casing	43
Cat 980 Loader Engine Unit 4	42
Pump Driver Engine Exhaust Silenced	41
Tractor Scraper, Scraper Engine Unit 1	41
Tractor Scraper, Tractor Engine Unit 1	41
Tractor Scraper, Scraper Engine Unit 2	41
Tractor Scraper, Scraper Engine Unit 3	41
Tractor Scraper, Scraper Engine Unit 4	41
Tractor Scraper, Tractor Engine Unit 2	41
Tractor Scraper, Tractor Engine Unit 3	41
Tractor Scraper, Tractor Engine Unit 4	41
CAT D8 Dozer Engine Unit 1	41
CAT D8 Dozer Engine Unit 2	41
CAT D8 Dozer Engine Unit 3	41
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	40
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	40
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	40
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	40
Generator Driver Engine Exhaust Silenced	39
Volvo A40 Truck Engine Unit 3	39
Volvo A40 Truck Engine Unit 4	39
Volvo A40 Truck Engine Unit 5	39
Volvo A40 Truck Engine Unit 6	39
Volvo A40 Truck Engine Unit 7	39
Volvo A40 Truck Engine Unit 8	39
Volvo A40 Truck Engine Unit 9	39
Other sources added	50
Total Facility Sound Level	**56.8**
Average Ambient Level	35
Total Facility Plus Ambient	**56.8**

Table 22 – Source Order Ranking of Block18 at Northeast Residence with Downwind Condition

Source	Residence Levels (dBA)
CAT D8 Dozer Engine Unit 1	43
Tractor Scraper, Scraper Engine Unit 1	43
Tractor Scraper, Tractor Engine Unit 1	43
Tractor Scraper, Scraper Engine Unit 2	43
Tractor Scraper, Scraper Engine Unit 3	43
Tractor Scraper, Scraper Engine Unit 4	43
Tractor Scraper, Tractor Engine Unit 2	43
Tractor Scraper, Tractor Engine Unit 3	43
Tractor Scraper, Tractor Engine Unit 4	43
CAT D8 Dozer Engine Unit 2	43
CAT D8 Dozer Engine Unit 3	43
Generator and Engine Casing	42
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	42
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	42
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	42
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	42
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	42
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	42
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	42
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	42
CAT 375 Backhoe Engine	42
Volvo A40 Truck Engine Unit 1	41
Volvo A40 Truck Engine Unit 2	41
Volvo A40 Truck Engine Unit 3	41
Volvo A40 Truck Engine Unit 4	41
Volvo A40 Truck Engine Unit 5	41
Volvo A40 Truck Engine Unit 8	41
Volvo A40 Truck Engine Unit 9	41
Volvo A40 Truck Engine Unit 10	41
Volvo A40 Truck Engine Unit 11	41
Volvo A40 Truck Engine Unit 6	41
Other sources added	51
Total Facility Sound Level	**57.9**
Average Ambient Level	35
Total Facility Plus Ambient	**57.9**

Table 23 – Source Order Ranking of Block19 at Northeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Generator and Engine Casing	42
Tractor Scraper, Scraper Engine Unit 1	41
Tractor Scraper, Tractor Engine Unit 1	41
Tractor Scraper, Scraper Engine Unit 2	41
Tractor Scraper, Scraper Engine Unit 3	41
Tractor Scraper, Scraper Engine Unit 4	41
Tractor Scraper, Tractor Engine Unit 2	41
Tractor Scraper, Tractor Engine Unit 3	41
Tractor Scraper, Tractor Engine Unit 4	41
CAT D8 Dozer Engine Unit 1	41
CAT D8 Dozer Engine Unit 2	41
CAT D8 Dozer Engine Unit 3	41
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	40
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	40
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	40
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	40
Volvo A40 Truck Engine Unit 10	39
Volvo A40 Truck Engine Unit 11	39
CAT 375 Backhoe Engine	39
Volvo A40 Truck Engine Unit 1	39
Volvo A40 Truck Engine Unit 2	39
Volvo A40 Truck Engine Unit 3	39
Volvo A40 Truck Engine Unit 4	39
Volvo A40 Truck Engine Unit 5	39
Volvo A40 Truck Engine Unit 6	39
Volvo A40 Truck Engine Unit 7	39
Volvo A40 Truck Engine Unit 8	39
Other sources added	49
Total Facility Sound Level	**56.1**
Average Ambient Level	35
Total Facility Plus Ambient	**56.1**

Table 24 – Source Order Ranking of Block20 at Southeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Generator and Engine Casing	47
Pump Driver Engine Casing	43
Cat 980 Loader Engine Unit 4	42
Pump Driver Engine Exhaust Silenced	41
Tractor Scraper, Scraper Engine Unit 1	40
Tractor Scraper, Tractor Engine Unit 1	40
Tractor Scraper, Scraper Engine Unit 2	40
Tractor Scraper, Scraper Engine Unit 3	40
Tractor Scraper, Scraper Engine Unit 4	40
Tractor Scraper, Tractor Engine Unit 2	40
Tractor Scraper, Tractor Engine Unit 3	40
Tractor Scraper, Tractor Engine Unit 4	40
CAT D8 Dozer Engine Unit 3	40
CAT D8 Dozer Engine Unit 1	40
CAT D8 Dozer Engine Unit 2	40
Generator Driver Engine Exhaust Silenced	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	39
Volvo A40 Truck Engine Unit 4	38
Volvo A40 Truck Engine Unit 5	38
Volvo A40 Truck Engine Unit 6	38
Volvo A40 Truck Engine Unit 7	38
Volvo A40 Truck Engine Unit 8	38
Volvo A40 Truck Engine Unit 9	38
Volvo A40 Truck Engine Unit 10	38
Other sources added	49
Total Facility Sound Level	**56.1**
Average Ambient Level	35
Total Facility Plus Ambient	**56.1**

Table 25 – Source Order Ranking of Block21 at Southeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Generator and Engine Casing	47
Pump Driver Engine Casing	43
Cat 980 Loader Engine Unit 4	42
Pump Driver Engine Exhaust Silenced	41
Generator Driver Engine Exhaust Silenced	39
Tractor Scraper, Scraper Engine Unit 1	39
Tractor Scraper, Tractor Engine Unit 1	39
Tractor Scraper, Scraper Engine Unit 2	39
Tractor Scraper, Scraper Engine Unit 3	39
Tractor Scraper, Scraper Engine Unit 4	39
Tractor Scraper, Tractor Engine Unit 2	39
Tractor Scraper, Tractor Engine Unit 3	39
Tractor Scraper, Tractor Engine Unit 4	39
CAT D8 Dozer Engine Unit 1	38
CAT D8 Dozer Engine Unit 2	38
CAT D8 Dozer Engine Unit 3	38
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	38
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	38
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	38
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	38
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	38
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	38
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	38
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	38
Volvo A40 Truck Engine Unit 9	37
Volvo A40 Truck Engine Unit 10	37
Volvo A40 Truck Engine Unit 11	37
CAT 375 Backhoe Engine	37
Volvo A40 Truck Engine Unit 1	37
Volvo A40 Truck Engine Unit 2	37
Volvo A40 Truck Engine Unit 3	37
Other sources added	48
Total Facility Sound Level	**55.3**
Average Ambient Level	35
Total Facility Plus Ambient	**55.3**

Table 26 – Source Order Ranking of Block22 at Northeast Residence with Downwind Condition

Source	Residence Levels (dBA)
Generator and Engine Casing	42
Tractor Scraper, Scraper Engine Unit 1	39
Tractor Scraper, Tractor Engine Unit 1	39
Tractor Scraper, Scraper Engine Unit 2	39
Tractor Scraper, Scraper Engine Unit 3	39
Tractor Scraper, Scraper Engine Unit 4	39
Tractor Scraper, Tractor Engine Unit 2	39
Tractor Scraper, Tractor Engine Unit 3	39
Tractor Scraper, Tractor Engine Unit 4	39
CAT D8 Dozer Engine Unit 1	39
CAT D8 Dozer Engine Unit 2	39
CAT D8 Dozer Engine Unit 3	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	39
Pump Driver Engine Casing	38
CAT 375 Backhoe Engine	38
Volvo A40 Truck Engine Unit 1	37
Volvo A40 Truck Engine Unit 2	37
Volvo A40 Truck Engine Unit 3	37
Volvo A40 Truck Engine Unit 4	37
Volvo A40 Truck Engine Unit 5	37
Volvo A40 Truck Engine Unit 6	37
Volvo A40 Truck Engine Unit 7	37
Volvo A40 Truck Engine Unit 8	37
Volvo A40 Truck Engine Unit 9	37
Other sources added	48
Total Facility Sound Level	**54.5**
Average Ambient Level	35
Total Facility Plus Ambient	**54.5**

Table 27 – Source Order Ranking of Block23 at West Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 4	39
Tractor Scraper, Tractor Engine Unit 4	40
Tractor Scraper, Scraper Engine Unit 1	39
Tractor Scraper, Tractor Engine Unit 1	39
Tractor Scraper, Scraper Engine Unit 2	39
Tractor Scraper, Scraper Engine Unit 3	39
Tractor Scraper, Tractor Engine Unit 2	39
Tractor Scraper, Tractor Engine Unit 3	39
CAT D8 Dozer Engine Unit 1	39
CAT D8 Dozer Engine Unit 2	39
CAT D8 Dozer Engine Unit 3	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	39
CAT 375 Backhoe Engine	38
Volvo A40 Truck Engine Unit 1	38
Volvo A40 Truck Engine Unit 2	38
Volvo A40 Truck Engine Unit 3	38
Volvo A40 Truck Engine Unit 4	38
Volvo A40 Truck Engine Unit 5	38
Volvo A40 Truck Engine Unit 6	38
Volvo A40 Truck Engine Unit 7	38
Volvo A40 Truck Engine Unit 8	38
Volvo A40 Truck Engine Unit 9	38
Volvo A40 Truck Engine Unit 10	38
Volvo A40 Truck Engine Unit 11	38
Other sources added	47
Total Facility Sound Level	**54.6**
Average Ambient Level	35
Total Facility Plus Ambient	**54.6**

Table 28 – Source Order Ranking of Block24 at West Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 1	40
Tractor Scraper, Tractor Engine Unit 1	40
Tractor Scraper, Scraper Engine Unit 2	40
Tractor Scraper, Scraper Engine Unit 3	40
Tractor Scraper, Scraper Engine Unit 4	40
Tractor Scraper, Tractor Engine Unit 2	40
Tractor Scraper, Tractor Engine Unit 3	40
Tractor Scraper, Tractor Engine Unit 4	40
CAT D8 Dozer Engine Unit 1	40
CAT D8 Dozer Engine Unit 2	40
CAT D8 Dozer Engine Unit 3	40
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	39
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	39
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	39
CAT 375 Backhoe Engine	38
Volvo A40 Truck Engine Unit 1	38
Volvo A40 Truck Engine Unit 2	38
Volvo A40 Truck Engine Unit 3	38
Volvo A40 Truck Engine Unit 4	38
Volvo A40 Truck Engine Unit 5	38
Volvo A40 Truck Engine Unit 6	38
Volvo A40 Truck Engine Unit 7	38
Volvo A40 Truck Engine Unit 8	38
Volvo A40 Truck Engine Unit 9	38
Volvo A40 Truck Engine Unit 10	38
Volvo A40 Truck Engine Unit 11	38
Other sources added	47
Total Facility Sound Level	**54.8**
Average Ambient Level	35
Total Facility Plus Ambient	**54.8**

Table 29 – Source Order Ranking of Block25 at West Residence with Downwind Condition

Source	Residence Levels (dBA)
Tractor Scraper, Scraper Engine Unit 3	41
Tractor Scraper, Scraper Engine Unit 4	41
Tractor Scraper, Tractor Engine Unit 3	41
Tractor Scraper, Tractor Engine Unit 4	41
Tractor Scraper, Scraper Engine Unit 1	41
Tractor Scraper, Tractor Engine Unit 1	41
Tractor Scraper, Scraper Engine Unit 2	41
Tractor Scraper, Tractor Engine Unit 2	41
CAT D8 Dozer Engine Unit 1	41
CAT D8 Dozer Engine Unit 2	41
CAT D8 Dozer Engine Unit 3	41
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 1	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 1	40
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 2	40
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 3	40
Tractor Scraper, Scraper Engine Exhaust Silenced Unit 4	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 2	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 3	40
Tractor Scraper, Tractor Engine Exhaust Silenced Unit 4	40
CAT 375 Backhoe Engine	40
Volvo A40 Truck Engine Unit 1	39
Volvo A40 Truck Engine Unit 2	39
Volvo A40 Truck Engine Unit 3	39
Volvo A40 Truck Engine Unit 4	39
Volvo A40 Truck Engine Unit 5	39
Volvo A40 Truck Engine Unit 6	39
Volvo A40 Truck Engine Unit 7	39
Volvo A40 Truck Engine Unit 8	39
Volvo A40 Truck Engine Unit 9	39
Volvo A40 Truck Engine Unit 10	39
Volvo A40 Truck Engine Unit 11	39
Other sources added	48
Total Facility Sound Level	**55.9**
Average Ambient Level	35
Total Facility Plus Ambient	**55.9**

Conclusion

This document reports the expected sound level at the 3 most impacted residences around the proposed Rojas Lac Ste Anne Gravel Pit under downwind conditions for the top soil removal of each proposed exploration block.

APPENDIX A

Explanation of Technical Details Regarding Sound Measurement and Analysis

Technical Details

Sound is the phenomena of vibrations transmitted through air, or other medium such as water or a building structure. The range of pressure amplitudes, intensities, and frequencies of the sound energy is very wide, and many specialized fields have developed using different ranges of these variables, such as room acoustics and medical ultrasound.

Due to the wide range of intensities, which are perceived as sound, standard engineering units become inconvenient. Sound levels are commonly measured on a logarithmic scale, with the level (in decibels, or dB) being proportional to ten times the common logarithm of the sound energy or intensity. Normal human hearing covers a range of about twelve to fourteen orders of magnitude in energy, from the threshold of hearing to the threshold of pain. On the decibel scale, the threshold of hearing is set as zero, written as 0 dB, while the threshold of pain varies between 120 to 140 dB. The most usual measure of sound is the sound pressure level (SPL), with 0 dB SPL set at 2.0×10^{-5} N/m^2 (also written 20 μPa), which corresponds to a sound intensity of 10^{-12} Watts/m^2 (or 1 picoWatt/m^2, written 1 pW/m^2).

Normal human hearing spans a frequency range from about 20 Hertz (Hz, or cycles per second) to about 20,000 Hz (written 20 KHz). However, the sensitivity of human hearing is not the same at all frequencies. To accommodate the variation in sensitivity, various frequency-weighting scales have been developed. The most common is the A-weighting scale, which is based on the sensitivity of human hearing at moderate levels; this scale reflects the low sensitivity to sounds of very high or very low frequencies. Sound levels measured on the A-weighted scale are written in A-weighted decibels, commonly shown as dBA or dB(A).

When sound is measured using the A-weighting scale, the reading is often called the "Noise level", to confirm that human sensitivity and reactions are being addressed. A table of some common noise sources and their associated noise levels are shown in Table B1.

When the A-weighting scale is not used, the measurement is said to have a "linear" weighting, or to be unweighted, and may be called a "linear" level. As the linear reading is an accurate measurement of the physical (sound) pressure, the term "Sound Pressure Level", or SPL, is usually (but not universally) reserved for unweighted measurements.

Noise is usually defined as "unwanted sound", which indicates that it is not just the physical sound that is important, but also the human reaction to the sound that leads to the perception of sound as noise. It implies a judgment of the quality or quantity of sound experienced. As a human reaction to sound is involved, noise levels are usually given in A-weighted decibels (dBA). An alternate definition of noise is "sound made by somebody else", which emphasizes that the ability to control the level of the sound alters the perception of noise.

Table B1 - Noise Levels of Familiar Sources

Source Or Environment	Noise Level (dBA)
High Pressure Steam Venting To Atmosphere (3m)	121
Steam Boiler (2m)	90-95
Drilling Rig (10m)	80-90
Pneumatic Drill (15m)	85
Pump Jack (10m)	68-72
Truck (15m)	65-70
Business Office	65
Conversational Speech (1m)	60
Light Auto Traffic (30m)	50
Living Room	40
Library	35
Soft Whisper (5m)	20-35

The single number A-weighted level is often inadequate for engineering purposes, although it does supply a good estimate of people's reaction to a noise environment. As noise sources, control measures, and materials differ in the frequency dependence of their noise responses or production, sound is measured with a narrower frequency bandwidth; the specific methodology varies with the application. For most work, the acoustic frequency range is divided into frequency bands where the center frequency of each band is twice the frequency of the next lower band; these are called "Octave" bands, as their frequency relation is called an "Octave" in music, where the field of acoustics has its roots. For more detailed work, the octave bands, and certain standard octave and 1/3 octave bands have been specified by international agreements.

Where the noise at the receiver is steady, it is easy to assess the noise level. However, both the production of noise at the source and the transmission of noise can vary with time; most noise levels are not constant, either because of the motion of the noise source (as in traffic noise), because the noise source itself varies, or because the transmission of sound to the receiver location is not steady as over long distances. This is almost always the case for environmental noise studies. Several single number descriptors have been developed and are used to assess noise in these conditions.

The most common is the measurement of the "equivalent continuous" sound level, or L_{eq}, which is the level of a hypothetical source of a constant level which would give the same total sound energy as is measured during the sampling period. This is the "energy" average noise level. Typical sampling periods are one hour, nighttime (9 hours) or one day (24 hours); the sampling period used must be reported when using this unit.

The greatest value of the L_{eq} is that the contributions of different sources to the total noise level can be assessed, or in a case where a new noise source is to be added to an environment, the total noise level from new and old sources can be easily calculated. It is also sensitive to short term high noise levels.

Statistical noise levels are sometimes used to assess an unsteady noise environment. They indicate the levels that are exceeded a fixed percentage of the measurement time period measured. For example, the 10%-ile level, written L_{10}, is the levels exceeded 10% of the time; this level is a good measure of frequent noisy occurrences such as steady road traffic. The 90% level, L_{90}, is the level exceeded 90% of the time, and is the background level, or noise floor. A steady noise source will modify the background level, while an intermittent noise source such as road or rail traffic will affect the short-term levels only.

One disadvantage with the L_{eq} measure, when used alone, is that nearby loud sources (e.g. dogs barking, or birds singing) can confuse the assessment of the situation when it is the noise from a distant plant that is the concern. For this reason, the equivalent level and the statistical levels can be used together to better understand the noise environment. One such indication is the difference between the L_{eq} and the L_{90} levels. A large difference between the L_{eq} and L_{90}, greater than 10 dB, indicates the intrusion of short-term noise events on the general background level. A small difference, less than 5 dB, indicates a very steady noise environment. If the L_{eq} value exceeds the L_{10} value this indicates the presence of significant short-term loud events.

For most noise measurement, instruments are adjusted so that the time response of the instrument is similar to the response of the human ear; this is the "Fast" setting. Measurement with the "Fast" setting therefore assesses the sound environment according to the way humans would hear it and react to it. Where the noise level varies substantially and an average level is wanted without the complexity of and L_{eq} or statistical measurement, the "Slow" setting is used on the sound level meter. The "Slow" setting is also typically used in industrial settings where hearing damage is a concern. Where the noise level changes very rapidly, for example due to impacts or detonations, the "Fast" and "Slow" settings do not respond quickly enough to assess the maximum levels, and the "Impulse" meter setting us used.

The Sound Power Level (abbreviated L_w, SWL or PWL) is the decibel equivalent of the total energy emitted from a source in the form of noise. The reference level for the sound power is 10^{-12} Watts, or 1 picoWatt (abbreviated pW). The sound power level is given by:

$$L_w, \text{SWL, PWL} = 10 \times \log_{10} (\text{Emitted Power} / 1 \text{ pW}) \text{ dB}$$

Therefore, a source emitting 1 Watt of power in the form of sound would have a sound power level of 120 dB. Sound power levels can be expressed in terms of frequency bands, an overall linear-weighted level or A-weighted, as is the case for sound pressure levels. However, sound power levels are inherent to the source of noise, whereas the sound pressure level is dependent on the source, but also on the distance from the source and other environmental factors.

Appendix I

Alberta Beach Granular Pre-Disturbance Soil Characterization (June 2011)

Prepared by Navus Environmental Inc.

ALBERTA BEACH GRANULAR
PRE-DISTURBANCE SOIL CHARACTERIZATION
N½ 33-053-03 W5M AND SW¼ 34-053-03 W5M

Prepared For:

Spencer Environmental Management Services Ltd
Suite 801, Capital Place
9707-110 Street,
Edmonton, Alberta
T5K 2L9

Prepared By:

Navus Environmental Inc.
Suite 207, 8711 – 50th Street
Edmonton, Alberta
T6B 1E7

June 2011

Alberta Beach Granular Pre-Disturbance Soil Characterization

N½ 33-053-03 W5M And SW¼ 34-053-03 W5M

Prepared For:

Spencer Environmental Management Services Ltd
Suite 801, Capital Place
9707-110 Street,
Edmonton, Alberta
T5K 2L9

Prepared By:

Navus Environmental Inc.
Suite 207, 8711 – 50th Street
Edmonton, Alberta
T6B 1E7

This information redacted as per Protection of Privacy Act (POPA)

June 27, 2011

FOR O. Stephen Abioye, M.Sc., A.I.T. — Date

Project Coordinator

This information redacted as per Protection of Privacy Act (POPA)

June 27, 2011

Date

Project Manager, Report Review

TABLE OF CONTENTS

1.0 INTRODUCTION ---- **1**

1.1 Objectives ---- *1*

2.0 BACKGROUND INFORMATION ---- **1**

2.1 Geological Characteristics ---- *1*

2.2 Topography and Soils ---- *2*

2.3 Vegetation ---- *2*

3.0 ASSESSMENT PROTOCOL ---- **3**

3.1 Methods of Soil Assessment ---- *3*

4.0 RESULTS ---- **4**

4.1 Landscape ---- *4*

4.2 Soil Assessment ---- *4*

5.0 CONCLUSIONS ---- **5**

6.0 REFERENCES ---- **7**

7.0 LIMITATIONS ---- **8**

LIST OF FIGURES

Figure 1. Test Pit Locations

LIST OF TABLES

Table 1. Soil Characterization

LIST OF APPENDICES

Appendix A. Site Photographs

1.0 INTRODUCTION

Spencer Environmental Management Services Limited retained Navus Environmental Inc. (Navus) to complete a pre-disturbance soil survey at N½ 33-053-03 W5M and SW¼ 34-053-03 W5M; the site of a proposed granular extraction project. It is located approximately 6 km south of Alberta Beach and Val Quentin, Alberta within Lac Ste. Anne County. The soil survey work was completed between May 31, 2011 and June 1, 2011 by Stephen Abioye and Kevin Renkema. This document provides a description of the site, methods used and results of the soil assessment.

1.1 Objectives

The objectives of the assessment are presented as follows:

- Assess topsoil and subsoil (B-horizon) depth, texture, color, consistency and structure in both forested and cultivated areas
- Prepare a report

2.0 BACKGROUND INFORMATION

The *Natural Regions and Subregions of Alberta* map indicates the site is located in the Dry Mixedwood Subregion of the Boreal Forest Natural Region. July is generally the warmest month with a mean temperature of 15.9 °C and January is generally the coldest month with a mean temperature of -16.8 °C. Maximum precipitation occurs in July with a total mean annual precipitation of 461 mm. Land use in the region is predominantly forestry and oil and gas, coal mining, recreation, grazing and agriculture (Natural Regions Committee, 2006).

2.1 Geological Characteristics

The Dry Mixedwood Natural Subregion comprises two distinct geological areas, mainly the undulating plains and hummocky uplands in central Alberta, and the level to gently rolling plains of the northern Peace River and Vermilion Lowlands. The bedrock formations in these two distinct areas include upper cretaceous sandstone, shale and siltstone formations. Surficial materials are moderately fine textured, moderately calcareous glacial till in central Alberta. Glaciofluvial sands and organic deposits (10%) with minor inclusions of glaciolacustrine materials also persist. Comparatively, the Peace River and Vermilion

Lowlands are predominatly comprised of textured glaciolacustrine and "lacustro-till" materials with glaciofluvial and eolian sands (15%). Organic deposits (10%) and small portions of glacial till are also present (Natural Regions Committee, 2006).

Wyatt et al. (1930) classified surficial deposits in Lac Ste. Anne County as residual deposits (formed by erosion processes of the underlying strata), unsorted glacial moraine (common in the northeast corner of the county), resorted glacial drift (deposited along old glacial drainage courses) and transported deposits (by running water and wind). Beneath the surficial materials lies the Lower Scollard Formation, which has a maximum thickness of 35 m. Underlying the Lower Scollard Formation is the Upper, Middle and Lower Horseshoe Canyon Formation, which has a maximum thickness of 350 m. The Bearpaw Formation underlies the Horseshoe Canyon Formation, and the Oldman Formation is found beneath the Bearpaw Formation (The Groundwater Centre, 2008).

2.2 Topography and Soils

In general, the topography of Lac Ste. Anne County is uneven and ranges from level, to undulating and rolling. Considerable portions of the area are occupied by lakes. Wyatt et al. (1930) reported an east-west trend in the drainage system, suggesting that the Chip Lake, Isle Lake and Lake St. Anne could have at one time, occurred as a long, narrow, continuous body of water. Although, wetlands are very numerous in the area, the natural drainage was considered good (Wyatt et al., 1930).

Four soil series are found on the assessed site (*Alberta Soil Information Viewer*, Government of Alberta, 2007), these soils are dominantly Dark Gray Luvisol (Uncas and Keephills soil series), Orthic Gray Luvisols (Hoadley soil series), and Organic soils (Golden spike soil series). The soils materials were believed to have developed mainly from Glaciofluvial, fluvial and lacustrine parent materials.

2.3 Vegetation

Lac Ste. Anne County is predominately cultivated with land used for annual crops, forages or tame pasture. Pockets of aspen forests with understory's consisting of low bush cranberry,

prickly rose, Canada buffaloberry are common throughout the county as well as fens vegetated with black spruce and tamarack. Aspen forests typically are found on fine textured Gray and Dark Gray Luvisols while black spruce and tamarack are found on organic soils (Willoughby et al., 2004).

3.0 ASSESSMENT PROTOCOL

Navus completed the field assessment between May 31st, 2011 and June 1st, 2011. Weather conditions were good with no frost and no snow on the ground. The site was used for tame pasture, annual crops (seeded just prior to the assessment) or was forested. Travel via an all terrain vehicle (ATV) left no ruts in the fields.

3.1 Methods of Soil Assessment

The site consisted of three quarter sections (64 ha each). Sampling was done along east-west transects in each quarter section. Topsoil assessment points were placed at 100 m intervals along each transect, and transects were spaced 100 m apart. Sixty four points per quarter section were assessed; a survey intensity level of 1 per ha (Figure 1). Subsoil assessment points were taken at approximately 200 m intervals or at every other topsoil assessment point; a survey intensity level of 1 per 2 ha. A Garmin GPSMAP® 60Cx was used to orientate transects and to determine assessment point location.

A shovel was used to dig pits for topsoil assessment points. Topsoil pits were dug to a minimum of 15 cm below the depth of the topsoil. A 2" hand-auger was used to assess the subsoil (B-horizon). Soil brought up by the hand-auger was used to assess the subsoil characteristics. Subsoil was characterized to the depth of the B-horizon or to a maximum depth of 1.2 m (maximum depth of the hand-auger). Subsoil was assessed for upland landscapes containing mineral topsoil. Detailed subsoil characteristics were assessed underneath organic soils only when the organic soil depth was shallow. The majority of organic soil depths were augered to a depth < 120 cm; however, few assessment points were hand augered past 120 cm to determine the maximum depth of organic soil in the area.

The Canadian System of Soil Classification (Soil Classification Working Group, 1998) was employed to characterize and document the topsoil and subsoil (B horizon) depth, texture, consistency, structure, moisture and color at each sample point. The Munsell ® Soil Color Charts were used to describe soil colour. Landscape characteristics including slope expression, percent slope, surface stoniness and land use were recorded at all sample locations. The soil profile and landscape was photographed at select assessment points. Photographs have been included in Appendix A.

4.0 RESULTS

4.1 Landscape

The site was dominantly used for pasture and annual crops with forested areas typically along the perimeter of each quarter section. The site was predominately level (0.5 to 2% slope) but undulating areas that had very gentle slopes (2 to 5%) were common. Surface stoniness ranged from nonstony in areas with organic soil to very stony in the cultivated and pasture areas. No evidence of erosion (rills or gullies) was noted at any of the assessment points. Ponding was observed in low areas with organic soils.

4.2 Soil Assessment

One hundred and fifteen sample locations contained mineral topsoil. Topsoil (mineral soil) was dominantly loam textured, friable, granular, moist with depths ranging from 10 to 50 cm with a mean of 22.5 cm (Table 1). The dominant color for mineral topsoil was very dark brown (10YR 2/2). Topsoil depths were generally deeper in low lying areas, near fence lines and edges of the forested areas. Shallower topsoil depths were observed on hill tops and on the sides of hills. One quarter section was not significantly different from another. The average volume of topsoil is 258,750 m^3.

Seventy five sample locations had organic soil. Organic soils were found in relatively level areas that were forested (black spruce, tamarack) or used for pasture. The depth of organic soil varied from 30 cm to 200 cm. Twenty one sample points had depths recorded to only 120 cm, at these locations that actual depth would vary between 120 cm and 200 cm. The average organic soil depth is 102 cm using 120 cm as the total depth for assessment points with depth

ranges recorded as 0-120+. The average volume of organic soil is approximately 765,000 m^3.

Subsoil (B-horizon) was dominantly clay loam textured, subangular blocky, friable, moist with depths ranging from 10 to 110 cm with a mean of 60.9 cm (Table 1). The dominant color for the subsoil ranged between light brownish gray to dark grayish brown (10 YR 6/2 to 10YR 4/2). The average volume of subsoil on upland landscapes is approximately 700,360 m^3.

5.0 CONCLUSIONS

For effective soil salvage in this area, all topsoil must be salvaged for the purpose of post-disturbance reconstruction and reclamation. Stripping of topsoil and stockpiling will likely be required. An average of 22.5 cm of topsoil will need to be stripped from areas where surface soil exists. In the isolated areas where organic soil is present, greater stripping depths will be required (50 cm+). Topsoil depths on the hilltops and side slopes are shallower versus the lower areas; therefore, stripping soil on hilltops and side slopes requires more attention. Care should be taken not to mix the upper subsoil (clay loam) with the topsoil during stripping. Topsoil stripping should not occur when the soil is either extremely dry or very moist or saturated.

Subsoil (B-horizon) will need to be stripped from areas where it is present. Areas with deep organic soils (120+ cm) may not have a B-horizon that is suitable for reclamation. Subsoil will need to be salvaged at an average depth of 60.9 cm. B-horizon can be distinguished by from the C-horizon by the presence of carbonates in the C-horizon and a slight colour change (C-horizon is lighter brown and/or gray than the B-horizon).

Topsoil, organic soil and subsoil should be stockpiled in regions where water saturation will likely not occur. Saturated conditions could degrade soil quality through increased anaerobic soil conditions and through loss of soil structure. The three different reclamation materials (topsoil, organic soil and subsoil) should be segregated for future use. Locations of stockpiles should be documented for future purposes. Additionally, to prevent loss of soil quantity and

quality, stockpiles should be revegetated. Species selected should be based on the climatic conditions of the region and soil physical properties noted. The species should be competitive enough to prevent encroachment of potential weeds. If certain species of an area want to be conserved for future revegetation (i.e. upland forest topsoil) then topsoil from those areas should be handled separately with additional care.

6.0 REFERENCES

Alberta Municipal Affairs, 2009. Government of Alberta. 2009 Official Population List, Alberta. 2 pp.

Government of Alberta. January, 2007. *Alberta Soils Information Viewer*. <http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag10372>. Accessed on 29 November 2010.

Hydrogeological Consultants 1999. Lac Ste. Anne County. Parts of the North Saskatchewan and Athabasca Basins. Parts of Tp 053, R 01 to 09, W5M. Regional Groundwater Assessment. Prepared for Lac Ste. Anne County

Macyk, T.M., L.K. Brocke, J. Fujikawa, J.C. Hermans and D. McCoy. 1987. Soil Quality Criteria Relative to Disturbance and Reclamation. Conservation and Development Branch, Alberta Agriculture. Edmonton, Alberta. 56 pp.

Natural Regions Committee 2006. Natural Regions and Subregions of Alberta. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Pub. No. T/852.

Soil Classification Working Group. 1998. The Canadian System of Soil Classification. NRC Research Press. Ottawa, Ontario. 187 pp.

The Groundwater Centre. Accessed June 2011. http://www.tgwc.com/ (c) MOW-TECH LTD.

Willoughby, M.G., C. Stone, C. Hincz, D. Moisey, G. Ehlert, and D. Lawrence. 2004. Guide To Range Plant Community Types and Carrying Capacity for the Dry and Central Mixedwood Subregions in Alberta: Fourth Approximation. Alberta Sustainable Resource Development, Public Lands and Forests Division.

Wyatt, F.A., J.D. Newton and T.H. Mather, 1930. Soil Survey of St. Anne Sheet. University of Alberta Bulletin No. 20. April, 1930.

7.0 LIMITATIONS

This report has been prepared for the sole benefit of Spencer Environmental Management Services Ltd. This document may not be used by any other person or entity, with the exception of Alberta Environment and Alberta Sustainable Resource Development, without the express written consent of Navus Environmental Inc. (Navus) and Spencer Environmental Management Services Ltd. Any use of this report by a third party, or any reliance on decisions made based on it, or damages suffered as a result of the use of this report are the sole responsibility of the user.

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted scientific practices current at the time the work was performed. The conclusions and recommendations presented represent the best judgement of Navus based on the data obtained during the assessment. Due to the nature of the assessment and the data available, Navus cannot warrant against undiscovered environmental liabilities. Conclusions and recommendations presented in this report should not be considered legal advice.

N

Legend

- Test Pit Location

0 0.1 0.2 0.5km

Scale 1 : 15 000

N1/2 Sec. 33 and SW Sec 34 Twp 05 Rg 03 W5M

navus ENVIRONMENTAL **Test Pit Locations**

DRAWN:	APPROVED:	DATE:	FIGURE:
AD	SA	JUN 7/11	1
FILE: 33and34-053-03 W5M.dwg			

NOTE:
Testhole locations surveyed by Navus (GPS).

Table 1. Pre-Disturbance Soil Characterization
Spencer Environmental Management Services Ltd.
Assessment Date: May 31 - June 1, 2011

Assessment Point	Quarter Section	UTM NAD83			Topsoil Characteristics						Subsoil Characteristics						Landscape Characteristics				Comments
		Easting	Northing	Zone	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Surface Stoniness	Slope Expression	Slope (%)	Land Use	Additional Soil Information
001	NW33-053-03 W5M	672310	5945316	11	0-15	Loam	Friable	Granular	Moist	10YR 2/2	15-100	Clay Loam	Firm	SBK*	Moist	10YR 4/4	S1 - S2	Slightly Undulating	0-0.5	Pasture	
002	NW33-053-03 W5M	672411	5945319	11	0-20	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S1 - S2	Slightly Undulating	0-0.5	Pasture	
003	NW33-053-03 W5M	672511	5954320	11	0-20	Loam	Friable	Granular	Moist	10YR 2/2	20-70	Clay Loam	Friable	SBK	Moist	10YR 4/2	S2 - S3	Slightly Undulating	0-0.5	Pasture	
004	NW33-053-03 W5M	672611	5945316	11	0-120+	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S2 - S3	Level	0-0.5	Pasture	10 cm Ap on the surface
005	NW33-053-03 W5M	672711	5945318	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	Moist	10YR 6/4	S1 - S2	Level	0-0.5	Pasture	
006	NW33-053-03 W5M	672811	5945319	11	0-120+	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0 -S1	Level	0-0.5	Pasture	
007	NW33-053-03 W5M	672910	5945321	11	0-120+	Organic Soil		-	Moist	10YR 2/2		-	-	-	Moist	10YR 6/4	S0 -S1	Level	0-0.5	Pasture	
008	NW33-053-03 W5M	673012	5945318	11	0-120+	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0 -S1	Level	0-0.5	Pasture	
009	NW33-053-03 W5M	672313	5945220	11	0-25	Loam	Friable	Granular	Moist	10YR 2/2	-	-	Friable	SBK	Moist	-	S0 -S1	Slightly Undulating	0.5-2	Annual Crop	
010	NW33-053-03 W5M	672413	5945220	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 2/2	25-60	Clay Loam	Friable	SBK	Moist	10YR 6/2	S2 - S3	Slightly Undulating	0.5-2	Annual Crop	
011	NW33-053-03 W5M	672513	5945220	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S2 - S3	Undulating	0.5-2	Annual Crop	
012	NW33-053-03 W5M	672613	5945220	11	0-35	Silty Loam	Friable	Granular	Moist	10YR 3/3	35-65	Clay Loam	Friable	SBK	Moist	10YR 6/1	S0	Undulating	0.5-2	Annual Crop	Lower slope, mottled subsoil
013	NW33-053-03 W5M	672713	5945221	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S2 - S3	Undulating	0.5-2	Annual Crop	
014	NW33-053-03 W5M	672813	5945221	11	0-40	Organic Soil		-	Moist	10YR 3/3	40-105	Clay Loam	Firm	SBK	Moist	10YR 7/1	S2 - S3	Undulating	0.5-2	Pasture	
015	NW33-053-03 W5M	672913	5945221	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
016	NW33-053-03 W5M	676012	5945220	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
017	NW33-053-03 W5M	673032	5945122	11	0-110	Organic Soil		-	Moist	10YR 4/3	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
018	NW33-053-03 W5M	672927	5945119	11	0-40	Organic Soil		-	Moist	10YR 3/1	40-100	Clay Loam	Friable	SBK	Moist	10YR 5/4	S0-S1	Slightly Undulating	0-0.5	Pasture	
019	NW33-053-03 W5M	672825	5945119	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S1	Undulating	0-0.5	Pasture	
020	NW33-053-03 W5M	672732	5945124	11	0-23	Loam	Friable	Granular	Moist	10YR 6/2	23-90	Clay Loam	Friable	SBK	Moist	10YR 3/2	S3	Undulating	0.5-2	Annual Crop	Coarse fragments and mottles
021	NW33-053-03 W5M	672624	5945121	11	0-17	Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S3	Undulating	0.5-2	Annual Crop	
022	NW33-053-03 W5M	672534	5945123	11	0-20	Loam	Friable	Granular	Moist	10YR 3/2	20-100	Clay Loam	Firm	SBK	Moist	10YR 3/3	S3-S4	Undulating	0.5-2	Annual Crop	
023	NW33-053-03 W5M	672431	5945123	11	0-120+	Organic Soil		-	Moist	10YR 3/2	-	-	-	-	-	-	S0	Level	0-0.5	Annual Crop	
024	NW33-053-03 W5M	672332	5945116	11	0-20	Loam	Friable	Granular	Moist	10YR 3/2	20-110	Clay Loam	Firm	SBK	Moist	10YR 4/2	S3	Undulating	0.5-2	Farmyard	
025	NW33-053-03 W5M	673014	5945020	11	0-20	Loam	Friable	Granular	Moist	10YR 6/2	20-40	Clay	Firm	SBK	Moist	10YR 4/1	S3-S4	Undulating	0.5-2	Farmyard	Mottled Subsoil
026	NW33-053-03 W5M	672914	5945020	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 4/3	-	-	-	-	-	-	S3-S4	Undulating	0.5-2	Annual Crop	
027	NW33-053-03 W5M	672814	59450202	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 3/3	15-50	Clay	Friable	SBK	Moist	10YR 6/1	S3-S4	Undulating	0.5-2	Annual Crop	Lower slope; mottled subsoil
028	NW33-053-03 W5M	672613	5945020	11	0-20	Clay Loam	Friable	Granular	Moist	10YR 4/3	-	-	-	-	-	-	S3	Undulating	0.5-2	Annual Crop	
029	NW33-053-03 W5M	672613	5945023	11	0-25	Loam	Friable	Granular	Moist	10YR 3/3	25-80	Clay	Firm	SBK	Moist	10YR 5/4	S3	Undulating	0.5-2	Annual Crop	
030	NW33-053-03 W5M	672531	5945020	11	0-20	Loam	Friable	Granular	Moist	-	-	-	-	-	-	-	S3-S4	Undulating	0-0.5	Annual Crop	
031	NW33-053-03 W5M	672428	5945023	11	0-17	Loam	Friable	Granular	Moist	-	17-110	Clay	Firm	SBK	Moist	-	S3-S4	Undulating	0-0.5	Annual Crop	
032	NW33-053-03 W5M	672330	5945021	11	0-12	Clay Loam	Friable	Granular	Moist	-	-	-	-	-	-	-	S3-S4	Undulating	0-0.5	Annual Crop	20% Coarse fragments in subsoil
033	NW33-053-03 W5M	672383	5944918	11	0-30	Silty Loam	Friable	Granular	Moist	10YR 2/1	30-90	Silty Loam	Friable	SBK	Moist	10YR 7/1	S3	Undulating	0.5-2	Pasture	
034	NW33-053-03 W5M	672483	5944918	11	-	Slough	-	-	Wet	-	-	-	-	-	-	-	-	-	-	-	
035	NW33-053-03 W5M	672584	5944919	11	0-22	Loam	Friable	Granular	Moist	10YR 3/2	22-100	Clay Loam	Friable	SBK	Moist	10YR 4/2	S3	Undulating	0.5-2	Annual Crop	
036	NW33-053-03 W5M	672679	5944922	11	0-23	Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S3	Undulating	0.5-2	Annual Crop	
037	NW33-053-03 W5M	672782	5944919	11	0-21	Silty Loam	Friable	Granular	Moist	10YR 3/2	21-90	SCL	Firm	SBK	Moist	10YR 5/4	S3	Undulating	0.5-2	Annual Crop	Mottled Subsoil
038	NW33-053-03 W5M	672882	5944923	11	0-30	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2-S3	Undulating	0.5-2	Annual Crop	
039	NW33-053-03 W5M	672987	5944922	11	0-40	Loam	Friable	Granular	Moist	10YR 2/1	40-120	SCL	Friable	SBK	Moist	10YR 5/4	S3	Undulating	0.5-2	Annual Crop	Mottled Subsoil
040	NW33-053-03 W5M	673053	5944917	11	0-20	Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Annual Crop	
041	NW33-053-03 W5M	672347	5944820	11	0-45	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
042	NW33-053-03 W5M	672447	5944820	11	0-130+	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
043	NW33-053-03 W5M	672548	5944820	11	0-70	Organic Soil		-	V.Wet	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
044	NW33-053-03 W5M	672647	5944821	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 6/2	20-55	Silty Loam	Friable	SBK	Moist	10YR 7/1	S0	Slightly Undulating	0.5-2	Pasture	
045	NW33-053-03 W5M	672847	5944820	11	0-15	Silty Loam	Friable	Granular	Dry	10YR 6/4	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
046	NW33-053-03 W5M	672847	5944820	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 6/2	15-50	Sandy Clay	Friable	SBK	Moist	10YR 6/4	S0	Slightly Undulating	0.5-2	Pasture	
047	NW33-053-03 W5M	672947	5944820	11	0-20	Silty Loam	Firm	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
048	NW33-053-03 W5M	673047	5944820	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 6/2	15-40	Silty Loam	Friable	SBK	Moist	10YR 6/4	S0	Slightly Undulating	0.5-2	Pasture	
049	NW33-053-03 W5M	673060	5944716	11	0-30	Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	
050	NW33-053-03 W5M	672965	5944716	11	0-15	Loam	Friable	Granular	Moist	10YR 3/1	15-50	Silty Loam	Friable	SBK	Moist	10YR 4/2	S2	Undulating	0.5-2	Pasture	
051	NW33-053-03 W5M	672855	5944719	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
052	NW33-053-03 W5M	672764	5944720	11	0-20	Loam	Friable	Granular	Moist	10YR 2/2	20-100	Clay Loam	Friable	SBK	Moist	10YR 4/2	S2	Undulating	0.5-2	Pasture	
053	NW33-053-03 W5M	672660	5944718	11	0-15	Loam	Friable	Granular	Dry	10YR 3/3	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	
054	NW33-053-03 W5M	672560	5944727	11	0-20	Sandy Loam	Friable	Granular	Moist	10YR 2/2	20-110	Clay Loam	Friable	SBK	Moist	10YR 6/2	S2	Undulating	0.5-2	Pasture	
055	NW33-053-03 W5M	672562	5944721	11	0-30	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S2	Slightly Undulating	0.5-2	Pasture	
056	NW33-053-03 W5M	672364	5944724	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
057	NW33-053-03 W5M	673047	5944620	11	0-25	Silty Loam	Friable	Platy	Moist	10YR 6/2	25-45	Clay	Friable	Platy	Moist	10YR 6/2	S0	Undulating	0.5-2	Pasture	
058	NW33-053-03 W5M	672947	5944621	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
059	NW33-053-03 W5M	672847	5944621	11	0-30	Silty Loam	Friable	Granular	Moist	10YR 6/2	30-80	Clay	Firm	SBK	Moist	10YR 6/2	S0	Undulating	0.5-2	Pasture	
060	NW33-053-03 W5M	672748	5944620	11	0-100	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
061	NW33-053-03 W5M	672647	5944620	11	0-30	Silty Loam	Friable	Granular	Moist	10YR 2/2	30-70	Clay Loam	Friable	SBK	Moist	10YR 6/2	S0	Slightly Undulating	0.5-2	Pasture	
062	NW33-053-03 W5M	672547	5944619	11	0-20	Sandy Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
063	NW33-053-03 W5M	672449	5944620	11	0-15	Loam	Friable	Granular	Moist	10YR 3/3	15-70	Clay Loam	Friable	SBK	Moist	10YR 5/4	S0	Slightly Undulating	0.5-2	Pasture	
064	NW33-053-03 W5M	672347	5944620	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	

**SBK=Subangular blocky*

Table 1 (Continued). Pre-Disturbance Soil Characterization
Spencer Environmental Management Services Ltd.
Assessment Date: May 31 - June 1, 2011

Assessment Point	Quarter Section	UTM NAD83			Topsoil Characteristics						Subsoil Characteristics						Landscape Characteristics				Comments
		Easting	Northing	Zone	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Surface Stoniness	Slope Expression	Slope (%)	Land Use	Additional Soil Information
065	NE33-053-03 W5M	673087	5945355	11	0-130	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	Moist	-	S0	Level	0-0.5	Pasture	
066	NE33-053-03 W5M	673187	5945348	11	0-80	Organic Soil		-	Wet	10YR 3/3	-	Sandy Loam	Friable	SBK*	Moist	10YR 6/2	S0	Level	0-0.5	Pasture	
067	NE33-053-03 W5M	673287	5945358	11	0-15	Silty Loam	Friable	Granular	Wet	10YR 3/3	15-65	Silty Clay	Friable	SBK	Moist	10YR 6/2	S0	Level	0-0.5	Pasture	
068	NE33-053-03 W5M	673387	5945318	11	0-15	Loam	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
069	NE33-053-03 W5M	673487	5945352	11	0-100	Organic Soil		-	Wet	10YR 3/3	-	Clay Loam	Friable	SBK	Moist	10YR 6/2	S0	Level	0-0.5	Pasture	
070	NE33-053-03 W5M	673587	5945359	11	0-120	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
071	NE33-053-03 W5M	673687	5945379	11	0-110	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
072	NE33-053-03 W5M	673787	5945380	11	0-80	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
073	NE33-053-03 W5M	673091	5945254	11	0-30	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
074	NE33-053-03 W5M	673192	5945251	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
075	NE33-053-03 W5M	673293	5945251	11	0-30	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
076	NE33-053-03 W5M	673390	5945253	11	0-110	Organic Soil		-	Moist	10YR 2/2	-	Silty Clay	Friable	SBK	Moist	10YR 7/1	S0	Level	0-0.5	Pasture	
077	NE33-053-03 W5M	673490	5945249	11	0-35	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
078	NE33-053-03 W5M	673592	5945250	11	0-80	Organic Soil		-	Moist	10YR 2/2	-	SiCL	Friable	SBK	Moist	10YR 6/4	S0	Slightly Undulating	0-0.5	Pasture	
079	NE33-053-03 W5M	673690	5945248	11	0-30	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
080	NE33-053-03 W5M	673803	5945256	11	0-35	Loam	Friable	Granular	Moist	10YR 2/2	35-100	Clay Loam	Firm	SBK	Moist	10YR 5/2	S3	Undulating	0.5-2	Pasture	
081	NE33-053-03 W5M	673878	5945150	11	0-30	Loam	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
082	NE33-053-03 W5M	673778	5945149	11	0-30	Loam	Friable	Granular	Moist	10YR 3/3	30-75	Silty Loam	Friable	SBK	Moist	10YR 5/1	S0	Slightly Undulating	0-0.5	Pasture	
083	NE33-053-03 W5M	673678	5945154	11	0-110	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
084	NE33-053-03 W5M	673578	5945153	11	0-10	Loam	Friable	Granular	Moist	10YR 7/1	10-30	Sandy Loam	Friable	SBK	Moist	10YR 6/4	S0	Slightly Undulating	0-0.5	Pasture	
085	NE33-053-03 W5M	673478	5945164	11	0-130	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
086	NE33-053-03 W5M	673378	5945151	11	0-100	Organic Soil		-	Moist	10YR 2/2	-	Loam	Friable	SBK	Wet	10YR 3/2	S0	Slightly Undulating	0-0.5	Pasture	
087	NE33-053-03 W5M	673278	5945156	11	0-100	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
088	NE33-053-03 W5M	673178	5945158	11	0-100	Organic Soil		-	Moist	10YR 2/2	-	Silty Loam	Firm	SBK	Wet	10YR 7/1	S0	Slightly Undulating	0-0.5	Pasture	
089	NE33-053-03 W5M	673885	5945056	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
090	NE33-053-03 W5M	673785	5945060	11	0-30	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	20% Coarse fragments in Ae
091	NE33-053-03 W5M	673680	5945057	11	0-90	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
092	NE33-053-03 W5M	673583	5945060	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	20% Coarse fragments in Ae
093	NE33-053-03 W5M	673482	5945061	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 2/2	25-110	Clay Loam	Firm	SBK	Moist	10YR 4/1	S3	Undulating	0.5-2	Annual Crop	
094	NE33-053-03 W5M	673385	5945056	11	0-50	Silty Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Annual Crop	
095	NE33-053-03 W5M	673281	5945057	11	0-25	Silty Loam	Friable	Platy	Moist	10YR 2/2	25-110	Clay Loam	Firm	SBK	Moist	10YR 3/3	S2	Undulating	0.5-2	Annual Crop	
096	NE33-053-03 W5M	673180	5945053	11	0-35	Silty Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S1	Undulating	0.5-2	Annual Crop	
097	NE33-053-03 W5M	673137	5944952	11	0-50	Organic Soil		-	Moist	10YR 2/2	50-100	Silty Loam	Friable	SBK	Moist	10YR 6/2	S0	Undulating	0.5-2	Pasture	Water table close to surface
098	NE33-053-03 W5M	673237	5944942	11	0-10	Loamy Sand			Moist	10YR 7/1	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
099	NE33-053-03 W5M	673337	5944924	11	0-35	Silty Loam	Friable	Granular	Moist	10YR 7/1	35-100	Silty Clay	Friable	SBK	Moist	10YR 7/2	S0	Slightly Undulating	0.5-2	Pasture	
100	NE33-053-03 W5M	673437	5944904	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
101	NE33-053-03 W5M	673537	5944951	11	0-20	Silty Clay	Friable	Granular	Moist	10YR 6/2	20-60	Silty Clay	Friable	SBK	Moist	10YR 7/1	S0	Slightly Undulating	0.5-2	Annual Crop	
102	NE33-053-03 W5M	673637	5944955	11	0-15	Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Annual Crop	
103	NE33-053-03 W5M	673737	5944955	11	0-15	Loam	Friable	Granular	Moist	10YR 6/2	15-50	Silty Loam	Friable	SBK	Moist	10YR 7/1	S0	Slightly Undulating	0.5-2	Pasture	20% Coarse fragments in subsoil
104	NE33-053-03 W5M	673837	5944955	11	0-20	Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
105	NE33-053-03 W5M	673123	5944855	11	0-20	Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	
106	NE33-053-03 W5M	673226	5944856	11	0-35	Organic Soil		-	Moist	10YR 2/2	35-120	SCL	Firm	SBK	Moist	10YR 5/2	S2	Undulating	0.5-2	Pasture	
107	NE33-053-03 W5M	673325	5944853	11	0-25	SiL-Loam	Friable	Granular	Moist	10YR 4/2	-	-	-	-	-	-	S1-S2	Undulating	0.5-2	Pasture	
108	NE33-053-03 W5M	673429	5944855	11	0-25	Sandy Loam	Friable	Granular	Moist	10YR 6/2	25-120	Clay Loam	Firm	SBK	Moist	10YR 4/2	S1-S2	Undulating	0.5-2	Pasture	
109	NE33-053-03 W5M	673528	5944855	11	0-30	Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S1-S2	Undulating	0.5-2	Pasture	
110	NE33-053-03 W5M	673627	5944855	11	0-30	Loam	Friable	Granular	Moist	10YR 3/3	30-120	Clay Loam	Firm		Moist	10YR 3/3	S1-S2	Slightly Undulating	0.5-2	Pasture	
111	NE33-053-03 W5M	673732	5944852	11	0-35	Loam	Friable	SBK	Moist	10YR 6/8	-	-	-	-	-	-	S1-S2	Slightly Undulating	0.5-2	Pasture	
112	NE33-053-03 W5M	673833	5944852	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 3/2	25-100	Clay Loam	Firm	SBK	Moist	10YR 4/2	S1-S2	Slightly Undulating	0.5-2	Pasture	
113	NE33-053-03 W5M	673887	5944770	11	0-13	Silty Loam	Friable	Granular	Moist	10YR 3/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
114	NE33-053-03 W5M	673787	5944770	11	0-25	Loam	Friable	Granular	Moist	10YR 3/2	25-100	Silty Clay	Firm	SBK	Moist	10YR 5/2	S0	Slightly Undulating	0-0.5	Pasture	
115	NE33-053-03 W5M	673687	5944770	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
116	NE33-053-03 W5M	673587	5944772	11	0-130	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Pasture	
117	NE33-053-03 W5M	673487	5944768	11	0-50	Loam	Friable	Granular	Moist	10YR 3/2	50-100	Silty Clay	Firm	SBK	Moist	10YR 6/2	S0	Slightly Undulating	0.5-2	Pasture	
118	NE33-053-03 W5M	673388	5944771	11	0-20	Loam	Friable	Granular	Moist	10YR 3/2	20-100	Silty Clay	Firm	SBK	Moist	10YR 6/2	S0	Slightly Undulating	0.5-2	Pasture	20% Coarse fragments in subsoil
119	NE33-053-03 W5M	673287	5944772	11	0-15	Loam	Friable	Granular	Moist	10YR 3/1	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	Upper slope position
120	NE33-053-03 W5M	673187	5944746	11	0-25	Loam	Friable	Granular	Moist	10YR 2/2	25-100	Clay Loam	Firm	SBK	Moist	10YR 3/2	S1-S2	Undulating	0.5-2	Pasture	Upper slope position
121	NE33-053-03 W5M	673884	5944659	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
122	NE33-053-03 W5M	673782	5944660	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
123	NE33-053-03 W5M	673683	5944655	11	0-120	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
124	NE33-053-03 W5M	673579	5944650	11	0-80	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
125	NE33-053-03 W5M	673487	5944652	11	0-16	Loam	Friable	Granular	Moist	10YR 2/2	16-100	Clay Loam	Firm	SBK	Moist	10YR 4/2	S3	Undulating	0.5-2	Annual Crop	
126	NE33-053-03 W5M	673381	5944651	11	0-30	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Annual Crop	Lower slope position
127	NE33-053-03 W5M	673281	5944648	11	0-25	Loam	Friable	Granular	Moist	10YR 2/2	25-80	Clay Loam	Friable	SBK	Moist	10YR 4/1	S0	Undulating	0.5-2	Annual Crop	Lower slope position
128	NE33-053-03 W5M	673187	5944636	11	0-35	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Undulating	0.5-2	Annual Crop	Lower slope position

**SBK=Subangular blocky*

Table 1 (Continued). Pre-Disturbance Soil Characterization
Spencer Environmental Management Services Ltd.
Assessment Date: May 31 - June 1, 2011

Assessment Point	Quarter Section	UTM NAD83			Topsoil Characteristics						Subsoil Characteristics						Landscape Characteristics				Comments
		Easting	Northing	Zone	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Depth (cm)	Texture	Consistency	Structure	Moisture	Color	Surface Stoniness	Slope Expression	Slope (%)	Land Use	Additional Soil Information
129	SW34-053-03 W5M	674946	5944565	11	-	Slough	-	-	Wet	-	-	-	-	-	-	-	-	-	-	-	
130	SW34-053-03 W5M	674046	5944570	11	0-130	Organic Soil		-	Wet	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
131	SW34-053-03 W5M	674145	5944563	11	0-120	Organic Soil		-	Moist	10YR 5/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
132	SW34-053-03 W5M	674245	5944555	11	0-30	Loam	Friable	SBK	Moist	10YR 5/1	-	-	-	-	-	-	S1	Undulating	0.5-2	Pasture	
133	SW34-053-03 W5M	674358	5944562	11	0-100	Organic Soil		-	Wet	10YR 5/3		-	-	-	-	-	S0	Undulating	0-0.5	Pasture	
134	SW34-053-03 W5M	674445	5944558	11	0-30	Loam	Friable	Granular	Moist	10YR 5/3	-	-	-	-	-	-	S1	Undulating	0-0.5	Pasture	
135	SW34-053-03 W5M	674546	5944562	11	0-30	Sandy Loam	Friable	Granular	Moist	10YR 5/3	30-80	Silty Loam	Firm	SBK*	Moist	10YR 4/2	S3-S4	Undulating	0.5-2	Pasture	
136	SW34-053-03 W5M	674660	5944566	11	0-30	Loam	Friable	Granular	Moist	10YR 2/2	30-80	Silty Loam	Friable	SBK	Moist	10YR 3/3	S3-S4	Undulating	0.5-2	Pasture	
137	SW34-053-03 W5M	673956	5944465	11	0-120+	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
138	SW34-053-03 W5M	674056	5944482	11	0-130+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
139	SW34-053-03 W5M	674156	5944470	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
140	SW34-053-03 W5M	674258	5944464	11	0-15	Loam	Friable	Granular	Moist	10YR 3/3	15-50	Sandy Loam	Firm	SBK	Moist	10YR 6/2	S2	Slightly Undulating	0.5-2	Forest	
141	SW34-053-03 W5M	674356	5944464	11	0-20	Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S2-S3	Slightly Undulating	0.5-2	Pasture	
142	SW34-053-03 W5M	674456	5944464	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S2-S3	Slightly Undulating	0.5-2	Pasture	
143	SW34-053-03 W5M	674557	5944469	11	0-20	Silty Clay	Firm	Granular	Moist	10YR 6/2	20-80	Silty Clay Loam	Firm	SBK	Moist	10YR 5/6	S0	Slightly Undulating	0.5-2	Pasture	
144	SW34-053-03 W5M	674656	5944466	11	0-20	Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
145	SW34-053-03 W5M	674688	5944364	11	0-20	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	
146	SW34-053-03 W5M	674583	5944360	11	0-15	Loam	Friable	Granular	Moist	10YR 2/2	15-70	Loamy Sand	Friable	SBK	Moist	10YR 6/2	S2	Undulating	2-5	Pasture	
147	SW34-053-03 W5M	674480	5944355	11	0-30	Silty Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S2	Undulating	2-5	Pasture	
148	SW34-053-03 W5M	674382	5944358	11	0-10	Loam	Friable	Granular	Moist	10YR 2/2	10-120	Sandy Clay Loam	Friable	SBK	Moist	10YR 5/3	S2	Undulating	0.5-2	Pasture	
149	SW34-053-03 W5M	674280	5944355	11	0-15	Loam	Friable	Granular	Moist	10YR 5/3	-	-	-	-	-	-	S2	Slightly Undulating	0.5-2	Pasture	
150	SW34-053-03 W5M	674183	5944354	11	0-23	Silty Loam	Friable	Granular	Moist	10YR 4/1	23-110	Loam	Friable	SBK	Moist	10YR 5/2	S1-S2	Slightly Undulating	0.5-2	Pasture	
151	SW34-053-03 W5M	674084	5944366	11	0-25	Loam	Friable	Granular	Moist	10YR 2/2	-	-	-	-	-	-	S0-S1	Slightly Undulating	0.5-2	Pasture	
152	SW34-053-03 W5M	673980	5944361	11	0-20	Clay Loam	Firm	SBK	Moist	10YR 3/2	20-80	Clay Loam	Firm	SBK	Moist	10YR 4/2	S1-S2	Undulating	0.5-2	Pasture	
153	SW34-053-03 W5M	674654	5944265	11	0-120+	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
154	SW34-053-03 W5M	674554	5944264	11	0-20	Silty Loam	Friable	Granular	Moist	10YR 6/2	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
155	SW34-053-03 W5M	674454	5944265	11	0-15	Loam	Friable	Granular	Moist	10YR 6/2	15-70	Clay Loam	Firm	SBK	Moist	10YR 7/1	S0	Slightly Undulating	0.5-2	Pasture	
156	SW34-053-03 W5M	674354	5944265	11	0-20	Loamy Sand	Friable	Granular	Moist	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
157	SW34-053-03 W5M	674254	5944265	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 7/1	15-70	Sandy Clay Loam	Friable	SBK	Moist	10YR 6/6	S0	Slightly Undulating	0.5-2	Pasture	Carbonates and gravels in subsoil
158	SW34-053-03 W5M	674154	5944367	11	0-40	Silty Clay	Firm	Granular	Moist	10YR 7/1	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
159	SW34-053-03 W5M	674056	5944267	11	0-15	Silty Loam	Friable	Granular	Moist	10YR 4/2	15-100	Clay Loam	Firm	SBK	Moist	10YR 7/1	S0	Undulating	0.5-2	Pasture	
160	SW34-053-03 W5M	673966	5944252	11	0-120+	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Pasture	
161	SW34-053-03 W5M	673972	5944155	11	0-15	Loam	Friable	Granular	Moist	10YR 5/3	15-80	Clay Loam	Friable	SBK	Moist	10YR 5/3	S0-S1	Level	0-0.5	Forest	Disturbed soil
162	SW34-053-03 W5M	674064	5944161	11	0-100	Organic Soil		-	Moist	10YR 5/2	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
163	SW34-053-03 W5M	674150	5944168	11	0-25	Clay Loam	Friable	SBK	Moist	10YR 2/1	25-100	Clay Loam	Friable	SBK	Moist	10YR 3/3	S0-S1	Level	0-0.5	Forest	
164	SW34-053-03 W5M	674257	5944153	11	0-30	Clay Loam	Friable	Granular	Moist	10YR 4/2	30-120	Sandy Clay Loam	Firm	SBK	Moist	10YR 4/4	S1-S2	Slightly Undulating	0.5-2	Forest	
165	SW34-053-03 W5M	674372	5944155	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 2/2	25-100	Clay Loam	Firm	SBK	Moist	10YR 4/2	S2	Undulating	0.5-2	Pasture	
166	SW34-053-03 W5M	674460	5944160	11	0-15	Sandy Loam	Friable	Granular	Moist	10YR 5/3	-	-	-	-	-	-	S1-S2	Undulating	0.5-2	Pasture	
167	SW34-053-03 W5M	674580	5944161	11	0-25	Clay Loam	Friable	Granular	Moist	10YR 5/3	25-90	Clay Loam	Firm	SBK	Moist	10YR 4/2	S1-S2	Undulating	0.5-2	Pasture	
168	SW34-053-03 W5M	674668	5944154	11	0-18	Loam	Friable	Granular	Moist	10YR 5/3	-	-	-	-	-	-	S2	Undulating	0.5-2	Pasture	
169	SW34-053-03 W5M	673979	5944052	11	0-100	Organic Soil		-	Wet	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
170	SW34-053-03 W5M	674081	5944053	11	0-130	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
171	SW34-053-03 W5M	674179	5944055	11	0-130	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
172	SW34-053-03 W5M	674279	5944053	11	0-30	Loam	Friable	Granular	Wet	10YR 3/3	30-95	Loamy Sand	Friable	SBK	Moist	10YR 5/4	S0	Level	0-0.5	Forest	
173	SW34-053-03 W5M	674377	5944052	11	0-85	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Pasture	
174	SW34-053-03 W5M	674479	5944052	11	0-20	Sandy Loam	Friable	Granular	Moist	10YR 5/3	20-95	Sandy Clay	Firm	SBK	Moist	10YR 5/2	S0	Slightly Undulating	0.5-2	Pasture	
175	SW34-053-03 W5M	674579	5944052	11	0-15	Loam	Friable	Granular	Moist	10YR 5/2	-	-	-	-	-	-	S0	Undulating	0.5-2	Pasture	
176	SW34-053-03 W5M	674679	5944052	11	0-25	Silty Loam	Friable	Granular	Moist	10YR 5/2	25-35	Clay	Firm	SBK	Moist	10YR 5/2	S0	Undulating	0.5-2	Pasture	Admixing caused by ploughing
177	SW34-053-03 W5M	674700	5943952	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Slightly Undulating	0.5-2	Forest	
178	SW34-053-03 W5M	674600	5943953	11	0-120+	Organic Soil		-	Moist	10YR 5/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
179	SW34-053-03 W5M	674501	5943952	11	0-120+	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
180	SW34-053-03 W5M	674400	5943955	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
181	SW34-053-03 W5M	674300	5943957	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
182	SW34-053-03 W5M	674200	5943953	11	0-120+	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
183	SW34-053-03 W5M	674100	5943954	11	0-100	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
184	SW34-053-03 W5M	674000	5943953	11	0-200	Organic Soil		-	Moist	10YR 3/3	-	-	-	-	-	-	S0	Level	0-0.5	Forest	
185	SW34-053-03 W5M	674745	5943850	11	0-100	Organic Soil		-	Moist	10YR 2/2	-	-	-	-	-	-	S1-S2	Slightly Undulating	0.5-2	Forest	
186	SW34-053-03 W5M	674654	5943850	11	0-22	Silty Loam	Friable	Granular	Wet	10YR 2/1	-	-	-	-	-	-	S0	Slightly Undulating	0-0.5	Forest	
187	SW34-053-03 W5M	674554	5943859	11	0-100	Organic Soil		-	Wet	10YR 2/2	-	Silty Loam	Friable	SBK	Wet	10YR 5/2	S0	Hummocky	0-0.5	Forest	
188	SW34-053-03 W5M	674457	5943856	11	0-80	Organic Soil		-	Wet	10YR 2/2	-	Silty Loam	Friable	SBK	Wet	10YR 5/2	S0	Hummocky	0-0.5	Forest	
189	SW34-053-03 W5M	674352	5943847	11	0-120+	Organic Soil		-	Wet	10YR 2/2	-	-	-	-	-	-	S0	Hummocky	0-0.5	Forest	
190	SW34-053-03 W5M	674256	5943854	11	0-120+	Organic Soil		-	Wet	10YR 2/2	-	-	-	-	-	-	S0	Hummocky	0-0.5	Forest	
191	SW34-053-03 W5M	674154	5943855	11	0-120+	Organic Soil		-	Wet	10YR 2/2	-	-	-	-	-	-	S0	Hummocky	0-0.5	Forest	
192	SW34-053-03 W5M	674044	5943849	11	0-120+	Organic Soil		-	Wet	10YR 2/2	-	-	-	-	-	-	S0	Hummocky	0-0.5	Forest	

*SBK=Subangular blocky

Photo 1. Viewing southeast from Pit 1 (NW-33-053-03 W5M).

Photo 2. Viewing southwest from Pit 8 (NW-33-053-03 W5M).

Photo 3. Viewing east from Pit 31 (NW-33-053-03 W5M).

Photo 4. Viewing north from Pit 31 (NW-33-053-03 W5M).

Photo 5. Viewing west from Pit 31 (NW-33-053-03 W5M).

Photo 6. Viewing south from Pit 31 (NW-33-053-03 W5M).

Photo 7. Viewing northwest from Pit 49 (NW-33-053-03 W5M).

Photo 8. Viewing northeast from Pit 64 (NW-33-053-03 W5M).

Photo 9. Viewing southwest from Pit 72 (NE-33-053-03 W5M).

Photo 10. Viewing east from Pit 93 (NE-33-053-03 W5M).

Photo 11. Viewing north from Pit 93 (NE-33-053-03 W5M).

Photo 12. Viewing west from Pit 93 (NE-33-053-03 W5M).

Photo 13. Viewing south from Pit 93 (NE-33-053-03 W5M).

Photo 14. Viewing northwest from Pit 121 (NE-33-053-03 W5M).

Photo 15. Viewing east from Pit 167 (SW-34-053-03 W5M).

Photo 16. Viewing north from Pit 167 (SW-34-053-03 W5M).

Photo 17. Viewing west from Pit 167 (SW-34-053-03 W5M).

Photo 18. Viewing south from Pit 167 (SW-34-053-03 W5M).

Photo 19. Viewing soil profile at Pit 93 (annual crop).

Photo 20. Viewing soil profile at pit 110 (pasture).

Photo 21. Viewing soil profile at Pit 167 (pasture).

Photo 22. Viewing soil profile at pit 186 (forested).

Appendix J

Public Open House Report (October 2011) Prepared by Marcomm Work Public Consultation &
Public Consultation Summary (February 2026) Prepared by Aspen Land Group Inc.

Gravel Pit Development near Alberta Beach
Developer: 1531486 Alberta Ltd.

Public Open House Report
October 13, 2011

Prepared by:

Marcomm Works
GAIN INSIGHTS. GET RESULTS

Table of Contents

Introduction and Consultation Approach 3
Open House Comments and Feedback 4

Appendices

A. Information and Advertising Materials.....9
B. Open House Attendees 12
C. Feedback Form 13

Introduction

1531486 Alberta Ltd. is applying to Lac Ste. Anne County for a development permit to operate a gravel pit on a 198 hectare site located about five kms south of Alberta Beach. The development permit application requires a number of studies and processes to be followed. One of these elements is to inform and educate affected parties regarding the application so they may have an opportunity to provide comment and feedback to both the developer and the County.

In July 2011, 1531486 Alberta Ltd. contracted Marcomm Works, an Edmonton consulting firm, to develop information materials and organize and facilitate an open house for local residents regarding the proposed gravel operation. The scope of the consultation was to include any area residents who may be interested in knowing more about the development application.

Consultation Approach

The consultation was designed to ensure that those interested in the proposed development would have a reasonable opportunity to learn more about it and provide their comments. This was done by encouraging contact with the developer, holding an open house and distributing information materials.

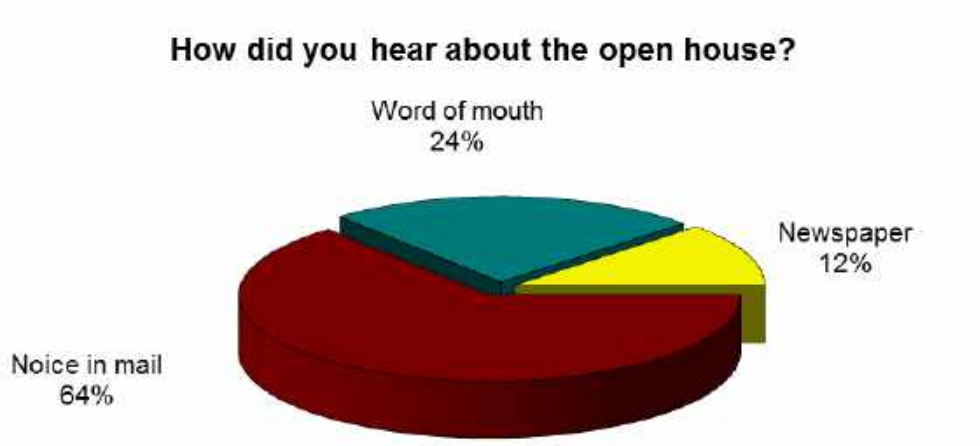
With the assistance of Lac Ste. Anne County staff, a mailing list of Lac Ste. Anne County residents who lived within a three mile radius of the proposed gravel pit was developed. The area covered was:

- North boundary: Highway 633
- South boundary: Parkland County line
- East boundary: Range Road 30
- West boundary: Range Road 40

Added to this list were elected officials and planning and development staff from the Lac Ste. Anne and Parkland Counties. The total mail list was 192. An open house was arranged and held September 29, 2011 at the Alberta Beach Agliplex. Advertising of the open house included:

1. Direct mail invitations: one mailed on September 12 and a reminder mailed on September 20.
2. Two quarter-page advertisements in the *Community Voice* newspaper: one on September 20 and again on September 27.
3. Poster outside of the Alberta Beach Agliplex.
4. Notification of Lac Ste. Anne County planning and development department of the event.

Nearly two-thirds who attended the open house learned about it from the direct mail invitations sent out.



An information package was prepared to provide people who attended the Open House or requested more information with a common understanding of the scope and impacts of the development. A feedback form was also created to supplement verbal questions/comments provided to the developer. Through this form, written feedback was sought from the 31 people who attended the open house. Nineteen people elected to provide their comments in writing.

This following section summarizes both the written and verbal feedback provided at the open house and subsequently by a couple of people who were unable to attend.

Open House Comments and Feedback

While a few people objected to the development proceeding, most were simply seeking more information or had specific issues that they wanted addressed as part of the development going ahead. Most of the concerns related to groundwater and truck traffic.

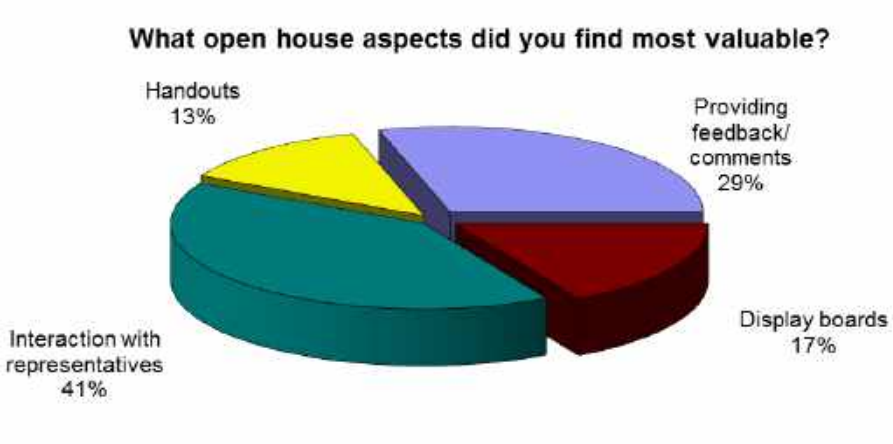
Understandably, those close to the proposed development wanted assurances their water supply would not be affected by the gravel pit operation. These assurances were provided by the developer. The Onoway Valley Conservation Alliance voiced their opposition to any gravel pit development that extracts material below the water table.

Truck traffic was an issue for many. Some of these concerns related to potential road noise affecting nearby residences. Others related to road congestion particularly on RR33 and at Highway 16. A few people suggested traffic from the gravel pit site use an alternative route.

Those in attendance were happy with the availability of information and access to the developer and his consulting team.

	Mean*
a. The information presented was useful and informative	4.3
b. The information was easy to understand	4.1
c. The project representatives were friendly, helpful and accessible	4.5
d. The project representatives provided satisfactory answers to questions	4.1
e. I have a better understanding of the development because of my attendance tonight	4.3
f. I had an opportunity to provide comments and feedback	4.2
g. The meeting location and format was appropriate	4.4

** n = 19. Scale of 1-5 with 1 means strongly disagree and 5 means strongly agree.*

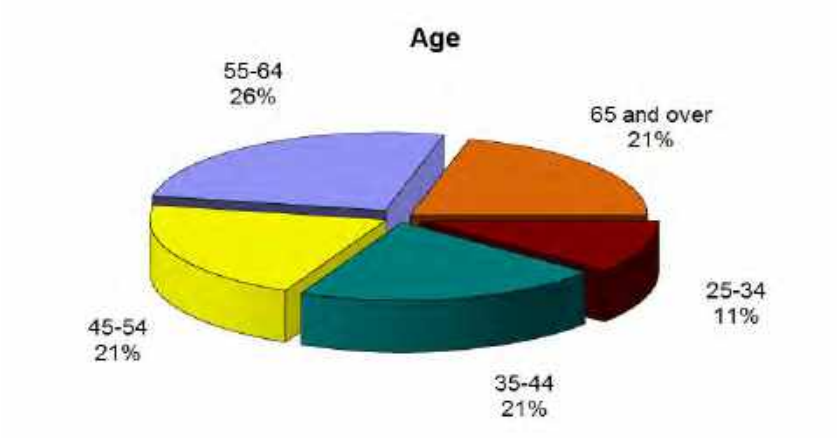


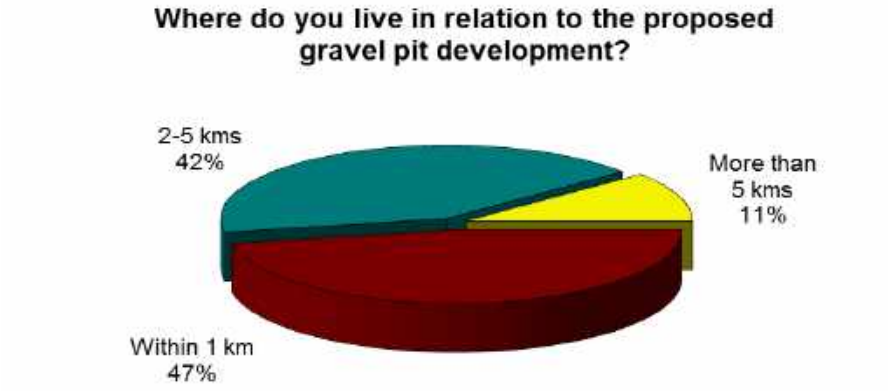
On average, attendees were neutral or slightly supportive of the developer's efforts to identify and mitigate any negative factors the development may cause.

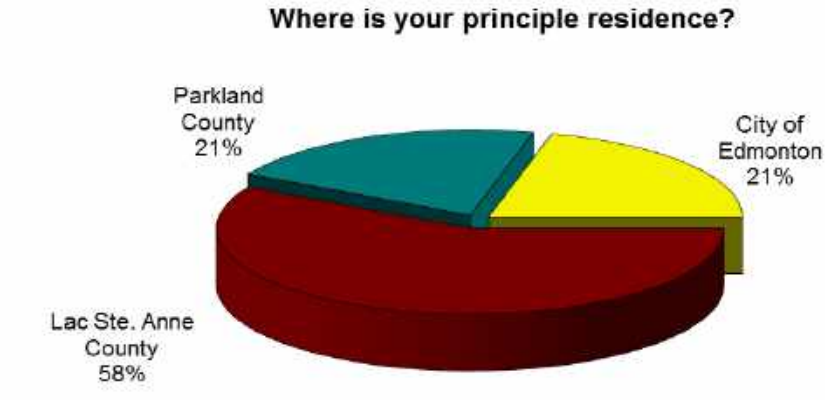
	Mean
a. The gravel pit development has taken into account all environmental factors	3.4
b. The gravel pit developer's proposed measures to offset any potential negative impacts are appropriate	3.1
c. The developer's plans to protect residential water sources are adequate	3.0
d. The proposed operating hours are appropriate	3.4
e. I agree with the reclamation plan	3.1
f. I have fewer concerns about the gravel pit development now than before I came to the open house	2.8

** n = 19. Scale of 1-5 with 1 means strongly disagree and 5 means strongly agree.*

Participant Demographics







Written & Verbal Comments

Water

- One person indicated he has shallow water wells in SE 33 that will be close to gravel extraction. He is concerned about losing his groundwater supply.
- Another person was concerned about the impact on groundwater but was pro-development. He did not have a well of his own that would be affected.
- A number of people asked and were informed that their groundwater supply was safe because bedrock water wells would not be affected by mining the gravel.
- Three people wanted the Water Well Survey to be updated with their water well information (they were not home and did not respond to follow-up when the survey was done).

Traffic

- "Haul Route: The proposal to haul south on RR33, merging with gravel trucks from both Burnco and Inland operations and then attempting to access Highway 16 is a ridiculously poorly thought out plan. In Parkland County two school busses morning and night travel this road. Many operators in the farming community of RR33 own land on both sides of the road and frequently cross with livestock and machinery. A large number of workers commute daily to the power plants and mines as well as other job locations. To merge gravel trucks from three companies with local traffic and commuters on a county road would be unacceptably dangerous. Lac St. Anne County has great access to Highway 16 via Highway 43 and Highway 633. Use it!"
- "The traffic assessment was carried out in September vs. higher volume traffic in July and August both on Highway 16 and RR33. The assessment should clearly show the present residential/other traffic, Burnco traffic, proposed Inland traffic and the traffic from this proposed development. An assessment for traffic on 633 and RR33 would be a good comparison."
- "What is missing is a traffic safety impact assessment of the proposed pit and Inland truck volume going south on RR33 to Highway 16 vs. north on 33 to 633 and south on 43 to the interchange that would take trucks much more safely onto Highway 16."
- Another person said he preferred to see trucks drive north on Range Road 33 rather than south.
- One person was happy to learn of the proposed haul route.
- A concern was expressed about the possible queue lengths waiting to access Highway 16 from RR33, especially with being stuck behind five or six gravel trucks with pups waiting to turn left during morning peak period.
- A question was asked about whether RR3 would be widened as it was by BURNCO as part of their development approval. If so, which side and how much land would be required? The resident was concerned about the future road right-of-way further encroaching on their property and dwelling.

- A concern was raised about increased rock chips on the road which could lead to cracked windshields and/or chips being embedded in tires.

Noise

- "One of the conditions of the development permit received by Burnco was that property line noise levels not exceed 55 db. The predicted levels at nearby residences as indicated in your handouts far exceed this level. I would also like to know the reading of loaded trucks passing residences."
- "The noise impact does not take into account prevailing winds which will carry noise. As well in the cold winter air with the leaves off the trees increased noise carried on the air has not been factored in. Also the key noise concern for us is the gravel truck and pup road noise – peak loads 67 full/67 empty. Last week five trucks went by on Wednesday and Thursday, were trucks and pups. The noise was so loud I could not hear my daughter talking to me on the phone as she stood on the house step. The trucks were moving at a high rate and when the fifth one went by a half ton moving north had to slow down and pull over as the gravel truck was taking up too much of the road. In early August we counted 20+ gravel trucks (no pup) run south on RR33 spaced 5-10 minutes apart. It was a Sunday and even thought they were running empty the noise was annoying."
- There was a concern with the noise of the trucks passing residences along RR33.

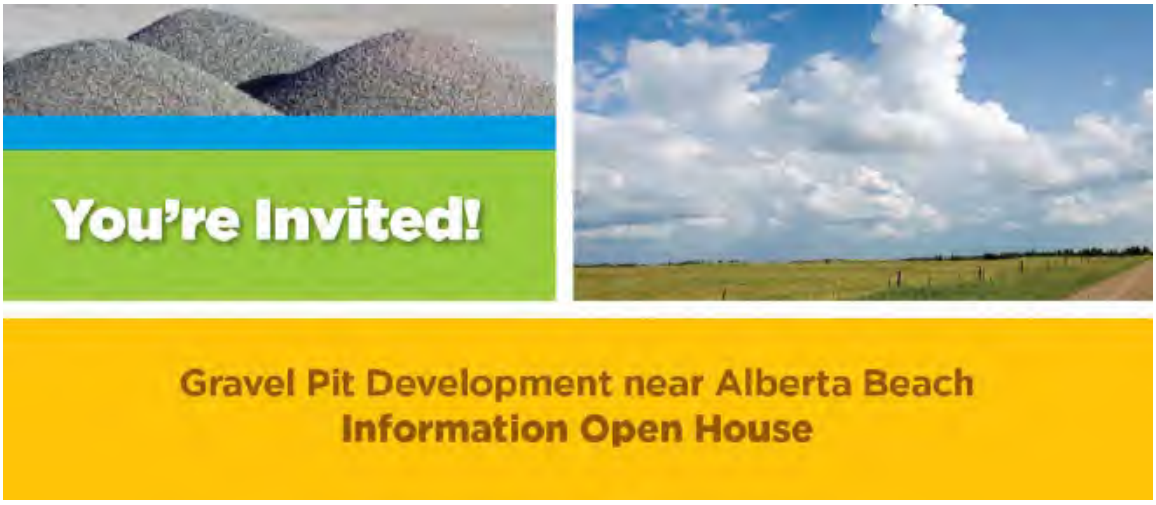
Reclamation

- "The land is definitely going to be lower even if reclaimed and the area is already low."

Other

- "Other operator's name should not be mentioned; be displayed on your presentation."
- "Don't want it. (2)"
- "The effect of the project must go beyond the immediate boundaries. It must span more time than 5+years. It must have samples/proof of reclamation to the depth of the disturbance re: surface and groundwater. It must also be combined with existing and past (cumulative effects) to identify if the area can absorb the loss of the natural capital/natural functions (environmental debt) that the County of Lac Ste. Anne will have to address/absorb."
- "My principle residence is presently in Edmonton. I purchased our property three years ago as a retirement place to live once I retired from my corporate job (have now retired). I did not plan on a retirement place to be surrounded by gravel pits (Inland is going in just south of us). "
- A representative of the Onoway River Valley Conservation Association is concerned about the cumulative impacts of all gravel operations.

Appendix A: Information and Advertising Materials



Sangudo School Sign Unveiled

Continued From Page 1

The original Sangudo School was one of 68 that dotted the landscape of what today is Lac Ste. Anne County. To date 62 of the 68 schools have been officially marked, a project undertaken by the Onoway and District Historical Guild three years ago.

Greetings were presented by Dwight Davidson and Lloyd Giebelhaus from the County and Albert Schalm representing Northern Gateway Public Schools. Mary Jane Suntjens, a former student and hostess for the day, then invited students and guests to Sangudo Community Hall where friendships were renewed, stories told and refreshments enjoyed by all. One story told of a teacher fainting when she saw blood streaming from a student's partially severed finger. Another student told of a protest by grade 1 students about too much homework—political activists got an early start in Sangudo!

Upcoming school sign unveilings include Wetonka on September 15 at 2:00 p.m. (contact Charles Grabler 780.785.2071), Royal Valley on September 18 (contact George Turk 780.785.2852) and Orangeville September 22 (contact Don Schnurer 780.785.8103). Other schools to be recognized this fall include Cosmo and Tipperary. For more information, contact Onoway and District Historical Guild (780.967.1015).

Although the goal of the Guild is to erect a permanent reminder at historic sites, the coming together of classmates and teachers of long ago is heartwarming and inspiring result. As they share memories of a world that has disappeared, they are encouraged to record these memories in writing or audio/video recording. These stories help preserve that world that is long gone and are such an important part of our history.

PUBLIC NOTICE

Gravel Pit Development Near Alberta Beach

Information Open House

Where: Alberta Beach Agriplex
4703 - 47 Avenue

When: Thursday, September 29
5:00 - 8:00 pm

What: Developers will share information about a gravel pit development proposed for a 198 hectare (480 acre) site located about five kms south of Alberta Beach adjacent to Township Road 540 and Range Road 33. The gravel extraction area is about 63 hectares (156 acres). Anyone interested in learning more about the development is invited to drop-in.

The open house is being hosted by Peter Wall, an Edmonton businessman who will be applying through his company 1531486 Alberta Ltd. to Lac Ste. Anne County for a development permit to operate the gravel pit.

For more information contact:
Bob Sanderson, RoJaS Management Ltd.
bob@rojas.ca • T: 780-719-9669

Chambers of Commerce
GROUP INSURANCE PLAN

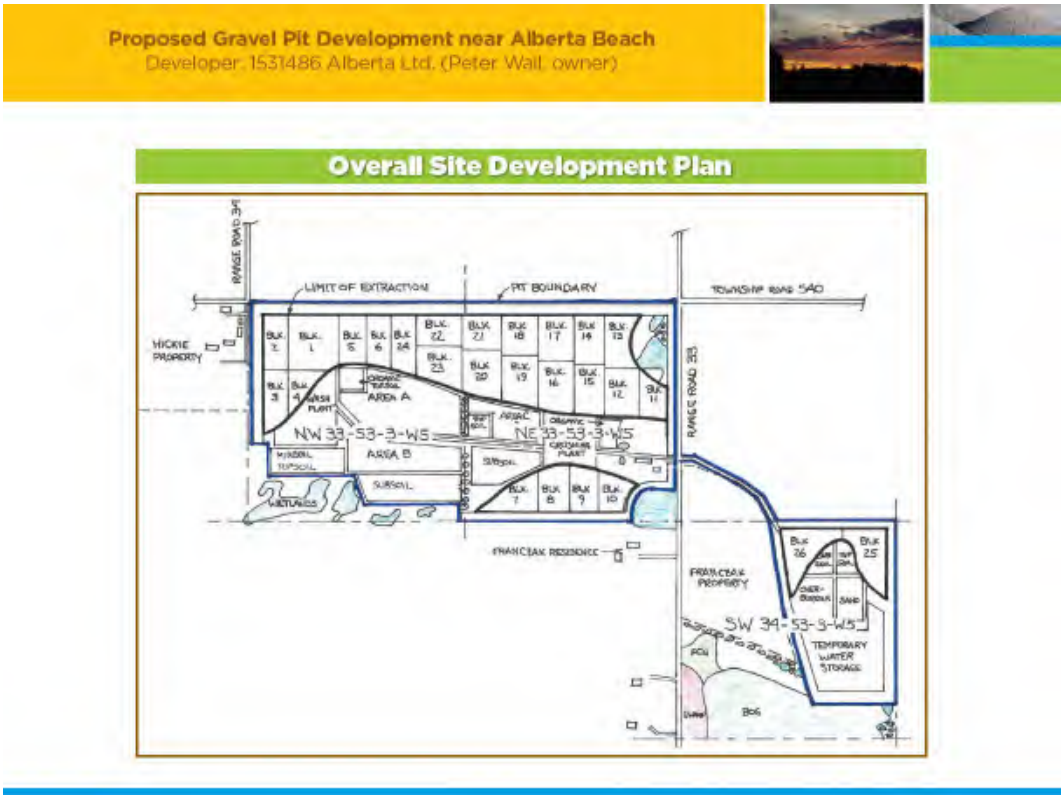
Dennis Chamney

Chambers Group Insurance
Today, over 27,000 companies participate in this group health insurance program, making it the largest of it's kind in Canada.

Whether you're a solo entrepreneur, home based business or part of your financial security, Chambers Plan Group Health Insurance lays a solid foundation for that security, based on a benefit program designed specifically for you and your company!

Go to...
www.chambergroupinsurance.com
phone 780-929-6787 or toll free 1-888-333-8650
email: dennis@chambergroupinsurance.com

...for more information.


Proposed Gravel Pit Development near Alberta Beach
Developer: 1531486 Alberta Ltd. (Peter Wall, owner)
Overall Site Development Plan
RANGE ROAD 34
LIMIT OF EXTRACTION
PIT BOUNDARY
TOWNSHIP ROAD 540
RANGE ROAD 33
HICKIE PROPERTY
AREA A
AREA B
NW 33-53-3-W5
NE 33-53-3-W5
SW 34-53-3-W5
FRANCZAK RESIDENCE
FRANCZAK PROPERTY
TEMPORARY WATER STORAGE
BOG

Appendix B: Open House attendees (who signed in)

Name
Harold & Ruth Fischer
Fritz & Eva Sonnenberg
Mick Northcott
Darren Kelm
Mike Kane
Francous Ouellet
Fred Smith
George & Sylvia Astelford
Lydia & Lorraine Ross
Don Ross & Brian Rice
Denis Henderson
Dave Franczak
Eugene Laniuk
Raymond Hickie
Tanya Vanderveen
Brad Whalen
Bob Wagner
Kathie Wiels
Glenn & Annette Hickie
Karen & Dean Hickie
Don Horutko
Jack Fraser
Barry Davydale
Rob White

Appendix C: Feedback Form

1. Please rate your level of agreement with the following statements, on a scale of 1 to 5 where 1 means "strongly disagree" and 5 means "strongly agree". Please check the appropriate box to the right of each statement.

1 = strongly disagree 2 = somewhat disagree 3 = Neutral 4 = somewhat agree 5 = strongly agree

	1	2	3	4	5
a. The information presented was useful and informative					
b. The information was easy to understand					
c. The project representatives were friendly, helpful and accessible					
d. The project representatives provided satisfactory answers to questions					
e. I have a better understanding of the development because of my attendance tonight					
f. I had an opportunity to provide comments and feedback					
g. The meeting location and format was appropriate					

2. How did you hear about this open house? *(Please check all that apply)*

- ☐ Newspaper advertisement
- ☐ Notice in the mail
- ☐ From a Lac Ste. Anne County staff or Council member
- ☐ Word of mouth from family, friends, neighbours, others
- ☐ Other _____

3. Which aspects of the open house did you find the most valuable? *(Please check all that apply)*

- ☐ Display boards
- ☐ Handout materials
- ☐ Interaction with representatives
- ☐ Opportunity to provide feedback/comments
- ☐ Other _____

4. Thinking now about the proposed gravel pit development as presented to you, please rate your level of agreement with the following statements, using the scale of 1 to 5.

	1	2	3	4	5
a. The gravel pit development has taken into account all environmental factors					
b. The gravel pit developer's proposed measures to offset any potential negative impacts are appropriate					
c. The developer's plans to protect residential water sources are adequate					
d. The proposed operating hours are appropriate					
e. I agree with the reclamation plan					
f. I have fewer concerns about the gravel pit development now than before I came to the open house					

Classification Information

5. Where do you live in relation to the proposed gravel pit development?

□ Within 1 km. □ 2-5 kms. □ More than 5 kms

6. Where is your principle residence?

□ Lac St. Anne County
□ Parkland County
□ City of Edmonton
□ Other _____

7. Which age category are you in?

□ 18 to 24
□ 25 to 34
□ 35 to 44
□ 45 to 54
□ 55 to 64
□ 65 and over

8. Do you have any other comments about the proposed gravel pit development near Alberta Beach?

11213 Winterburn Rd NW
Edmonton, AB T5S 2B2

Office (780) 809 8191
Fax (780) 809 8190
Site aspenlandgroup.com

February 26, 2026

Lac Ste. Anne County
Planning and Development Services
56521 Range Rd 65
Lac Ste. Anne County, AB T0E 2A0

Reference: 1531486 Alberta Ltd.
Public Consultation Summary - Lac Ste. Anne County Proposed Re-Districting
NE & NW 33-053-03-W5M and SW 34-053-03-W5M

1531486 Alberta Ltd. has ongoing public consultation with members of the Lac Ste. Anne County (LSAC) community regarding the proposed re-districting and subsequent renewal of a previously authorized sand and gravel extraction operation within the NE & NW 33-053-03-W5M and SW 34-053-03-W5M. This letter serves as a summary of the public consultation that 1531486 Alberta Ltd. has undertaken in 2025 and the feedback received from the surrounding residents of the prosed operation. It also outlines how 1531486 Alberta Ltd. responded and/or intends to provide further information to address the questions and concerns brought forward during consultation.

Draft invitation package to the Open House were provided to LSAC administration on October 10, 2025. To ensure surrounding residents were fully informed, additional information was added to the invitation that provided additional detailed information of the project, along with an opportunity to provide feedback and comments outside the open house. LSAC administration confirmed the invitation package was acceptable and confirmed that 206 invitations were required to be mailed. Invitation packages to attend an Open House were prepared by Aspen Land Group Inc. (Aspen) and sent to LSAC on October 28, 2025; LSAC administration was responsible for addressing and putting the 206 packages in the mail. To increase reachability of the individuals knowledgeable of the project, two contacts were included in the invitations for landowners to contact for additional information. In addition to the invitation packages, newspaper advertisements were published in the Lac Ste. Anne Bulletin in the November 17th and 24th, 2025 issues. The invitation packages and advertisement were completed in accordance with the regulations and timelines in Section 3.5.2 of the Land Use Bylaw. A copy of the invitation packages mailed to residents is included in Appendix A, and copies of the printed newspaper advertisements are included in Appendix B.

The Open House was held at the centrally located Alberta Beach Agliplex Hall on December 2, 2025, from 2:00-4:00pm. This time was chosen as it was viewed that this time was best suited for the local

demographic. Twelve community members attended the open house, and a copy of the sign-in sheets have been provided in Appendix C. Two adjacent residents reached out via email and one adjacent resident reached out via phone call ahead of the open house. Additional physical comment forms were provided at the event, and attendees were encouraged to take them home, and return by December 31, 2025, in an effort to allow ample time for consideration of any concerns with the development.

One physical comment form was received at the Open House, and two comment forms were received through email in advance of the Open House. Copies of these comment forms are included in Appendix D. None of the comments were outright opposed to the project, as all were seeking additional information to determine their level of support. The responses requested additional information, inquired about the potential for local employment opportunities, and requested a berm be added to the operational plan. A summary of the comment forms is outlined in Table 1 below.

Table 1. Summary of Comment Forms						
Respondent & Residential Address	Proximity to proposed operation	Form of Contact	Date of Contact	Form of Feedback Received	Level of Support (Support/ Oppose/ Neutral)	Summary of Consultation Comments/Concerns Raised
Pat Young – 53513 RR35 Lot 105	Adjacent, to the southwest of NW-33-053-03-W5M	In-person	December 2, 2025	Open House Feedback Form	Not indicated	Concerns about the level of noise generated by operations. Asked for the inclusion of a berm on the west edge of the pit which he indicated would give his support to the project.
Jon Rutland – 53531 RR 32	To the east of the project on RR 32	Email	December 2, 2025	Emailed Open House feedback form	Not indicated	Requested additional information to determine his level of support. Concerns included silica, dust, noise, and damage to county roads, as well as a decrease in property value for the surrounding residents.
Deb Giroux – SE 07-054-03-W5M	To the northwest of the project within the SE 07-054-03-W5M	Email	December 1, 2025	Emailed Open House feedback form	Opposed (possibly)	Questions regarding the use of county roads, including access to the pit, haul route location, and widening of Range Road 33.

In addition to the comment forms, one attendee at the Open House specifically highlighted concerns as to how the upgrades to Range Road 33 would be completed and whether there would be impacts to her land, located south of the development. She has historically experienced problems with drainage as a result of construction with the Range Road 33 and WILD Water Commission Pipeline and wanted to ensure the upgrades would be completed efficiently and flooding to her land would be mitigated.

Another attendee requested a noise and site barrier along the northern portion of the NE 33-053-03-W5M to mitigate visual and noise impacts from their place of residence.

While also in attendance at the Open House, the landowners of the NE 33-053-03-W5M, Donald, Duane and Joyce Drews, contacted Aspen and 1531486 Alberta Ltd. following receipt of the Open House invitation and requested a meeting in person as they wanted to better understand the sequence of operations and the location of the internal haul route. 1531486 Alberta Ltd. went to their property to meet with them and to discuss these items. 1531486 Alberta Ltd. is committed to partnering with the Drews to coordinate the mine sequencing plan with future farm management. During this meeting, the rationale behind the changes to the pit boundary resulting from the installation of the West Inter Lake district (WILD) Water Commission water pipeline in the road allowance to the north and subsequent appropriate setback were also explained.

Finally, David Franczak has previously been in contact with 1531486 Alberta Ltd. regarding impacts to his groundwater supply. Historically, his concerns have been mitigated but when he did not attend the Open House, 1531486 Alberta Ltd. reached out to Mr. Franczak on January 13, 2026. Due to conflicting schedules they have not met yet, however, representatives from 1531486 Alberta Ltd. will continue to reach out to him to discuss his concerns and/or review groundwater monitoring data with him.

Summary of Concerns

From all the responses and conversations from the consultation process, the following concerns were raised:

- Noise and visual impacts from operations,
- Dust pollution from operations,
- The location of the haul route / road conditions,
- A potential decrease in property value,
- The mine sequencing plan,
- Impacts on groundwater supply/water wells,
- Environmental concerns for peat oversaturation and tree health, and
- Opportunities for local employment.

Summary of Responses to Concerns Raised

Please see the responses from 1531486 Alberta Ltd. below addressing the concerns raised throughout the public consultation process. These responses also correspond with the information that was provided directly to landowners, and/or at the Open House, both through open conversations and the display of four informational posters. A copy of these posters has been included in Appendix E.

Noise and Visual Impacts

All operations within the pit will be conducted in accordance with municipal and provincial regulations governing noise levels. Berms will be strategically placed along the northeastern perimeter of the NE 33-053-03-W5M across from the nearest residences to reduce noise. Additionally, as per Pat Young's request, 1531486 Alberta Ltd. will ensure that topsoil and subsoil stockpiles will be stockpiled along the westernmost /southernmost edge of the pit to mitigate noise for the residents of Greentree Estates. A copy of the revised Operations Plan has been provided in Appendix F.

The additional efforts will be made to mitigate the overall noise levels from the operation: 1531486 Alberta Ltd. will strive to ensure that all equipment is properly maintained, all trucks hauling from the pit will be in good working order, the use of retarder brakes will be prohibited at or near the pit, processing activities will only occur during permitted hours, and unnecessary engine idling will be minimized.

Dust Pollution

The majority of extraction will occur under damp to wet conditions which will significantly reduce dust. However, additional mitigation measures for dust control will include watering active areas within the pit, internal haul roads, and the LSAC roads as required. Berms and long-term stockpiles of reclamation material will be vegetated. Progressive reclamation will be employed during the pit lifespan to limit the overall disturbance and open areas at any one time. Crushers will be situated at the lowest possible elevation, all loads of aggregate material will be properly enclosed, and speed limits along municipal roadways will be strictly adhered to in an effort to help reduce the overall dust emission from the operation.

Haul Route and Road Conditions

The haul route will be exclusively on Range Road 33 from the pit entrance south, directly to Highway 16. No material is intended to be hauled north of the pit entrance on Range Road 33. Prior to operations, Range Road 33 will be widened and upgraded from the previous improvement within Parkland County to the pit entrance in LSAC. All improvements will be conducted according to best management practices and will be attempted to be completed as efficiently as possible while not compromising quality. No hauling of material will occur north of the pit access within LSAC, along Township Road 540, or on Range

Road 34. 1531486 Alberta Ltd. will ensure trucks travelling to and from the proposed operation are following the posted speed limit and are well maintained. 1531486 Alberta Ltd. will work with residents along the haul route to address any concerns that may arise during operations. Prior to any hauling, 1531486 Alberta Ltd. will obtain road use agreements from both LSAC and Parkland County and abide by any conditions.

It is understood that LSAC has completed the road design to upgrade Range Road 33 and may start construction in the near future. However, if LSAC has not started construction prior to development, 1531486 Alberta Ltd. is prepared to enter into a Development Agreement and/or Road Use agreement for portions of the haul route along Range Road 33 requiring upgrading to the pit entrance as per LSAC's road design. If the road has been upgraded by LSAC, 1531486 Alberta Ltd. will enter into a Road Use Agreement.

Property Value

1531486 Alberta Ltd. has held Development Permit No. 193193-13-D0019 for this pit since May 26, 2011, and there are numerous aggregate developments in the vicinity. Given this, it is not likely that the current operating plan for the pit will have any impact on surrounding property value. Mitigation measures for dust, noise, and traffic will all be in place to minimize impacts on surrounding residents. With these measures in place, the value of surrounding properties is not expected to be significantly impacted, as it will continually allow for the enjoyment of each respective property with periods of minor disturbance.

As a result of this project, a portion of Range Road 33 will be upgraded, and approximately $120,000 per year will be made in Community Aggregate Payment (CAP) Levy payments to LSAC to benefit the immediate and larger surrounding area. This will equate to approximately $2.4 million in CAP Levy payments over the lifetime of the pit.

Mine Sequencing

Progressive reclamation will be used throughout the pit lifespan to limit the overall disturbance at any one time. Mining has been spilt into three phases each containing separate mining blocks that will be disturbed and reclaimed sequentially. The mine sequencing plan has been created to limit movement of equipment and allow for progressive reclamation to occur. The internal haul route will be used as much as possible to avoid unnecessary traffic on Range Road 33. 1531486 Alberta Ltd. will continue to work with the Drews to ensure the sequencing works to the advantage of their farm management, as well as listen to feedback from surrounding landowners. Please see Attachment F for the Revised Operations Plan.

Wells, Groundwater, and Environmental Concerns

Based on groundwater analysis, it is not likely that groundwater wells in the surrounding area will be affected by the project's operations. Groundwater modeling and forecasting indicates that only shallow water wells are at risk for potential impacts during extraction operations. All the Open House attendees who brought forth water well concerns were confirmed to have deep wells within the bedrock and are therefore unlikely to experience impacts on their wells. In addition to 1531486 Alberta Ltd.'s Groundwater Protection Plan, 1531486 Alberta Ltd. holds various authorizations from Alberta Environment and Protected Areas under the *Water Act* for their proposed activities which contains compliant investigation clause should an adjacent water well user's water supply becomes impacted.

The surface level of all waterbodies (recharge ponds and end pit waterbodies) will be below the peat layer in the area. The peat layer is very shallow; either at or near ground level. Residents expressed concerns that the peat layer will be oversaturated following reclamation. However, it is unlikely that the peat layer will become oversaturated as there will be minimal contact with the water from pit waterbodies and the adjacent peat lands. Additionally, as the peat layer is not continuous across the site, it is possible no peat would be present at the waterbody locations, thus further limiting the possibility of oversaturation to the peat and associated negative environmental consequences.

Summary of Public Consultation

The concerns which were raised during the Open House pertained predominantly to the location of the current road conditions of Range Road 33 along the haul route, and noise. 1531486 Alberta Ltd. has revised their operations plan accordingly to mitigate visual and noise impacts to those who raised concerns. Given LSAC's recent plans to upgrade Range Road 33 from Parkland County to Alberta Beach, 1531486 Alberta Ltd. will continue to work with LSAC administration to ensure that their portion of the haul route is fairly contributed to.

Overall, 1531486 Alberta Ltd. has attempted to address all concerns raised, and they are committed to working with the adjacent residents during operations. They will continue to monitor feedback from surrounding residents during operation of the pit and address any concerns moving forward. 1531486 Alberta Ltd. has stated that they are willing to meet individually with any concerned landowners at a time and location of their choosing, should they wish.

If you should have any questions or concerns with the information provided, please do not hesitate to contact the undersigned at (780) 809-8191 or alternatively at ddunbar@aspenlandgroup.com.

Regards,

Dana Dunabr, BIT.
Junior Environmental Specialist
Aspen Land Group Inc.

Appendix A: Open House Invitation Package
Appendix B: Public Notice Tear Sheets
Appendix C: List of Open House Attendees
Appendix D: Comments From Attendees and Subsequent Email Correspondence
Appendix E: Open House Posters
Appendix F: Revised Operations Plan

Appendix A: Open House Invitation Package

Please take notice!

As a stakeholder near the development, you are invited to attend a public open house. The open house will give information about the Aggregate Resource Extraction and Processing development.

The **AGGREGATE RESOURCE EXTRACTION and PROCESSING** is within the requirements and standards set by Lac Ste. Anne County. The land parcel is 132.68 hectares (327.86 acres) in size.

The pit is an existing permitted development, located on NE & NW 33-53-03-W5M and SW 34-53-03-W5M. The pit will be 63.61 ha in size and previously held Development Permit No. 193193-13-D0019, which now requires renewal.

To renew the Development Permit, a land districting change is required to redistrict the land from the existing Agricultural '1' District (AG1) land use to an Aggregate Resource Extraction & Processing (AR) land use in accordance with the Lac Ste. Anne County's Land Use Bylaw 22-2017.

Please see the Additional Information Attachment for a detailed breakdown on pit activities and the multiple mitigative measures to control dust and noise from the pit.

The land will be reclaimed back to agricultural lands of equivalent land use capability, alongside two end pit waterbodies.

Access from the site will be made via Range Road 33 north from Highway 16, as shown on the adjacent drawing (in purple).

As a stakeholder with property in the vicinity of the described development, you are invited to an "OPEN HOUSE" to review and discuss documents and drawings for the development, to be known as Alberta Beach Pit.

WHERE: Alberta Beach Agliplex Hall

ADDRESS: 4811 46a Ave, Alberta Beach, AB T0E 0A0

WHEN: Tuesday, December 2, 2025

TIME: 2:00pm-4:00pm

FOR MORE INFORMATION:

Lesley Foy
Aspen Land Group Inc.
lfoy@aspenlandgroup.com
(780) 809-8191 Ext. 22

Lucas Bodnar
1531486 Alberta Ltd.
lbodnar@gjconstruction.ca
(780) 454-0700

OPEN HOUSE
&
PUBLIC CONSULTATION
for 1531486 Alberta Ltd.

December 2, 2025
2:00pm – 4:00pm

NW & NE 33-53-03 W5M and SW 34-53-03 W5M
Lac Ste. Anne County

Please note that personal mail addresses were not shared and privacy of this information was maintained by Lac Ste. Anne County and Parkland County.

<u>Additional Information</u> – Open House & Public Consultation for 1531486 Alberta Ltd.

Alberta Beach Pit

Pit Activities

An illustration of the Pit Operation Plan is shown on the included Drawing 1-1. Pit operations will include stripping and stockpiling of reclamation material, aggregate extraction and processing (crushing and washing), hauling, pit dewatering, and reclamation activities.

The haul route will be from the pit, south on Range Road 33 until it connects with Highway 16, as highlighted in purple on the front page of this invitation. All pit traffic will utilize the proposed haul road.

Dust and Noise Control

Mitigation measures to control dust will be implemented to accommodate surrounding landowners and will include watering internal roads and workspaces and vegetating long term reclamation stockpiles and berms. Progressive reclamation techniques will be employed to limit the overall disturbance at any one time.

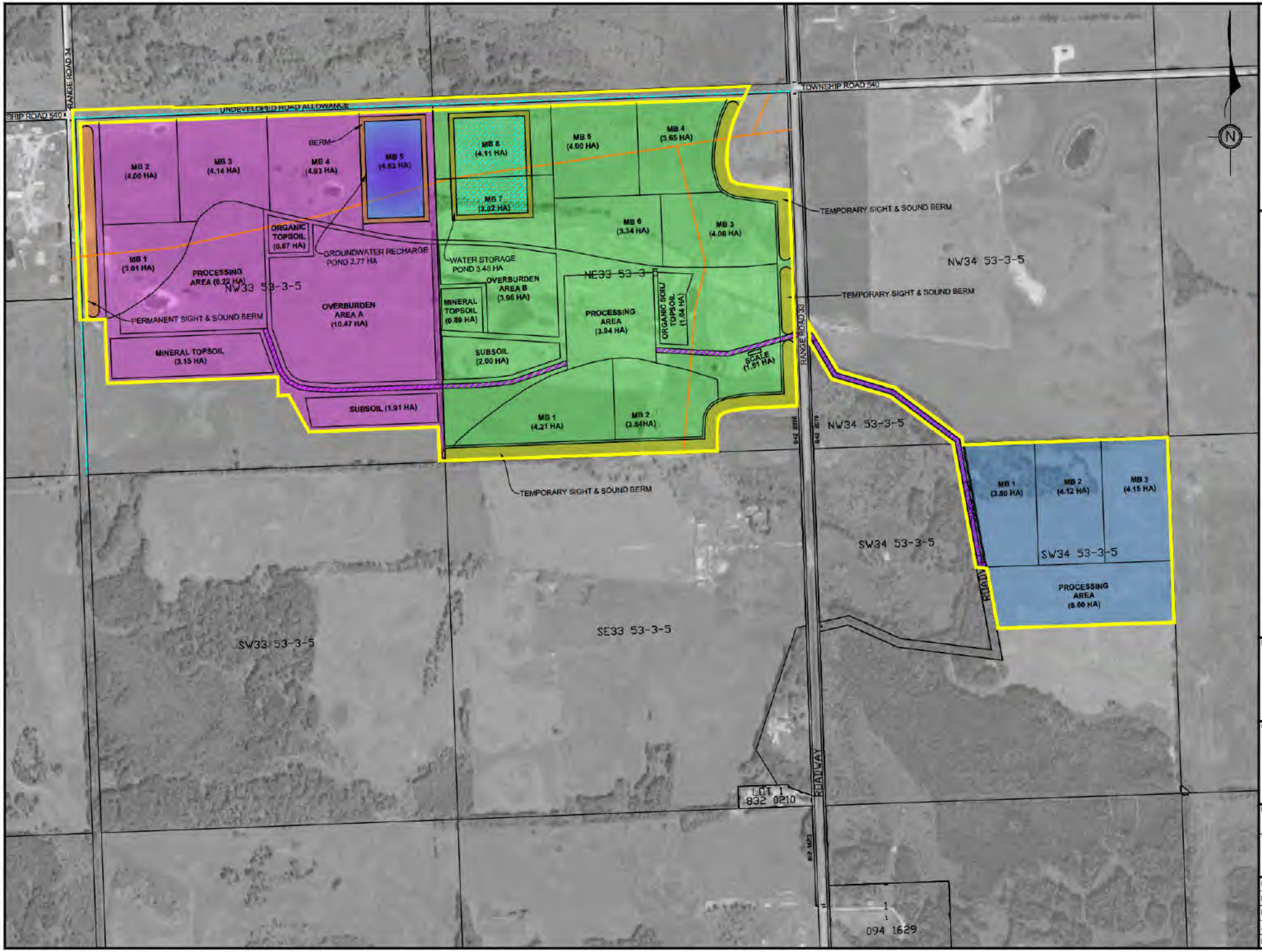
Noise control measures will include the proper maintenance of equipment, restricting the use of engine retarder brakes, creating site and sound berms along the perimeter of the site in the N 33-053-03-W5M, and utilizing white noise backup alarms rather than traditional alarm systems.

Additionally, to mitigate for potential impacts to groundwater, a groundwater review has been conducted by Hydrogeological Consultants Ltd. (HCL), and a monitoring program has been in place for the area since 2018. Representatives from HCL with also be present at the open house.

Open House Information

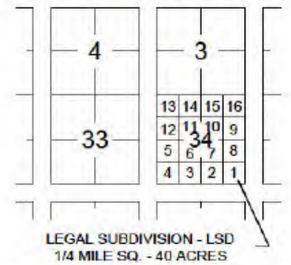
1531486 Alberta Ltd. and Aspen Land Group Inc. would once more like to invite you to attend the open house on <u>December 2, 2025, at the Alberta Beach Agliplex Hall (4811 46a Ave, Alberta Beach, AB T0E 0A0) from 2:00 p.m. to 4:00 p.m.</u> to discuss these details of the Alberta Beach Pit, located at NE & NW 33-53-03-W5M and SW 34-53-03-W5M. Please be advised there will be no formal presentation.

If you have are unable to attend the open house, return the attached comment card via email to lfoy@aspenlandgroup.com or to the Aspen Land Group office located at 11213 Winterburn Rd NW, Edmonton, AB, T5S 2B2. Additional copies of the comment cards will be available at the open house.



LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- PROPERTY LINE
- PIT BOUNDARY (127.84 HA)
- STE. ANNE GAS ROW
- WILD WATER COMMISSION PIPELINE ROW
- PHASE I
- PHASE II
- PHASE III
- INTERNAL HAUL ROADS

Prepared By

Aspen LAND GROUP

Client

1531486 ALBERTA LTD.

Project

ALBERTA BEACH PIT

Title

PIT OPERATION PLAN

Checked By: L. FOY & D. DUNBAR	Scale 1:8000
Designed By: L. FOY	Drawing No. 1 - 1
Drawn By: T. FOY & J. MOJICA	
Air Photo: 2022	
DATE: SEPTEMBER 26, 2025	

<u>Comment Form</u> – Open House & Public Consultation for 1531486 Alberta Ltd. Alberta Beach Pit

We are collecting this information to help us better understand and address your concerns in an effort to work together and mitigate issues that are important to you. Please note that **additional writing space for comments is attached.**

1. Please indicate your level of support for this project.

   1 = strongly opposed, 2 = opposed, 3 = unaffected, 4 = in support of, 5 = strongly in support of

   1 2 3 4 5

   Comments:

   _____

   _____

2. Please list all of your concerns regarding this proposed development and how you will be impacted.

   Comments:

   _____

   _____

   _____

   _____

3. If you have concerns listed above please use the space below (or on the attached sheet) to detail how you feel 1531486 Alberta Ltd. can mitigate those concerns to your satisfaction.

   Comments:

   _____

   _____

   _____

   _____

Thank you for taking the time to complete this form.

4. Name:_____

Address:_____

Phone Number:_____

Email Address: _____

Where is your property in relation to the proposed development?

_____

Would you like a 1531486 Alberta Ltd. representative to contact you? Yes ☐ No ☐

Comments:_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Please return to:

lfoy@aspenlandgroup.com or Aspen Land Group Inc.
11213 Winterburn Road N.W
Edmonton, AB T5S 2B2

Contact Information:

Lesley Foy
(780) 809-8191 Ex. 22
lfoy@aspenlandgroup.com

or

Lucas Bodnar
(780) 454-0700
lbodnar@gjconstruction.ca

Thank you for taking the time to complete this form.

Appendix B: Public Notice Tear Sheets

1531486 Alberta Ltd.

Alberta Beach Pit Open House

1531486 Alberta Ltd. has applied to renew their development permit and redistrict the land for the existing gravel pit within NE & NW 33-53-03-W5M within Lac Ste. Anne County. The open house will discuss the development details.

When: Tuesday December 2, 2025 from 2:00p.m. to 4:00p.m.

Where: Alberta Beach Agliplex Hall (4811 46a Ave, Alberta Beach, AB T0E 0A0)

For more information please contact:

Lesley Foy	Lucas Bodnar
Aspen Land Group Inc.	1531486 Alberta Ltd.
lfoy@aspenlandgroup.com	lbodnar@gjconstruction.ca
(780) 809-8191 Ext. 22	(780) 454-0700

Continued from page 8

endurance and sacrifice that helped shape Canada's national identity. It is a reminder of the price of peace and the strength of those who serve.

We remember them. We honour them. We will not forget.

#CanadaRemembers

- What kind of shorts do clouds wear? Thunderpants.
- You heard the rumor going around about butter? Never mind, I shouldn't spread it.
- Two windmills are standing on a wind farm. One asks "What's your favorite kind of music?" The other replies, "I'm a big metal fan."

MorENERGY
Veterinary Services

Box 249
5502 Lac St. Anne Trail N
Onoway, AB T0E 1V0

587.689.6890
info@morenergyvet.com
www.morenergyvet.com

Credible Or Clickbait? Finding The Right Financial Advice

(NC) Open conversations about money are powerful. They can help break taboos around topics like debt and savings and help you get a handle on your finances.

But research shows that only one-third of Canadians turn to someone for financial advice. Of those who do reach out, the most common source of advice is friends and family, followed by banks, investment firms or insurance providers with professional advisors or planners last on the list.

Getting financial advice—whether paid or free—can reduce your financial stress

Continued on page 10

Lac Ste. Anne
DENTURE CLINIC LTD.

Conveniently located in Onoway since 2004

Scheduling to suit your needs with either single appointments or multiple same-day appointments available to accomodate less travel time.

GRAHAM J. E. ANDERSON
DENTURIST

www.lacsteannedentureclinic.ca

780-967-7774

5112 Lac Ste Anne Trail South, Unit 1, Onoway, AB

Continued from page 11

to include your pet in your plans.

4. **Find pet-friendly accommodation.** Not all hotels or short-term rentals allow pets and even for those that do, the rules can vary greatly based on pet size and number, so it's best to confirm any policies before booking. For example, Choice Hotels Canada has hundreds of pet-friendly properties across the country, allowing you to experience more with your pet.
5. **Consider how others may view your pet.** Whether you're at a hotel or out and about in public spaces with your pet, always be courteous of others. Be mindful that not everyone is comfortable around animals. Keep pets leashed in shared spaces, always clean up after them and avoid leaving them unattended in the room unless allowed. This helps avoid disrupting other guests or causing unnecessary stress to your pet.

While travelling with a pet can take a bit of extra planning, it can be an unforgettable shared experience. You can find pet-friendly travel options at choicehotels.com.

1531486 Alberta Ltd.

Alberta Beach Pit Open House

1531486 Alberta Ltd. has applied to renew their development permit and redistrict the land for the existing gravel pit within NE & NW 33-53-03-W5M within Lac Ste. Anne County. The open house will discuss the development details.

When: Tuesday December 2, 2025 from 2:00p.m. to 4:00p.m.

Where: Alberta Beach Agliplex Hall (4811 46a Ave, Alberta Beach, AB T0E 0A0)

For more information please contact:

Lesley Foy	Lucas Bodnar
Aspen Land Group Inc.	1531486 Alberta Ltd.
lfoy@aspenlandgroup.com	lbodnar@gjconstruction.ca
(780) 809-8191 Ext. 22	(780) 454-0700

Legion

Onoway Legion 132

Mon., Dec. 1

7 pm

Onoway Legion

Annual General Meeting & Elections

Agenda

- Annual Report
- Review 2024/25 audited financial statements
- Appoint auditors for the 2025/26 fiscal year
- Elect Officers & Members for the Executive Committee

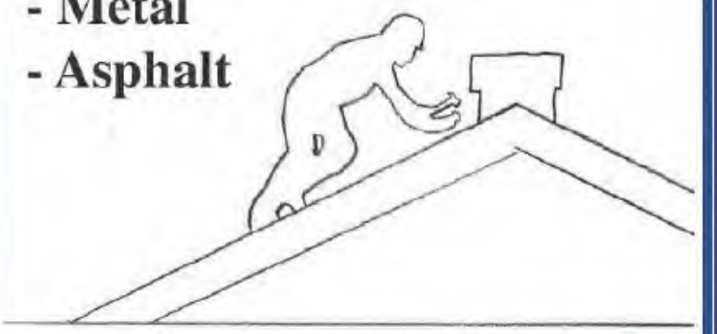
Election Positions:

President
1st Vice President
2nd Vice President
Secretary
Treasurer
Sergeant at Arms
Service Officer
Directors (5 positions)

Don't miss this important meeting!

Quality Roofing

- Metal
- Asphalt



Roofing installations and repairs

780-239-1491

Appendix C: List of Open House Attendees

1531486 Alberta Ltd.

Alberta Beach Pit - Open House & Public Consultation

December 2, 2025

Alberta Beach Agliplex Hall

Name	Ben Hillman
	This information redacted as per Protection of Privacy Act (POPA)
	This information redacted as per Protection of Privacy Act (POPA)
	This information redacted as per Protection of Privacy Act (POPA)
	This information redacted as per Protection of Privacy Act (POPA)
	This information redacted as per Protection of Privacy Act (POPA)
	This information redacted as per Protection of Privacy Act (POPA)
	This information redacted as per Protection of Privacy Act (POPA)

Name	Bo Kluyh
Address	
Phone #	
E-mail	

Name	DUANE DREWS
Address	
Phone #	
E-mail	

Name	FRITZ SONNENBERG
Address	
Phone #	
E-mail	

Name	Michael Ball & Lavena Satdeo
Address	
Phone #	
E-mail	

The privacy of all personal information will be maintained. Thank you for taking the time to attend this event.

1531486 Alberta Ltd.

Alberta Beach Pit - Open House & Public Consultation

December 2, 2025

Alberta Beach Agliplex Hall

Name	Eric Drews
Address	
Phone #	
E-mail	

Name	Pat Young
Address	This information redacted as per Protection of Privacy Act (POPA)

This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)

Name	Jason Hick. -
Address	This information redacted as per Protection of Privacy Act (POPA)

This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)

Name	Amy Warren
Address	This information redacted as per Protection of Privacy Act (POPA)

This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)

Name	
Address	
Phone #	
E-mail	

The privacy of all personal information will be maintained. Thank you for taking the time to attend this event.

1531486 Alberta Ltd

Alberta Beach Pit - Open House & Public Consultation

December 2, 2025

Alberta Beach Agliplex Hall

Name	Lorraine Ross
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	

Name	[illegible]
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	
This information redacted as per Protection of Privacy Act (POPA)	

Name	
Address	
Phone #	
E-mail	

Name	
Address	
Phone #	
E-mail	

Name	
Address	
Phone #	
E-mail	

The privacy of all personal information will be maintained. Thank you for taking the time to attend this event.

Appendix D: Comments From Attendees and Subsequent Email Correspondence

Dana Dunbar <ddunbar@aspenlandgroup.com>

1531486 Alberta Ltd - Alberta Beach Pit

1 message

Lucas Bodnar <lbodnar@gjconstruction.ca> Fri, Jan 9, 2026 at 9:17 AM
To: "This information redacted as per Protection of Privacy Act (POPA)"
Cc: "lfoy@aspenlandgroup.com" <lfoy@aspenlandgroup.com>, Dana Dunbar <ddunbar@aspenlandgroup.com>

Good morning Pat,

I am reaching out on behalf of 1531486 Alberta Ltd regarding the Alberta Beach Pit and the comment card you filled out.

On the comment card you noted that you were concerned with noise and would like to see a berm North to South on the West end of the project.

Once operational, we would have no issue stockpiling material North to South on the West end of the project to mitigate noise for nearby residences.

On top of building berms, we will also implement the following to mitigate noise impacts during operations:

- All equipment will be properly maintained.
- Strobe lights will be used during hours of darkness in place of backup beeper alarm systems.
- During daytime hours, directional white-noise backup alarms will be used instead of traditional alarms.
- All processing activities will occur only during permitted hours.
- Sight-and-sound berms will be strategically placed along the northern perimeter of the Site in N 33-053-03 W5M, across from residences, to reduce noise.
- All haul trucks will be kept in good working order.
- The use of engine retarder brakes will be prohibited within the pit and along the haul route.
- Unnecessary engine idling will be minimized, and equipment will be shut off when not in use.

Please let me know if you have any other questions.

Regards,

Lucas Bodnar | **G&J Construction Group LP / Joburg Aggregates Ltd.**

11610 151 Street | Edmonton, AB | T5M 4E9

PH: 780 454 0700

www.gjconstruction.ca

Asphalt | Concrete | Earthworks | Landscaping | Street Sweeping | Line Marking | Snow Removal | Equipment Rentals

Pat Young - December 2, 2025.pdf
1593K

Lesley Foy <lfoy@aspenlandgroup.com>

Re: Public consultation response 1531486 Alberta Ltd.

1 message

Debbie Giroux This information redacted Wed, Dec 3, 2025 at 4:11 PM
To: Lucas Bodnar <lbodnar@gjconstruction.ca>
Cc: lfoy@aspenlandgroup.com

Thank you for your response. I wanted to ensure the trucks aren't going to be accessing via 633 and RR34. And the road widening is another issue that I wanted to know. Appreciate the information.
Debbie Giroux

On Dec 3, 2025, at 2:06 PM, Lucas Bodnar <lbodnar@gjconstruction.ca> wrote:

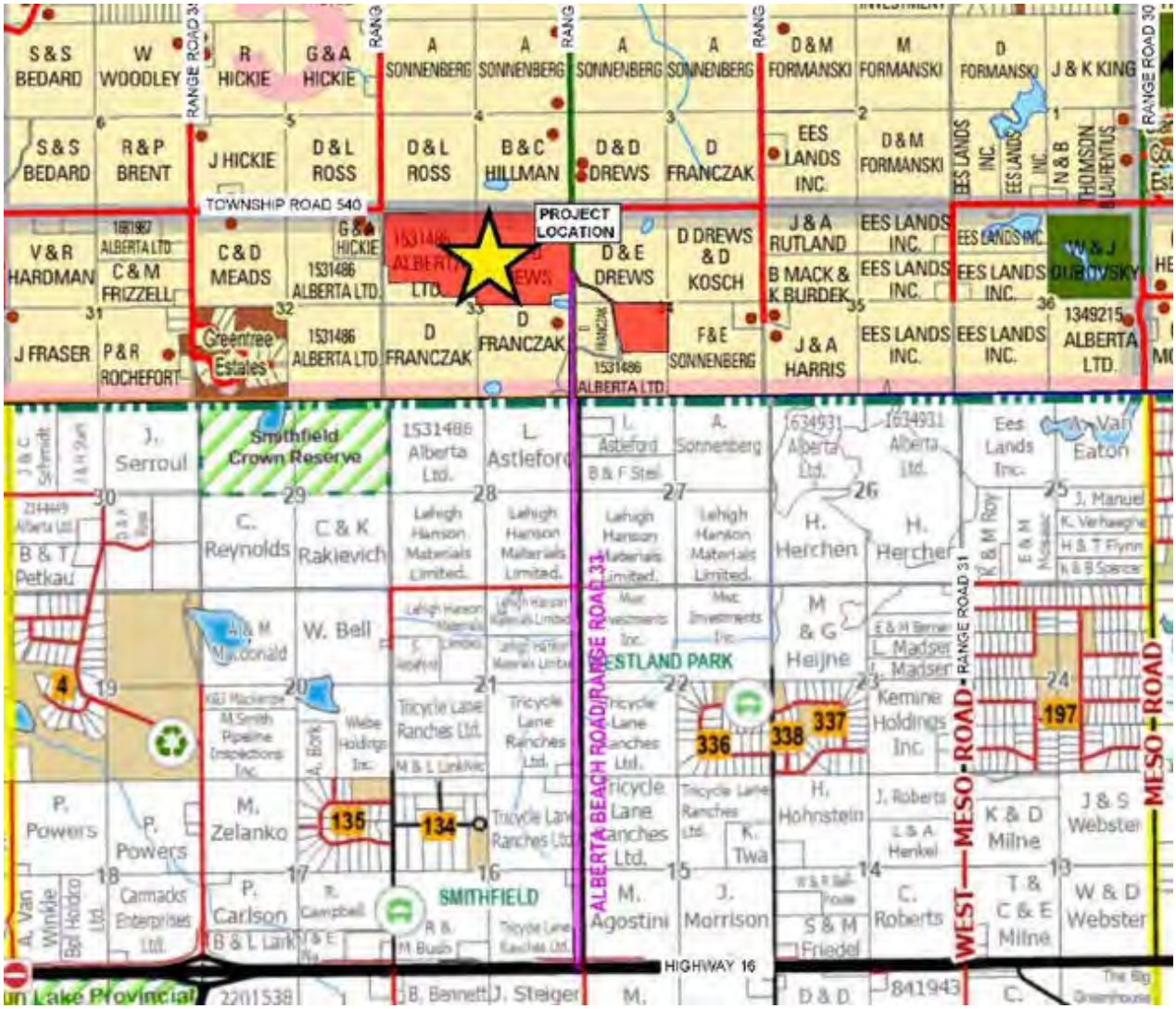
Hi Debbie,

Thank you for reaching out. Please see answers to your questions below:

1. The road will be widened and upgraded from the south end of the previous improvement in Parkland County to the pit entrance in Lac Ste. Anne County, at minimum. Lac Ste. Anne County is currently in the design phase for upgrading Range Road 33 from the county border to Highway 633. Prior to any pit operations, a road use agreement will be obtained from both Lac Ste. Anne County and Parkland County.

2. All trucks will access the pit via Highway 16 and Range Road 33. The designated truck route is shown in purple on the map below.

3. Trucks will *not* be permitted to access the pit from Range Road 34.



Let us know if you have any further questions.

Regards,

Lucas Bodnar | **G&J Construction Group LP / Joburg Aggregates Ltd.**

11610 – 151 Street | Edmonton, AB | T5M 4E9

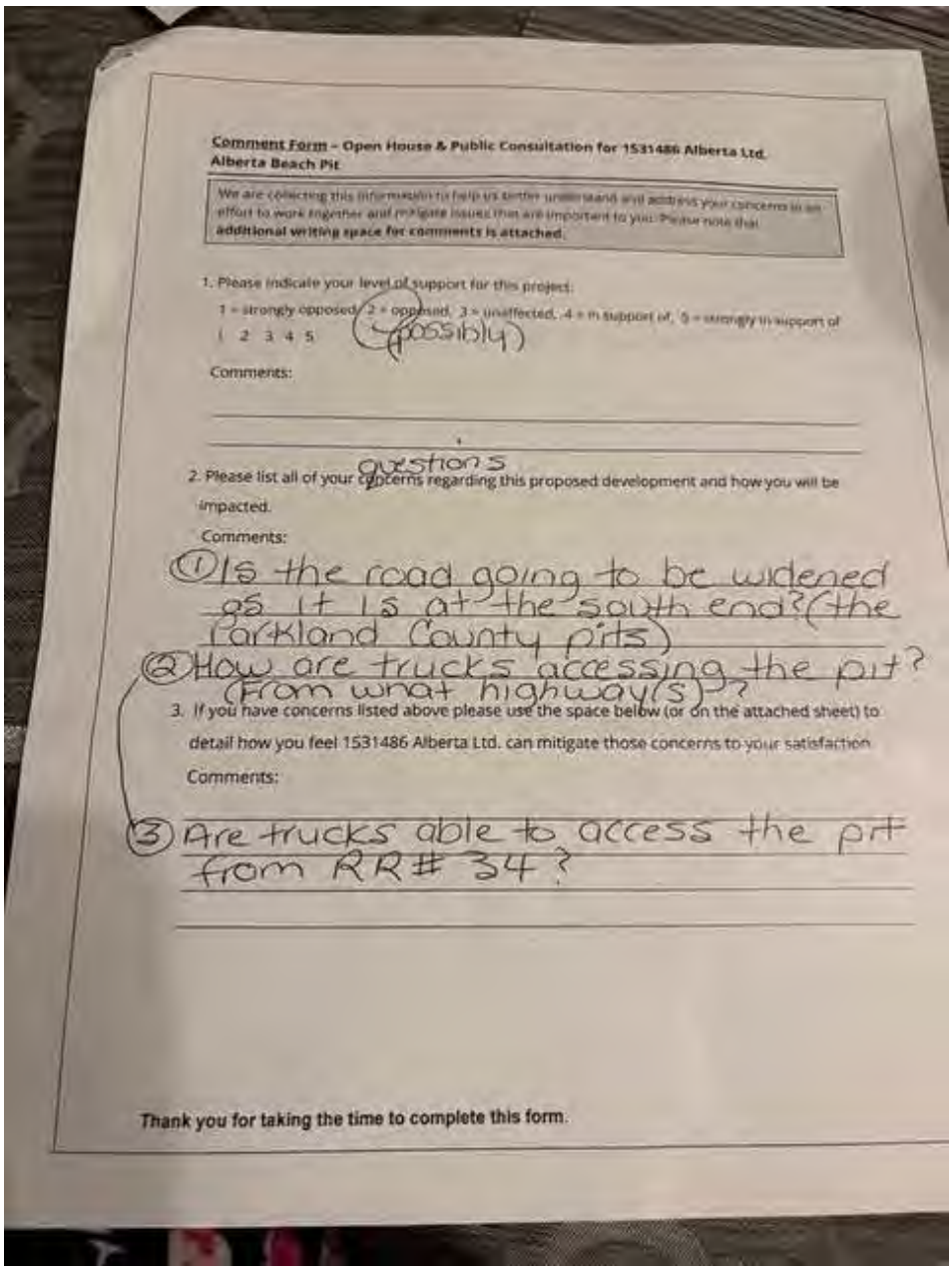
PH: 780-454-0700

www.gjconstruction.ca

Asphalt | Concrete | Earthworks | Landscaping | Street Sweeping | Line Marking | Snow Removal | Equipment Rentals

From: Debbie Giroux This information redacted as per Protection of Privacy Act
Sent: Monday, December 1, 2025 10:24 PM
To: lfoy@aspenlandgroup.com
Cc: Lucas Bodnar <lbodnar@gjconstruction.ca>
Subject: Public consultation response 1531486 Alberta Ltd.

Lesley Foy and Lucas Bodnar:
I planned on attending the open house tomorrow however my schedule has changed. For your attention I've photographed my questions I had planned to ask. Thank you
Debbie Giroux



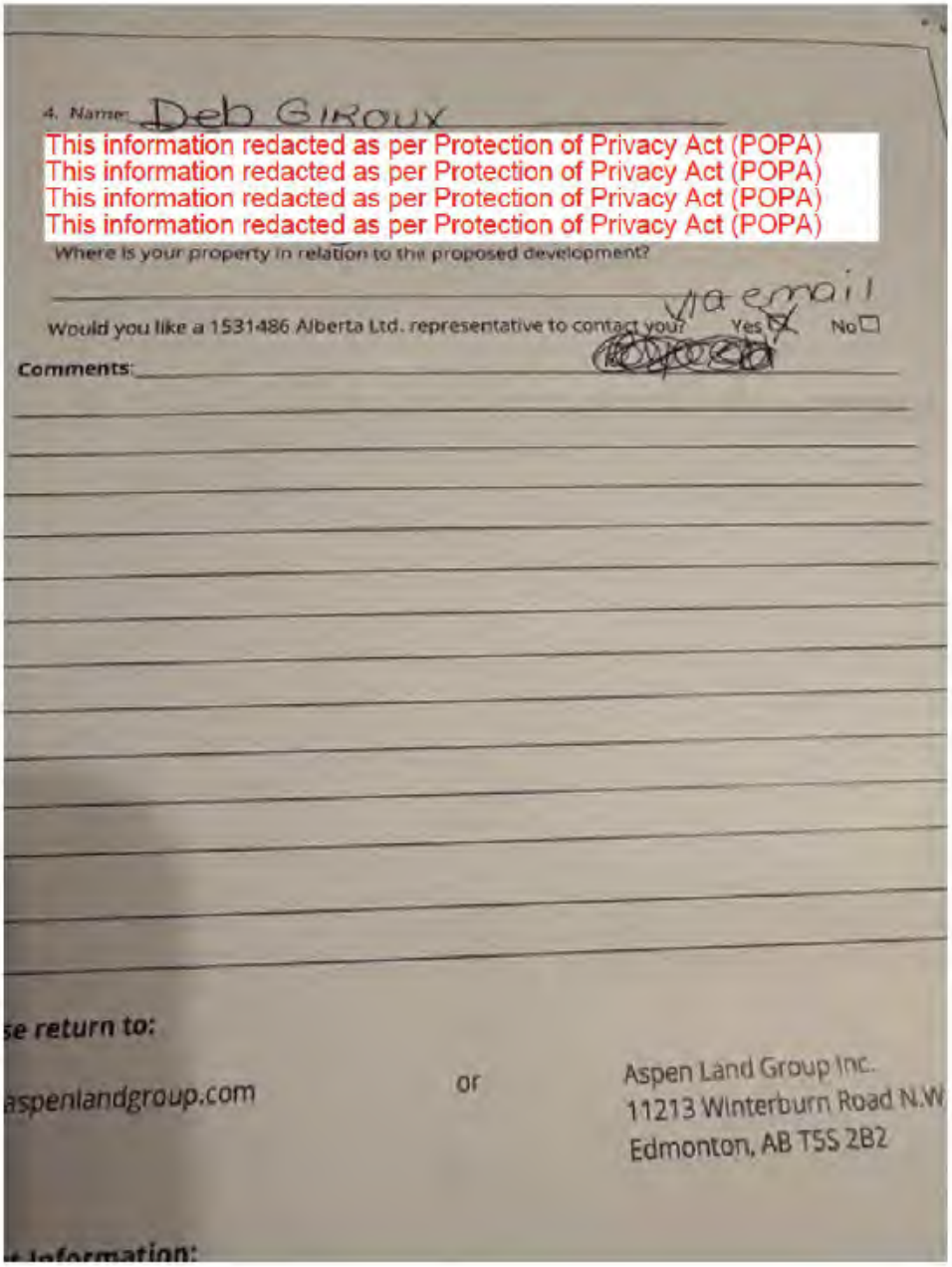
Comment Form – Open House & Public Consultation for 1531486 Alberta Ltd.
Alberta Beach Pit

We are collecting this information to help us better understand and address your concerns in an effort to work together and mitigate issues that are important to you. Please note that additional writing space for comments is attached.

1. Please indicate your level of support for this project:
1 = strongly opposed, 2 = opposed, 3 = unaffected, 4 = in support of, 5 = strongly in support of
1 2 3 4 5 (possibly)
Comments:

2. Please list all of your concerns (questions) regarding this proposed development and how you will be impacted.
Comments:
① Is the road going to be widened as it is at the south end? (the Parkland County pits)
② How are trucks accessing the pit? (From what highway(s)?
3. If you have concerns listed above please use the space below (or on the attached sheet) to detail how you feel 1531486 Alberta Ltd. can mitigate those concerns to your satisfaction
Comments:
③ Are trucks able to access the pit from RR# 34?

Thank you for taking the time to complete this form.



4. Name: Deb GIROUX

This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)

Where is your property in relation to the proposed development?

Would you like a 1531486 Alberta Ltd. representative to contact you? Yes ☒ No ☐ via email

Comments:

se return to:

aspenlandgroup.com

or

Aspen Land Group Inc.
11213 Winterburn Road N.W
Edmonton, AB T5S 2B2

e information:

Comment Form – Open House & Public Consultation for 1531486 Alberta Ltd.
Alberta Beach Pit

We are collecting this information to help us better understand and address your concerns in an effort to work together and mitigate issues that are important to you. Please note that **additional writing space for comments is attached.**

1. Please indicate your level of support for this project.

   1 = strongly opposed, 2 = opposed, 3 = unaffected, 4 = in support of, 5 = strongly in support of

   1 2 3 4 5

   Comments:

   could be in favor of pit if a berm was put up towards my place in greenting estates subdivision

2. Please list all of your concerns regarding this proposed development and how you will be impacted.

   Comments:

   noise

3. If you have concerns listed above please use the space below (or on the attached sheet) to detail how you feel 1531486 Alberta Ltd. can mitigate those concerns to your satisfaction.

   Comments:

   would like to see a berm North to south on the west end of project.

Please note, the privacy of any shared information will be maintained.
Thank you for taking the time to complete this form.

Lesley Foy <lfoy@aspenlandgroup.com>

Re: Public consultation response 1531486 Alberta Ltd.

1 message

Debbie Giroux This information redacted Wed, Dec 3, 2025 at 4:11 PM
To: Lucas Bodnar <lbodnar@gjconstruction.ca>
Cc: lfoy@aspenlandgroup.com

Thank you for your response. I wanted to ensure the trucks aren't going to be accessing via 633 and RR34. And the road widening is another issue that I wanted to know. Appreciate the information.
Debbie Giroux

On Dec 3, 2025, at 2:06 PM, Lucas Bodnar <lbodnar@gjconstruction.ca> wrote:

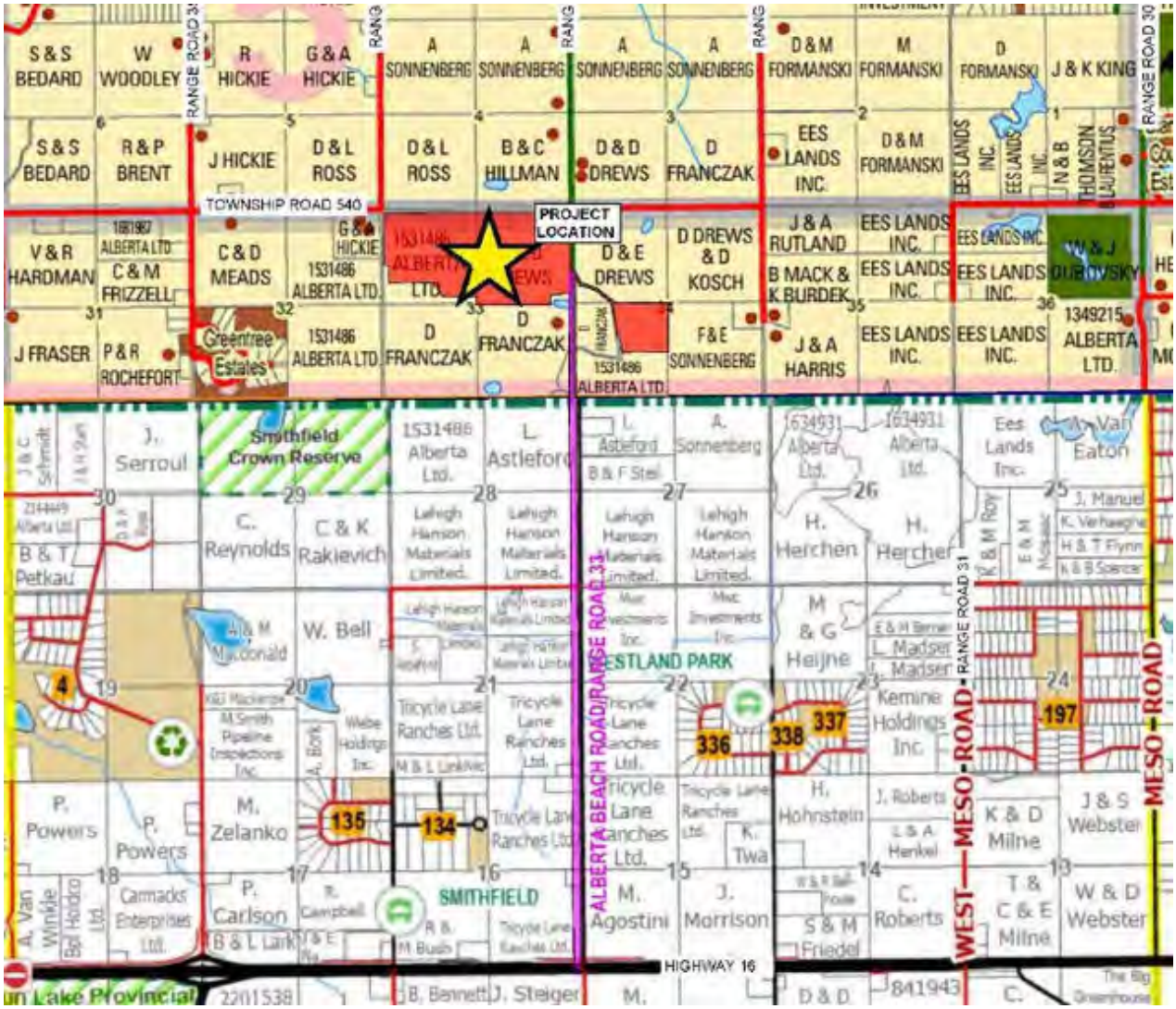
Hi Debbie,

Thank you for reaching out. Please see answers to your questions below:

1. The road will be widened and upgraded from the south end of the previous improvement in Parkland County to the pit entrance in Lac Ste. Anne County, at minimum. Lac Ste. Anne County is currently in the design phase for upgrading Range Road 33 from the county border to Highway 633. Prior to any pit operations, a road use agreement will be obtained from both Lac Ste. Anne County and Parkland County.

2. All trucks will access the pit via Highway 16 and Range Road 33. The designated truck route is shown in purple on the map below.

3. Trucks will *not* be permitted to access the pit from Range Road 34.



Let us know if you have any further questions.

Regards,

Lucas Bodnar | **G&J Construction Group LP / Joburg Aggregates Ltd.**

11610 – 151 Street | Edmonton, AB | T5M 4E9

PH: 780-454-0700

www.gjconstruction.ca

Lesley Foy <lfoy@aspenlandgroup.com>

Public Consultation for 1531486

1 message

Jon Rutland This information
To: "lfoy@aspenlandgroup.com" <lfoy@aspenlandgroup.com>

Tue, Dec 2, 2025 at 1:13 AM

Please see attached comment form.

Sent from my iPhone

gravel pit project.pdf
210K

Comment Form – Open House & Public Consultation for 1531486 Alberta Ltd.
Alberta Beach Pit

We are collecting this information to help us better understand and address your concerns in an effort to work together and mitigate issues that are important to you. Please note that **additional writing space for comments is attached.**

1. Please indicate your level of support for this project.

   1 = strongly opposed, 2 = opposed, 3 = unaffected, 4 = in support of, 5 = strongly in support of

   1 2 3 4 5

   Comments:

   I cannot answer this without more info

2. Please list all of your concerns regarding this proposed development and how you will be impacted.

   Comments:

   - Noise concerns, dust / silica concerns, damage to county roads etc..
   - Devaluation of property due to project in area.

3. If you have concerns listed above please use the space below (or on the attached sheet) to detail how you feel 1531486 Alberta Ltd. can mitigate those concerns to your satisfaction.

   Comments:

Thank you for taking the time to complete this form.

4. Name: Jan Rutland

This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)
This information redacted as per Protection of Privacy Act (POPA)

Where is your property in relation to the proposed development?

1 range road east of project

Would you like a 1531486 Alberta Ltd. representative to contact you? Yes ☒ No ☐

Comments: I would like to know what opportunities will be available for local residents and contractors. I have a Heavy Equipment repair company and would like to know if local residents who are directly affected will be given priority for contracts within the project. Essentially what is in it for locals who will be affected?

Please return to:

lfoy@aspenlandgroup.com or Aspen Land Group Inc.
11213 Winterburn Road N.W
Edmonton, AB T5S 2B2

Contact Information:

Lesley Foy
(780) 809-8191 Ex. 22
lfoy@aspenlandgroup.com

or

Lucas Bodnar
(780) 454-0700
lbodnar@gjconstruction.ca

Thank you for taking the time to complete this form.

Asphalt | Concrete | Earthworks | Landscaping | Street Sweeping | Line Marking | Snow Removal | Equipment Rentals

From: Lesley Foy <lfoy@aspenlandgroup.com>
Sent: Wednesday, December 3, 2025 11:32 AM
To: Jon Rutland This information
Cc: Lucas Bodnar <lbodnar@gjconstruction.ca>
Subject: Re: Public Consultation for 1531486

Hi Jon,

Thank you for taking the time to fill out and submit the comment form.

I noticed your request for a representative to contact you to discuss the operation and application details. I have copied Lucas Bodnar on this email, and he will be reaching out to you shortly.

Regards,
Lesley Foy

On Tue, Dec 2, 2025 at 1:13 AM Jon Rutland <j This information redacted as per wrote:

> Please see attached comment form.
>
> Sent from my iPhone

From: Lucas Bodnar <lbodnar@gjconstruction.ca>
Sent: Friday, December 12, 2025 3:43 PM
To: Jon Rutland
Cc: lfoy@aspenlandgroup.com
Subject: RE: Public Consultation for 1531486

Hi Jon,

I appreciate your openness and the clarity around the concerns you and your neighbours have regarding noise impacts. While I understand the mitigations may not fully eliminate operational noise, your insight as someone living nearby is valuable, and it's important for us to keep that in mind as the project progresses.

I also appreciate you highlighting opportunities for local involvement. Ensuring that local contractors and businesses are considered wherever possible is an important way to strengthen community support and create shared benefits. As we move closer to the operational phase, we will certainly look at how local expertise can be included, and I'll make sure your request for priority consideration is part of those discussions.

Thank you again for engaging constructively and for your willingness to work with us rather than against the project. I will keep you updated as timelines firm up, and I'm happy to stay connected as things continue to move forward.

Regards,

Lucas Bodnar | **G&J Construction Group LP / Joburg Aggregates Ltd.**
11610 – 151 Street | Edmonton, AB | T5M 4E9
PH: 780-454-0700
www.gjconstruction.ca

Asphalt | Concrete | Earthworks | Landscaping | Street Sweeping | Line Marking | Snow Removal | Equipment Rentals

---

From: Jon Rutland <This information
d t d
Sent: Wednesday, December 10, 2025 1:37 PM
To: Lucas Bodnar <lbodnar@gjconstruction.ca>
Subject: Re: Public Consultation for 1531486

Thank you for the quick response Lucas,

I appreciate the explanation of mitigations that are being implemented, however being that there are gravel pits further up the county road that can be heard from my place I can assure you that no berms, white noise backup alarms or any of these will eliminate the noise from a dozers/excavators rattling around the claim.

I am not looking to stop the project or derail permits etc... What I would like to see is for some of us who will be directly affected have some opportunities within the project.

For example:

- If there are opportunities to hire local contractors over Edmonton based businesses, then we should be given priority. If us locals are invested in the project in some way it definitely gives less reason to be opposed to it. If there is zero gain except the county road upgrading or some tax revenue for the county councilors to waste then of course people will be 100% opposed to the project.

Thank you for listening and hearing out my concerns, I hope to hear from you in the future as the project is closer to operation.

R5 Farm and Mechanical
Jon Rutland
This
information

Sent from Outlook

From: Lucas Bodnar <lbodnar@gjconstruction.ca>
Sent: December 3, 2025 2:27 PM
To: Jon Rutland This information
Cc: Lesley Foy <lfoy@aspenlandgroup.com>
Subject: RE: Public Consultation for 1531486

Hi Jon,

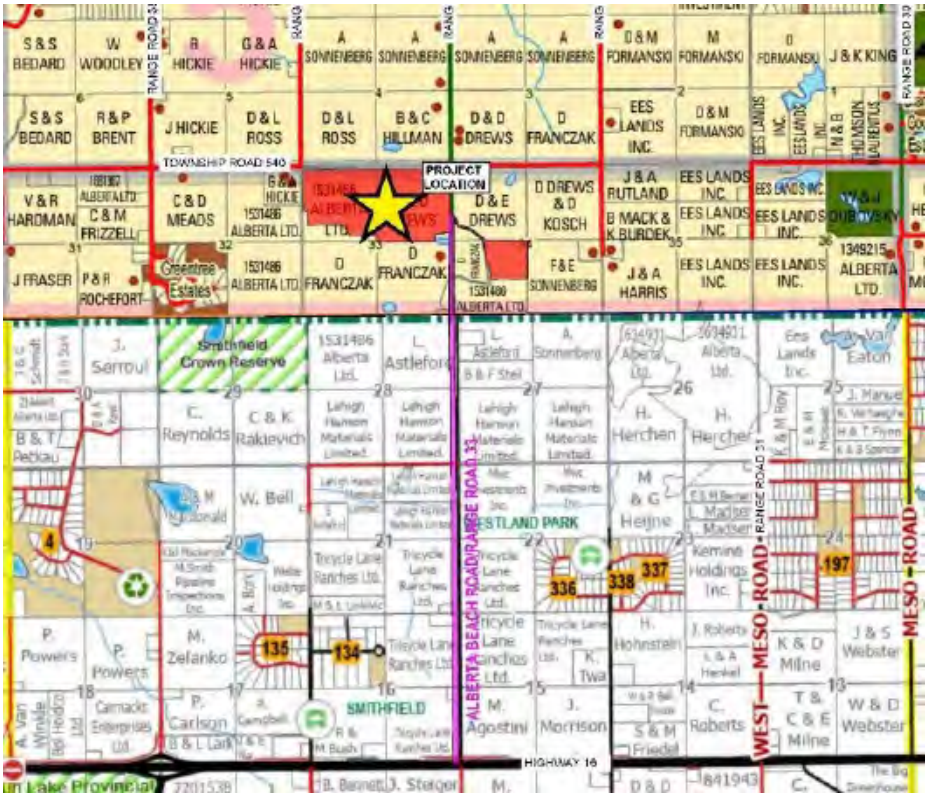
Thank you, for reaching out. Please see answers to your questions below:

Dust and erosion within the Site will be managed through regular watering of internal roads and the vegetation of sight-and-sound berms and long-term reclamation material stockpiles. Pit run aggregate will be extracted in a damp to wet condition, which will significantly reduce dust generated during crushing. Crushers will be positioned at the lowest practical elevation, all aggregate loads will be properly enclosed and posted speed limits will be strictly followed along the haul routes. Progressive reclamation will begin as early as possible to limit the overall area of active disturbance.

To mitigate noise impacts during operations, the following measures will be implemented:

- All equipment will be properly maintained.
- Strobe lights will be used during hours of darkness in place of backup beeper alarm systems.
- During daytime hours, directional white-noise backup alarms will be used instead of traditional alarms.
- All processing activities will occur only during permitted hours.
- Sight-and-sound berms will be strategically placed along the northern perimeter of the Site in N 33-053-03 W5M, across from residences, to reduce noise.
- All haul trucks will be kept in good working order.
- The use of engine retarder brakes will be prohibited within the pit and along the haul route.
- Unnecessary engine idling will be minimized, and equipment will be shut off when not in use.

The road will be widened and upgraded from the south end of the previous improvement in Parkland County to the pit entrance in Lac Ste. Anne County, at minimum. Lac Ste. Anne County is currently in the design phase to upgrade Range Road 33 from the county border to Highway 633. Prior to commencing operations, a road use agreement will be obtained from both Lac Ste. Anne County and Parkland County. All trucks will access the pit from Highway 16 and Range Road 33; the designated truck route is shown in purple below.



Regarding concerns about potential property devaluation, the Site has held a permit since 2015 and is now applying for renewal. We have not observed any negative impacts on property values during that time. Once operations begin, our intent is to extract the gravel and reclaim the land back to productive farmland as quickly as possible to reduce disruption for nearby residents.

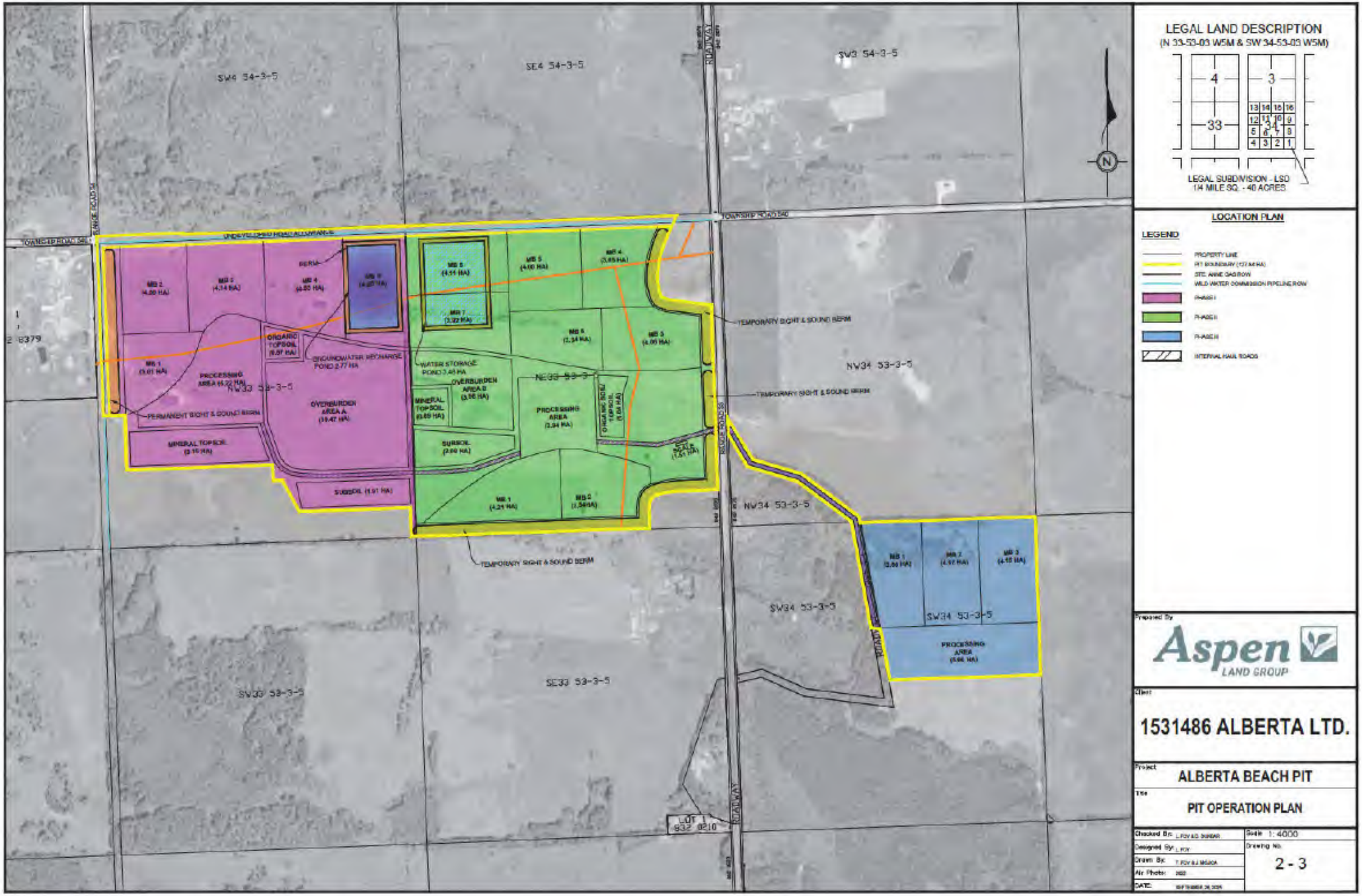
We are a local, family-owned and operated business, and we remain committed to providing opportunities within the communities where we operate. As part of this project, we will contribute to upgrades to Range Road 33 and the designated haul route, and we anticipate providing approximately $120,000 per year—roughly $2.4 million over the life of the project—in Community Aggregate Payment (CAP) Levy payments to Lac Ste. Anne County to be used at their discretion.

Let us know if you have any further questions and we would be happy to discuss.

Regards,

Lucas Bodnar | **G&J Construction Group LP / Joburg Aggregates Ltd.**
11610 – 151 Street | Edmonton, AB | T5M 4E9
PH: 780-454-0700
www.gjconstruction.ca

Appendix E: Open House Posters



LEGAL LAND DESCRIPTION
(N 33-53-03 W5M & SW 34-53-03 W5M)

LOCATION PLAN

LEGEND

- PROPERTY LINE
- PIT BOUNDARY (137.46 HA)
- STE. ANNE GAS ROW
- WILD WATER COMMISSION PIPELINE ROW
- PHASE I
- PHASE II
- PHASE III
- INTERNAL HAUL ROADS

Prepared By

Aspen LAND GROUP

Client

1531486 ALBERTA LTD.

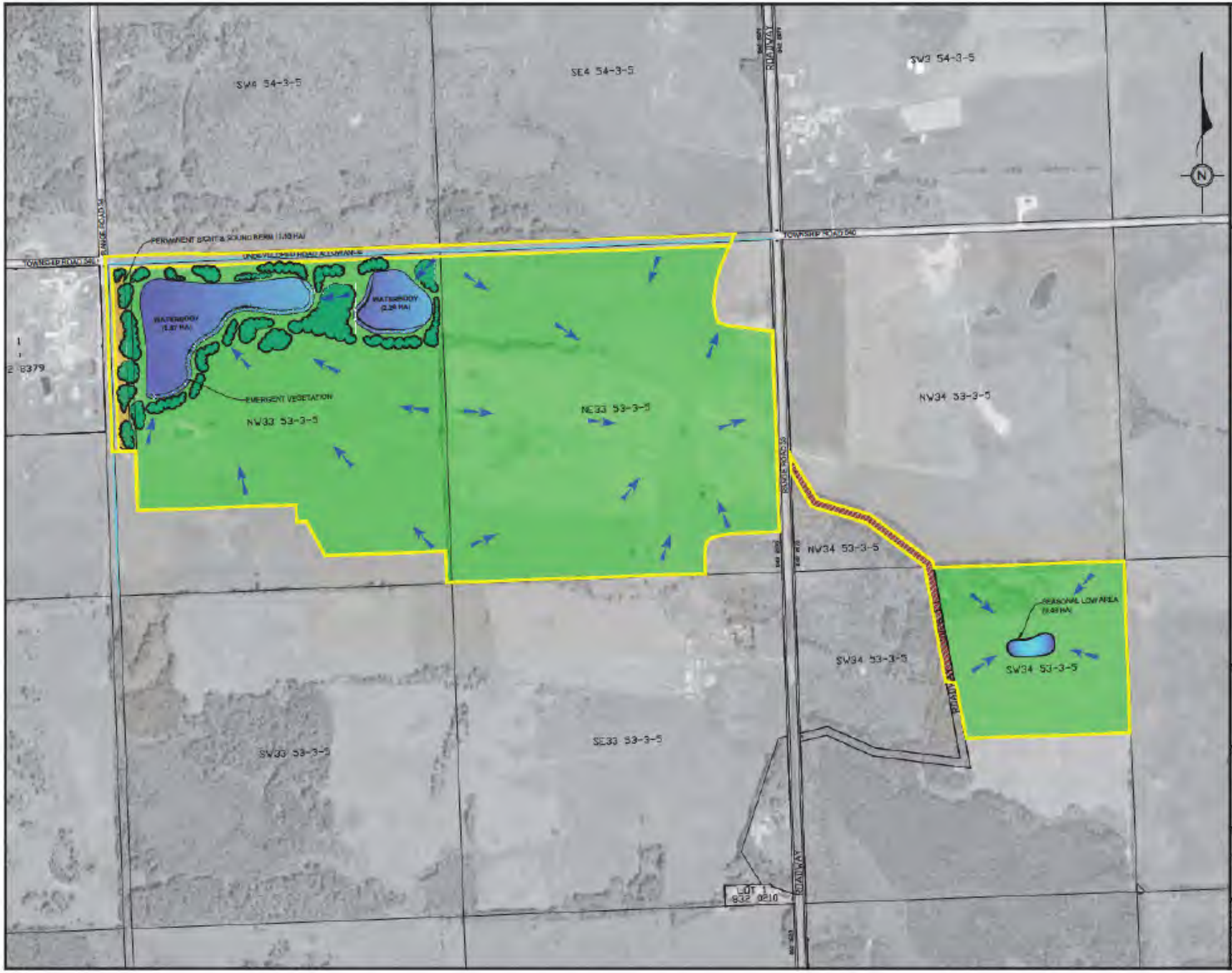
Project

ALBERTA BEACH PIT

Title

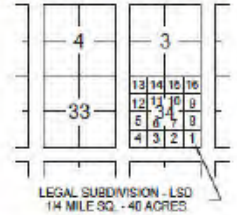
PIT OPERATION PLAN

Checked By: L.FOY AG. SHINEAR	Scale: 1: 4000
Designed By: L.FOY	Drawing No. 2 - 3
Drawn By: T.FOY & J.MUGA	
Air Photo: 2022	
DATE: SEPTEMBER 26 2024	



LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- PROPERTY LINE
- PIT BOUNDARY (127.90 HA)
- WILD WATER COMMISSION PIPELINE ROW
- UPGRADED ROADWAY 5025 ST (1.56 HA)
- CULTIVATION/PASTURE (111.03 HA)
- WATERBODIES (4.37 HA)
- EMERGENT VEGETATION WITHIN WATERBODIES (0.99 HA)
- UPLAND HABITAT (5.97 HA)
- DRAINAGE ARROWS

Prepared By:

Aspen LAND GROUP

Client:

1531486 ALBERTA LTD.

Project:

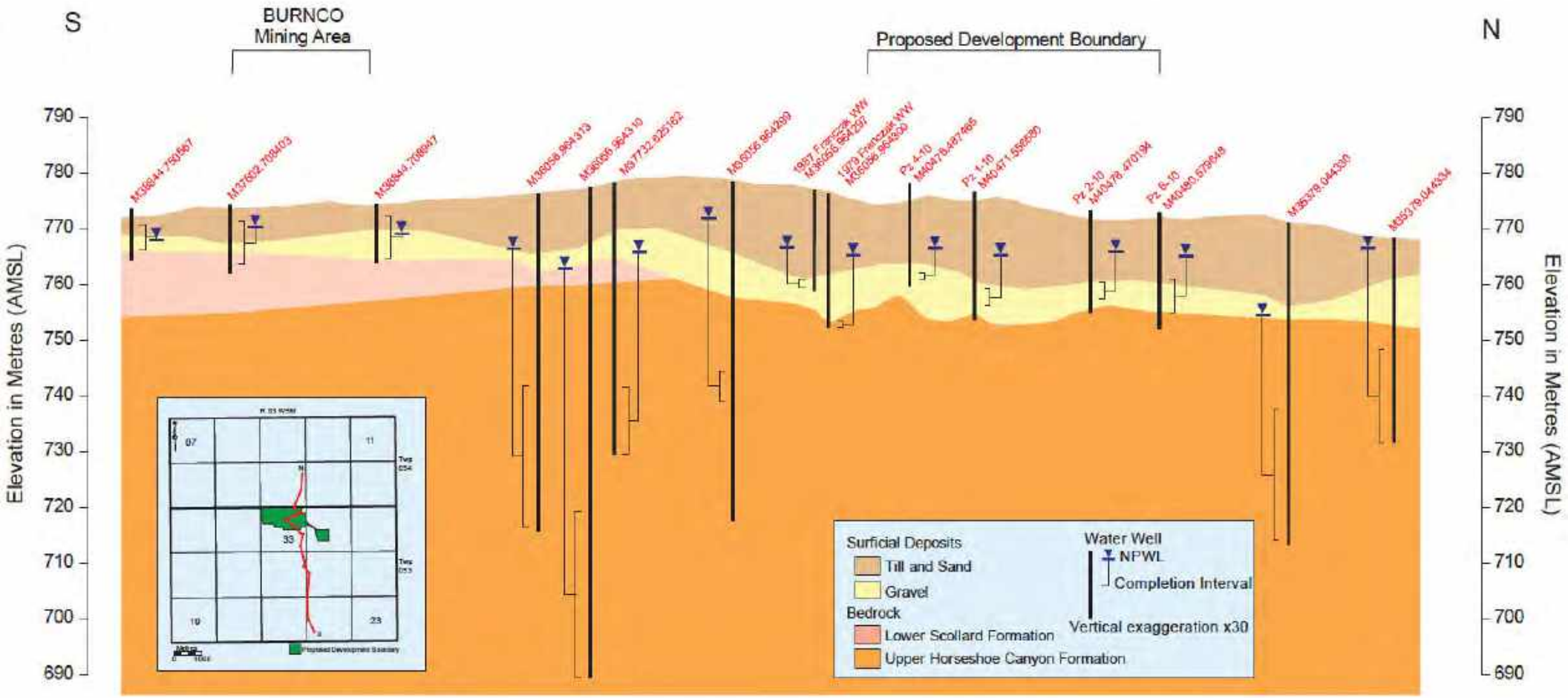
ALBERTA BEACH PIT

Title:

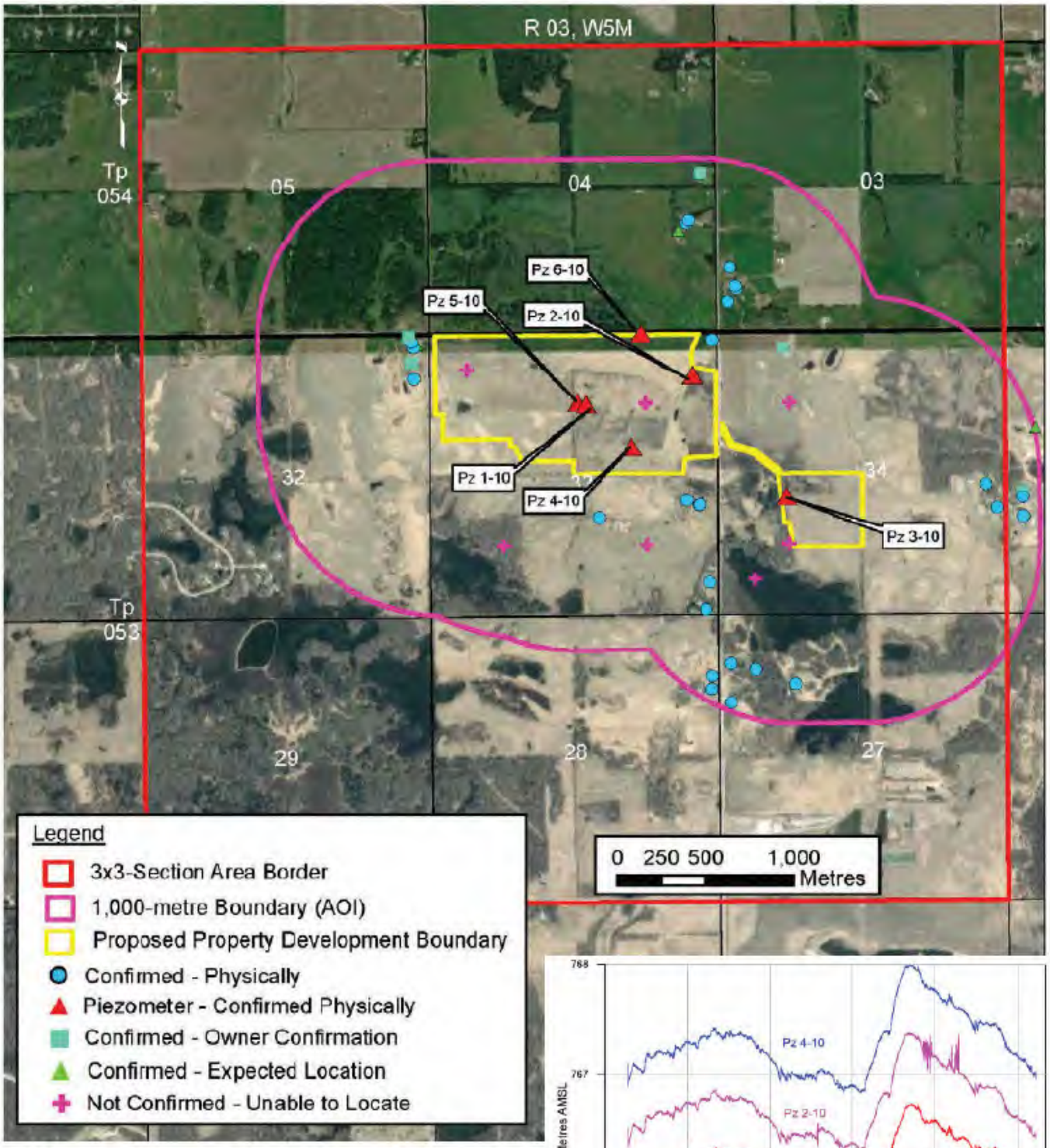
RECLAMATION PLAN

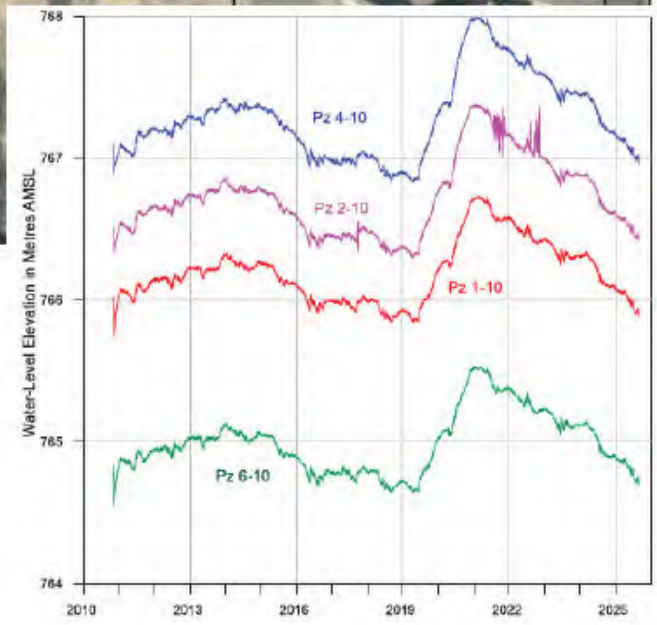
Checked By: L.FOY & D.WINDER	Scale: 1: 4000
Designed By: L.FOY	Drawing No.
Drawn By: L.FOY & J.MOJICA	3 - 3
Air Photo: 2022	
DATE: MARCH 17, 2023	

South - North Cross Section through Alberta Beach Pit



Field Verified Well Survey & Hydrograph





HCL
hydrogeological consultants ltd.

MR-0266 / 25-0191.01

Appendix K

Question and Responses from Lac Ste. Anne County

ASPEN LAND GROUP INC.

June 20, 2013

Lac Ste. Anne County
P.O. Box 219, 4928 Langston Street
Sangudo, AB T0E 2A0

Sent via Email: mferris@gov.lacsteanne.ab.ca

Attention: **Matthew Ferris**
Manager of Planning and Development

Reference: **1531486 Alberta Ltd.**
Alberta Beach Pit
N 33 & SW 34-053-03 W5M
Aggregate Applications Processing Form – Discretionary Checklist

On behalf of 1531486 Alberta Ltd., Aspen Land Group Inc. (ALGI) has completed a response to the questions you emailed ALGI on May 21, 2013 in regards to the aggregate application processing checklist submitted to Lac Ste. Anne County (LSAC) on April 12, 2013 for the Alberta Beach Pit located within the NW 33 & SW 34-053-03 W5M. The responses to your questions are included below with a copy of each question.

1. With multiple items labeled appendix there is some confusion on which diagrams I'm suppose to look at in reference to our checklist.

   The appendices referenced in the checklist correspond with information within the appendices of the Pit Registration, *Water Act* Authorizations & Development Permit Application report, as listed on Page iv of the report and on the title inserts on the front and sides of the report binders. Where Appendix C is referenced in the checklist, the corresponding technical report(s) located within Appendix C of the Pit Registration, *Water Act* Authorizations & Development Permit Application report is also listed under the "NOTES" column of the checklist. Please note that appendices within any of the technical reports in Appendix C are not referenced in the checklist.

2. An overall site plan seems to be missing but this could be a result of the above issue. Please provide.

   Appendix G of the Pit Registration, *Water Act* Authorizations & Development Permit Application report contains the mining and reclamation drawings, or the overall site plan. Appendix G is referenced several times in the checklist, with a list of which drawings (1-16) apply to the checklist item.

3. The report mentions 4 animal species ranked as sensitive or threatened what steps are being taken to ensure the impact on them in negligible.

   As discussed in Section 6.0 of Spencer Environmental Management Services Ltd.'s (Spencer) report included in Appendix C of the Pit Registration, *Water Act* Authorizations & Development Permit Application report, two of the four special status species, common yellowthroat and sora were located outside the proposed impact area. Although the barn swallow and western toad were found within the proposed impact area, the habitat quality within impacted areas is mostly rated as low due to agricultural activities in Spencer's report. The proposed development plan would result in the loss of wetland habitat within the project Site; however wetland loss will be compensated through collaboration with Duck Unlimited Canada, as discussed in Section 2.1.2.4 (pages 2-3) of the Pit Registration, *Water Act* Authorizations & Development Permit Application report.

4. Your site security plan is insufficient, fence, gate and signs is not enough please provide more detail.

   There is currently a fence around the property boundary of the NE and NW 33-053-03 W5M. A fence will not be installed around the mining area within the SW 34-052-03 W5M as this area is not adjacent to a public roadway or within 100 m of a residential dwelling. Secure gates will be installed at both entrances to the Site which lead into the Phase II and Phase III areas from Range Road 33 as shown on Drawing No. 5 (Appendix G) of the Pit Registration, *Water Act* Authorizations & Development Permit Application report. The gates will be locked during non-operating times.

   As outlined in Section 5.13.4 of the Pit Registration, *Water Act* Authorizations & Development Permit Application report, signage will be installed at the Site entrances and along the haul route to inform local traffic of the project. Signage will also be installed around the perimeter of the Site. "DANGER OPEN PIT" and "NO TRESPASSING" signs will be placed at the Site entrances and around the Site perimeter. "TRUCK TURNING" signs will be installed at turning points along the haul route. Signs will conform to municipal and provincial requirements and the location of signs shall be approved by Public Works for Lac Ste. Anne County and shall be of a professional grade as approved by Alberta Transportation.

   As a public safety measure, lighting will also be installed onsite. Lighting will be positioned so that no direct light is directed at any of the three nearby residences. A safety and emergency response plan will be also be developed which has adequate provisions for fire prevention and protection to the satisfaction of the manager of the Emergency Services Department for Lac Ste. Anne County.

5. Please provide the contact info of the people within 2km around the site. You provided their names but we want to ensure you do have their contact information so that we know you will or have contacted them.

The contact information of the landowners within 2 km of the Site, within Lac Ste. Anne County is shown in Table 1 below.

Table 1. Landowners Within 2 km of the Site

Location	Registered Owners and Contact Information
SE 05-054-03 W5M	Lydia Ross 52 Gariepy Crescent Edmonton, AB T6M 1A1
SW 04-054-03 W5M	Lydia Ross 52 Gariepy Crescent Edmonton, AB T6M 1A1
NW 04-054-03 W5M	Benjamin Walter Sonnenberg (780) 924-2482 54032 Range Road 33 Alberta Beach, AB
NE 04-054-03 W5M	Benjamin Walter Sonnenberg (780) 924-2482 54032 Range Road 33 Alberta Beach, AB
SE 04-054-03 W5M	Benjamin Walter Sonnenberg and Arthur Sonnenberg (780) 924-2482 54032 Range Road 33 Alberta Beach, AB
SW 03-054-03 W5M	Donald Drews (780) 924-2463 P.O. Box 60 Alberta Beach, AB T0E 0A0
NW 03-054-03 W5M	Benjamin Walter Sonnenberg (780) 924-2482 54032 Range Road 33 Alberta Beach, AB
NE 03-054-03 W5M	Arthur E. Sonnenberg (780) 924-2482 54032 Range Road 33 Alberta Beach, AB
SE 03-054-03 W5M	Stephen Franczak, Maggie Franczak and David Franczak (780) 924-2440 P.O. Box 328 Alberta Beach, AB T0E 0A0
SW 34-053-03 W5M	1531486 Alberta Ltd. (780) 454-0700 11610 – 151 Street Edmonton, AB T5M 4E9
NW 34-053-03 W5M	Donald Drews (780) 924-2463 P.O. Box 60 Alberta Beach, AB T0E 0A0
NE 34-053-03 W5M	Fritz R. Sonnenberg (780) 924-3392 P.O. Box 25 Alberta Beach, AB T0E 0A0
SE 34-053-03 W5M	Fritz R. Sonnenberg (780) 924-3392 P.O. Box 25 Alberta Beach, AB T0E 0A0
SW 33-053-03 W5M	Stephen Franczak (780) 924-2440 P.O. Box 328 Alberta Beach, AB T0E 0A0

Table 1. Landowners Within 2 km of the Site	
Location	**Registered Owners and Contact Information**
NW 33-053-03 W5M	1531486 Alberta Ltd. (780) 454-0700 11610 – 151 Street Edmonton, AB T5M 4E9
NE 33-053-03 W5M	Donald Drews (780) 924-2463 P.O. Box 60 Alberta Beach, AB T0E 0A0
SE 33-053-03 W5M	Stephen Franczak (780) 924-2440 P.O. Box 328 Alberta Beach, AB T0E 0A0
SE 33-053-03 W5M	Marius Whalen and Amy Warren Site 105, Comp 6, RR 1 Alberta Beach, AB T0E 0A1
NE 32-053-03 W5M	1531486 Alberta Ltd. (780) 454-0700 11610 – 151 Street Edmonton, AB T5M 4E9
SE 32-053-03 W5M	1531486 Alberta Ltd. (780) 454-0700 11610 – 151 Street Edmonton, AB T5M 4E9

6. What you have proposed to mitigate sound is insufficient the county would like more done to reduce the sound.

In addition to the proposed measures to mitigate noise at the Site as outlined in Section 5.16 of the Pit Registration, *Water Act* Authorizations & Development Permit Application report, the following measures will be implemented:

- The use of particularly noisy vehicles will be limited.
- Crushing and washing will both initially occur at the wash plant site located within the NW 33-053-03 W5M while mining of Phase I occurs. Once mining progresses to Phase II and II, crushing will occur at the crushing plant site located within the NE 33-053-03 W5M. Both locations are centrally located within the quarter section away from the pit boundary and the three residences. Site and sound berms and treed areas along the perimeter of the Site will buffer the residences from noise.
- The crusher muffler will be pointed away from the direction of the residences as much as possible.
- All existing stands of trees and shrubbery just outside the Site will be preserved for sound attenuation purposes.
- The height from which material is dropped into or from trucks will be minimized as much as possible.
- Equipment will be shut off when not in use and engines will not be unnecessarily revved.
- Truck tailgates will be kept closed where possible.
- Where the noise is directional, the source will be pointed away from noise-sensitive locations.
- Internal haul routes will be properly maintained and steep gradients will be avoided.
- Attention will be given to local weather conditions, particularly wind speed and direction.

7. Please provide the public consultation report I cannot seem to locate it in the binder.

   The Public Open House Report, prepared by Marcomm Works is located within Appendix C of the Pit Registration, *Water Act* Authorizations & Development Permit Application report. It is located within Binder Volume 2, Tab No. 3. A copy of the report is also attached for your convenience.

8. I may have missed it but in regards to the reclaim process is it to take place gradually or all at once.

   Progressive reclamation will be implemented for this operation (i.e. it will progress gradually). Section 6.0 of the Pit Registration, *Water Act* Authorizations & Development Permit Application report outlines the Conservation and Reclamation Plan and provides an in depth explanation as to how the Site will be mined implementing a direct placement technique once mining progresses into the fourth mining block of each phase.

If you require any further information or have any questions please call the undersigned at (780) 934-0211.

Yours truly,

This information redacted as per Protection of Privacy Act (POPA)

Michele Corry, P. Ag.
Aspen Land Group Inc.

Cc: Peter Wall, 1531486 Alberta Ltd.

Attachments: Public Open House Report - Marcomm Works

March 2, 2015

Lac Ste. Anne County
4928 Langston Street
Box 219
Sangudo, AB T0E 2A0

Attention: Matthew Ferris, RRP, MCIP
Manager of Planning and Development, Lac Ste. Anne County

Reference: 1531486 Alberta Ltd. - Alberta Beach Pit
Review of the Alberta Beach (1531486 Alberta Ltd.) Sand and Gravel Operation,
Lac Ste. Anne County, Alberta

Aspen Land Group Inc. has been retained by 1531486 Alberta Ltd. to prepare a response to the Review of the Alberta Beach (1531486 Alberta Ltd.) Sand and Gravel Operation, Lac Ste. Anne County, Alberta report received on January 26, 2015 regarding 1531486 Alberta Ltd.'s development permit application. Responses to your questions are included below with a copy of the question.

1) Hydrogeology

Section 2.1.2 Evaluation of Results

1. *An assessment of potential impacts to natural heritage features outside of the extraction areas is not provided within the reporting. Lac Ste. Anne County should seek clarification from the proponent as to whether or not changes in groundwater flow or changes in the overall site water budget (if any) will potentially impact any significant features (see Section 2.2) adjacent to the extraction area.*

   Response:

   In terms of natural heritage features, the *Listing of Historical Resources* (September 2014 Edition) published by Alberta Culture identifies lands that contain or are believed to contain historical resources, including primarily archaeological and paleontological sites, Aboriginal traditional use sites of a historic resource nature and historic structures.

The Alberta *Historical Resources Act* may require proposed activities likely to threaten the integrity of a historical resource to be preceded by a Historical Resources Impact Assessment. Based on the Listing of Historic Resources (September 2014 Edition) there are no historical resources listed for the Site location or surrounding lands. Therefore a historical resources impact assessment is not required.

In terms of changes to groundwater flow or water budget, as discussed in Section 6.2 and shown on Drawings No. 10 to 15 of the Aspen report, once mining is completed within the mining blocks associated with the waterbodies, a minimum of one metre of reject material or sandy overburden will be placed in the bottom of these mined out blocks to tie the waterbodies into the aquifer associated with the adjacent un-mined gravel formation. It is essential that an effective hydraulic connection is maintained between the waterbodies and the aquifer as it will ensure the waterbodies can function as groundwater recharge ponds during dewatering operations. To reduce the amount of groundwater mounding that could potentially occur in areas that are upgradient, one metre of reject or sandy overburden material will also be placed throughout the bottom of the entire pit.

2. *While the recommendations are considered appropriate, we would suggest that the proponent make the following changes to the HCL (2012) monitoring plan:*

-Monitoring should be conducted within all site piezometers. Those monitors that are outside of the dewatering ZOI will still provide useful control points. Monitoring could be completed cost effectively by using automated data loggers that are manually downloaded less frequently (i.e., weekly or monthly).

Response:

HCL recommended monitoring within four of the six piezometers initially as mining will begin within Section 33. Once mining progresses into Section 34 piezomenter (Pz) 3-10 would come on line to monitor conditions. If monitoring was to include Pz 3-10 before mining begins within Section 34 this data would be used as a means of obtaining baseline data related to natural water-level fluctuations.

In this case five of the six piezometers would be used for monitoring. It is HCL's professional opinion that it is not necessary to monitor both Pz 1-10 and 5-10. i.e. all six piezometers. The reason Pz 1-10 and 5-10 piezometers are so close together was to ensure that there was measureable drawdown in at least one piezometer during the extended aquifer test with Pz 1-10. Monitoring just one of them should be sufficient. Data loggers would be used throughout the monitoring program and are in fact currently collecting baseline data.

3. *Installation of automated data logger in at least one nearby residential water well. This should be downloaded quarterly, or immediately in response to a complaint. Because water levels in residential wells are strongly influence by daily usage, continuous water level monitoring is generally required to confirm water level trends and potential adverse effects.*

Response:

As stated in Section 7 of the HCL report, the three Franczak water wells in SE 33-053-03 W5M are completed in the gravel aquifer and are within 200 metres of the proposed mining area in the south half of NE 33, it is recommended that at least daily water level monitoring in at least one of the Franczak water wells commence prior to development in the south half of NE 33. Monitoring will continue throughout mining and after one year of mining, the monitoring data will be analyzed; if there are significant discrepancies to the preliminary review, an updated hydrogeological analysis will be considered.

4. *Groundwater quality sampling should include potential contaminates of concern for pit operations, such as petroleum hydrocarbons.*

Response:

Consideration will be given to including a once-annual analysis of petroleum hydrocarbons from the piezometers in the groundwater monitoring plan.

Also as stated in Section 5.17 of the Aspen report, to reduce the risk of any hydrocarbons contaminating the groundwater aquifer, all petroleum products will be stored in Canadian Standards Association approved fuel vault containers. Spill containment products will be at the Site at all times and employees will be trained in their use.

2) Section 2.1.3 Evaluation of Proposed Mitigation Measures

5. *The proponent should address the potential concerns related to upgradient mounding on either existing water users or the environment. The design and construction of a groundwater bypass system is potential costly, impractical and might not be required, even in the event of groundwater mounding.*

Response:

As discussed in Section 6.2 and shown on Drawings No. 10 to 15 of the Aspen report, once mining is completed within the mining blocks associated with the waterbodies, a minimum of one metre of reject material or sandy overburden will be placed in the bottom of these mined out blocks to

tie the waterbodies into the aquifer associated with the adjacent un-mined gravel formation. It is essential that an effective hydraulic connection is maintained between the waterbodies and the aquifer as it will ensure the waterbodies can function as groundwater recharge ponds during dewatering operations.

In addition, to reduce the amount of groundwater mounding that could potentially occur in areas that are upgradient, one metre of reject or sandy overburden material will also be placed throughout the bottom of the entire pit to maintain the conveyance of groundwater flow.

3) Vegetation and Wetlands

Section 2.2.1 Evaluation of Scope

1. *Mapping of the locations of the identified uncommon plants (S3) would be beneficial to allow the reader to review the distribution of these plants within the study area.*

Response:

Figure 4.1 of the attached Spencer report shows all areas of plant communities found within the site and Table 4.4 outlines the identified S3 plants and their correlating location shown in Figure 4.1. As the figure and table can be used together to verify the location of the S3 plants, the creation of a new map is not needed.

2. *As there are other natural features including wetlands within the adjacent lands (e.g., 120 m) of the study area, potential indirect impacts to these features should be considered.*

Response:

Please refer to Section 5.4.1.2 of the Environmental Impact Assessment in Support Of Alberta Beach Granular Pit Revised Final Report prepared by Spencer Environmental Management Services Ltd. (November 2014) included as an attachment. A discussion regarding adverse impacts to the wetlands on adjacent lands has been included in their report.

2.2.2 Evaluation of Results

3. *In addition to the discussion on ecological connectivity, the study should include an analysis and discussion regarding buffers for retained wetlands adjacent to the proposed extraction area.*

Response:

Please refer to the February 24, 2015 letter prepared by Spencer Environmental Management Services Ltd. included as an attachment.

4. *Discussion regarding the location and retention of these areas should be included. Similarly, in areas where there are currently no opportunities identified for buffers or setbacks to wetlands that are being retained.*

Response:

Please refer to the February 24, 2015 letter and Section 5.4.1.2 of the Environmental Impact Assessment in Support Of Alberta Beach Granular Pit Revised Final Report both prepared by Spencer Environmental Management Services Ltd. included as an attachment.

5. *What are hydrological requirements for these areas and potential subsequent impacts from direct encroachment? Will there be any potential impacts to the wetland during dewatering for the pit operation and localized draw down of the groundwater? Is the fen site #41 a wetland feature of high conservation merit as per the Lac Ste. Anne County's Land Use Bylaw 16-08?*

Response:

Please refer to Section 5.4.1.2 of the Environmental Impact Assessment in Support Of Alberta Beach Granular Pit Revised Final Report prepared by Spencer Environmental Management Services Ltd. (November 2014) included as an attachment. A discussion regarding adverse impacts to the wetlands on adjacent lands has been included in the report.

Please note as shown on Figure 5.1 of Spencer's revised report, fen site #41 will no longer be disturbed by mining activities.

2.2.3 Evaluation of Proposed Mitigation Measures

6. *As discussed in Section 2.2.2 there are areas of retained wetland that have no proposed buffer or setback. There will be direct encroachment in some cases, such as site # 41, for which no assessment of impact or mitigation has been proposed. An assessment of the impacts should be completed.*

Response:

Please refer to the February 24, 2015 letter and Section 5.4.1.2 of the Environmental Impact Assessment in Support Of Alberta Beach Granular Pit Revised Final Report both prepared by

Spencer Environmental Management Services Ltd. included as an attachment. A discussion regarding adverse impacts to the wetlands on adjacent lands has been included in the report. Please note as shown on Figure 5.1 of Spencer's revised report, fen site #41 will no longer be disturbed by mining activities.

2.2.4 Evaluation of Environmental Effects

7. *Based on the results of the study and the objectives of the EIA to identify wetlands with the "highest conservation value", it appears that the site #41 wetland would qualify as high conservation value. This is unclear in the report and further clarification is recommended.*

Response:

As shown on Figure 5.1 of Spencer's revised report, fen site #41 will no longer be disturbed by mining activities.

8. *If the site #41 wetland is considered to be of high conservation value as the EIA suggests, adjusting the extraction limit should be considered to further reduce or eliminate direct encroachment into wetland site #41. An assessment for an appropriate buffer is recommended.*

Response:

As shown on Figure 5.1 of Spencer's revised report, fen site #41 will no longer be disturbed by mining activities.

4) Wildlife and Wildlife Habitat

2.3.3 Evaluation of Proposed Mitigation Measures

1. *Based on the number of stations surveyed (13), it is not clear in the methodology whether the typical protocol of sampling online in the early morning(approximately 06:00 to 10:30 hrs) when birds are most active was implemented. If surveys were completed in the late morning or afternoon, there is the potential for under sampling.*

Response:

Please refer to the February 24, 2015 letter prepared by Spencer Environmental Management Services Ltd. included as an attachment.

2. *There is no discussion regarding impacts and species-specific mitigation for the four special status species recorded from the study area, namely Western Toad, Barn Swallow, Common Yellowthroat and Sora. There is also no related discussion regarding Short-eared Owl, Olive-sided Flycatcher, Canadian Toad, and Long-tailed Weasel.*

   Response:

   Please refer to the February 24, 2015 letter prepared by Spencer Environmental Management Services Ltd. included as an attachment.

3. *A proposed wetland compensation monitoring program has been provided which in our opinion is appropriate. Including the monitoring of wildlife as part of the program could be considered to measure\ the success of the restoration.*

   Response:

   As discussed in Section 5.3 of Spencer's report, if ESRD accepts construction of the proposed naturalized seasonal low area as part of wetland compensation for the project, 1531486 Alberta Ltd. will meet conditions attached to that proposal, including implementation of wetland performance monitoring. If required, a detailed monitoring program will be submitted to ESRD under separate cover prior to completion of extraction activities in the first full quarter section or according to dates outlined in the approval. Monitoring of wildlife can be included in the monitoring program submitted to ESRD if required.

4. *An assessment of potential impacts to provincially "Sensitive" species would be helpful in addressing appropriate mitigation and/or compensation and should be provided by the proponent.*

   Response:

   Please refer to the February 24, 2015 letter prepared by Spencer Environmental Management Services Ltd. included as an attachment.

5) Noise

2.4.2 Evaluation of Results

1. *However, there is limited discussion on the significance of the noise levels provided, whether they are acceptable or unacceptable (using a threshold or benchmark) or whether any mitigation measures should be implemented. Further, there is no description as to whether or not the increase in noise daytime noise levels is "acceptable" from the proponent's perspective. A proxy municipality could be utilized as a comparison (i.e., County of Parkland, which has been utilized before by Lac Ste. Anne County).*

   Response:

   Patching Associates Acoustical Engineering Ltd. conducted a noise impact assessment for the proposed project area. Modelling was done for the most impacting proposed operation (topsoil removal) from all blocks at the potentially affected receiver locations and noise levels showed to be between 54.5 – 68.9 dBA during these operations.

   The neighbouring county's (Parkland County) bylaw for maximum continuous noise level of 85 dBA has been used for comparison with this project. Based on the data presented in Patching Associates Acoustical Engineering Ltd. report, at no point during the life of this project is the noise level expected to reach this 85 dBA limit.

2.4.3 Evaluation of Proposed Mitigation Measures

2. *As discussed in Section 2.4.2, no mitigation measures have been proposed in the noise assessment report. Further, no discussion or rationale on why mitigation measures are not provided (i.e., not required) has been included in the report. This information should be provided by the proponent.*

   Response:

   Mitigation measures to reduce noise impact due to mining activities are outlined in 5.16 of the Aspen report and include:

   - Equipment will be properly maintained.
   - Strobe lights will be used during hours of darkness instead of backup beeper alarm systems.
   - All processing will occur during permitted hours.
   - Sight and sound berms will be strategically placed along the perimeter of the Site in the N ½ 33-053-03 W5M across from residences to minimize noise.
   - All trucks hauling from the Site will be in good working order.
   - The use of engine retarder brakes will be prohibited within the pit and along the haul route.

2.4.4 Evaluation of Environmental Effects

3. *As the report did not discuss monitoring of noise levels to ensure the predicted impacts are correct once the project is implemented, the County should propose details/parameters on a monitoring program and how it will be implemented and enforced. A well designed EMP can be used to identify impacts based on monitoring results and provide mitigation measures as necessary.*

   Response:

   Noise monitoring will be conducted during anticipated periods of increased noise levels. A handheld sound level meter will be used to measure the values, and mitigation measures will be implemented if noise levels approach Parkland County's limit of 85 dBA.

4. *As a good neighbour policy, a Noise Complaint Response Policy/Protocol should be implemented to allow for the public to raise concerns with the developer/operator should noise levels become a nuisance.*

   Response:

   1531486 Alberta Ltd. will prepare an EMP once the project has been approved. A noise complaint response policy will be included in the EMP.

6) Air Quality

2.5.1 Evaluation of Scope

1. *Based on the information provided, no assessment of conclusions related to impacts or proposed mitigation measures could be provided. Clarification, including additional reporting for air quality should be requested from the proponent.*

   Response:

   1531486 Alberta Ltd. intends to maintain compliance with the Occupational Health and Safety standards for air quality/particulates to ensure the health and well-being of all staff present on site. Air quality issues will be addressed on a visual or complaint basis, and appropriate mitigation measures will be implemented.

7) Traffic

2.6.3 Evaluation of Proposed Mitigation Measures

1. *The mitigation measures proposed are largely limited to the right turn and left turn parallel lanes as well as widening Range Road 33. The upgrades and warrants are appropriate as recommended; however, the cost should be borne by the project proponent as they are the reason behind the necessity of the upgrades.*

Response:

As stated in the traffic report submitted by EBA Engineering Consultants Ltd. the responsibility of the upgrades and warrants were to be discussed with Lac Ste. County and as such 1531486 Alberta Ltd. will incur the costs of the road upgrades.

Thank you for the opportunity to provide more information related to the development of the 1531486 Alberta Ltd. Alberta Beach Pit. If you have any further questions or require more please contact me at (780) 809-8191.

Yours truly,

This information redacted as per Protection of Privacy Act (POPA)

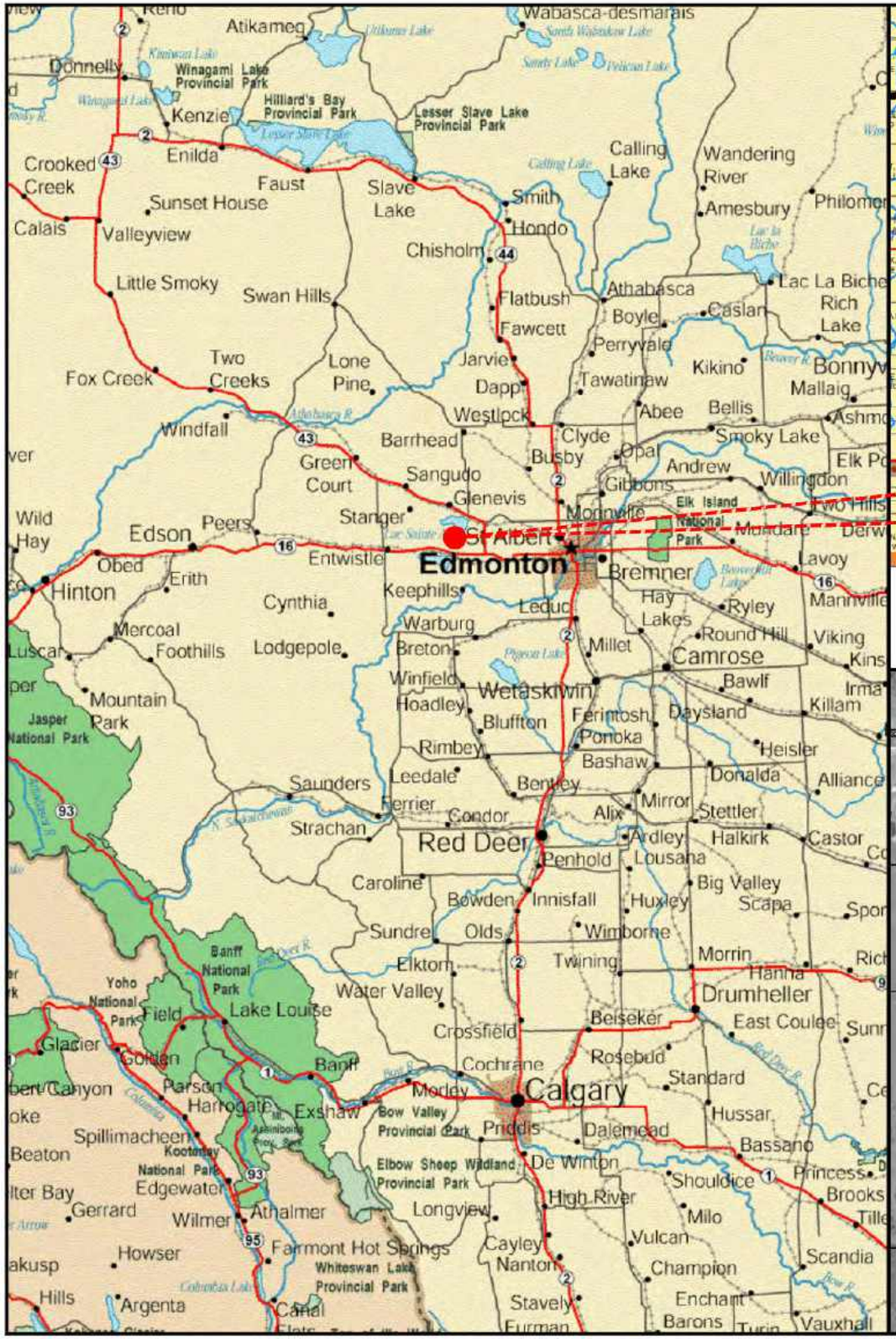
Michele Corry
Aspen Land Group Inc.

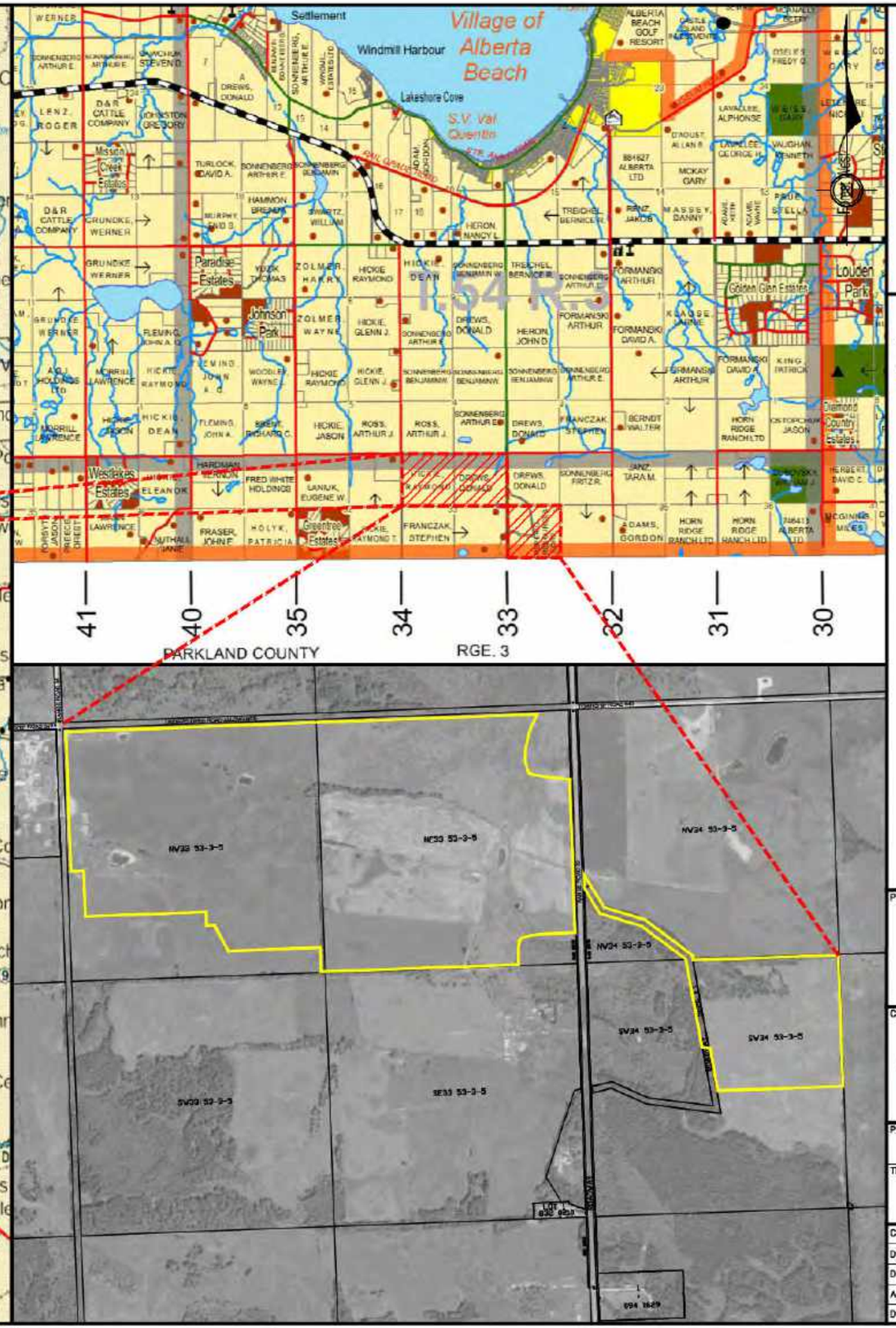
Cc. 1531486 Alberta Ltd.

Attachments

Appendix L

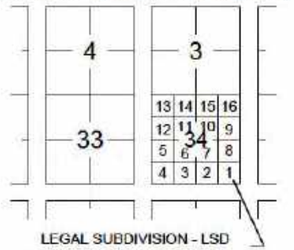
Conservation and Reclamation Drawings





LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

PROPERTY LINE

PIT BOUNDARY (127.84 HA)

Prepared By

ASPEN LAND GROUP INC.

Client

1531486 ALBERTA LTD.

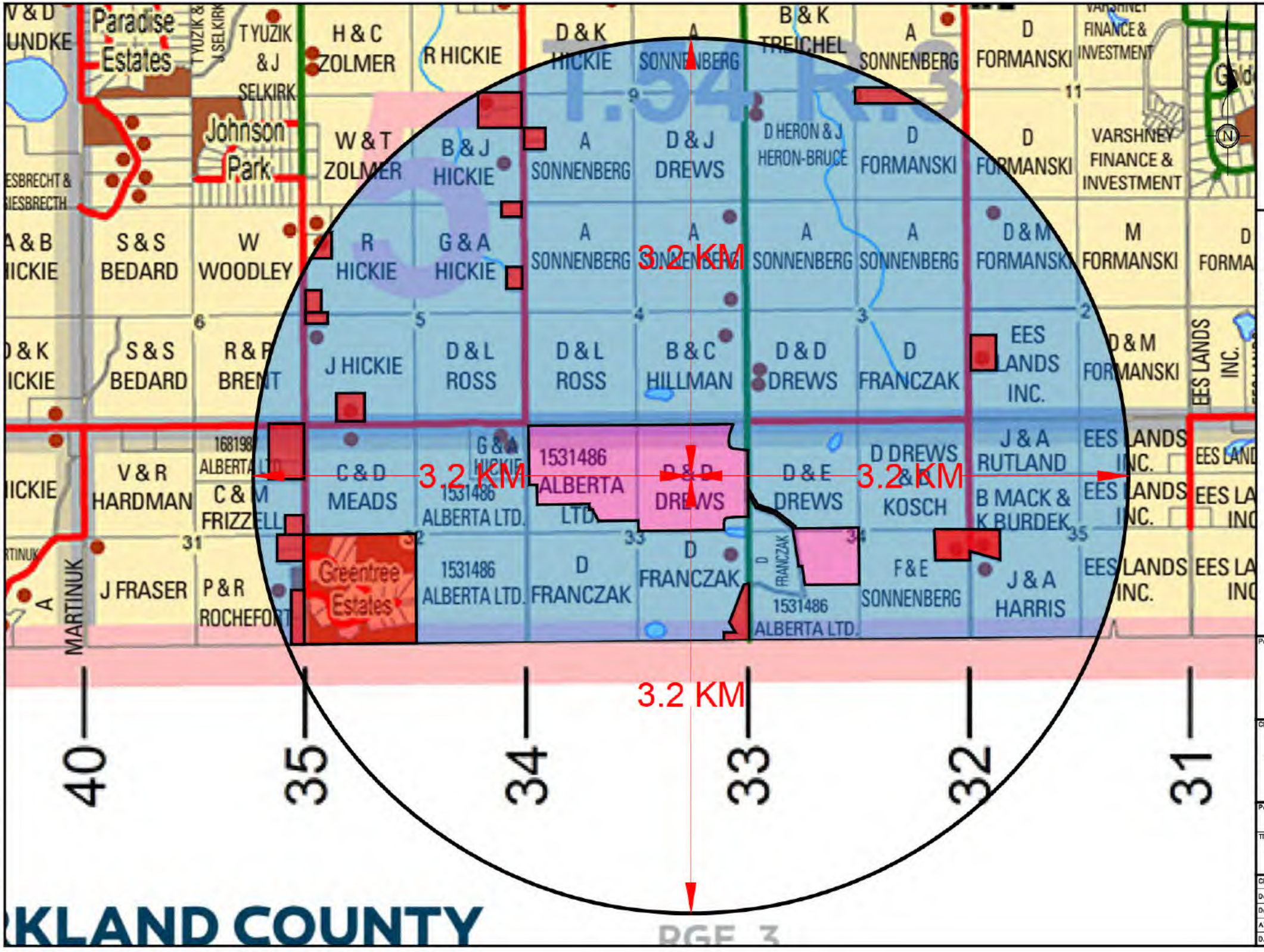
Project

ALBERTA BEACH PIT

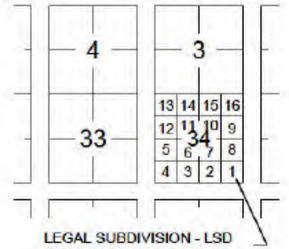
Title

LOCATION PLAN

Checked By: L. FOY	Scale NTS
Designed By: L. FOY	Drawing No. 1 - 16
Drawn By: T. FOY	
Air Photo: 2022	
DATE: MARCH 20, 2025	



LEGAL LAND DESCRIPTION
(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- PIT BOUNDARY
- AGRICULTURAL
- COUNTRY RESIDENTIAL

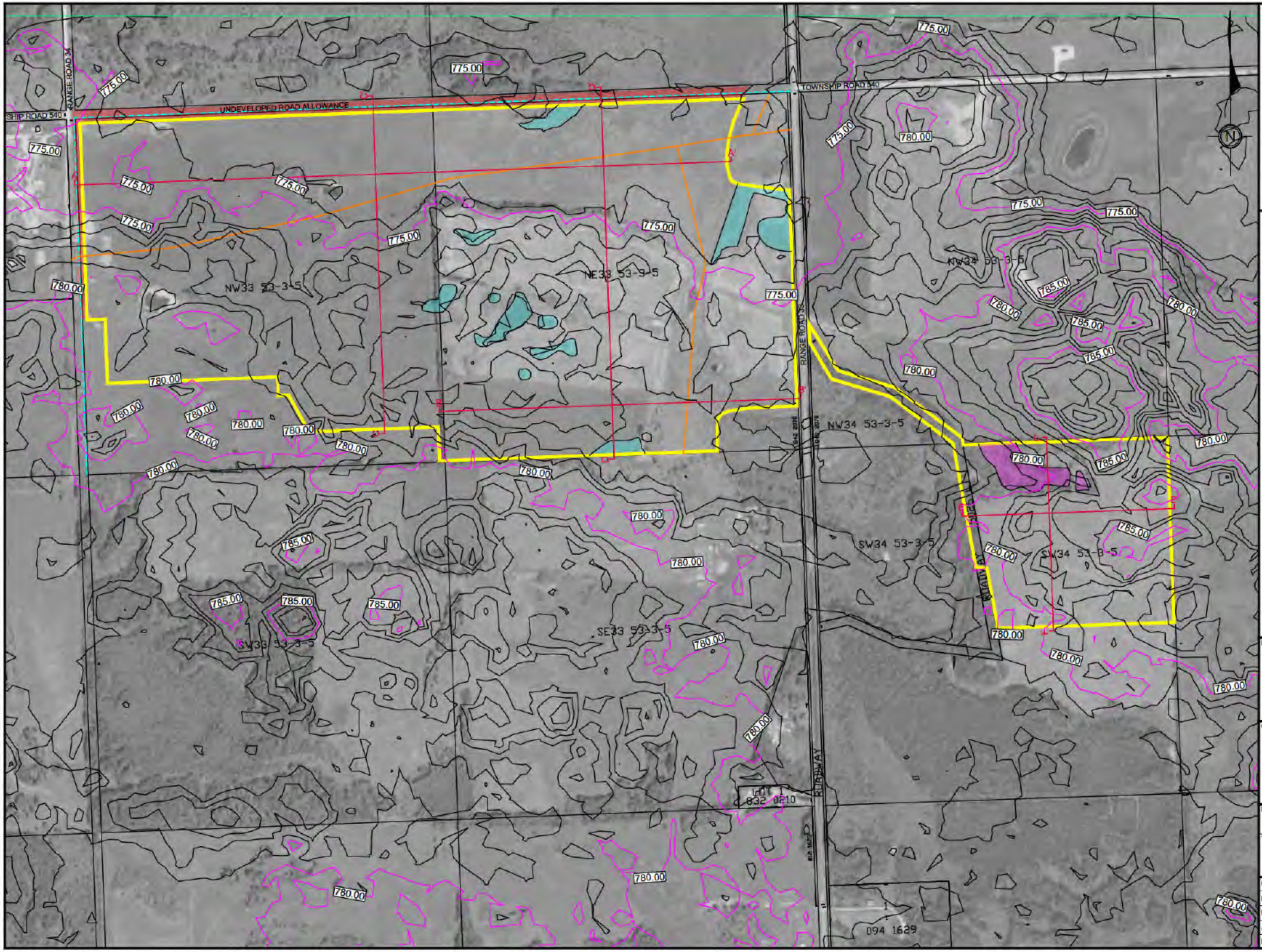
Prepared By
ASPEN LAND GROUP INC.

Client
1531486 ALBERTA LTD.

Project
ALBERTA BEACH PIT

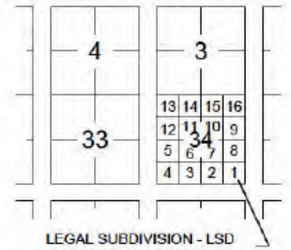
Title
ADJACENT LAND USES

Checked By: L. FOY	Scale 1: 26000
Designed By: L. FOY	Drawing No. 2 - 16
Drawn By: T. FOY	
Air Photo: NA	
DATE: MARCH 20, 2025	



LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- PROPERTY LINE
- PIT BOUNDARY (127.84 HA)
- STE. ANNE GAS ROW
- WILD WATER COMMISSION PIPELINE ROW
- MARSH - EMERGENT
- SWAMP - TREED
- SWAMP - SHRUB
- PREVIOUSLY PERMITTED AREA REMOVED

Prepared By

ASPEN LAND GROUP INC.

Client

1531486 ALBERTA LTD.

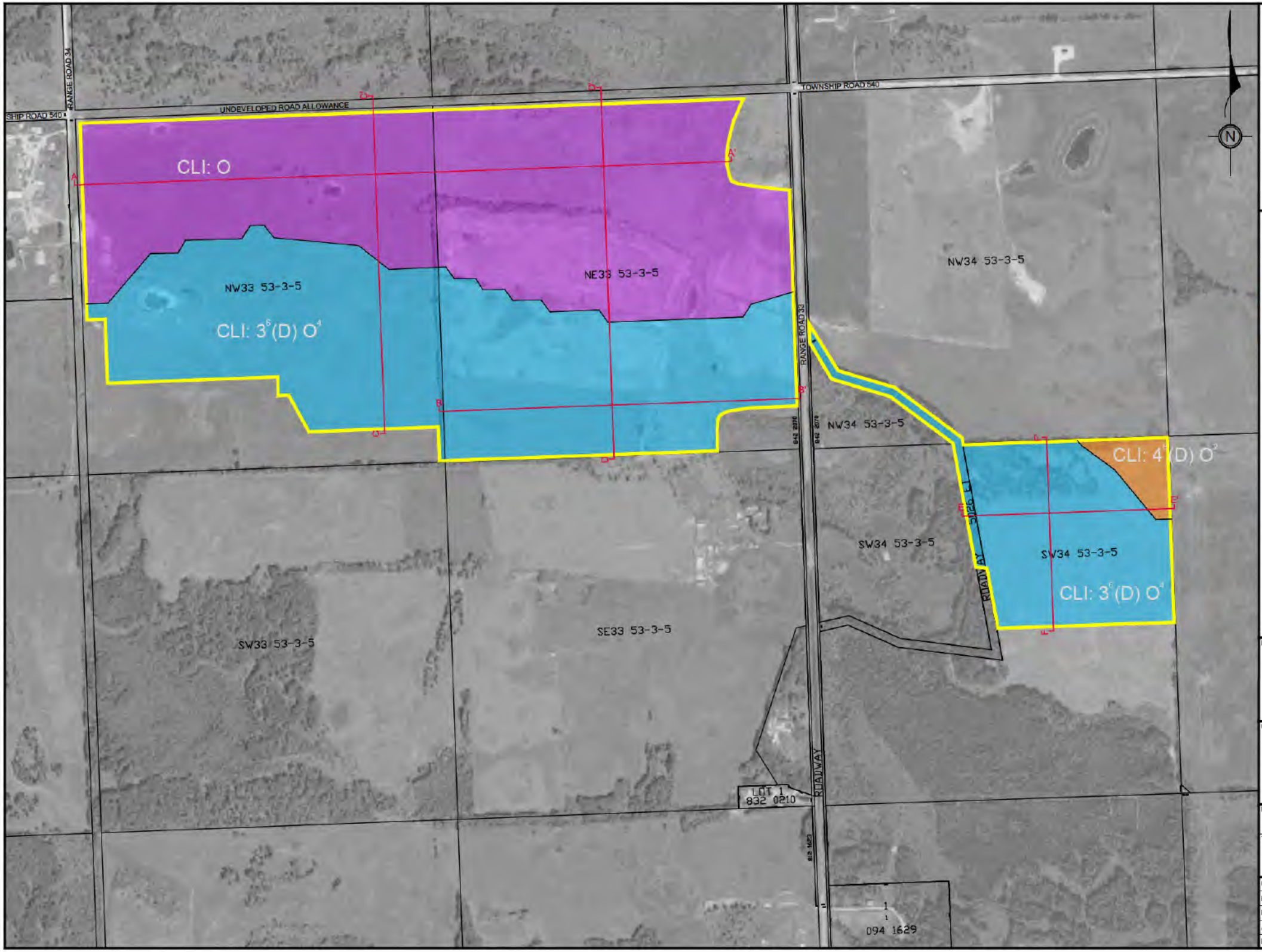
Project

ALBERTA BEACH PIT

Title

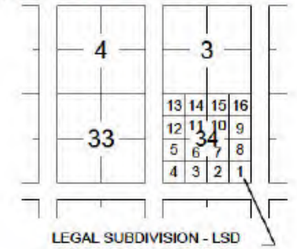
EXISTING FEATURES SHOWING CONTOURS

Checked By: L. FOY	Scale 1:8000
Designed By: L. FOY	Drawing No. 3 - 16
Drawn By: T. FOY	
Air Photo: 2022	
DATE: MARCH 28, 2025	



LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- PROPERTY LINE
- PIT BOUNDARY (127.84 HA)
- CLI: O
- CLI: 3^6(D) O^4
- CLI: 4^1(D) O^2

Prepared By

ASPEN LAND GROUP INC.

Client

1531486 ALBERTA LTD.

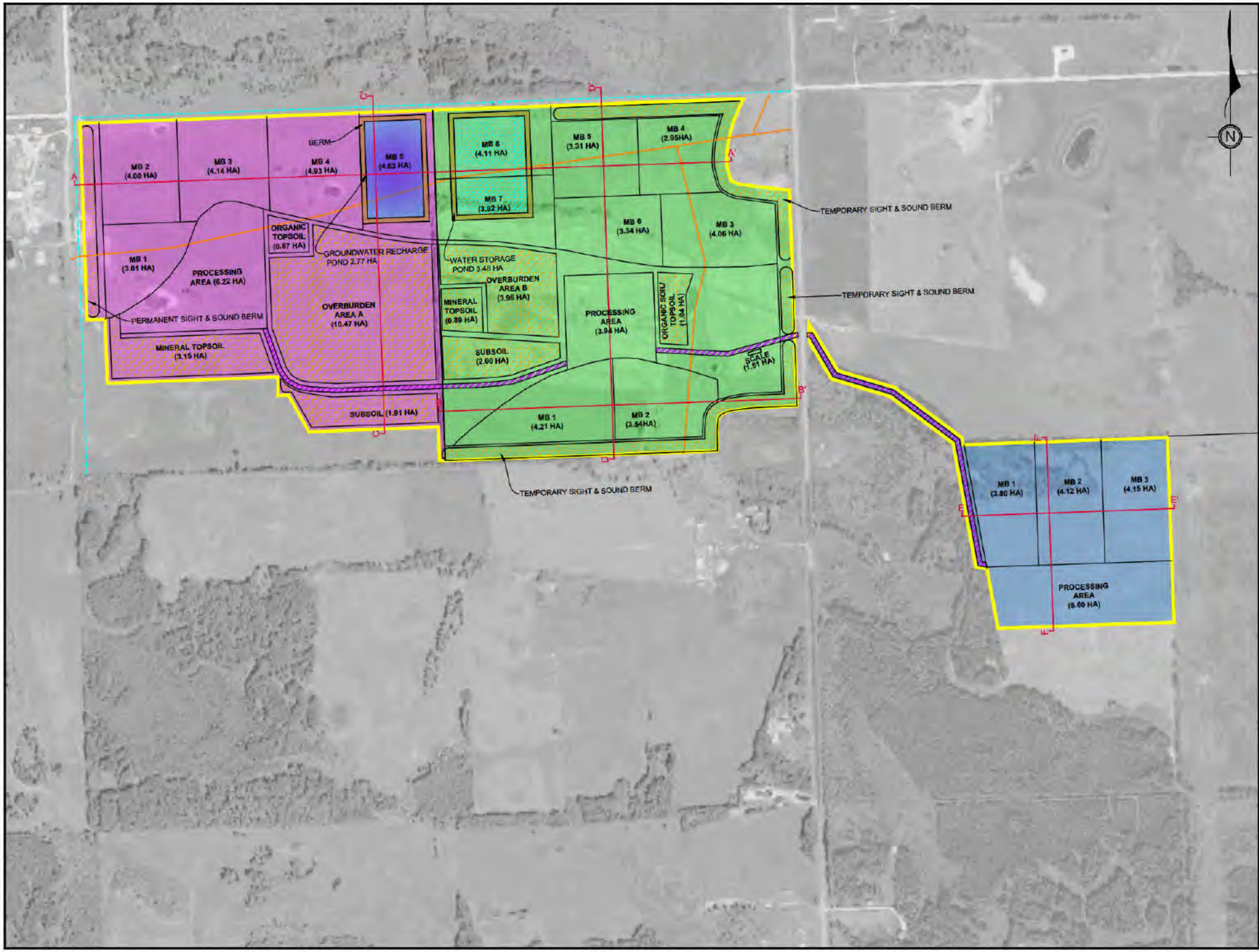
Project

ALBERTA BEACH PIT

Title

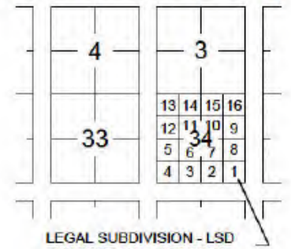
SOIL CAPABILITY (CLI)

Checked By: L. FOY	Scale 1:8000
Designed By: L. FOY	Drawing No. 4 - 16
Drawn By: T. FOY	
Air Photo: 2022	
DATE: MARCH 27, 2025	



LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- PROPERTY LINE
- PIT BOUNDARY (127.84 HA)
- STE. ANNE GAS ROW
- WILD WATER COMMISSION PIPELINE ROW
- PHASE I
- PHASE II
- PHASE III
- INTERNAL HAUL ROADS
- RECLAMATION MATERIAL STOCKPILES/BERMS

Prepared By

Aspen LAND GROUP

Client

1531486 ALBERTA LTD.

Project

ALBERTA BEACH PIT

Title

MINE SEQUENCING PLAN HIGHLIGHTING PHASES I-III

Checked By: L. FOY	Scale 1: 8000
Designed By: L. FOY	Drawing No. 5 - 16
Drawn By: T. FOY	
Air Photo: 2022	
DATE: FEB. 4, 2026	

RANGE ROAD 34

TOWNSHIP ROAD 540

UNDEVELOPED ROAD ALLOWANCE

MB 2
(4.00 HA)

MB 3
(4.14 HA)

MB 4
(4.93 HA)

MB 5
(4.63 HA)

BERM

MB 1
(3.01 HA)

PROCESSING
AREA (6.22 HA)

ORGANIC
TOPSOIL
(0.67 HA)

GROUNDWATER RECHARGE
POND 2.77 HA

NW33 53-3-5

OVERBURDEN
AREA A
(10.47 HA)

PERMANENT SIGHT & SOUND BERM

MINERAL TOPSOIL
STOCKPILE AREA
(3.15 HA)

SUBSOIL (1.91 HA)
STOCKPILE AREA

A

B

C

N

1

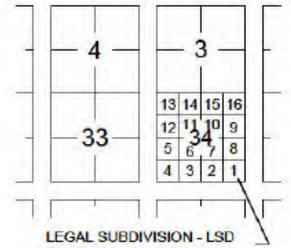
1

082 8379

-5

LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- PROPERTY LINE
- PIT BOUNDARY (127.84 HA)
- STE. ANNE GAS ROW
- WILD WATER COMMISSION PIPELINE ROW
- INTERNAL HAUL ROAD
- SIGHT AND SOUND BERMS

Prepared By

Aspen LAND GROUP

Client

1531486 ALBERTA LTD.

Project

ALBERTA BEACH PIT

Title

**MINE SEQUENCING PLAN
PHASES I**

Checked By: L. FOY	Scale 1:3500
Designed By: L. FOY	Drawing No. 6 - 16
Drawn By: T. FOY	
Air Photo: 2022	
DATE: FEB. 4, 2026	

TOWNSHIP ROAD 540

D

D'

A

A'

B

B'

MB 8
(4.11 HA)

MB 7
(3.92 HA)

MB 5
(3.31 HA)

MB 4
(2.95HA)

MB 6
(3.34 HA)

MB 3
(4.06 HA)

MB 1
(4.21 HA)

MB 2
(3.54HA)

MB 5
63 HA)

1.91 HA)
E AREA

RECHARGE

WATER STORAGE
POND 3.48 HA

OVERBURDEN
AREA B
(3.96 HA)

MINERAL
TOPSOIL
(0.89 HA)

SUBSOIL
(2.00 HA)

PROCESSING
AREA
(3.94 HA)

ORGANIC SOIL/
TOPSOIL
(1.04 HA)

SCALE
(1.51 HA)

NE33 53 3 5

NW34 53-3-5

TEMPORARY SIGHT & SOUND B

TEMPORARY SIGHT & SO

RANGE ROAD 33

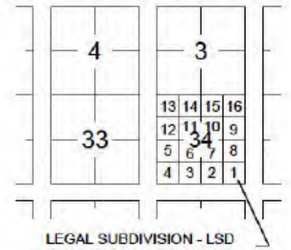
842 2070

842 2070

N

LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- PROPERTY LINE
- PIT BOUNDARY (127.84 HA)
- STE. ANNE GAS ROW
- WILD WATER COMMISSION PIPELINE ROW
- INTERNAL HAUL ROAD
- SIGHT AND SOUND BERMS

Prepared By

Aspen LAND GROUP

Client

1531486 ALBERTA LTD.

Project

ALBERTA BEACH PIT

Title

**MINE SEQUENCING PLAN
PHASES II**

Checked By: L. FOY	Scale 1:3500
Designed By: L. FOY	Drawing No. 7 - 16
Drawn By: T. FOY	
Air Photo: 2022	
DATE: FEB. 4, 2026	

TEMPORARY SIGHT & SOUND BERM

RANGE ROAD 33

842 2070

842 2070

NW34 53-3-5

SW34 53-3-5

SW34 53-3-5

SW34 53-3-5

ROAD

SCALE
(1.51 HA)

B'

L

E

E'

L

MB 1
(3.80 HA)

MB 2
(4.12 HA)

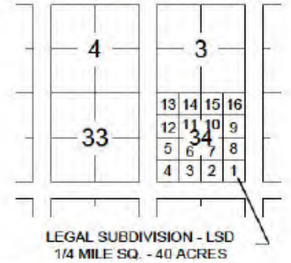
MB 3
(4.15 HA)

PROCESSING
AREA
(5.60 HA)

N

LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- PROPERTY LINE
- PIT BOUNDARY (127.84 HA)
- STE. ANNE GAS ROW
- WILD WATER COMMISSION PIPELINE ROW
- INTERNAL HAUL ROAD
- SIGHT AND SOUND BERMS

Prepared By

Aspen LAND GROUP

Client

1531486 ALBERTA LTD.

Project

ALBERTA BEACH PIT

Title

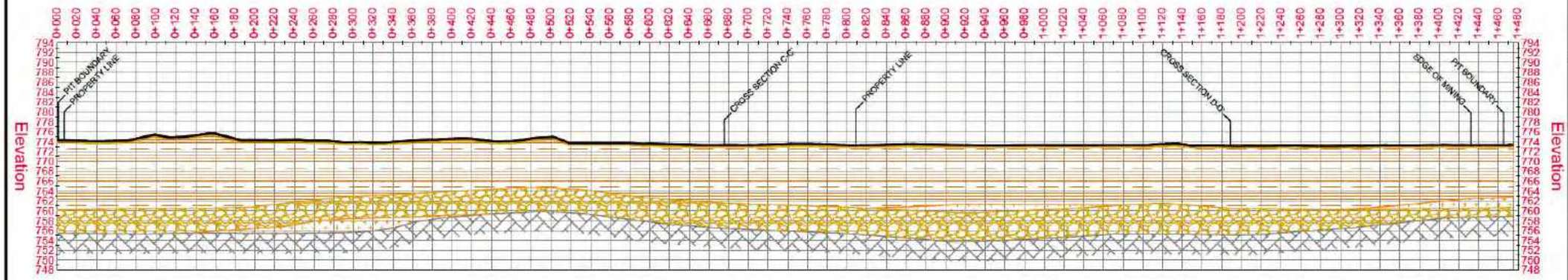
**MINE SEQUENCING PLAN
PHASES III**

Checked By: L. FOY	Scale 1: 3500
Designed By: L. FOY	Drawing No. 8 - 16
Drawn By: T. FOY	
Air Photo: 2022	
DATE: FEB. 4, 2026	

T.54 R.5
Johnson Park
Paradise Estates
Golden Glen Estates
Louden Park
Cheyenne Estates
Westlakes Estates
Greentree Estates
Laurentia Heights
Lakewood Estates II
Diamond Country Estates
Smithfield Crown Reserve
Manly Corner Crown Reserve
Wabamun Lake Provincial Park
Lakeview
WESTLAND PARK
SMITHFIELD
ALBERTA BEACH ROAD/RANGE ROAD 33
WEST MESO ROAD
MESO ROAD
CLEAR LAKE
AB ENV PRO
AB. ENVIRONMENT LAND SER. SECT & AB ENV PRO
1531486 ALBERTA LTD.
1349215 ALBERTA LTD.
841943 Alberta Ltd.
2201538 Alberta Ltd.
2144449 Alberta Ltd.
1681967 ALBERTA LTD.
634931 Alberta Ltd.
1634931 Alberta Ltd.
Lehigh Hanson Materials Limited.
Mwc Investments Inc.
Ees Lands Inc.
Tricycle Lane Ranches Ltd.
Carmacks Enterprises Ltd.
Bpl Holdco Ltd.
Cougar Creek Golf Resort Inc.
Kemine Holdings Inc.
Wiebe Holdings Inc.
5 Ply Holdings
Varshney Finance & Investment
D Heron & J Heron-Bruce
M & L Linklvic
W & R Bellhouse
S & M Friedel
T & K Bohachyk
W & M Brennan
J & L Schlenker
K. Scheiderman
V. Rimmer
Atb Financial
Lakeview Estates
Silver Diamond Estates Corp.
Ees Lands Inc.
Ees Lands Inc.
Ees Lands Inc

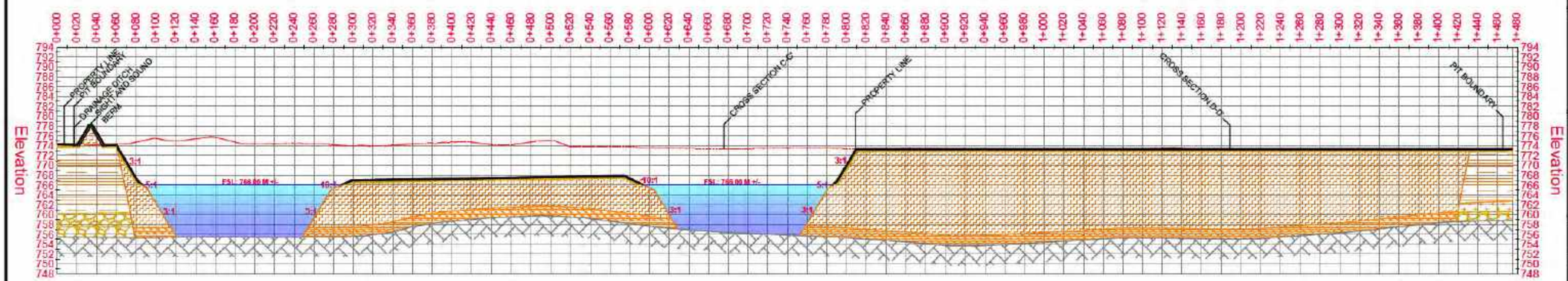
SCALE:
V=1:900
H=1:4500

Cross Section A-A' Existing

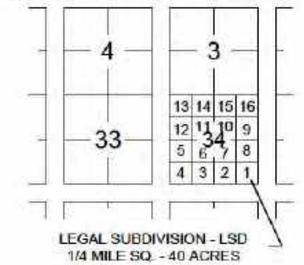


SCALE:
V=1:900
H=1:4500

Cross Section A-A' Reclaimed



LEGAL LAND DESCRIPTION
(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- ORIGINAL GROUND
- TOPSOIL
- SUBSOIL
- OVERBURDEN
- SANDY OVERBURDEN
- AGGREGATE
- REPLACED OVERBURDEN
- REJECT SAND/SANDY OVERBURDEN
- BEDROCK

Prepared By
ASPEN LAND GROUP INC.

Client
1531486 ALBERTA LTD.

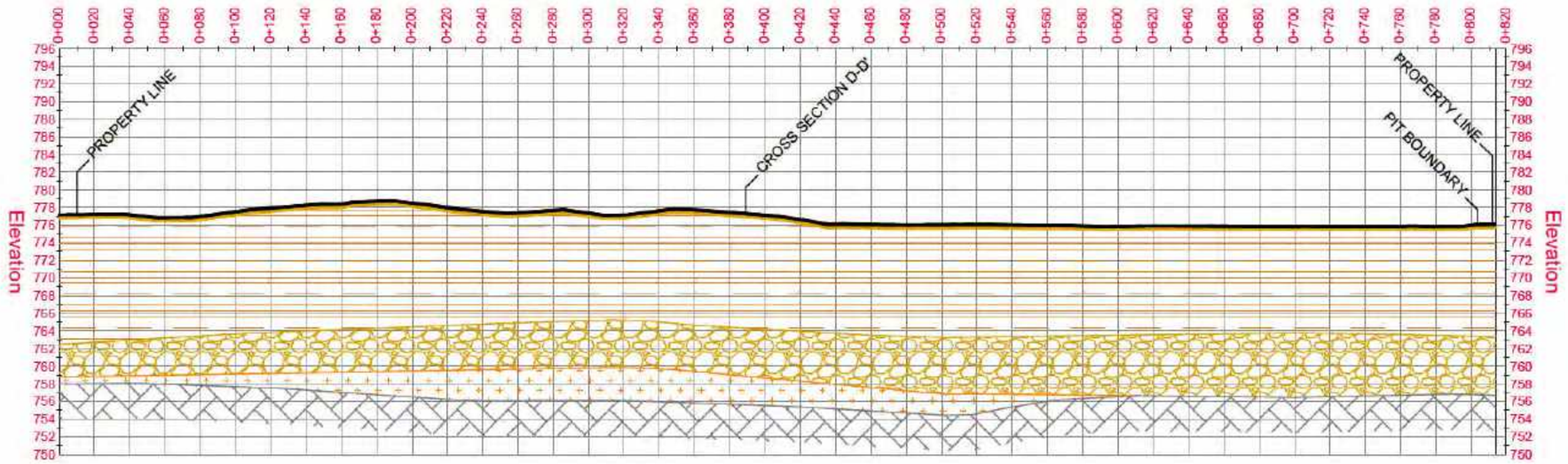
Project
ALBERTA BEACH PIT

Title
CROSS SECTION A-A' EXISTING & RECLAIMED CONDITIONS

Checked By: L. FOY	Scale AS SHOWN
Designed By: L. FOY	Drawing No. 10 - 16
Drawn By: T. FOY	
Air Photo: NA	
DATE: MARCH 27, 2025	

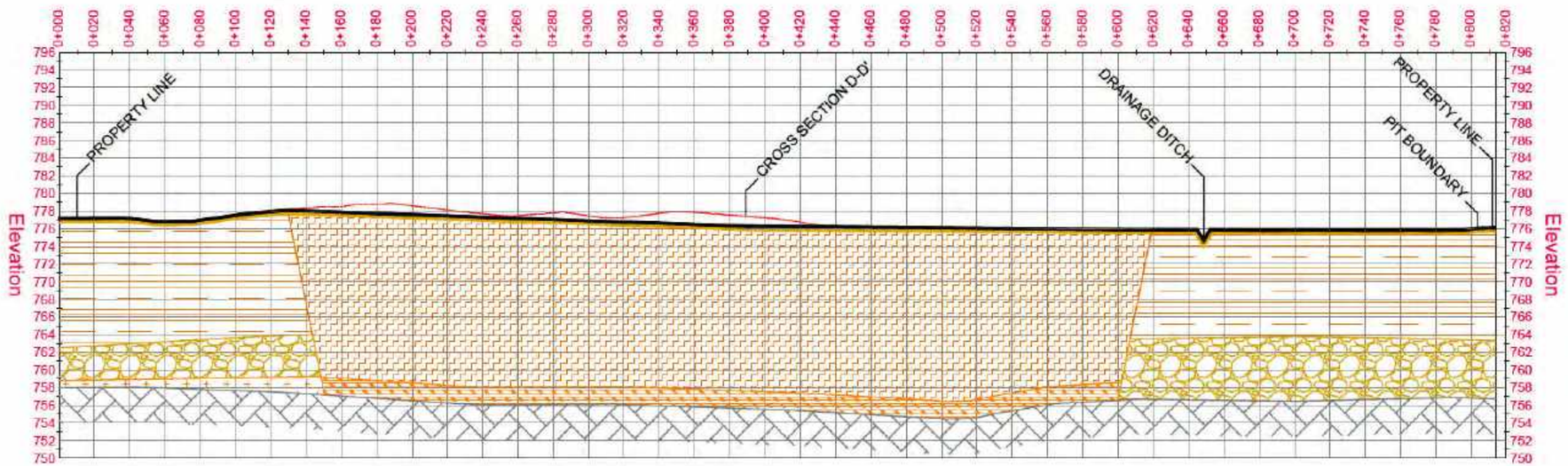
SCALE:
V=1:600
H=1:3000

Cross Section B-B' Existing

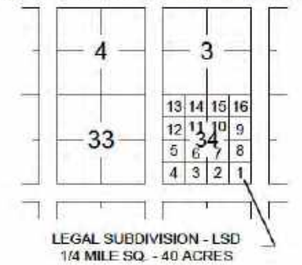


SCALE:
V=1:600
H=1:3000

Cross Section B-B' Reclaimed



LEGAL LAND DESCRIPTION
(N 33-53-03 W5M & SW 34-53-03 W5M)



LOCATION PLAN

LEGEND

- ORIGINAL GROUND
- TOPSOIL
- SUBSOIL
- OVERBURDEN
- SANDY OVERBURDEN
- AGGREGATE
- REPLACED OVERBURDEN
- REJECT SAND/SANDY OVERBURDEN
- BEDROCK

Prepared By
ASPEN LAND GROUP INC.

Client
1531486 ALBERTA LTD.

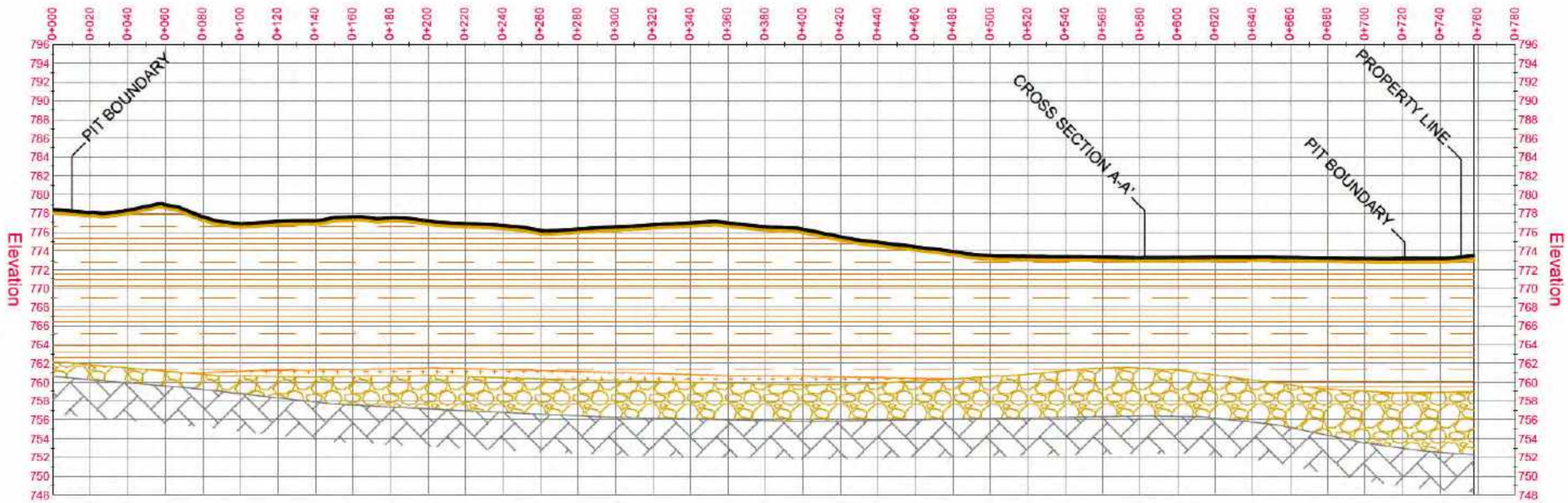
Project
ALBERTA BEACH PIT

Title
CROSS SECTION B-B' EXISTING & RECLAIMED CONDITIONS

Checked By: L. FOY	Scale AS SHOWN
Designed By: L. FOY	Drawing No. 11 - 16
Drawn By: T. FOY	
Air Photo: NA	
DATE: MARCH 20, 2025	

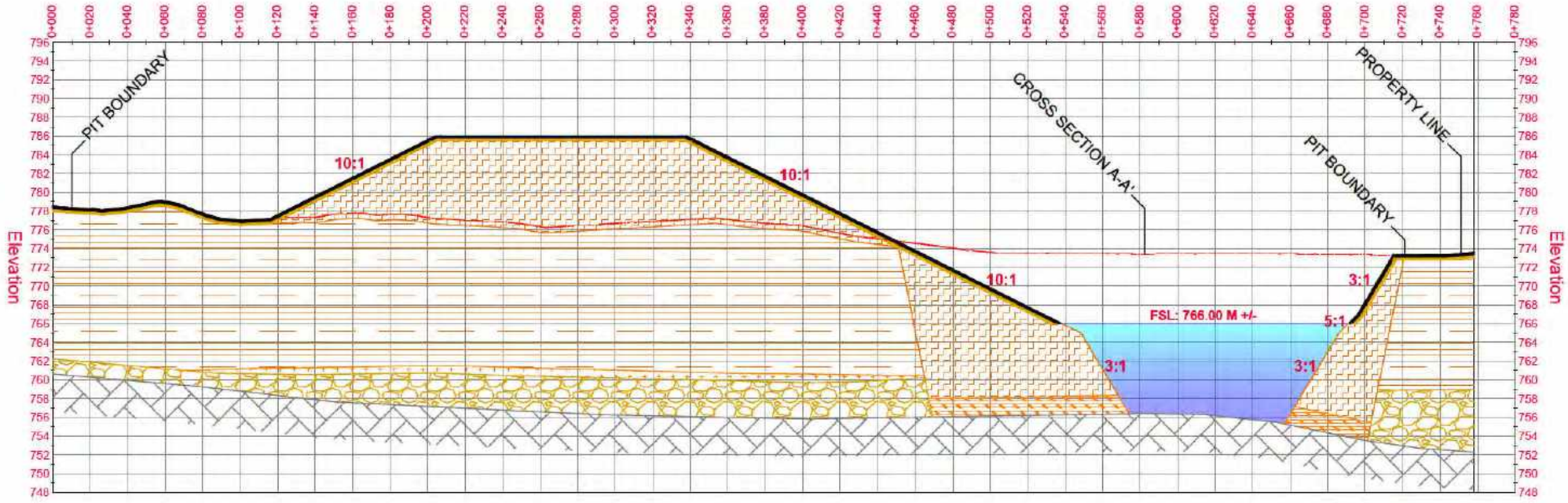
Cross Section C-C' Existing

SCALE:
V=1:500
H=1:2500



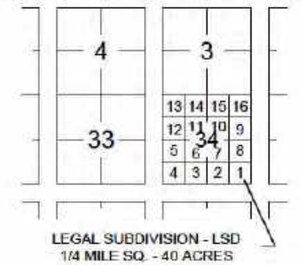
Cross Section C-C' Reclaimed

SCALE:
V=1:500
H=1:2500



LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LOCATION PLAN

LEGEND

- ORIGINAL GROUND
- TOPSOIL
- SUBSOIL
- OVERBURDEN
- SANDY OVERBURDEN
- AGGREGATE
- REPLACED OVERBURDEN
- REJECT SAND/SANDY OVERBURDEN
- BEDROCK

Prepared By

ASPEN LAND GROUP INC.

Client

1531486 ALBERTA LTD.

Project

ALBERTA BEACH PIT

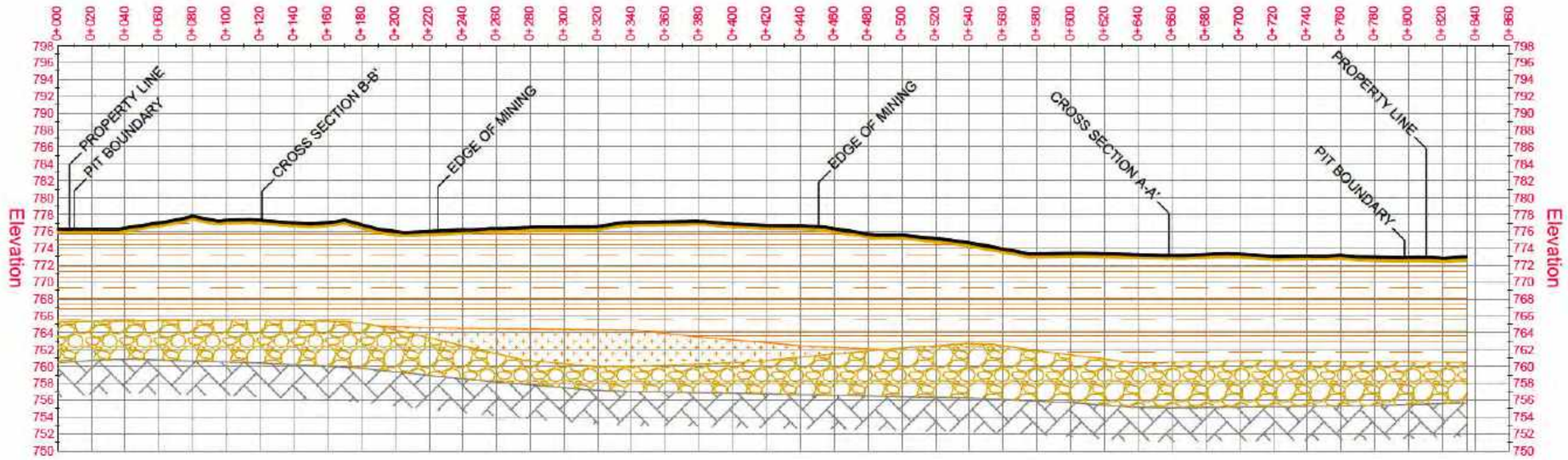
Title

CROSS SECTION C-C' EXISTING & RECLAIMED CONDITIONS

Checked By: L. FOY	Scale AS SHOWN
Designed By: L. FOY	Drawing No. 12 - 16
Drawn By: T. FOY	
Air Photo: NA	
DATE: MARCH 27, 2025	

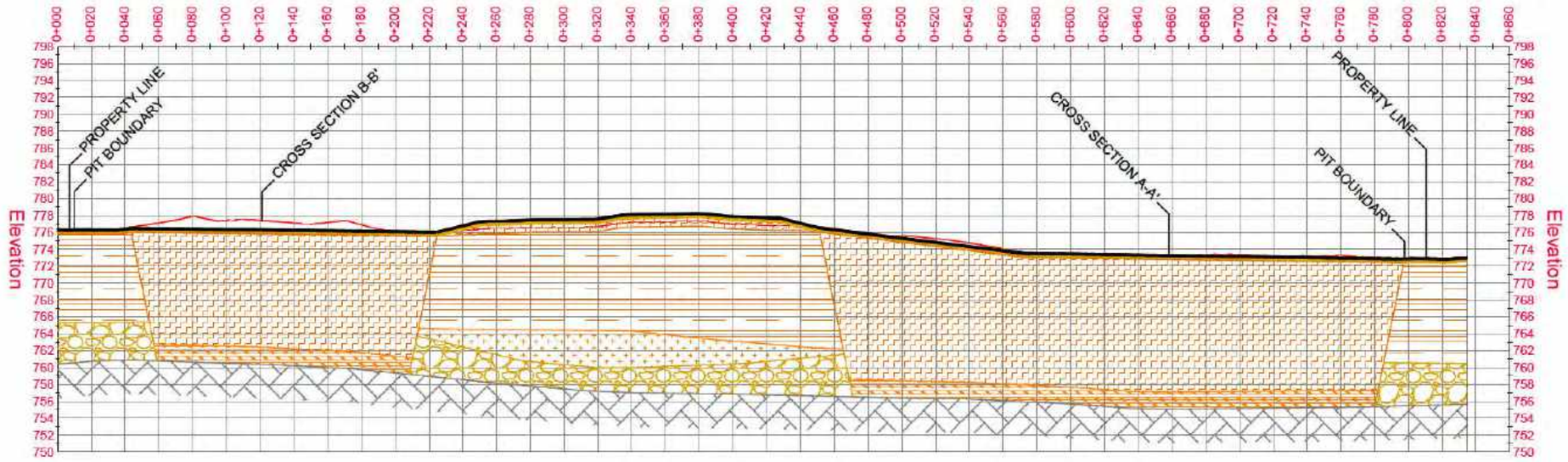
SCALE:
V=1:600
H=1:3000

Cross Section D-D' Existing

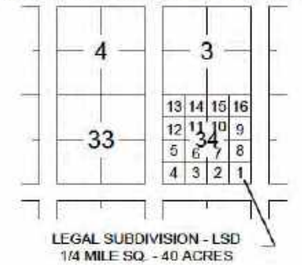


SCALE:
V=1:600
H=1:3000

Cross Section D-D' Reclaimed



LEGAL LAND DESCRIPTION
(N 33-53-03 W5M & SW 34-53-03 W5M)



LOCATION PLAN

LEGEND

- ORIGINAL GROUND
- TOPSOIL
- SUBSOIL
- OVERBURDEN
- SANDY OVERBURDEN
- AGGREGATE
- REPLACED OVERBURDEN
- REJECT SAND/SANDY OVERBURDEN
- BEDROCK

Prepared By

ASPEN LAND GROUP INC.

Client

1531486 ALBERTA LTD.

Project

ALBERTA BEACH PIT

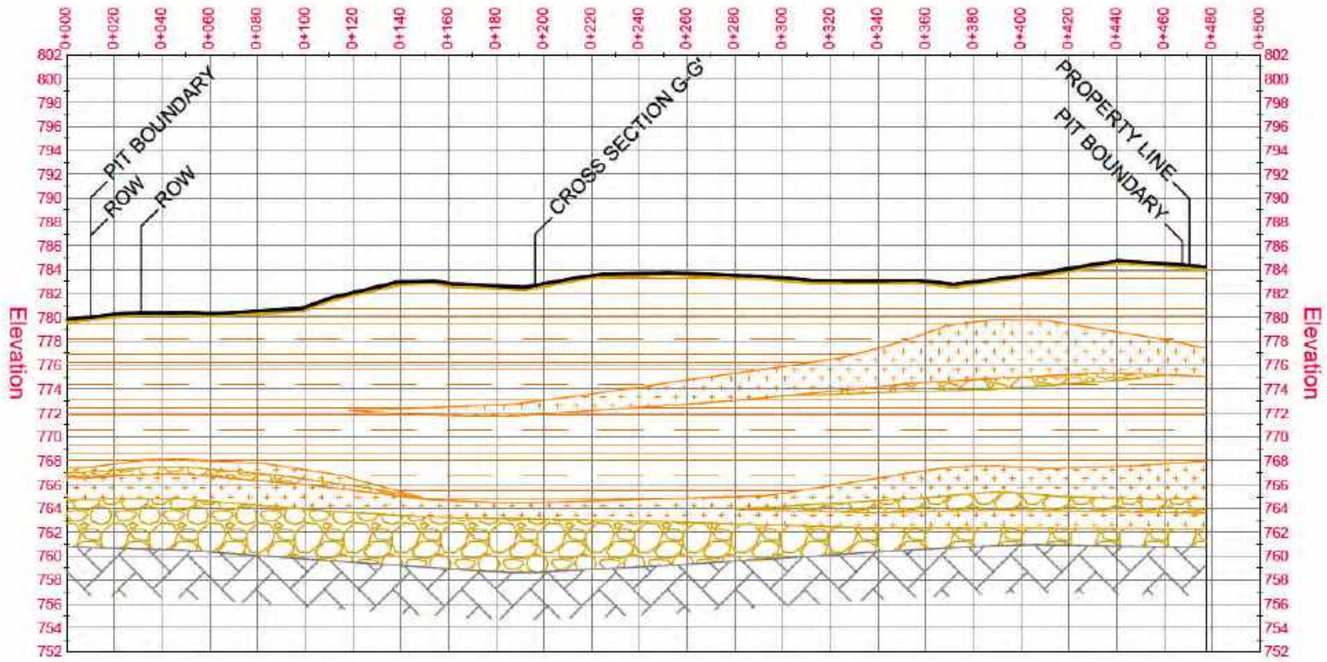
Title

CROSS SECTION D-D' EXISTING & RECLAIMED CONDITIONS

Checked By: L. FOY	Scale AS SHOWN
Designed By: L. FOY	Drawing No. 13 - 16
Drawn By: T. FOY	
Air Photo: NA	
DATE: MARCH 27, 2025	

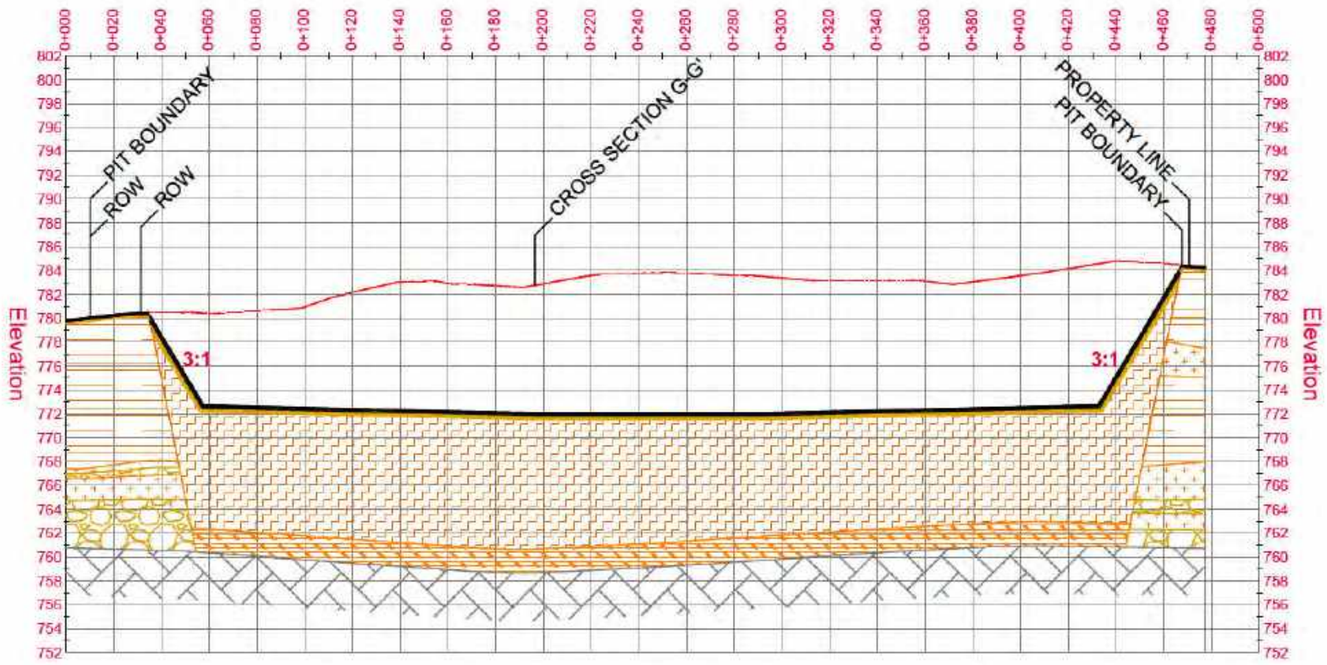
Cross Section E-E' Existing

SCALE:
V=1:500
H=1:2500



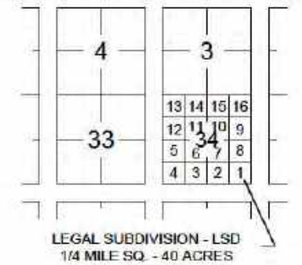
Cross Section E-E' Reclaimed

SCALE:
V=1:500
H=1:2500



LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- ORIGINAL GROUND
- TOPSOIL
- SUBSOIL
- OVERBURDEN
- SANDY OVERBURDEN
- AGGREGATE
- REPLACED OVERBURDEN
- REJECT SAND/SANDY OVERBURDEN
- BEDROCK

Prepared By

ASPEN LAND GROUP INC.

Client

1531486 ALBERTA LTD.

Project

ALBERTA BEACH PIT

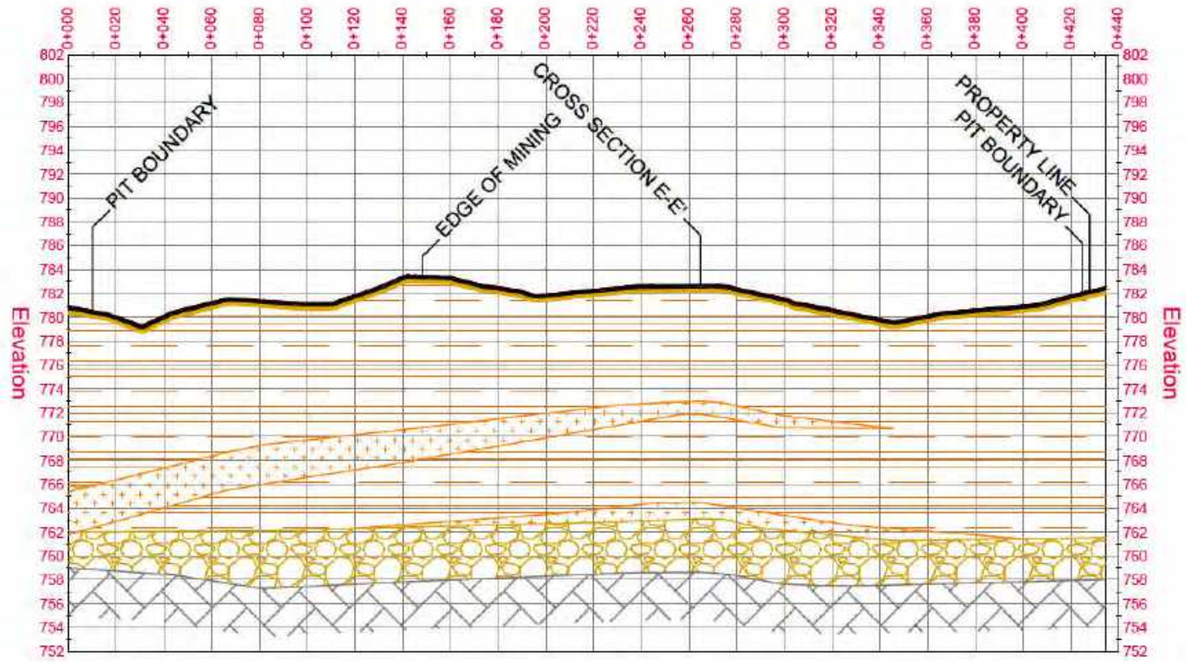
Title

CROSS SECTION E-E' EXISTING & RECLAIMED CONDITIONS

Checked By: L. FOY	Scale AS SHOWN
Designed By: L. FOY	Drawing No. 14 - 16
Drawn By: T. FOY	
Air Photo: NA	
DATE: MARCH 20, 2025	

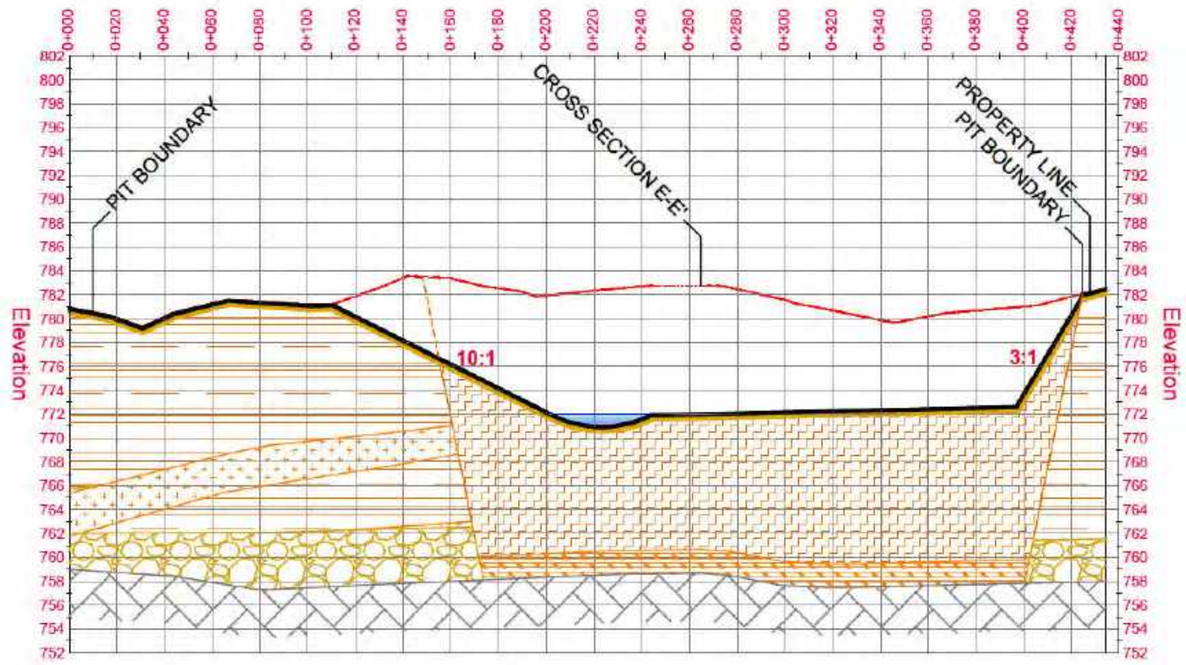
Cross Section F-F' Existing

SCALE:
V=1:500
H=1:2500



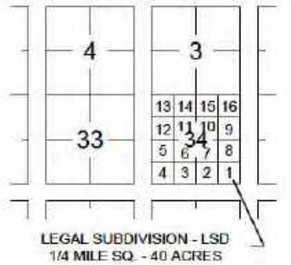
Cross Section F-F' Reclaimed

SCALE:
V=1:500
H=1:2500



LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LOCATION PLAN

LEGEND

- ORIGINAL GROUND
- TOPSOIL
- SUBSOIL
- OVERBURDEN
- SANDY OVERBURDEN
- AGGREGATE
- REPLACED OVERBURDEN
- REJECT SAND/SANDY OVERBURDEN
- BEDROCK

Prepared By

ASPEN LAND GROUP INC.

Client

1531486 ALBERTA LTD.

Project

ALBERTA BEACH PIT

Title

CROSS SECTION F-F' EXISTING & RECLAIMED CONDITIONS

Checked By: L. FOY	Scale AS SHOWN
Designed By: L. FOY	Drawing No. 15 - 16
Drawn By: T. FOY	
Air Photo: NA	
DATE: MARCH 20, 2025	

PERMANENT SIGHT & SOUND BERM (1.19 HA)

UNDEVELOPED ROAD ALLOWANCE

TOWNSHIP ROAD 540

RANGE ROAD 34

WATERBODY (5.87 HA)

WATERBODY (2.20 HA)

EMERGENT VEGETATION

NW33 53-3-5

NE33 53-3-5

NW34 53-3-5

RANGE ROAD 33

SEASONAL LOW AREA (0.49 HA)

SW34 53-3-5

SW33 53-3-5

SE33 53-3-5

LOT 1
832 0210

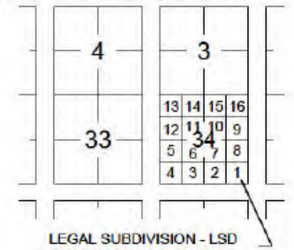
RAILWAY

094 1629

N

LEGAL LAND DESCRIPTION

(N 33-53-03 W5M & SW 34-53-03 W5M)



LEGAL SUBDIVISION - LSD
1/4 MILE SQ. - 40 ACRES

LOCATION PLAN

LEGEND

- PROPERTY LINE
- PIT BOUNDARY (127.84 HA)
- WILD WATER COMMISSION PIPELINE ROW
- UPGRADED ROADWAY 5026 ET (1.58 HA)
- CULTIVATION/PASTURE (111.03 HA)
- WATERBODIES (8.07 HA)
- EMERGENT VEGETATION WITHIN WATERBODIES (0.86 HA)
- UPLAND HABITAT (5.87 HA)
- DRAINAGE ARROWS

Prepared By

ASPEN LAND GROUP INC.

Client

1531486 ALBERTA LTD.

Project

ALBERTA BEACH PIT

Title

RECLAMATION PLAN

Checked By: L. FOY	Scale 1:8000
Designed By: L. FOY	Drawing No. 16 - 16
Drawn By: T. FOY	
Air Photo: NA	
DATE: MARCH 27, 2025	

Appendix M

Emergency Response Plan (February 2026)

11213 Winterburn Rd NW
Edmonton, AB T5S 2B2

Office (780) 809 8191
Fax (780) 809 8190
Site aspenlandgroup.com

Emergency Response Plan

ALBERTA BEACH PIT

N 33 and SW 34-053-03 W5M

FEBRUARY 2026

Prepared for 1531486 Alberta Ltd.

Table of Contents

1.0 Purpose 3

2.0 Pit Overview 3

3.0 Hours of Operation 3

4.0 Extraction Details 3

5.0 Processing Details 5

6.0 Internal Location Details 6

7.0 Surface Water 7

8.0 Waste and Disposal 7

9.0 Security Plan 8

10.0 On-site Communication 12

11.0 Evacuation Procedures 12

12.0 Emergency Muster 12

13.0 Hazard Assessment 12

14.0 Emergency Classifications 12

1.0 Purpose

1531486 Alberta Ltd. has implemented the Emergency Response Plan (ERP) to provide a clear and comprehensive framework for effectively managing emergencies that may arise during operations at the Alberta Beach Pit. This plan is designed to protect the health and safety of all personnel and aims to ensure effective response to incidents such as fires, hazardous material spills, severe weather events, or other unforeseen emergencies.

This plan meets the requirements of Lac Ste. Anne County's Land Use Bylaw No. 22-2017 by including all information required under Section 3.5.10.

2.0 Pit Overview

The Site is located within Lac Ste. Anne County (LSAC) within the N 33 & SW 34-053-03-W5M on private land, approximately five kilometers south of Alberta Beach, adjacent to Township Road 540 and Range Road 33. The pit holds Development Permit No. 193193-13-D0019, with an application for renewal submitted to LSAC. The pit is proposed to operate for approximately 23 years. Progressive reclamation will be implemented throughout operations, and ongoing for the duration of the pit lifespan. Final reclamation will result in the land being returned to agricultural use with the creation of two end pit water bodies and a seasonal low area.

3.0 Hours of Operation

Table 1. Breakdown of Hours of Operation

Activity	Hours
Pit Operations	Monday through Saturday – 6:00 AM to 7:00 PM. No Activity on Sunday or Statutory Holidays.
Passive Pit Operations	7 days a week/ 24hours a day
Hauling Operations	Monday through Saturday – 6:00 AM to 7:00 PM. No Activity on Sunday or Statutory Holidays.

4.0 Extraction Details

Over the pit lifespan, an estimated total of 6.1 million tonnes of sand and gravel will be mined over three planned mining phases. Descriptions of the extraction process including sequencing, stripping, and stockpiling details for each mining phase are included in Tables 4, 5 and 6.

Table 2. Summary of Mine Sequencing Plan for Phase I		
Location	Area (ha)	Activity
MB 1	3.01	Mineral topsoil will be stripped and stockpiled in the mineral topsoil stockpile area, subsoil will be stripped and stockpiled in the subsoil stockpile area. Overburden will be stripped and direct placed in Area A.
MB 2	4.00	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area, subsoil will be stripped and stockpiled in the subsoil stockpile area and overburden will be directly placed into MB 1.
MB 3	4.14	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area, subsoil will be direct placed into MB 1 and overburden will be directly placed into MB 2.
Direct placement of reclamation material continues from this point on.		

Table 3. Summary of Mine Sequencing Plan for Phase II		
Location	Area	Activity
Mineral Topsoil Stockpile Area	0.89 ha	This area will be used to stockpile mineral topsoil salvaged from overburden Area B, the subsoil stockpile area, the processing area and MB 1 and MB 2.
Organic Soil/ Topsoil Stockpile Area	1.04 ha	This area will be used to stockpile organic topsoil salvaged from MB 2.
Crushing Plant Site	3.94 ha	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area and subsoil will be stripped and stockpiled in the subsoil stockpile area.
Overburden Area B	3.96 ha	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area and subsoil will be stripped and stockpiled in the subsoil stockpile area.
Subsoil Area	2.00 ha	Subsoil will be stripped and stockpiled in the subsoil area.

MB 1	4.21 ha	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area, subsoil will be stripped and stockpiled in the subsoil stockpile area and overburden will be stripped and used to construct the sight and sound berm along the north, east and south sides of the NE 33-053-03 W5M; the remaining overburden will be stockpiled in Overburden Area B.
MB 2	3.54 ha	Organic soil will be stripped and stockpiled in the organic soil/topsoil area, subsoil will be stripped and stockpiled in the subsoil stockpile area and overburden will be directly placed into MB 1.
MB 3	4.06 ha	Topsoil will be stripped and stockpiled in the mineral topsoil stockpile area, subsoil will be direct placed into MB 1 and overburden will be directly placed into MB 2.
Direct placement of reclamation material continues from this point on.		

Table 4. Summary of Mine Sequencing Plan for Phase III

Location	Area	Activity
Internal Haul Road	0.07 ha	Existing roadway; no topsoil or subsoil will need to be salvaged.
Processing Area	5.60 ha	Topsoil and subsoil from under the overburden and subsoil stockpiles will be stripped and stockpiled adjacent to the mining blocks.
MB 1	3.80 ha	Topsoil, subsoil, sandy overburden and other types of overburden will be stockpiled adjacent to the mining blocks area with portions of the processing area.
MB 2	4.12 ha	Topsoil and subsoil will be stockpiled adjacent to the mining blocks area with portions of the processing area. Sandy overburden will be directly placed into MB 1.
MB 3	4.15 ha	Organic soil will be directly placed into MB 1. Sandy overburden and all other types of overburden will be directly placed to MB 2.

5.0 Processing Details

The majority of the aggregate products will be produced by portable crushing and screening operations. Three processing areas will be used over the life of the pit; processing areas will move as mining progress through the phases. A stationary wash plant operation will be set up in the NW 33-053-03 W5M initially, the wash plant operation may be relocated as operations progress through the phases. The wash plant will

recirculate the wash water and will use a series of settling ponds to remove the silt from the wash water. Approximately 495 m^3 of water per day will be used at the wash plant, approximately 10% of which will be lost to evaporation. Adsorption of water into the product will be minimal as the material comes from below the water table and the pores are already saturated. Source water for the wash plant will initially be taken from the groundwater recharge pond and then from the 5.8 ha waterbody once it is constructed to a point that it can supply water. No wash water will be reintroduced into the recharge pond or waterbodies, nor will any wash water be released offsite.

Aggregate processing (crushing and washing) will occur at the wash plant site located in the NW 33-053-03 W5M while mining of Phase I occurs. Once mining progresses to Phase II and III, aggregate processing may move with the mining Phases. An estimated 25% of the products will be washed.

The crushing operation will use a conventional one stage crushing and screening process. Not many boulders needing a secondary crusher are expected to be extracted, so a primary crusher is not expected to be needed. These boulders will be separated from the remaining aggregate and sold as rock products.

6.0 Internal Location Details

6.1 Stockpiles

Stockpiles will be located in the designated Mineral Topsoil Area, Organic Soil/ Topsoil, and Overburden Areas in each mining phase, as outlined in the extraction details in Table 2, 3 and 4.

6.2 Roads and Vehicles

An internal haul road will be constructed through the centre of the Site, running approximately east west to provide access to all portions of the Site. Topsoil and subsoil will be stripped from the haul road within the N 33-053-03 W5M and stockpiled at the nearest stockpile location. The clay excavated from the recharge pond will be used to construct the haul road within the N 33-053-03 W5M.

Abandoned Roadway 5026 ET will be used to access Phase III. Vegetation along this roadway will be removed and the surface will be upgraded as necessary to provide a temporary driving surface. The internal haul road will be approximately 1,100 m long within Phases I and II and 750 m long within Phase III. The portion of road within the N 33-053-03 W5M will be constructed without ditches and will be one metre in height with 3:1 side slopes and a 10 m wide top. A 600 mm culvert will be installed where appropriate to accommodate any surface water drainage.

Product aggregate will be hauled from the property first along internal haul roads and will then exit the Site on to Range Road 33. The product will be hauled south to Highway 16 and the majority of trucks will proceed

east to the Edmonton area. The proposed haul route will pass through both Lac Ste. Anne and Parkland County.

Adequate space for truck parking or staging will be provided on the Site so trucks will not have to stop and park on municipal roads. A designated fuelling and maintenance area will be located within the processing area and constructed on overburden material. Adequate space for servicing, fueling and rinsing of trucks will be provided.

7.0 Surface Water

During operations, all surface runoff from the disturbed areas within the active pit area will, as much as possible, be maintained on site and redirected to waterbodies/low areas within the pit.

A drainage ditch will be constructed along the west and north sides of the NW 33-053-03 W5M outside of the planned Permanent Sight and Sound Berm to accommodate surface water drainage from the NE 32-053-03 W5M and areas upgradient of the Site. A drainage ditch will also be constructed from the existing dugout in the NE 33-053-03 W5M to the eastern property line to compensate for the removal of the drainage ditch that currently leads northeast from the dugout. A 600 mm CSP culvert will be placed under the perimeter berm to the ditch on Range Road 33. Topsoil and subsoil will be salvaged prior to the construction of the ditch and will be replaced once construction is complete and seeded following construction with an appropriate mix to prevent erosion and weed emergence.

8.0 Waste and Disposal

A designated garbage area with proper fencing and screening will be maintained on site. Qualified contractors will be retained to haul away and dispose of effluent waste, household garbage, portable toilets, sewage, and any other waste as needed. All wastes will be disposed of using proper methods.

All petroleum products will be stored in approved double walled fuel vault containers per requirements outlined by the Canadian Standards Association. Spill containment products will be at the Site at all times and employees will be trained in their use. Secondary containment of no less than 100% of the largest container shall be provided to all areas where lubricating oil is stored onsite. Double walled fuel storage tanks and a designated fueling/maintenance area will be used during mining operations to reduce the risk of any hydrocarbons contaminating the soils and groundwater aquifer. The designated fueling/maintenance area will be located within the processing area and constructed on overburden material. All fuel spills will be immediately contained, cleaned up, and hauled to a Class II landfill for proper disposal.

9.0 Security Plan

9.1 Potential Emergencies and Response Procedures

Table 5. Emergencies and Response Procedures	
Potential Emergency	Response Procedure
Fires (equipment, fuel, grass, wildfire)	Use equipment fire extinguishers as first line of defense against flames. Call 911 immediately for larger fires; timely response is critical. The nearest fire response is through Lac Ste. Anne County Fire Services (Table 2).
Medical Emergency	Qualified First Aiders and kits will always be present on site. Call 911 immediately for more serious injuries. STARS Air Ambulance may be contacted if required.
Vehicle Rollover or Collision	Freeze the scene and ensure the safety of all involved personnel. Immediately notify the Site Supervisor of the incident via radio or cellphone. Assess for injuries and fire risks. In the event of fuel line or containment puncture, protect environment from spills using vehicle spill kits. Do not move or approach the vehicles until it is declared safe.
Mudslide or Landslides	Remain in equipment if safe to do so. Immediately notify the Site Supervisor or nearest personnel of the incident via radio or cellphone. Berms have been constructed to mitigate landslide risk.
Spills (Fuel or oil)	Contain the spill using equipment spill kits. Wear appropriate Personal Protective Equipment (PPE) prior to engaging in clean-up efforts. Priority should be given to prevent the entry of pollutant material into waterways. Alberta Environment must be contacted should reportable quantities exceed threshold values. Containers to be used to collect used oil and spill filters will be located at the designated location within the processing area.
Drowning or water-related emergencies	Lifesaving equipment (floatation rings) will be stationed near waterbodies. When working around water, always utilize the buddy system, and ensure a personal flotation device is worn within 5 meters of the shoreline.
Severe Weather (lightning, storms, tornadoes, heavy snow, extreme cold)	If adverse weather is detected near the pit operation, an announcement will be issued by the Site Supervisor. Operations will cease during extreme weather and will resume after the "all clear" signal has been given via radio, cellphone, or in person.

Wildlife Encounters	If wildlife is encountered on site, attempt to maintain distance. Do not make sudden moves or loud noises. Attempt to back away and return to vehicles or an indoor location. Report any encounters to a site supervisor. Staff are encouraged to carry bear spray.
Responding to a complainant, the County or Regulatory Body	The Site Manager will respond to all complaints related to pit operations within 24 hours by contacting the complainant to inform them of status of the investigation or to update them with the findings of the investigation. If the information collected from the survey procedures indicates that the Site is not the source of the complaint, the complainant shall be notified of this finding in writing. Responses to the County and Regulatory Body will be made in a timely manner when requests are received. Records will be kept of correspondences with complainants, the County and/or Regulatory Body.

9.2 Monitoring Procedures

As daily Field Level Hazard Assessments are completed, the site is continually monitored for changes to the site conditions and safety levels.

Additionally, Hydrogeological Consultants Ltd. (HCL) has been monitoring the groundwater regime since receiving authorization under the *Water Act* in 2018 and monitoring efforts will continue throughout the operation's lifespan. Groundwater diversions will be monitored both as per the *Water Act* Authorizations and HCL recommendations.

9.3 Periods of Inactivity

While there is not a designated period of pit inactivity, operations will slow over the winter months.

9.4 Site Security Features

The Site has been fenced along all sides where public access or wildlife entry is possible. Cattle gates will be installed and locked during non-operating times. "No Trespassing" advisories and signs have been installed, which conform to municipal and provincial requirements.

Pertinent information regarding site operations, registrations and records will be kept at the scale house and made available upon request.

The following equipment will be available on site:

- Fire extinguishers inside of all vehicles/equipment

- A Level 2 First Aid Kit in the Site Supervisor's company truck. Additionally, 2 certified First Aiders must be on site at all times.
- Emergency blankets and supplies will be available at the office/scale house

9.5 Pit Location

The Site is located within Lac Ste. Anne County within the N 33 & SW 34-053-03-W5M on private land, approximately five kilometers south of Alberta Beach, adjacent to Township Road 540 and Range Road 33.

9.6 Adjacent Landowners

The name and address of the landowners and occupants that are affected by the proposed development within a 2km radium or along the proposed haul route are listed in Table 6. As this document will be made available upon request on site, phone numbers have not been included to maintain privacy.

Table 6. Landowners Adjacent to the Pit or Haul Route	
Location	**Landowner**
Lac Ste. Anne County	
NE 05-054-03 W5M	G. & A. Hickie
NW 04-054-03 W5M	A. Sonnnenberg
NE 04-054-03 W5M	A. Sonnnenberg
NW 03-054-03 W5M	A. Sonnnenberg
NE 03-054-03 W5M	A. Sonnnenberg
SE 05-054-03 W5M	D. & L. Ross
SW 04-054-03 W5M	D. & L. Ross
SE 04-054-03 W5M	B. & C. Hillman
SW 03-054-03 W5M	D. & D. Drews
SE 03-054-03 W5M	D. Franczak
NE 34-053-03 W5M	D. Drews & D. Kosch
SE 34-053-03 W5M	F. & E. Sonnenberg
NE 32-053-03 W5M	G. & A. Hickie
NE 32-053-03 W5M	1531486 Alberta Ltd.
SE 32-053-03 W5M	1531486 Alberta Ltd.
NE 33-053-03 W5M	D. & E. Drews
NW 34-053-03 W5M	1531486 Alberta Ltd.
SE 33-053-03 W5M	D. Franczak
SW 34-053-03 W5M (NW 1/4)	D. Franczak

SW 34-053-03 W5M (SE 3/4)	1531486 Alberta Ltd.
NW 33-053-03 W5M	1531486 Alberta Ltd.
NE 33-053-03 W5M	D. & D. Drews
Parkland County	
NE 29-053-03 W5M	Smithfield Crown Reserve
NW 28-053-03 W5M	1531486 Alberta Ltd.
NE 28-053-03 W5M	L. Astleford
NW 27-053-03 W5M (N 1/2)	L. Astleford
NW 27-053-03 W5M (S 1/2)	B & F. Stell
SE 28-053-03 W5M	Lehigh Hanson Materials Ltd.
SW 27-053-03 W5M	Lehigh Hanson Materials Ltd.
NE 21-053-03 W5M	Lehigh Hanson Materials Ltd.
NW 22-053-03 W5M	MWC Investments Inc.
SE 21-053-03 W5M	Tricycle Lane Ranches Ltd.
SW 22-053-03 W5M	Tricycle Lane Ranches Ltd.
NE 16-053-03 W5M	Tricycle Lane Ranches Ltd.
NW 15-053-03 W5M	Tricycle Lane Ranches Ltd.
SE 16-053-03 W5M	Tricycle Lane Ranches Ltd.
SW 15-053-03 W5M	M. Agostini

9.7 Emergency Contact List

Table 7. Emergency Contacts - Alberta Beach Pit	
Contact Type	Information
Safety Manager:	Lucas Bodnar (780) 454 - 0700 lbodnar@gjconstruction.ca
Site Supervisor:	TBD
Nearest Hospital:	WestView Health Center 4405 S Park Drive Stony Plain, AB (780) 968 - 3600
Police Department:	Parkland RCMP Detachment 91 Campsite Road Spruce Grove, AB

	(825) 220 - 2000
Fire Department:	Lac Ste. Anne. County Fire Station (East) 2317 Township Road 545 Onoway, AB (780) 967 - 0483
OH&S	(780) 415 - 8690 or 1 (800) 415 - 8690

10.0 On-site Communication

Two-way radios will be used for on-site communication. Cell phones are to be used for external communication and emergency calls. An Alarm signal ''EMERGENCY, EMERGENCY, EMERGENCY'' is to be raised via radio or verbal command in the event of an incident.

11.0 Evacuation Procedures

Evacuate to muster point (by the truck scale in Phase II) upon alarm. The Site Supervisor will conduct a head count for all personnel. Personnel will be evacuated off-site using Range Road 33. Do not re-enter the work area until authorized.

12.0 Emergency Muster

The Site Muster Point is located at the truck scale area in the southeastern portion of the NE 33-053-3-W5M (Phase II), marked with signage. In the event of an emergency, employees are to remain at the muster point until accounted for.

13.0 Hazard Assessment

The Site Supervisor will conduct a Site-Specific Hazard Assessment prior to any work. Reassessment is required with any changes in job scope or conditions. The current hazard assessment will be reviewed at each Pre-Job meeting.

14.0 Emergency Classifications

In the event of an emergency, the Site Supervisor will classify the emergency level and coordinate the appropriate response.

- Level 1: A Minor incident that can be managed internally (ex: a minor abrasion).
- Level 2: Moderate incident requiring limited outside support (ex: a broken arm).
- Level 3: Major emergency requiring full external support (ex: a major equipment fire).

Appendix N

ACIMS & FWMIT Search Results

Date: 21/1/2025
Requestor: Consultant
Reason for Request: Environmental Assessment
SEC: 34 **TWP:** 053 **RGE:** 03 **MER:** 5

Alberta Parks

Non-sensitive EOs (updated: June 2022)

M_RR_TTT_SS	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D

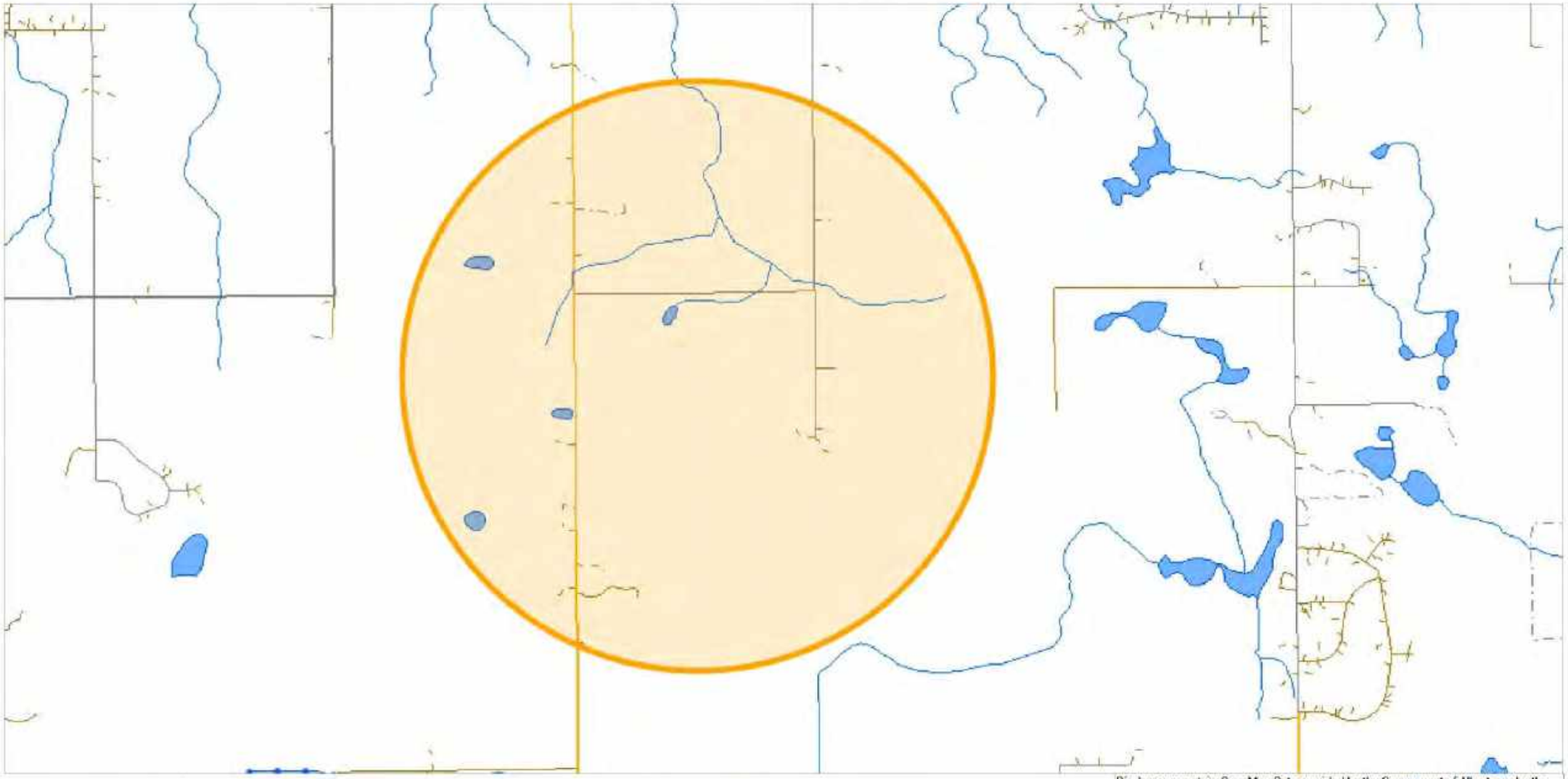
No Non-sensitive EOs Found: Next Steps - See FAQ

Sensitive EOs (updated: June 2022)

M-RR-TTT	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D

No Sensitive EOs Found: Next Steps - See FAQ

Fish and Wildlife Internet Mapping Tool



Alberta Environment and Parks

0.6 0 0.29 0.6 Kilometers

Projection: NAD_1983_10TM_AEP_Forest
Map Scale: 36,112
Printed on: January 22, 2025 14:32:35 -07:00

Display may contain: Base Map Data provided by the Government of Alberta under the Alberta Open Government Licence. Cadastral and Dispositions Data provided by Alberta Data Partnerships. GeoEye, All Rights Reserved. © 2021 Airbus DS, Licensed by Planet Labs Geomatics Corp., www.planet.com

© 2025 Government of Alberta

The Crown provides this information without warranty or representation as to any matter including but not limited to whether the data/information is correct, accurate or free from error, defect, danger or hazard and whether it is otherwise useful or suitable for any use the user may make of it.

This site is created, maintained, and monitored by AEP in direct consultation with the data authority.

Legend

- Invasive Species Observations
  - Invasive Plant
  - Invasive Fish
  - Other
- Fish Survey
- Aquatic Habitat
- Fish Culture Stocking
- FWMIS Lakes/Ponds/Reservoirs
  - Lake/Pond/Major River
  - Reservoir
  - Canal/Dugout/Lagoon
  - Icefield
  - Oxbow
  - Wetland
- FWMIS River and Stream By Feature Type
  - Intermittent/Perennial/Recurring Stream
  - Lake/River Representation Flow
  - Canal
  - Icefield
  - Oxbow
  - Aquaduct; Ditch; Spillway
- Railway (20K Large Scale)
  - Single Line
  - Double Line
  - Multiple Line
  - Spur Line
  - Abandoned
- Paved Road Label (20K)
- Paved Road (20K)
  - Primary Divided
  - Primary Undivided 4L
  - Primary Undivided 2L
  - Primary Undivided 1L
  - Interchange Ramp
  - Secondary Divided
  - Secondary Undivided 4L
  - Secondary Undivided 2L
  - Secondary Undivided 1L
- Gravel Road Label (20K)
- Gravel Road (20K)
  - Primary Undivided 2L
  - Primary Undivided 1L
  - Secondary Undivided 2L
  - Secondary Undivided 1L
- Other Road Label
- Other Road
  - Unimproved
  - Unclassified
  - Truck Trail
  - Winter
  - Ford Winter Crossing
  - Ferry Route
- Road Point
  - Bridge
  - Overpass/Underpass
  - Ford/Winter Crossing
  - Port of Entry
  - Miscellaneous Control Device
  - Tunnel
  - Ferry Crossing
- Railway Point
  - Bridge
  - Station

Appendix O

Importation Management Plan

ALBERTA BEACH PIT

IMPORTATION MANAGEMENT PLAN

Purpose: To ensure 1531486 Alberta Ltd. minimizes the risk that 1531486 Alberta Ltd. will be jointly and severally liable for the clean-up of the Alberta Beach Pit (the "**Site**") resulting from the acceptance of fill other than Clean Fill for the use of reclamation material.

Scope: This procedure applies to the Site. Awareness and training of this policy will be provided to all employees and contractors at the Site and to customers delivering fill.

Definitions:

- "**Acceptable Fill**" means fill that meets all of the following requirements:
    - Results indicating substance concentrations within the material meet *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP, 2016) as amended*;*
    - does not contain chemical or radiological substances from human activities;
    - tests negatively for club root;
    - has not originated or been mixed with any soil, from soil treatment or remediation activities, raw sewage, dry cleaning sites or other cleaning activities, or any other locations with high potential of contamination; and,
    - does not include the constituents or qualities listed in Table 1- Unacceptable Soils include in Schedule 'A;;
    - meets the definition of Clean Fill.
- "**Affiliated Company**" means a company that is related to 1531486 Alberta Ltd. through share structure and/or ownership.
- "**Clean Fill**" means fill with substance concentrations less than those defined under the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP, 2016) and contains no club root spores;
- **"Club Root Testing"** means the completion of a test by an accredited laboratory identifying the presence or absence of club root spores. Required when a source location is, or has been, used for agriculture production in the last 10 years.
- **"Customer**" means either an affiliated company or third-party company that will be import material to the site.
- **"Greenfield Site**" means an area of agriculture or forest land, or some other site which has not been previously developed or polluted as confirmed by a Phase I ESA.
- "**Petroflag Test**" means a field portable method for the determination of total petroleum hydrocarbons in soil that does not distinguish between aromatic and aliphatic hydrocarbons, but quantifies all fuels, oils, and greases as total hydrocarbons. Analysis of a 10 gram soil sample is performed using three simple steps: extraction, filtration, and analysis. Petroflag analysis method detection limit is 15ppm, with a 10% +/- MDL.
- **"Environmental Site Assessment (ESA)"** means an investigation in relation to the land to determine the environmental condition of a property.
- "**Phase I ESA**" means a report carried out in accordance with the *Alberta Environmental Site Assessment Standard* (AEP, 2016) or the Phase I Environmental Assessment Guideline for Upstream Oil and Gas Sites, as amended (AENV, 2001b). Required for all non-greenfield sites.
- **"Phase 2 ESA"** means a report carried out in accordance with the *Alberta Environmental Site Assessment Standard* (AEP, 2016) or the Phase 2 Environmental Site Assessment Checklist (ESRD, 2013). Required for all non-greenfield sites when recommended by the Phase 1.

ALBERTA BEACH PIT

IMPORTATION MANAGEMENT PLAN

- "**Site Specific Fill Declaration**" means a declaration by Customer, among other thing, agreeing and acknowledging that the fill meets the definition of Clean Fill.
- "**Soil Characterization Report"** means a report outlining sampling methodology and laboratory physical and chemical characterization results. Required for Greenfield Sites.
- "**Third Party Company"** means a company or entity that is unrelated to 1531486 Alberta Ltd. through share structure and/or ownership and is completely independent of 1531486 Alberta Ltd.

General Requirements:

In order to provide 1531486 Alberta Ltd. with sufficient assurance that fill to be deposited at the Site meets the definition of Acceptable Fill, the following process and due diligence sampling must be followed:

1. Each Customer must be educated about the Imported Fill Material Management Policy and the Site-Specific Fill Declaration.

2. Each Customer must sign a Site-Specific Fill Declaration for each source site where the fill originated. Source sites composed of multiple parcels of adjoining land require one Site Specific Fill Declaration.

3. Each Customer must provide a copy of the Phase I ESA, the Phase 2 ESA (when recommended by the Phase 1) and/or Soil Characterization Report with soil analytical results from an accredited laboratory from the source site where the fill originated in order for 1531486 Alberta Ltd. to determine whether the fill qualifies as Acceptable Fill. Documentation must be submitted to 1531486 Alberta Ltd. review and be representative of the fill within 6 months of the anticipated delivery date.

4. 1531486 Alberta Ltd. or its designate, will conduct QA/QC Sampling of the fill.

Fill Acceptance Process and QA/QC Measures:

1. 1531486 Alberta Ltd. Area Environment Manager:
    a. Review the supporting documentation to determine whether the fill from the source site qualifies as Clean Fill and confirm determination to Pit Management.

2. On Site Management:
    a. Confirm the customer has completed and executed a Site-Specific Fill Declaration and provided the necessary reporting required for each source site and that the Area Environment Manager has approved each source site.
    b. Arrange delivery with the customer after the Area Environment Manager has confirmed the fill is acceptable.
    c. Record the following for each load of fill delivered:
        i. Date,
        ii. customer name,
        iii. site source name,
        iv. vehicle license or truck identification number,
        v. weight of load/quantity of fill,
        vi. type of fill and
        vii. location of load placement.
    d. Conduct:

i. Petroflag test on one sample load per 1,000 m^3 of the incoming loads originating from each source site and record and document the Petroflag results, from Third Party Companies.
ii. Visual inspection on all incoming loads.

e. Reject loads that do not pass Petroflag, visual inspection for reasons noted below.

3. Monitoring Requirements
   a. Review the Soil Characterization Report and visually inspect all incoming loads of fill for any unacceptable soils as defined in Table 1.
   b. Conduct a Petroflag tests, when required.
   c. Conduct due diligence sampling on Third Party Company incoming loads at a rate of once per approximately 1,000 m^3 for the following parameters:
      i. Hydrocarbons
      ii. Volatile and Semi Volatile Organic Compounds (VOC)
      iii. Semi Volatile Organic Compounds (sVOC) including Polycyclic Aromatic Hydrocarbons (PAH)
      iv. Polychlorinated Biphenyls (PCB)
      v. Total Metals (including arsenic and inorganic mercury)
      vi. pH
      vii. Pesticides (oranochlorides)
   d. 1531486 Alberta Ltd. will collect a composite sample from the backfill area and analyze for the parameters listed above for the due diligence sampling, prior to covering with fill or upon completion of the delivery.
   e. Annual groundwater quality monitoring prior to and after fill material is used for reclamation, until reclamation certification.

4. Load Rejection
   a. Reject loads if Source Specific Fill Declaration Form is not on file.
   b. Reject loads if the Environment Manager has not confirmed material has been verified as Acceptable Fill.
   c. Reject loads if they do not pass the visual or Petroflag test on during delivery.
   d. Any fill that has been placed on site but is later shown to not meet the criteria of Acceptable Fill via on site sampling will be rejected and must be picked up by the customer with 48 hours of being notified that material has failed testing.

Record Keeping and Documentation:

All records, test results, declarations, supporting documentation and other relevant information will be retained on site for the duration of the operation of the fill acceptance program. All documentation will be scanned at the time of receipt and retained electronically by Pit Management and the Environment Manager. Once the fill acceptance program is complete and fill is no longer being received, records may be removed from site but must be archived and retained indefinitely.

Forms and Templates:

- Site Specific Fill Declaration

Records:

- Site Specific Fill Declarations
- Phase 1 ESA and Phase 2 ESA
- Soil Characterization Reports (or similar)
- Analytical and Club Root Analyses

ALBERTA BEACH PIT

IMPORTATION MANAGEMENT PLAN

References:

- Alberta Environment. 2001. Phase 1 Environmental Site Assessment Guideline for Upstream Oil and Gas Sites. Alberta Environment, Edmonton, Alberta. Report # ESD/LM/01-1. ISBN: 0- 7785-1421-8 (Printed Edition), 0-7785-1422-6 (On-line Version), Publication No: T/573. 16 pp. https://open.alberta.ca/dataset/ad267908-bdf4-4c97-ad9f-760a547e4245/resource/78d43883-0334-4220-a037-2746648390a1/download/6821.pdf
- Alberta Environment and Parks (AEP), 2016. Alberta Environnemental Site Assessment Standard. https://open.alberta.ca/dataset/3acc7cff-8c50-44e8-8a33-f4b710d9859a/resource/579321b7-5b66-4022-9796-31b1ad094635/download/environmentsiteassessstandard-mar01-2016.pdf
- Alberta Environment and Parks (AEP), 2016. Alberta Tier 1 Soils and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. 197 pp. https://open.alberta.ca/dataset/842becf6-dc0c-4cc7-8b29-e3f383133ddc/resource/1b851705-0622-485d-beee-752a627bdfc4/download/2016-albertatier1guidelines-feb02-2016a.pdf+
- Alberta Environment and Sustainable Resource Development (ESRD), May 2013. Phase 2 Environmental Site Assessment Checklist.

Attachments:

- Site Specific Fill Declaration

ALBERTA BEACH PIT

IMPORTATION MANAGEMENT PLAN

Schedule "A"
Table 1

Table 1

UNACCEPTABLE SOILS	
Organic Soil	Peat
Soils Containing	Construction, demolition, land-clearing waste
	Asphalt
	Tires, rubber, or plastic materials
	Garbage, or man-made materials
	Sludge
	Compost
	Wood waste
	Hydrovac Material

SITE SPECIFIC FILL DECLARATION

This declaration is required to deposit fill at the Alberta Beach Pit.

CUSTOMER INFORMATION

Customer: _____ Contact Name: _____

Address: _____ Contact Title: _____

_____ Email Address: _____

_____ Phone No: _____

Trucking Sub-Contractor: _____

SOURCE SITE INFORMATION

Site Address: _____

Current Use of Site: _____

Landowner Information: _____

Email Address: _____

Contact Phone No: _____

CHARACTERIZATION REQUIREMENTS

Source Site	☐ Greenfield	☐ Residential	☐ Previously Developed

1. Has the site been used for agriculture in the past 10 years?

- ☐ Yes – Results of Clubroot Testing: _____
- ☐ No

2. Type of material being imported:

- ☐ Topsoil
- ☐ Subsoil
- ☐ Overburden/Clay

3. Has a Phase 1 ESA or Soil Characterization Report been submitted by the customer?

- ☐ Yes – if other, describe: _____
- ☐ No – fill cannot be accepted until information has been received.

4. Are there any known or suspected contaminants of concern?

- ☐ Yes – Describe: _____
- ☐ No

5. Are there any notable odors, distinct stains, or visible debris?

- ☐ Yes – Describe: _____
- ☐ No

6. Estimated Volume: _____

DECLARATION

The Customer hereby acknowledges an agrees as follows:

1. The Customer has received and reviewed a copy of the Imported Fill Material Management Policy.

2. All fill delivered to the Alberta Beach Pit meet the requirements of Acceptable Fill as defined in the Imported Fill Material Management Policy and any applicable federal, provincial or local environmental laws.

3. The Customer agrees to defend, indemnify and hold 1531486 Alberta Ltd. harmless from and against any and all claims, demands, causes of action, damages, losses (including consequential losses or damages), liabilities, penalties, fines, fees and expenses (including reasonable attorneys' fees and expenses and the costs of investigation), caused by or resulting from the Customer's breach of this declaration.

4. 1531486 Alberta Ltd. may require the Customer to inspect or sample the fill at Customer's sole cost.

5. 1531486 Alberta Ltd. reserves the right to inspect and sample fill and the Customer acknowledges that such inspection or sampling as well as 1531486 Alberta Ltd.'s decision to accept fill based on the information shall not reduce, restrict or otherwise limit the Customer's liability for such fill.

6. 1531486 Alberta Ltd. may reject any fill that it determines, in its sole discretion, does not meet the requirements of acceptable fill. In such event 1531486 Alberta Ltd. shall notify the Customer that it must remove such fill within 24 hours at its sole cost and risk. In the event the Customer fails to do so 1531486 Alberta Ltd. may remove and dispose of such fill in accordance with all applicable laws and the Customer shall reimburse 1531486 Alberta Ltd. for the costs thereof within 15 days of the delivery of an invoice.

Date: _____

Customer Name: _____

By: _____
I have authority to bind the Customer

Title: _____

SITE APPROVAL (to be completed by 1531486 Alberta Ltd. following receipt of signed Declaration)

Results of the soil characterization report review by Environment Manager/Onsite Manager:

☐ Approved – fill meets the definition of acceptable fill as defined in the Imported Fill Material Management Policy, is accepted, and can be placed in a backfill area (location to be documented) following completing the site due diligence visual, odor and PetroFlag assessment (when required).

☐ Rejected – load is rejected and cannot be accepted.

Date: _____ Position: _____

Name: _____ Signature: _____